

# **Towards Automated Feedback on Students' Research Writing: Theory, Design and Evaluation**

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Thesis submitted in fulfilment of the requirements for the degree of  
Doctor of Philosophy  
under the supervision of Kirsty Kitto, Simon Buckingham Shum, and Simon  
Knight.

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# Certificate of Original Authorship

I, Sophie Abel declare that this thesis, is submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Connected Intelligence Centre here at the University of Technology Sydney.

This thesis is wholly my own work unless otherwise referenced or acknowledged. In addition, I certify that all information sources and literature used are indicated in the thesis.

This document has not been submitted for qualifications at any other academic institution.

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# Abstract

Effective research writing skills are essential for Higher Degree Research (HDR) students. Research funding restructures and new university policies driven by the knowledge economy have led to the massification of research degrees, which in turn has led to new types of HDR students, HDR degrees and shorter completion times. HDR students are now expected to publish during their candidature, rather than after. This increased pressure on HDR students to write about their research effectively, and quickly, while also conducting research, is even more problematic when most HDR students find research writing difficult and many supervisors find teaching research writing challenging. Despite these pressures, research writing pedagogy has largely remained the same and so innovative solutions are critical to help develop HDR students' research writing skills. A potential approach to this challenge is through writing analytics. A sub-field of learning analytics, writing analytics use analytical techniques and natural language processing to provide instant, formative feedback on student writing. The use of such tools in HDR contexts is limited, with few evidence-based design principles for creating such tools.

This thesis documents the design, implementation and evaluation of AcaWriter, a writing analytics tool, for HDR contexts. Applying a Design Based Research approach this research explored how students learn research writing, their research writing experiences, their experiences with supervisor feedback, and perceptions using the writing analytic tool. The outcome is a writing analytics tool for HDR contexts, along with a set of design principles and a framework for writing analytics tools in HDR contexts. Insights from students' research writing experiences then lead to the creation of a Multi-level Model of Research Writing Development (MMRWD) framework to provide research writing development and support for HDR students.

The design principles and frameworks established in this research provide conceptual and technical advances towards developing theoretically grounded and evidence-based tools that enable the design and implementation of HDR research writing development and support.



# Chapter 1: Introduction

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*“I need help with my writing” was a common request when I was an academic language and learning educator at an Australian university. Our small team was already running writing circles, facilitating workshops and providing students with one-on-one consultations. Our calendars were always fully booked providing these services to HDR students. And while most of the students came to workshops and writing circles, many did not, and preferred one-on-one consultations. They wanted immediate, actionable feedback, someone to look at their writing and guide them through the next steps. But we couldn’t see every student when they reached out for our expert support. We were three staff members supporting the largest HDR faculty on campus, as well as completing our daily business as usual duties. I thought there has to be something else out there to support HDR students. It is this need that led me to this research.*

## 1.1 Context and Problem Statement

Writing effectively is critical for Higher Degree Research<sup>1</sup> (HDR) students. Effective written communication skills are necessary to complete the dissertation and therefore are a core graduate outcome. Effective written communication skills are necessary for publishing research, applying for research grants and employability, making writing one of the core skills identified by employers as necessary for HDR graduates (McGrail et al., 2006). HDR students are expected not just to conduct research, but also to write about it effectively. Critically, it is through their writing that HDR students must demonstrate their understanding of the literature, its significance and the original contribution to knowledge in their field of study. Students are ultimately awarded their degree based on their dissertation, and it is through publishing during their degree that students begin to situate

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<sup>1</sup> In Australia, Higher Degree Research is defined as programs where research comprises at least two thirds of the course (Tertiary Education Quality and Standards Agency, 2018). They include Masters by Research, Professional Doctorates and the Doctor of Philosophy.

themselves in their discourse communities. However, many students find research writing difficult (Aitchison et al., 2012) and such difficulties can impact completion and academic success (Lee & Aitchison, 2009). It is therefore surprising to find a significant absence of research into HDR research writing programs and HDR students' research writing practices. This lack of attention is evident in the scarcity of systematic writing instruction in HDR programs (Aitchison & Lee, 2006), the under-theorised research on doctoral writing pedagogy and supervision (Danby & Lee, 2012; Kamler & Thomson, 2014), and the dearth of resources available for supervisors and program administrators to address the challenges involved in doctoral writing (Lee & Aitchison, 2009).

Contemporary changes have put pressure on higher degree research education. Universities are under pressure to translate “their research into economic, environmental, social and other benefits” (Australian Research Council, 2018). These pressures have led to “ever new demands of writing” (Lee & Aitchison, 2009). The globalised knowledge economy has commodified knowledge and, driven by economic demands, imposed unprecedented pressure on higher degree researchers (Danby & Lee, 2012). Doctoral candidates are one of the largest cohorts of knowledge workers in this market, as nations compete for new research and innovative solutions for complex problems. These changes have influenced research funding restructures, and new university policies mean that many HDR students are now often required to publish during their candidature rather than after (Aitchison et al., 2010; Lee & Kamler, 2008). These growing pressures mean that writing effectively also impacts institutions of study, making research outputs (publications) a key indicator of research quality, impacting research funding and rankings (Australian Research Council, 2018). This increased pressure to publish and make research accessible therefore heightens the need for institutions to provide more effective forms of research writing instruction.

This drive to compete in the knowledge economy has also led to the massification of higher research degrees (Danby & Lee, 2012) and the diversification of HDR students (Aitchison & Guerin, 2014). Doctoral degree enrolments are increasing worldwide (Nerad, 2020), along with the creation of new doctoral programmes, such as professional doctorates. The student profile has therefore changed with more culturally and linguistically diverse students (Aitchison & Guerin, 2014), and modes of study have also markedly shifted to now encompass part-time, external and online. PhD students no longer only follow a single traditional pathway of an undergraduate degree to a

postgraduate qualification, to doctoral study. The numbers of professional candidates are increasing and are more than likely to enter doctoral degrees based on their professional experience rather than their prior academic qualifications (Kiley, 2018). It becomes a challenging problem therefore to better support HDR students to develop their scholarly writing and initiate them into their discourse communities, especially when limited research exists on HDR students and their research writing practices.

This expansion and diversification of the sector has opened up traditional disciplinary boundaries with new transdisciplinary, interdisciplinary and cross-disciplinary research fields, requiring new ways of working, significantly impacting the way students and supervisors work. Students are now expected to complete their doctoral degree within shorter time frames, supervision teams are larger with members from different fields, and academics are required to supervise more students to completion in shorter periods, with limited resources to support doctoral students and supervisors. Overall, this shift in practice is changing HDR education, student experiences, the design and function of HDR programmes, with scholarly writing placed at the centre (Aitchison & Guerin, 2014). These changes mean that innovative solutions that can scale sustainably could support students and supervisors with the teaching and learning of research writing.

The search for innovative solutions demands an understanding of writing in the HDR context. Scholarly writing, while an essential component of academia, remains a “contentious space” for students, supervisors and academic writing teachers (Aitchison & Guerin, 2014, p. 3). Students find scholarly writing challenging (Aitchison et al., 2012), supervisors question why their students ‘can’t write’ (Kamler & Thomson, 2014) and academic language and learning educators are often called upon to ‘fix’ student writing (Aitchison & Lee, 2006). Universities have facilitated a range of initiatives to alleviate the tensions that exist within the HDR writing context, such as ad hoc writing programs, one-off workshops, writing groups, ‘shut up and write’ sessions, and consultations with academic language and learning educators, yet, research writing is still a challenge for HDR students. The supervisor/student apprenticeship model is still the main avenue for teaching HDR students how to write. However, the small amount of research into this concludes that many supervisors are not confident in teaching writing to their students (Aitchison et al., 2012; Catterall et al., 2011) and research has shown that some supervisors struggle to support their students and find teaching research writing challenging (Aitchison et al., 2012; M. A. Maher et al., 2014; Paré, 2011). Supervisor

feedback, which is critical for developing students' research writing skills, fostering scholarly growth, writing the doctorate and timely completion, is often vague and difficult to understand (Paré, 2010, 2011). While supervisors are capable writers and peer reviewers themselves, such that they 'know good writing when they see it', like many experts, this does not mean they are good writing teachers. Many lack the rhetorical and linguistic knowledge to provide insightful advice (Paré, 2010, 2011). The need to provide alternative resources to develop student scholarly writing for both students and supervisors in this contentious space is paramount.

It is in this context that recent advances in Learning Analytics (LA) and specifically, Natural Language Processing (NLP) techniques, holds promise: developing HDR students' scholarly writing does not have to be limited to supervisors and academic writing teachers. Instead, writing analytics which places an emphasis on supporting student writing practices (Buckingham Shum et al., 2016), provides a novel potential to tackle the challenge of developing students' scholarly writing at scale. Writing analytics tools measure and analyse written text through NLP techniques to provide instant, automated feedback on student writing. Of the many writing analytics tools currently being used to help students develop their writing, which are surveyed in Chapter 2 section 2.3, are predominantly used in undergraduate programs and K-12 school classroom settings, with only one implemented in the US graduate student context, and none implemented in the Australian HDR context.

One such writing analytics tool that could fill this gap is AcaWriter. AcaWriter analyses students' texts and provides formative feedback on their academic writing (Knight et al., 2018; Knight, Shibani, et al., 2020). Specifically, it identifies the rhetorical functions of sentences, such as providing *background* information or showing *contrasting ideas*, by identifying rhetorical metadiscourse patterns (Chapter 8 provides a more detailed explanation of AcaWriter). These rhetorical functions are also called 'rhetorical moves'. AcaWriter notifies its users of the rhetorical moves in their text. Rhetorical knowledge and awareness are essential for understanding how texts work and how to create them, especially academic texts like journal articles and PhD theses. In fact, this understanding of how texts work is crucial for researchers when it comes to publishing their research (R. Murray, 2010). AcaWriter's automated feedback on the presence of the rhetorical functions of a text can help raise students' rhetorical awareness and in turn develop and improve their scholarly writing. Until I commenced this project, AcaWriter has only been

used in undergraduate contexts (Knight et al., 2018; Shibani, 2019) and has not been applied in research writing genres. A gap remains on the potential of using writing analytics tools as an innovative solution in the teaching and learning of scholarly writing, especially in the Australian HDR context. **Therefore, the aim of this research was firstly, to investigate HDR students' research writing experiences, and secondly, to design, implement and evaluate AcaWriter in the development of HDR students' research writing at an Australian university.**

In this thesis, I argue that new modes of research writing development and support are needed in HDR programs to address the diverse needs of students and the current lack of resources and support to develop HDR students' research writing. This study documents the systematic evolution of a writing analytics tool designed to assist HDR students to develop their scholarly writing. In order to create such a tool, I explored how students learn research writing, their research writing experiences and their experiences with supervisor feedback, as well as their experiences and perceptions using the writing analytic tool.

## 1.2 Research questions

This research aimed to explore HDR students' research writing experiences and establish if writing analytics tools could be an innovative and effective approach to address the current lack of resources and support to develop HDR students' research writing.

To gain an understanding of HDR students learning context and their research writing experiences the following two research questions were established:

- 1. How do HDR students learn research writing?*
- 2. What are HDR students' research writing barriers and what are their experiences in terms of supervisor feedback?*

To design, implement and evaluate a writing analytics tool that can support and develop HDR writing a third research question was posed:

- 3. How can writing analytics tools be designed, implemented and evaluated to help develop HDR students' research writing skills?*

### 1.3 Significance & contributions

This research adopted a novel Design Based Research (DBR) approach to develop, implement and evaluate educational innovations for HDR writing. The iterative cycles of design, testing and refinement led to the creation of an empirically grounded writing analytics tool and design principles. This practical contribution of applying such an approach enables researchers, practitioners and educational technologists to design, implement and evaluate theory driven tools in specific learning contexts.

In addressing the four research questions, this research makes four key contributions:

#### 1.3.1 Evidence of how HDR students learn to write, and a research writing development framework

Very little research exists on how students learn research writing. This research provides insights into HDR students' research writing experiences, in particular **how they actually learn research writing** (Chapter 4 and Chapter 6). This novel contribution is based on the fact that no study has reported how HDR students learn research writing.

This research explored the barriers to HDR students in terms of their research writing process and their experiences with supervisor feedback in this research journey. The findings from this research confirm and extend previous studies, establishing that students find research writing challenging, that supervisors are an essential part of the research writing process, who lack research writing training, and whose feedback is often confusing and evokes negative emotions. Evidence was gathered from studying students' research writing experiences, both at one point in time and longitudinally.

The findings from this research led to the creation of the *Multi-level Model of Research Writing Development (MMRWD)* (Chapter 10: section 10.2.2), a systematic approach to providing ongoing research writing development and support for HDR students. This approach may be of use to institutional policy makers in charge of HDR research writing programs as they examine the current approaches in place to support both supervisors and students. The MMRWD may guide policy makers to develop new targeted writing development programs that provide effective, just in time writing support to meet the diverse needs of students.

### 1.3.2 Extension of research writing pedagogy and creation of an online course

This research supports and extends the growing body of literature on research writing pedagogy. It confirms that *genre-based pedagogies* (8.1.1), in particular the *rhetorical move* analysis approach (8.1.2), and the teaching and learning cycle (8.1.3), are both effective methods of teaching research writing (Chapter 9). This research extends the application of these two approaches by creating an online abstract research writing course (9.5). This resource is valuable for both HDR students and supervisors, and those who need to learn more about writing effective abstracts. The effectiveness of the free online course may initiate a trend of providing such research writing support online. This research is significant for supervisors, learning designers, and practitioners involved in creating and facilitating research writing workshops, courses and programs.

### 1.3.3 A writing analytics tool for HDR contexts

The main contribution of this research is the evolution of a writing analytics tool for research writing. This research designed and created two additional parsers for AcaWriter; the CARS parser (8.4 - 8.5), and the abstract parser (9.5.2). AcaWriter was implemented in research writing classrooms in an Australian university and embedded in an online course, the first writing analytics tool of its kind to be implemented in an Australian HDR context. It serves as a stepping stone for an innovative approach to the teaching and learning of research writing.

### 1.3.4 Design principles for writing analytics tools

This research has established design principles and a writing analytics framework for HDR contexts (10.4.3). It has demonstrated how theory and the learning context is used to design writing analytics tools and automated feedback. This research is valuable for educational technologists and learning analytics researchers, particularly in the future development of writing analytics tools for HDR contexts.

## 1.4 Thesis Structure

This thesis takes the form of nine chapters organised as follows:

**Chapter 2** reviews the literature to understand the key issues in higher degree research education and research writing, institutional research writing support, learning analytics and learning design to establish and justify the rationale for undertaking this research.

The chapter also identifies the current gap in the literature motivating the need to investigate HDR students' research writing experiences and the creation of a writing analytics tool as a potential solution to the lack of resources and support to develop HDR students' research writing.

**Chapter 3** explains and provides the rationale for applying a design based research (DBR) approach to conduct this research. It also presents the learning context, data collection and data analysis tools and outlines the procedures within the four DBR phases.

**Chapter 4** presents insights in students' research writing experiences, in particular how they learn research writing and the barriers they encounter during the research writing process.

**Chapter 5** highlights the criticality of writing in the HDR context and provides insights into the perspectives of supervisors and graduate research staff on the issues relating to research writing in HDR contexts.

**Chapter 6** provides an in-depth view on HDR students' research writing barriers, their strategies to develop their research writing and their perspectives on supervisor feedback.

**Chapter 7** concludes the first phase of the DBR process by synthesising the findings of Chapters 4, 5 and 6. It then explains how writing analytics can help support students with research writing. The chapter also presents the initial design principles for a writing analytics tool for HDR contexts.

**Chapter 8** presents the theoretical framework used to design the writing analytics tool and its implementation. It also describes how the additional parsers and automated feedback were created for AcaWriter to suit the HDR context.

**Chapter 9** presents the four iterations conducted in this research. It describes each iteration's design, implementation, evaluation and findings, along with design reflections that detail the changes that led to refinements in subsequent iterations.

**Chapter 10** concludes the thesis by presenting a discussion of the key findings and how they address the four research questions. This chapter also presents the research contributions to the body knowledge, recommendations and suggestions for future research. The chapter also highlights the challenges and limitations of this research.



# Chapter 2: Literature Review

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This review critically examines the literature according to the themes of: higher degree research (HDR) and research writing, institutional research writing support, learning analytics and learning design. It demonstrates that there is limited evidence based research on how HDR students learn research writing, and that there are limited resources to assist students with their research writing. Writing analytics tools are a possible approach to help and develop HDR students' research writing. However, a lack of design principles available to guide the creation of such tools and embed writing analytics tools in HDR education presents challenges for all who wish to follow this avenue.

## 2.1 Higher Degree Research & Research Writing

Doctoral education is undergoing significant contemporary change (Aitchison et al., 2012; Boud & Lee, 2009; Catterall et al., 2011; Green, 2009), with many pressures emerging: shorter completion times (i.e. 3 year periods are the norm); government policy influences on doctoral practices (Kiley, 2011); the globalisation of the knowledge economy (Carter, 2011; Danby & Lee, 2012; Green, 2009); the massification of doctoral education and an increase in doctoral students (Nerad, 2020); and an emphasis on publishing research (Jackson, 2013). These changes have led to scrutiny in research accountability, quality assurance, doctoral graduate outcomes and research publication outputs (Aitchison et al., 2012; Badenhorst & Guerin, 2016; Jackson, 2013; Kiley, 2011), and as such have increased pressure on all involved: institutions, supervisors and students. What is significant about these changes is that they have led to even greater demands and expectations of doctoral students, who are expected to publish while undertaking their doctoral degree rather than the more traditional approach of writing papers after they graduate (Aitchison et al., 2010; Lee & Kamler, 2008). Commensurately, there is increasing pressure on supervisors and institutions to address writing as part of research literacies (Badenhorst & Guerin, 2016). While public policy requires institutions to use publication rates as measures of research outputs and performance, doctoral pedagogical support has not substantially improved with supervision still the dominant mode by which students learn research writing (Kamler & Thomson, 2014). These changes mean that

more support or intervention is needed for supervisors and students when developing and learning scholarly writing.

### 2.1.1 Diversification of higher degree research students

If these demands were not already high stakes, the diversity of doctoral candidates is growing (Kiley, 2018) due to factors such as an increase in international higher degree research (HDR) students and the growth of new professional doctoral degrees (Aitchison & Guerin, 2014). This increase of new doctoral degrees along with the increasing diversity of HDR students calls for additional writing support initiatives. One study has shown that students with English as an additional language struggled with coherence, developing an argument, and incorporating ideas from multiple authors and developing their voice (F. Hyland, 2016). Others have reported that students have linguistic difficulties with tenses, limited vocabulary and grammar (Bitchener & Basturkmen, 2006; Dong, 1998; Qian & Krugly-Smolka, 2008). Identifying and learning complicated linguistic practices is a challenge for many HDR students (Aitchison et al., 2012). However, research writing is more than just linguistic ability. Industry professional candidates who have returned to university after a number of years, and have not engaged in scholarly academic writing, also find it difficult. While equipped to write technical reports, undertaking a literature review where an argument is presented, critical appraisal is necessary, and synthesising various authors, is an overwhelming task for most professional doctorate candidates, let alone those who may have English as an additional language.

Increasing numbers of distance HDR students mean alternative methods of providing writing support should also be a priority for universities. External doctoral students face more challenges than on-campus students. They are more likely to face “social isolation, lack of accountability, self-doubt and loss of motivation” and have low self-esteem and low self-confidence (Kozar & Lum, 2013, p. 133). Lindner, Dooley, & Murphy’s (2001) study on the differences between on-campus and distance learners in knowledge, skills, and abilities, found that students studying on-site had higher perceived abilities in research skills such as organising information, synthesis and written expression than distance students. They also note that on-campus students had better written expression than the distance education students. Although these challenges are present, online writing support for external HDR students is limited. However, Covid-19 saw universities

invest more in online technologies and provide research writing support online such as online boot camps and webinars on research writing.

### 2.1.2 Students' research writing experiences

While HDR students are important knowledge makers in this new global knowledge economy, limited research exists on HDR students' research writing practices. HDR students not only contribute to institutions' research outputs, they are also an avenue of revenue, as each HDR completion in Australia provides that university with government funding. However, "we still know relatively little about the teaching and learning practices of students and supervisors vis-a-vis doctoral writing" and "relatively little about how doctoral students actually learn research writing" (Aitchison et al., 2012, pp. 435–436). Barnacle and Mewburn (2010) together explain that "much of what the candidate learns, particularly about research practices, remains hidden" (p. 440), expanding to say that "approaches to research candidate professional development need to be informed by an understanding of how both knowledge and the candidate themselves are being situated within research contexts and practices" (p. 442). And while Aitchison et al. (2012) called for this much needed information, limited research has explored *how* HDR students learn research writing. And it is the recent and current changes in HDR cohorts, and their current learning contexts that make it imperative this much needed information is explored. Only then can research writing support models be improved.

Studies that do exist explore what helps students learn thesis writing (Odena & Burgess, 2017) and the factors that impede or enable students' thesis writing process (Lindsay, 2015). Most of the literature on HDR concentrates on supervisor feedback (Carter & Kumar, 2017; Paré, 2010, 2011), students' doctoral journey (McAlpine, 2012), students' experiences in writing groups (Aitchison, 2009, 2010; Kumar & Aitchison, 2017) and identity formation (Barnacle & Mewburn, 2010; Coffman et al., 2016; Cotterall, 2011b, 2015; Mantai, 2019). Studies that have explored students' research writing practices have found that research writing is challenging and full of emotion (Aitchison et al., 2012; Burford, 2015, 2017b; Cotterall, 2011a; Russell-Pinson & Harris, 2019; Starke-Meyerring, 2011). Burford (2017a) argues that doctoral writing should be explicitly examined through an affective-political lens, in particular to understand how doctoral students feel and their emotional context when engaged with the practices of doctoral writing in the context of contemporary changes to doctoral education (see 2.1). Burford (2017a) claims that this approach provides a more complex lens to examine doctoral

writing as it enables researchers and practitioners to question what “burdens of writing in the current context may be, both for the learning and development of students, and for their own wellbeing” (p. 26). Cotterall (2011a) concluded from her study that framing research writing as a practice would help students increase their knowledge of research writing and enhance their research writing skills. Acknowledging the gaps in research writing and doctoral education, Pat Thomson and Helen Kara have created the *Insider Guides to Success in Academia*, a series of pocket books that provide advice and guide research students on the challenges faced during candidature authored by experts on the issues. Odena and Burgess (2017) argue that students’ diverse backgrounds and the complexity involved in academic writing needs to be taken into consideration when teaching doctoral writing. Both Aitchison et al. (2012) and Starke-Meyerring (2011) argue that a more systematic approach to research writing development is needed in doctoral programs. More recently, Burford et al. (2021) call for a re-imagining of doctoral writing. The editors seek to rebalance the traditional focus on “the pragmatics of “what works” in doctoral writing policies, practice, and pedagogy” by exploring “different tools and approaches that might enliven our ideas of what doctoral writing may be and how it might be researched” (p. 6). Yet, even within mainstream pedagogical approaches to research writing, to date, there is still relatively little attention paid to students’ research writing practices, and significant debate remains regarding best practice systemic approaches to supporting HDR students in becoming proficient scholarly writers.

### 2.1.3 Research writing features

Writing is both a reflective practice and a social practice; a conversation between the author and the audience, where knowledge and meaning is produced. While HDR students know how to write, many still find research writing difficult (Aitchison et al., 2012; Catterall et al., 2011; Cotterall, 2011a). It is common for them to view writing as a set of skills; applying grammatical rules, punctuation and structure. It seems they may not

realise that they are writing for their discourse community<sup>2</sup>. This means that they often ‘do writing’ without knowing or understanding the writing process. The increase of ‘how to write your thesis’ guide books reinforces this notion that writing is a skills-based problem (Kamler & Thomson, 2008), mistakenly illustrating to students that writing is simple and linear, a “straightforward process conduit for thought” (Kamler & Thomson, 2014, p. 4), and can be fixed quickly. They go on to state that viewing research writing as a skill-deficit problem leads to viewing students as those who do “get it” or do not “have it” instead of looking at the institutional context of their writing (Kamler & Thomson, 2014, p. 4).

Quality scholarly writing involves more than just understanding and applying grammar rules. Scholarly writing involves rhetorical insight; understanding the audience and providing appropriate cues to facilitate understanding (see section 8.1.2 for more information on rhetorical moves). Rhetorical understanding is necessary for creating and disseminating knowledge (R. Murray, 2010; Tardy, 2005). However, understanding this rhetorical nature of research writing is challenging for HDR students. They may lack rhetorical awareness, as students are unfamiliar with disciplinary writing conventions and are unaware of their audience (M. A. Maher et al., 2014), and this lack of rhetorical awareness is particularly difficult for international students (Paltridge & Starfield, 2007). The rhetorical complexity of the dissertation is also a challenge for HDR students (P. Thompson, 2016), as they are now expected to write for their discipline’s discourse convention. Despite this expectation, most HDR students do not have the expertise in applying the discipline discourse convention in their writing, and few HDR students have the experience of writing for an academic audience (Torrance et al., 1992). This lack of experience impacts both thesis writing as well as publication writing. Studies examining the publication rates of PhD students in tourism and hospitality, and psychology indicate that students seem to not be publishing and when they do, they may not be publishing in high quality venues (Carr & Hayes, 2017; Evans et al., 2018). The quality and quantity

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<sup>2</sup> Swales (1990) defines a discourse community is a group of members that have a common goal, where members use mechanisms of communication to communicate their goals. A discourse community has discursal and genre expectations where there are shared, specialised lexical terms and members have discursal expertise.

of publications reflects students' lack of experience in publishing which suggests that there is an overall issue with research writing across publication and thesis.

#### 2.1.4 Summary

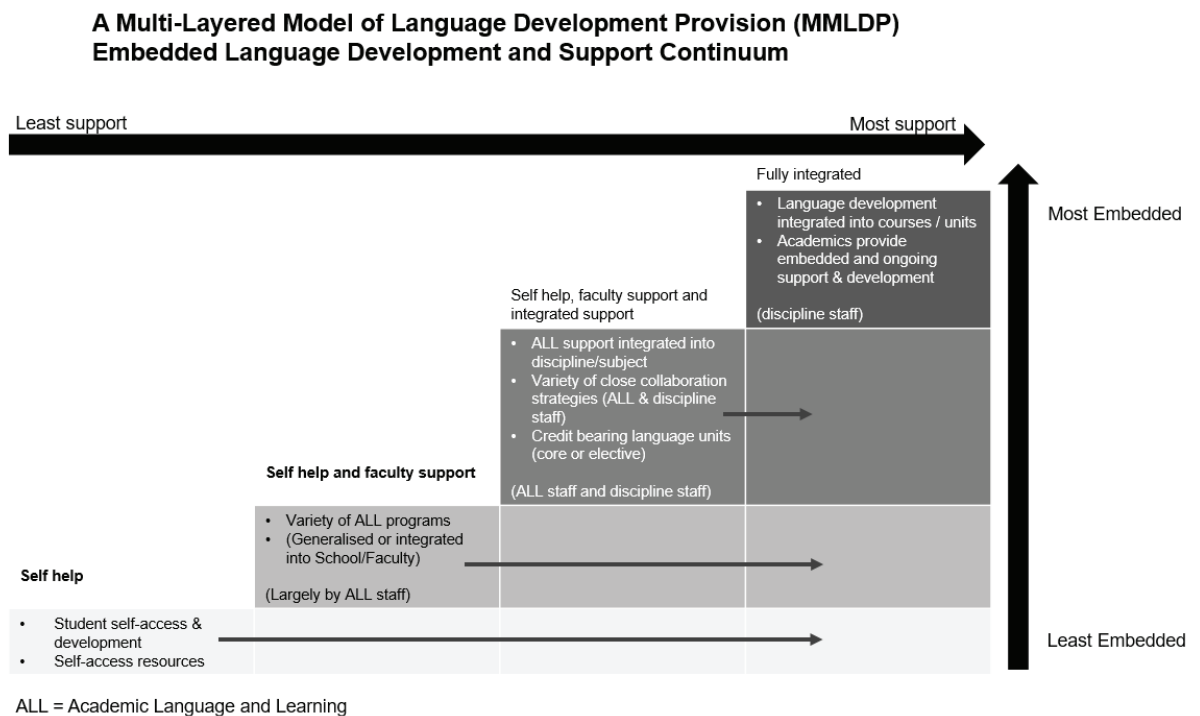
HDR education has undergone significant changes in a globalised knowledge economy where knowledge is commodified and driven by economic demands. These demands have led to an increase in HDR enrolments worldwide, the creation of new doctoral programmes, and an increased emphasis on publication as a key measure of research quality. Despite all these factors, little attention has been paid to research writing development in HDR programs or on HDR students' research writing practices. This research is urgently needed as institutions, students and supervisors are now expected to publish and compete in the knowledge economy, yet HDR students find research writing difficult. This increased pressure to publish means that more support is needed on developing and learning scholarly writing.

## 2.2 Institutional Research Writing Support

Government funding linked to research outputs and timely completion has created further institutional pressure to ensure students' timely completion. Meeting institution's administrative deadlines for timely finish can cause feelings of frustration among students, particularly when they require more time to finish or achieve their personal standards (Emmioğlu et al., 2017). Universities provide generic doctoral support as they strive for improved doctoral completion rates. However, not providing adequate support in research and research writing, especially when students need it can cause feelings of exclusion from the academic community (Emmioğlu et al., 2017). Therefore, providing multiple opportunities of research writing support for students is of importance.

Australian universities provide their own version of generic HDR writing support with different structures and programs which are generally not compulsory. Yet, there has been little discussion of the development, practice (Carter & Laurs, 2014) and impact of generic doctoral pedagogy, and limited explicit pedagogical frameworks exist for HDR writing support (Link, 2018). Therefore, for institutions wanting to develop a successful HDR writing program, information or evidence on what strategies would be useful in designing and implementing HDR research writing programs is difficult to identify. Other academic language development models exist to help think about how language

development can be supported. For example, Briguglio and Watson’s (2014) Multi-layered Model of Language Development Provision (MMLDP) (Figure 2.1). While such models focus on undergraduate programs and coursework units, there is no such model for HDR writing. The HDR context is far more complex as there are greater differences such as widely varied development needs, a lack of formal credit bearing courses, and varied interaction dynamics between ALL educators, discipline experts, and the student.



**Figure 2.1 – Reproduced from Briguglio and Watson’s (2014) Multi-layered Model of Language Development Provision (MMLDP)**

Information on research writing pedagogies and interventions are scattered throughout the literature and in various disciplines with little to no evaluation of the effectiveness of research writing interventions. The variety of research writing support interventions reported in the literature can be categorised into three approaches: (1) writing workshops, (2) writing groups, and (3) individual consultations. However, most evaluations reported in the literature addresses writing groups, with relatively little focus on academic workshops, and less again regarding individual consultations.

### 2.2.1 Writing workshops

Most Australian universities offer ‘bolt-on’ writing support programs for HDR students, typically run by Academic Language and Learning (ALL) educators who specialise in the genres of writing used within different disciplines. They are generally offered by learning support centres or centralised HDR departments. Bolt-on programs are defined as extra-curricular skill courses that are not embedded within a discipline or degree and are not compulsory. These programs are valuable for doctoral students as this generic bolt-on support can complement the supervisory practice by providing additional support and development for novice research writers (Carter & Laurs, 2014). This combined approach allows the ALL educators to “sustain the writing process”, by providing workshops on grammar, rhetorical strategies and ‘how to write’ sessions in parallel to supervisory support (Carter, 2011, p. 725). However, this non-embedded nature can be problematic because the programs are often seen as unimportant or unnecessary (Carter, 2011) by students and supervisors.

The majority of bolt-on writing programs are centralised and available to all students, while others are faculty/school specific, or created for similar disciplines. For example, the University of Technology Sydney’s (UTS) centralised Academic Literacies Program provides ‘how to workshops’ on a range of writing genres, for example writing introductions, as well as providing workshops on thesis organisation and structure. In contrast, prior to 2018 Queensland University of Technology (QUT) provided a bolt on writing program, that was faculty specific, not entirely generic and provided novice researchers at the start of their PhD journey a place to engage with their discourse community (Gonano & Nelson, 2012). Little literature exists on the impact between centralised research writing programs and faculty-specific writing programs. However, it appears that faculty specific workshops are generally better attended than centralised workshops (Guerin, 2014). Guerin (2014) suggests that this higher rate is the result of students feeling that the content, while generic, is focused on their discipline needs. Her account demonstrates the need for bolt-on research writing programmes to be connected to students’ discipline and discourse community for students to perceive the usefulness of the workshops.

Embedded, compulsory writing workshops within HDR programmes are scarce in the Australian context. If they do exist, reporting of such programmes is limited. Although writing initiatives embedded within doctoral and higher research degree courses occur



predominantly in North American universities, detailed, discipline-specific research writing courses are still not generally included in the graduate curriculum at research-intensive universities (Leak et al., 2015). This evidence of poor writing support once again raises the question as to why HDR writing support is limited, considering that effective scholarly writing is crucial not only for research students but also their supervisors and institutions. Without mastering scholarly writing skills, research students limit their opportunities for successful careers in academia and research.

### 2.2.2 Writing groups

Writing groups, writing circles and writing retreats allow HDR students to come together to write, share their writing, critique and provide feedback on each other's work, and learn more about the writing process itself (Aitchison & Guerin, 2014). 'Shut up and write' sessions have been employed in universities to motivate students to write with their peers and foster camaraderie among HDR students (Mewburn et al., 2014). In addition to bolt-on workshops, writing groups have become a strategy to help develop students writing and increase writing productivity (Aitchison & Guerin, 2014). Receiving feedback on writing is an important part of research writing and the writing process, which is why writing groups have been shown to improve writing and produce better quality text (Aitchison, 2010; Aitchison & Guerin, 2014).

The valuable opportunities these writing groups provide for research students are based on a developmental approach to learning research writing grounded in the regularity of peer interactions and learning through the meetings. Evidence of this developmental approach is provided by Guerin et al. (2013) in a two-year run writing group where English as an additional language students reported their grammar and vocabulary improved. Notably, Guerin et al. (2013) found that native English speakers also "became more aware of the language itself", examined their work more closely and were "more aware of the need to make ourselves understood by a linguistically diverse audience" (p.70). Writing groups also provide students a place where they can learn more about the various elements involved in research writing. In Aitchison's (2009) study of writing groups students reported they learned numerous and various aspects of writing from grammatical features of writing to style, structure, building an argument, writing for your audience, and to behavioural aspects of writing. These students indicated they also learned to write through critiquing the texts of their peers, and so providing further evidence of the rich landscape where students gain a deeper understanding of texts.

While texts and language are the focus of writing groups, they also facilitate the building of community. Writing groups are a safe place for students to come and share their challenges with research and research writing. They provide a supportive environment for students to express their emotions, feelings and phobias of writing (Ferguson, 2009), and it appears this kind of space is needed while studying a research degree where most environments students engage in are high stakes, full of expectations and competition. Students want spaces where there is “less pressure to perform and a greater emphasis on support and empathy” (Aitchison & Mowbray, 2013, p. 865). Writing groups help students build their confidence (Aitchison & Mowbray, 2013), overcome isolation (Guerin et al., 2013), and develop their identity (D. Maher et al., 2008), serving to help students with their writing, as well as the emotional aspects of candidature.

There is no one way to conduct a writing group. Writing groups need to be malleable so they meet the needs of its members (Aitchison & Guerin, 2014). While some writing groups are semi-facilitated or student led (Kozar & Lum, 2015), they are typically facilitated by ALL educators, which raises the question of sustainability of writing groups – having multiple groups and meeting regularly. Kumar and Aitchison (2017) however have developed a program where the issue of sustainability resolved. Their centrally run Doctoral Writing Course train and mentor students to facilitate their own writing groups within their faculty, and then go on to facilitate the course itself. This initiative demonstrates how writing groups can operate beyond a centralised model.

### 2.2.3 Individual consultations

One of the ways that institutions provide additional feedback to students is through individual consultations with ALL educators also known as ALL advisers. Although most institutions provide one-on-one writing support for HDR students, evaluation of the effectiveness of this intervention is limited, and in fact, is under-reported across all degree levels, due to “‘practitioners’ lore’...that advisers learn incidentally in the course of conversation rather than collecting them by methods recognized as research” (Chanock, 2007, p. 4). One such study that did evaluate its HDR one-on-one writing support intervention found that individual consultations developed students’ writing confidence, improved students’ drafts, improved their research writing skills such as developing sentences and linking ideas, and improved their self-editing skills (O’Mahony et al., 2013). Similarly, Ma’s (2019) study of individual consultations (including consultations paid by students) revealed that students one-on-one consultations increased students’

confidence, improved English language skills, and improved students' research writing as they were able to identify weaknesses in their writing. In her study, Ma also discovered students accessed one-on-one support because their needs were not met in research writing workshops or credit-bearing writing courses. These studies together establish that one-on-one writing support is perceived to be valuable by HDR students since the personalised feedback they receive is targeted to their individual needs as well as provided developmental writing support over time. However, not all universities provide such a service and as seen in Ma's study, even when the service is provided, it is not always accessible to students. The one-on-one consultations provided at the university where this study took place were not widely advertised to HDR students, nor easily accessible with only one adviser available to all the research students. This limited resource could be due the expensive nature of providing such support despite the reported benefits for students. This raises the question of quality education vs cost. Individual consultations with ALL advisers is a scarce resource, which means that additional writing support is needed.

#### 2.2.4 Supervision

Supervisors are integral in the doctoral process. They provide expert knowledge, help students think critically about their subject and help enculturate students into their discourse community. Essentially, supervisors are "writing teachers" as they provide "feedback, questions, suggestions, and instruction" (Paré, 2011). However, supervisors more often than not, do not have the time, writing expertise or pedagogical training to assist their students in the writing process (Aitchison et al., 2012; Catterall et al., 2011). Studies have shown that supervisor feedback can be unclear and difficult to understand (Paré, 2010, 2011). Nonetheless, supervision is still the main method for teaching writing and educating students (Aitchison et al., 2012; Kamler & Thomson, 2014). While some supervisors are confident helping students in the writing process, many are not (Catterall et al., 2011). Many supervisors themselves were not taught 'how to write', and have learned implicitly, making it difficult for them articulate this tacit knowledge (Aitchison et al., 2012; Paré, 2011). When Aitchison et al. (2012) asked supervisors how they taught students to write, many found it hard to answer, with Aitchison et al. (2012) suggesting that supervisors own writing practices had become so routine that it was unnoticeable, making it hard for them to consider their own writing practices. While most institutions provide supervisor research training, research writing is an area that is not extensively

covered in such programmes which consequently offer limited support to supervisors regarding how to develop students' research writing skills (Guerin et al., 2017).

Research on academics' writing practice is limited, and that which is available focuses on publication outputs, rather than how the writing is developed and produced (Kempenaar & Murray, 2016). Such research could help to shed light on potentially successful research writing processes and strategies. However, it will be important to link such research with an investigation of how it can be linked to strategies for developing student writing. While supervision is the primary way HDR students are taught scholarly writing, limited research exists on this practice. In addition, little is known about HDR students' process of writing a thesis. Additional research is needed to understand the student-supervisory relationship when it comes to scholarly writing so that institutions can provide resources, suggestions and other forms of writing development to support supervisors and students.

### 2.2.5 Summary

This section has shown that limited research is available on HDR writing and research writing pedagogy. More research in these areas would help institutions, supervisors and ALL practitioners develop better writing support models and interventions to develop students' scholarly writing. While, supervisors are the primary teachers of research writing, many of them struggle to teach research writing to their students, and students find research writing challenging. Although institutions provide research writing support in the form of workshops, writing groups, and individual consultations, new innovative solutions are needed to assist both students and supervisors in the learning and teaching of research writing. The next section describes how a technological approach can provide a new form of research writing support.

## 2.3 Learning Analytics

Learning Analytics (LA) is a rapidly expanding research area of Technology Enhanced Learning (TEL). The increased use of TEL tools has provided access to user data with opportunities to explore students' learning processes. LA focuses on the "measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimising learning and the environments in which it occurs" (SoLAR, 2021). Most learners in higher education now use an online platform to

complete learning activities and interact with course learning material which allows learners' interactions to be captured and stored. This data can be analysed to "identify patterns of learning behaviour that can provide insights into education practice" (Gašević et al., 2015, p. 64) and can "suggest ways in which educators can make improvements" (Long & Siemens, 2011). Applications of LA have been used to model student behaviour, predict student performance, increase student reflection and awareness, predict student dropout and retention, improve assessment and feedback, and recommend sources (Papamitsiou & Economides, 2014). As the use of LA becomes more widespread across higher education new innovative applications can be used to support HDR students in their learning.

While LA aims to enhance student learning, student-facing solutions are limited to LA dashboards that focus on improving engagement, academic performance, and retention. The majority of these dashboards have been used in undergraduate contexts, with few applied in the HDR context. And only a small number have focused on student writing. A criticism of such dashboards is that there is still a lack of empirical work on their effectiveness and the little empirical research that does exist demonstrates that LA tools that are developed are not theory driven, especially tools that provide feedback (Gašević et al., 2015). Therefore, one of the priorities of my research was to develop a theory driven writing analytics tool that helps develop HDR students' research writing skills. The remainder of this section of the literature review will critically review the writing analytic tools available.

### 2.3.1 Writing analytics

Writing analytics is a sub-domain of learning analytics that focuses on supporting student writing practices. Writing analytics measure and analyse written texts to gain deeper insights into student writing processes and products to improve the teaching and learning of writing (Buckingham Shum et al., 2016). It uses natural language processing (NLP) techniques to analyse language in texts (written or spoken) using a variety of computational techniques including both rule-based and machine learning methods (see next section). These analyses can then be used to explore textual features that illuminate the *writing process*, and the *written product*. Once validated, such textual analyses can be automated, and delivered as an online service to students via feedback tools. While writing analytics is a new field within learning analytics, a range of tools (from research prototypes to commercial products) provide different services, including essay scoring

and formative feedback. For the purpose of this review, these tools will be discussed under the broad category of *automated essay evaluation*.

### 2.3.2 Automated essay evaluation tools

Automated Essay Evaluation (AEE) tools use computational methods to evaluate and score written prose (Shermis et al., 2013; Shermis & Lottridge, 2018). The most prominent form of AEE tools are automated essay scoring (AES) systems to assess the quality of texts and provide a numeric score. Examples of these systems include *E-Rater* developed by the Educational Testing Service (ETS) and *IntelliMetric* developed by Vantage Learning. These systems are predominantly used in high stakes summative writing assessments and are utilized by large-scale testing services to score standardised tests such as, the university Graduate Record Examination (GRE) (Dikli, 2006) and the Test of English as a Foreign Language (TOEFL). Such systems use machine learning techniques, whereby learning models are trained with texts that have been graded by expert human raters (Dikli, 2006). Numerous studies have reported high levels of agreement between human raters and the AES systems, with the level of agreement similar to that of two human raters (Warschauer & Ware, 2006). AES systems are used in these contexts as an alternative to human graders, as they offer a cost effective and time efficient method for scoring large scale assessments. While these systems provide cost effective measures, critics argue that that AES systems devalue the “power of writing” as students would feel that they were only writing to the machines (J. Wang & Brown, 2008). Other critics argue that AES dehumanise both writer and reader, as they “insidiously silence students’ voices” and the texts are not worthy enough of human readers (Drechsel, 1999, p. 385), especially for students who write essays as part of university entrance assessment as they expect a human reaction to their writing.

In contrast, Automated Writing Evaluation (AWE) tools analyse student writing and generate instant feedback on students’ texts (which may include indicative scores) so that students can revise their texts and improve their writing. Different AWEs provide different forms of feedback, including textual reports and visual annotation of the text. For example, *E-rater* is used within *Criterion*, a web-based application that scores and provides automated formative feedback on essay writing based on grammar, mechanics, word usage, discourse structure and style (Burstein et al., 2004). *Criterion* also allows students to plan and then produce as many drafts as they want receiving automated feedback along the way. It also provides users with definitions of the feedback,

explanation of the errors detected and examples of correct and incorrect use. *Criterion* is predominantly used in K-12 classrooms, but is also used in higher education contexts. Similarly, *MyAccess!* uses *IntelliMetric* to score essays and provide feedback on rhetorical organisation, language use and style, grammar, and spelling (Vantage Learning, 2003). *MyAccess!* also contains a translator, a multilingual dictionary and thesaurus, and provides students with multilingual feedback.

Studies on these two tools have shown promising results when it comes to improving student writing. One study using *Criterion* explored 6<sup>th</sup> to 12<sup>th</sup> grade students' revisions from first to final essay submission, and found that essay scores, error rates and use of discourse elements improved in subsequent drafts (Attali, 2004). The results imply that the students were able to understand and apply the automated feedback they received. Similarly, a study investigating English as a Foreign Language (EFL) college students' self-correction using *MyAccess!* found that students' writing scores improved as well as language use, style and organisation (Chou et al., 2016). Students were able to utilize *MyAccess!* feedback and improve their subsequent drafts. These studies suggest that automated feedback tools have the capacity to improve student writing.

AWEs encourage students to write drafts, as they provide more opportunities for deliberate practice. More sophisticated AWEs also provide writing instruction through a variety of ways in addition to automated feedback. For instance, *Writing Pal* which focuses on adolescents learning to write persuasive essays, uses animation to first teach writing strategies to students, who then practice those strategies learned through game-based learning. *Writing Pal* provides students with strategy instruction through nine modules which are based on writing instruction research, and expert writing educators and researchers (Crossley et al., 2016). Each module focuses on specific phases of the writing process: prewriting, drafting and revising. Next, during the writing practice students receive both formative and summative feedback: the essays are given a rating from poor to great on a six-point scale and are given formative feedback that focuses on strategy-based solutions. *Writing Pal's* AWE system assesses texts on cohesion, rhetorical style, language use, and linguistic sophistication (McNamara et al., 2013).

Numerous studies have been conducted to determine whether *Writing Pal* is beneficial for students. One study used a pre and post-test study to explore changes in essay quality (Roscoe et al., 2014). The study found that the students' post essay scores increased when assessed by both AWE system and human rating. The post-study essays were better

structured and more developed, with less repetition and more lexical diversity. The same study also looked at students' perceptions of the game-based instruction and the automated feedback, with the majority of students reporting that the games were helpful in practising the writing strategies and that the automated feedback was useful. However, they do note that some students found the feedback difficult to understand and had difficulty in revising their essays. These findings show that automated feedback along with writing instruction is effective in developing students' writing practices as well as improving the quality of their writing, but with differential effects depending on students' abilities.

Another AWE tool *OpenEssayist*, also provides feedback on university student essays by extracting key phrases and summaries. Through these two extractions, *OpenEssayist* then provides feedback on the essay's key words and phrases, identifying the most representative sentences, and providing feedback that encourages students to reflect on what they have written and whether they have or have not expressed their central ideas (Whitelock et al., 2015). Drawing on graph theory, *OpenEssayist* also trialled the use of 'rainbow diagrams' as another form of visual feedback to illustrate how sentences and concepts are connected to each other in an essay (Whitelock et al., 2014). The rainbow diagram shows the connectedness between sentences by allocating each sentence with a coloured node and a line that connects each node. The nodes are linked together when the same word/s are present in both sentences. The colour of the nodes changes slightly in the rainbow spectrum with the beginning sentence coloured violet and the last sentence coloured red. *OpenEssayist's* rainbow diagram illustrates how different forms of visualisations can be used to provide feedback to students.

A study exploring how undergraduate students used *OpenEssayist* reported that students preferred particular analytical features (Whitelock et al., 2015). That is students preferred the key words and key sentence feature which highlight the key concepts used in the essay. When it came to receiving feedback, students preferred highlighted text of key words and then highlighted key sentences, instead of having both highlighted at the same time. These preferred features demonstrate that the students were most interested in the key concepts they expressed and the structure of their essay. The students reported that they found these features useful because it allowed them to check the essay structure, check their reference back to the essay question, identify repetition, and determine whether any concepts needed more emphasis if they did not appear in the feedback. These



findings imply that automated feedback can help facilitate reflection in the writing process as students went through a checking process.

In a different study *OpenEssayist*'s rainbow visualisation was trialled to see if users could understand explanations about the rainbow diagrams and match the rainbow diagrams to specific essays: was the feedback helpful in understanding the structure of a good essay and could it be used to improve writing? (Whitelock et al., 2014). The participants reported that they learnt more about the structure of good essays and how the connectedness of concepts in essays could be improved based on the visualisations. Their trial did not include undergraduate students, instead mainly with teaching and learning staff and doctoral students, which demonstrates that automated feedback on writing is a promising avenue of writing support for higher degree research students.

Similarly, *Glosser* (Villalón et al., 2008) provides feedback on the connectedness of university students' essays using text mining techniques and Latent Semantic Analysis (LSA). LSA analyses the relationships between terms in a document by looking at their distribution and co-occurrence. For example, identifying the most to the least important concepts covered in the text. Using these techniques *Glosser* provides feedback on structure, coherence, and topics. The feedback is based on the Measuring the Academic Skills of University Students (MASUS) criteria: Use of Source Material, Structure and Development of Answer, Control of Writing Style, Grammatical Correctness, Qualities of Presentation (Bonanno et al., 2007). In the *Glosser* interface, each feedback section (structure, coherence, topics) also generates trigger questions to prompt students to reflect on their writing. For example, in the feedback on *coherence*, the question *Do you understand how each paragraph and sentence follows from the previous one?* is posed along with the analytical feedback showing breaks in the coherence of the writing (O'Rourke, 2010). *Glosser* uses this method of question prompts and identified features of writing (through analytical techniques) to help students with the writing process in the three feedback sections of the system. While *Glosser* aims to support students in their writing process, it has been only evaluated on validating the significance and relevance of the analytical features (the gloss) with question prompts. The authors state that to determine the impact of *Glosser* on students learning and writing, an in-depth evaluation of students using the tool as part of their learning activity is required.

While seemingly constructive and interactive, the main criticism of AWE systems is that they are not able to understand and evaluate essays in the same way that humans do. It

has been argued that since these systems are programmed they cannot evaluate the intrinsic qualities of an essay such as meaning, purpose and argumentation (Condon, 2013; Deane, 2013). Critics argue that they focus on surface level and generic features of writing which may encourage students to pay attention to those features rather than on meaning and communication. This argument rests on the fact that AWE systems neglect the social and communicative dimensions of writing, in particular, that writing is a socially situated practice. Writing is a social act in the sense that it takes place in a social realm as writers engage in dialogic communication that is entrenched with ideologies, power and identity (Chapetón Castro & Chala, 2013). The argument is that AWE neglects this element of the writing process since students are writing to a computer program for feedback on their form of writing, rather than to influence a human, thus distorting the rich and complex practice of writing. For instance, students may modify their writing to replicate the formulaic features of a text so that they receive the highest score, but lack “meaningful engagement with active readers” (Cheville, 2004, p. 51).

Further criticism has centred around the ways AEE tools may promote gaming the system, where students focus on certain text features known to give a good score, and consequently produce an illogical essay, but still receive the maximum score (Powers et al., 2002). Another criticism is that they only focus on the essay genre, when students are expected to produce many different types of texts during their schooling and university years. Opponents of AEE tools have even argued that such tools may replace teachers’ evaluation entirely (Cheville, 2004). Further criticism is that these tools do not take into account theoretical and pedagogical perspectives of writing, in particular AWEs that are created by commercial companies such as *Criterion* and *MyAccess!* The research focus of these commercially developed tools has been on psychometric issues and technical aspects such as their scoring capabilities and their validity against human scorers (Warschauer & Ware, 2006), with little to no research focusing on how AWE tools can support students’ writing process and develop student writing (Cotos, 2015).

While, these products provide holistic scoring and formative feedback, instructional guidance and pedagogical applications of such tools in the teaching and learning of writing has not been considered nor studied extensively. For example, although Attali’s (2004) study found that students’ overall essay scores increased, error rates decreased and students revised their drafts according to the feedback provided by *Criterion*, out of 33,171 student submissions, only 9604 submitted their essay more than once for

feedback, indicating that the tool was not improving repeated revision practices among most students. These low submission rates suggest that perhaps the implementation of the tool was not effectively integrated in writing instruction. Little information on how the tool was implemented in the classroom is provided, down-playing the importance of the teacher and learning design in creating the right context for such tools to make the most difference. Chen and Cheng (2008) established in their study that autonomous use of *MyAccess!* with minimal teacher instruction caused frustration and hindered student learning of writing. They found that students perceived using *MyAccess!* more favourably when it was used in the early stages of drafting and revising along with teacher and peer feedback at the later stage of the writing process. They stress that human facilitation should not be absent when using AWE tools in writing instruction and that teachers should understand the limitations of the tool along with students' learning context and needs. Therefore, successful implementation of AWE tools requires carefully designed writing pedagogy so that it exploits the affordances that AWE tools have to offer and is used effectively.

Proponents of AEE accept the argument that AEE tools cannot evaluate writing like humans, but argue that they are still valuable in the teaching and learning of writing. As AEE tools focus on specific text features such as structure, appropriate language use and grammar, these tools can be used to “support practice to build fluency and control in text production processes” (Deane, 2013, p. 18). Proponents of AEE tools, like Deane (2013, p. 18) argue that when they are used to identify students who need to “improve the fluency, control, and sophistication of their text production processes” or provide those students with the “opportunity to practice and increase their fluency while also learning strategies that will decrease their cognitive load” then the argument for AEEs is sound. However, if the tools are used to assess meaning, purpose and quality of argumentation then use of the tools is unfounded. While critics of AEE tools claim that these tools will replace human evaluation, it would be in these circumstances where human evaluation would be required. Attali (2013, p. 195) proposes that we take a “division of labour” approach where AEE tools are used to complement human evaluation; AEE tools are used to measure certain constructs of writing, while human evaluation focuses on higher-order writing skills and deeper features of writing such as purpose and audience. Warschauer and Grimes (2008) confirm this notion and state that AEE tools are most useful in assisting students in reducing mechanical errors in their texts and in doing so allow

teachers to pay more attention to content and style. By taking this approach and understanding the strengths and limitations of the AEE tools, they could be used in more innovative ways to help develop and support students' writing practices.

There is an additional range of arguments and evidence that AEE tools can help develop student writing practices and increase their motivation. For instance, AEE tools can increase school students' motivation to write and revise (Grimes & Warschauer, 2010). Providing scores and automated feedback offers opportunities for deliberate practice where students may be motivated to improve their drafts based on their scores before submitting their work for feedback from their educators (Kellogg & Raulerson, 2007). Submitting writing to AEE tools prevents feelings of being judged personally as the feedback is anonymous and impersonal, and allows students to repeatedly submit their drafts until they feel comfortable enough to hand in to their teachers (Weigle, 2013). Receiving immediate feedback on multiple drafts provides students with additional writing support as teachers often do not have time to review and provide feedback on multiple drafts. Ultimately, AEE tools can be used assist the teacher with writing instruction, provide feedback at scale and foster student writing practice through automated feedback.

### 2.3.3 Freely available AWE tools

Free AWE tools are also available for students to help them with their writing. These tools use NLP techniques to provide feedback on grammar, sentence structure, vocabulary and style. These tools are often web-based or are downloadable and act as plugins for word processors. Some provide a premium version for a cost. Examples of such tools include *Grammarly* (<https://www.grammarly.com>), *Writefull* ([www.writefull.com](http://www.writefull.com)), *The Writer's Diet* (<https://writersdiet.com>) and the *Hemingway Editor* (<https://hemingwayapp.com/>). These tools offer students automated feedback on various aspects of their writing. For example, *Grammarly* provides feedback predominantly on surface level features such as grammar, the *Hemingway Editor* provides feedback on wordy, complex sentences and provides a readability score, and *The Writer's Diet* "calculates the fitness" of texts based on five grammatical categories (Sword, 2015). While these tools are readily available and provide feedback on writing, the feedback is quite general and they are not necessarily designed to provide feedback on research writing. The one tool that comes close to providing research writing feedback is Writefull as its analytics is based on trained journal articles and its "edits are tailored

to scientific writing” (Writefull, 2022). Critics of these tools argue that they do not take into account the “social contexts of writing”, remove students from the “community in which they are learning to write” and consider writing as “text” (Benzie & Harper, 2020). Additionally, limited research exists on the effectiveness of these tools when it comes to improving the quality of students’ writing and their texts.

#### 2.3.4 Research writing AWE tools

While the tools discussed above focused on the textual features of essays, several tools exist that analyse the specific textual features found in research writing. These tools provide annotations of the communicative stages, also known as rhetorical moves, at the sentence level that appear in the text. A rhetorical move is a string of text that performs a specific communicative function (Swales & Feak, 2009). An example of such a tool is *SAPIENTA* which identifies the communicative stages of biochemistry and chemistry research articles, which they call Core Scientific Concepts (CoreSCs) (Liakata et al., 2012). The CoreSCs that *SAPIENTA* is able to recognise include *hypothesis, motivation, goal, object, background, method, experiment, model, observation, result* and *conclusion*. *SAPIENTA* has the potential to assist research students with their research writing, but it is currently not used in a pedagogical context. Instead, *SAPIENTA* has been used to extract summaries of articles to provide a more detailed summary than an abstract (Liakata et al., 2012). On the other hand, *Mover* has been experimentally tested in a classroom setting to determine if it helps develop students’ research writing (Anthony & Lashkia, 2003). *Mover* is a text analysis tool that annotates research article introductions based on Swales’ Create a Research Space (CARS) model (1990) (see section 8.1.2 for a detailed explanation). In the study students were able to annotate the discourse features of published research articles more quickly with the help of *Mover* vs. doing it by hand without *Mover*, and students were able to analyse structural and discourse features of their own abstracts more quickly with the help of *Mover*. However, the experiment was only conducted with six graduate students and not within a HDR research writing program. Another limitation of *Mover* is that it does not provide actionable feedback for its users. While the tool shows students the moves they have written, it does not provide feedback on the moves that are missing and how to achieve those moves in their writing.

In contrast, *SciPo* does provide actionable feedback to support Brazilian Computer Science PhD students with their thesis writing. *SciPo* also analyses rhetorical structures and aims to support computer science students in writing the abstract and introduction

sections of theses. In particular, it assists students to write more informative abstracts so that readers can identify quickly the research aim and its novelty. *SciPro* analyses Portuguese academic texts on “schematic structure, rhetorical strategies and lexical patterns” (Feltrim et al., 2006). *SciPo* contains four sections: *Abstracts Case Base*, *Introductions Case Base*, *Rules and Similarity Measures*, and *Critiquing Rules*. The Abstract and Introduction Case Base includes annotated abstracts and introductions describing rhetorical moves and lexical patterns that students can refer to when they are writing. Rules and Similarity Measures uses pattern matching based on similarity rules among a list, so that students can search for specific schematic structures. The Critiquing Rules provide feedback on students text based on four rules: content critiques (absence of moves/components), order critiques (occurrence order and order deviation), content suggestions and order suggestions.

*SciPo* appears to be a useful tool to help novice scholarly writers with their abstract and introduction writing in Portuguese, however its effectiveness to help students with their research writing has not been fully evaluated. Although, Feltrim et al. (2006) set out to evaluate the effectiveness of the critiquing feature, they only evaluated *SciPo* with four Masters of Computer Science students who had recently finished their dissertation. In an experimental setting, the students rewrote their dissertation abstracts using *SciPo* and were then asked to complete a questionnaire. The questionnaire revealed that the students had a positive experience using *SciPo*, considered the tool useful and would use it again in an authentic situation. Three of the four students reported that the critiques and suggestions were relevant. To determine if *SciPo* improved the quality and structure of the rewritten abstracts, an expert in academic writing analysed the original abstracts and the *SciPo* rewritten abstracts. The expert found that the rewritten abstracts were more informative than the original abstracts. However, the expert did not classify them as better quality than the original abstracts as other writing problems were present, for example grammar. This experiment shows that writing analytic tools like *SciPo* are useful to help develop students’ research writing. However, a major limitation of this study is the lack of participants, similar to the experiments conducted with *Mover* (Anthony & Lashkia, 2003). More participants are needed to fully assess the effectiveness of the tool.

The most advanced, and widely used, AWE tool that has been created specifically to develop students’ research writing is the *Research Writing Tutor* (RWT) (Cotos, 2016). *RWT* uses NLP techniques to compare student writing against a corpora of published

research articles. This makes *RWT* more sophisticated than the other tools reviewed, since students can compare their drafts to published research articles in their discipline. Similar to *Mover* and *SciPo*, *RWT* also detects rhetorical moves based on Swales' CARS (1990) model.

*RWT* contains 3 modules: a *learning module*, a *demonstration module* and a *feedback module*. The learning module explains the genre of research writing and uses a corpus of research articles to define and explain research writing moves, as well as provide suggestions and examples. The demonstration module shows how the moves learned in module 1 appear in research articles, and the feedback module allows students to receive automated feedback on rhetorical conventions in their writing. The automated feedback consists of two levels: macro and micro. The macro-level feedback looks at the rhetorical composition of the writing and colour-codes the moves present in the submitted draft. In addition to the colour-coding of moves, the students' drafts are compared to research articles from *RWT*'s corpus where numerical feedback is given in the form of pie charts, and range bars summarise the distribution of moves contained in the draft. The micro-level feedback focuses on the rhetorical intent of the sentences within the moves, and is interactive. Students are asked questions and are given comments about their sentences which they can disagree or agree with by clicking on the 'thumbs down/up/neutral' buttons. Students are also able to make notes about the feedback given which they can export along with automated comments.

Studies investigating how *RWT* impacts research students and their writing have found that the automatic feedback influenced students' revision process, helping them to develop new strategies while focusing more upon the rhetorical composition of their drafts (Cotos, 2012). However, Cotos (2012) does note that some students relied heavily on *RWT*'s numerical feedback in achieving the average percentage in their discipline. Another study reported that 80% of students believed they had learned genre moves via the tool, and 77% said they could put into practice what they learned from *RWT* (Cotos, 2016). The same study also found that students' drafts improved extensively from their first drafts to their last drafts. Cotos and Huffman's (2013) user study reports that students found the feedback helpful and that it encouraged self-reflection on their writing. Ramaswamy (2012) studied the usability and usefulness of *RWT*'s feedback, reporting that the feedback helped students think about and analyse their writing. These studies strengthen the argument that automated feedback can help students learn rhetorical

conventions of research articles, facilitate reflection and revision, develop students' research writing skills and improve the quality of their writing.

### 2.3.5 AcaWriter

While traditional AEE tools identify grammatical errors, discourse structure and topic-relevant word usage, *AcaWriter*, similar to the research writing tools, provides automated feedback on rhetorical moves. *AcaWriter* was created to help develop students' academic and reflective writing. *AcaWriter* uses a rhetorical parser that identifies sentences that signal rhetorical moves drawing on Swales' (1990) genre analysis and Hyland's (2005) metadiscourse framework. A rhetorical move is a string of text that conveys a communicative function (Swales, 2004) (see section 8.1.2 for more information). The rhetorical moves include phrases and sentences that signpost to the reader important aspects of the text, for example, the author's position, and the purpose of a text. To identify the rhetorical moves *AcaWriter* uses a rule-based approach. This approach involves creating a hand-crafted system of rules based on linguistic structures, discerned by a linguist, from close analysis of representative texts (note that this is in contrast to a machine learning approach such as used by *RWT*). In the case of *AcaWriter* the rules are based on a concept matching framework (Sándor, 2007) which represents metadiscourse cues of defined rhetorical moves that are instantiated in syntactically related constituent concepts in sentences (see section 8.4 for a detailed explanation). *AcaWriter* identifies the following rhetorical moves: *Background*, *Contrast*, *Emphasis*, *Novelty*, *Question*, *Surprise and Trend*.

Several studies have been conducted testing the efficacy of *AcaWriter* in the teaching and learning of writing in different learning contexts, including pharmacy reflective writing (Gibson et al., 2017), legal essays (Knight et al., 2018) and business reports (Shibani, 2019). To study the perceived usefulness of *AcaWriter*, Shibani (2019) placed students in two different conditions when it came to a revision activity. One group used *AcaWriter* to revise a draft that was provided, while the other group revised the draft without the use of *AcaWriter*. The revised essays were then graded by a subject expert. The study showed that students who used *AcaWriter* perceived the revision activity more useful than those who did not use *AcaWriter* and the revised essays that used *AcaWriter* scored higher than those that did not use *AcaWriter* (Shibani, 2019). Similar results were also seen when *AcaWriter* was used in an Accounting unit; many students who used *AcaWriter* found the activity useful and students who completed the *AcaWriter* activity received a higher grade



in an essay assessment task than those who did not complete the *AcaWriter* activity (Shibani, 2019). These findings indicate that *AcaWriter* is a valuable tool when it comes to developing student writing. Shibani, et al. (2022) also report the impact of *AcaWriter* on the quality of student writing, demonstrating that those students who engaged more deeply with its feedback, scaffolded by an annotation and reflection activity, produced higher quality final submissions. While a direct causal link is not established, they propose that this is plausible evidence of the importance of student's *automated* feedback literacy, an extension of the broader notion of *student feedback literacy* proposed by Molloy, et al. (2020).

While *AcaWriter* has been investigated for essay and report writing in undergraduate contexts, and reflective writing in post-graduate course work subjects, its potential to develop research writing skills has yet to be established. Establishing how *AcaWriter* could be improved specifically to guide and support HDR students with their research writing is a major contribution of this research.

### 2.3.6 Summary

AWE tools like *RWT*, *Writing Pal*, and *AcaWriter* can foster student writing, and as seen with *RWT*, *Mover* and *SciPo* they can also develop students' research writing skills. However, more research is needed to validate their effectiveness in higher education classrooms and at scale. Similarly, few studies have investigated how AWE tools can be used effectively to help higher degree research students develop and improve their writing to produce quality research writing. These are advanced tools emerging from research labs, which have not been widely available in a robust form for universities to adopt until recently (with the open source release of *AcaWriter*).

Most studies on writing analytics and AWEs investigate their technical performance, which while important, does not illuminate the contributions of writing instruction and writing pedagogy, which together define the learning experience. If the aim of LA is to have a better understanding of learners and their learning processes to support learners, then this is an important research gap. While the AWEs mentioned above are designed for the classroom, little research has been conducted on how AWEs are used by students and teachers, and if there is an impact on student writing in the long term. Additionally, limited research exists on how effective AWE tools are used as a pedagogical tool in the teaching and learning of writing. How they are actually used remains to be investigated.

Therefore, investigating how research writing pedagogy can help design writing analytics and AWE tools, and, developing an understanding of how students learn research writing, has been a priority of my research.

## 2.4 Learning design

Learning design is the process of designing for learning, i.e., the tasks, resources, and learner interactions planned to address targeted learning outcomes. A learning design describes the learning experience and includes: the learning activities devised by the teacher; how students interact with each other and the teacher during the learning activities, and the learning resources used throughout the learning experience. Learning designs can present a teaching and learning process for one session or an aspect of learning (see Goodyear et al., 2006) or can present the entire learning and teaching process for a semester. While there is no uniform way to present learning designs, learning designs contain three core elements: resources provided to the learners to assist them in completing the tasks; tasks that learners are expected to undertake; and support mechanisms provided to help learners engage with the tasks and resources, this includes teacher interaction and learner interaction, for example discussion moderation or peer feedback (Lockyer et al., 2013). Learning designs are expressed in artefacts that document the design process, which can be a model, description, pattern or template. Learning designs encapsulate the “broad picture of a series of planned pedagogical actions rather than detailed accounts of a particular instructional event” (Lockyer et al., 2013, p. 1142). The artefact of the learning design, therefore, is the representation and documentation of a teaching and learning process that uses a notational form so that the design can be shared, adapted, or reused by an educator for their learning context (Agostinho, 2006).

### 2.4.1 Learning design and learning analytics

While learning designs provide a representation of the teaching and learning process, they do not identify whether students are engaged in the design during implementation. Lockyer, Heathcote and Dawson (2013, p. 1440) state that “learning design establishes the objectives and pedagogical plans, which can then be evaluated against the outcomes captured through learning analytics”. This is where learning analytics and learning design can come together to provide a more complete view of how the learning activities are impacting learners. Lockyer et al. (2013) propose the idea of checkpoint and process analytics to inform the learning design outcomes and to facilitate action. Checkpoint and

process analytics allows educators to evaluate their learning design in context with real time data on how learners are engaging in the learning environment. Checkpoint analytics provides an overview of students' access to the resources outlined in the learning design, while checkpoint data does not reveal insight into students learning processes, checkpoint analytics does give teachers a broad overview of students' access to the resources and their progression through the learning tasks. In contrast, process analytics provides educators with direct insight on how students are processing information and applying knowledge in tasks that students are required to complete as part of the learning design. These two analytics applied together provides a richer understanding of how students are learning which in turn gives teachers another way to evaluate the effectiveness of the learning design.

However, HDR learning presents a challenge: How do we align learning analytics to a learning processes that may have varied or limited learning design, or create such designs in tandem with supportive analytics? Learning design that aligns student facing learning analytics and writing analytics in HDR contexts is limited. Beyond the HDR context, most learning analytics is teacher focused, with dashboards providing the most common form of student-facing learning analytics, indicating to students their progress in a course (Arnold & Pistilli, 2012). However, these approaches build on relatively structured sequences of learning undertaken by cohorts of students with an instructor. Therefore, it is not clear how dashboard based approaches could be adapted to the HDR context, which is inherently less structured, with more diffuse social interactions. While some learning design patterns exist for student-facing LA and writing analytics tools (Kitto et al., 2016; Shibani, 2019), none have been used in teaching researching writing, and in conducting my literature review I have yet to find any other learning design framework, model or pattern for incorporating writing analytics tools into a pedagogical approach aiming to improve research student writing practices.

For LA tools to be used effectively and improve students' outcomes, educators should also be involved in the development and implementation of such tools. Bakharia et al. (2016, p. 329) argue that a "knowledge gap" exists for teachers and educators attempting to "bridge the divide between the information provided by learning analytics and the types of pedagogical actions designed by teachers to support student learning". To address this gap Bakharia et al. (2016) proposed a conceptual framework where the teacher plays crucial a role in bringing context to the learning analytics, analysis of the data, and making

decisions on its possibilities, for example how feedback is provided to learners and the modification of the learning design. Therefore, it is important for educators and teachers to be involved in the integration of learning analytic tools in the classroom as they provide pedagogical knowledge of how best to integrate the tool to support student learning.

Kruse and Pongsajapan (2012) provide an example of this integration, by presenting the idea that to make learning analytics about learning students could be a co-interpreter of their data, where students are aware of their own actions, and use that data to reflect on and potentially change their behaviour. They proposed that inquiry based learning, an established pedagogical approach could be used as a framework to map learning analytics to student learning activities. In this approach the learning activities would be developed around learning analytics which would help students to ask questions about their learning and guide them on a path of inquiry with activities that help discover their own metacognitive strengths and weaknesses. Consequently, making students active learners rather than passive learners. A similar approach has been considered in this research where the writing analytics is mapped to the students' learning activities.

Therefore, to effectively implement writing analytics to develop students' research writing, the learning design used to integrate writing analytics in the learning and writing process must be carefully considered. Warschauer and Ware (2006, p. 169) argue that "any classroom innovation, and especially those using technology, will likely have its best effect if it is fully integrated into instruction". An example of writing analytics integration in the classroom can be seen in Shibani et al.'s (2019) Contextualizable Learning Analytics Design (CLAD) model in which learning design and learning analytics are integrated to provide contextualised support for learners. This model has been implemented in undergraduate coursework units where the writing analytic tool, *AcaWriter* was aligned with the unit's assessment rubric, co-designed with the unit educator. Their empirical studies found that students had an increased perceived usefulness and understanding of the intervention and automated feedback compared to an early study where *AcaWriter* only provided general feedback on student writing. By aligning the activities and automated feedback to the unit's assessment rubric students found the automated feedback useful in improving their writing for their subject. Therefore, just providing technology for the classroom does not mean that the technological tools will have meaningful uptake from educators and/or students or a meaningful outcome for students. The technological tool and learning design must be

aligned for meaningful outcomes and uptake. On that note Wise (2014) argues that if learning analytic tools are to have a meaningful impact on teaching and learning, then the design of how these tools will impact educators and learners should be taken into account to support the effective implementation of learning analytic tools. Mangaroska and Giannakos (2019, p. 516) stress that to do this a framework should be developed “to capture and systematize learning design data grounded in learning analytics and learning theory, and document what learning design choices made by educators influence subsequent learning activities and performances over time”. One way to do this is by developing learning design patterns and design principles for student facing learning analytics, like *AcaWriter*.

#### 2.4.2 Summary

Learning design provides documentation of teaching and learning processes. Learning analytics captures student learning data. Combining these two components together would allow for greater insight into students’ learning processes and another way to evaluate the learning design. While learning design and learning analytics are compatible, a framework that aligns the two fields together is necessary for them to be effective. This means that if LA and writing analytics tools are to be used to assist and develop student writing then a learning design model must be incorporated in research writing pedagogy. However, no such learning design model or framework exists in aligning writing analytics tools with research writing pedagogy. Learning design patterns that align with research writing pedagogy were therefore developed to document how *AcaWriter* could be implemented into HDR workshops, and evidence based learning design principles for a HDR writing analytics tool were also developed as per research question three. In this research the learning design patterns take form of conjecture maps (Sandoval, 2014) and is explained in more detail in Chapter 3. The final design principles and design framework developed for writing analytics tools for HDR contexts are presented in section 10.4.3.

#### 2.5 Conclusion

This literature review examined the themes of doctoral education and research writing, institutional research writing support, learning analytics, and learning design. This review has shown that limited research exists on research writing development in HDR programs, HDR students’ research writing practices and research writing pedagogy. Writing the thesis is one of the greatest writing challenges that HDR students will face during their

candidature. This challenge is twofold. First, it is likely the first time that a HDR student will have to write a 60,000+ word document. And perhaps more importantly, the complexity of the rhetorical task is a significant, and likely new, challenge for HDR candidates. I argue that it is imperative to understand how students learn research writing and their research writing practices as this information can help institutions and practitioners develop more effective learning design for research writing pedagogy, research writing tools and interventions that could help them in this process. Due to the ongoing pressure faced by institutions, supervisors and students, I argue that new innovative solutions are needed in the HDR programs to support and develop students' research writing. Learning analytics, in particular writing analytics, are a potential approach to provide research writing support. Therefore, this research created additional features to the writing analytics tool, *AcaWriter* to develop students' research writing skills.

While this review found AWE tools that have been used to help develop HDR students' research writing, more research is needed to validate their effectiveness in HDR contexts, especially in Australian HDR programs where credit bearing writing courses do not always exist. However, best practice approaches for using writing analytic tools to enhance research writing pedagogy are not currently well understood. It is argued here that learning design patterns and principles that embed writing analytics tools into research writing pedagogy is an effective approach to document how *AcaWriter* is implemented into HDR workshops.

Overall, this chapter suggests that further investigation is needed in HDR students' research writing experiences and that new innovative solutions are needed in research writing development and support. The next chapter discusses the research approach and methods used in the design, implementation and evaluation of *AcaWriter* for the purposes of supporting HDR students to learn research writing.

# Chapter 3: Research Methodology

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This chapter discusses the research approach and methodology of this research. It begins by introducing the learning context that the research was conducted in and restating the aim of this research. The chapter then describes the Design Based Research (DBR) approach and articulates why such an approach was taken. Next, it situates this research as a mix-methods study within the DBR approach. An overview of the DBR stages of this research are introduced, followed by the data collection strategies and analysis. Finally, the ethical considerations of this research are also discussed.

## 3.1 Learning context

This study is situated in a higher education institution in Australia where most research writing programs are ad hoc, offered only a few times during the semester, and not always compulsory. The main research writing program offered to all students at this university consisted of ‘how to workshops’ focused on different aspects of research writing, for example, ‘writing introductions and conclusions’. These workshops were centrally run and held once a semester, and then again during the semester break where all the semester’s workshops were combined over three days. Overall, workshops were held four times a year. In addition to the centrally run program, some faculties ran their own writing workshops and other faculties included credit bearing compulsory writing courses in their HDR programs. While other institutions around the world offer compulsory course work research writing programs, this inconsistent approach to research writing development means not all students’ needs are being addressed. That is, there is no standard model for HDR writing support across faculties, and since students do not all have the same writing needs, there are challenges in identifying the specific needs of HDR students, creating programs to support them, and evaluating these programs. Therefore, the aim of this research was *firstly, to investigate HDR students’ research writing experiences, and secondly, to design, implement and evaluate AcaWriter in the development of HDR students’ research writing at an Australian university.*

### 3.2 Design Based Research

DBR was first presented to educationalists in the early 1990s as ‘design experiments’ by Collins (1992) and Brown (1992), that applied methods from the design sciences to systematically design and study new technologies in authentic educational environments rather than the more controlled, artificial environments of laboratory settings. As such, DBR facilitates the investigation of complex educational phenomena in naturalistic contexts through a series of methodological approaches (Barab & Squire, 2004). It strives to enhance “the impact, transfer, and translation of education research into improved practice” and “stresses the need for theory building and the development of design principles that guide, inform and improve both practice and research in educational contexts” (Anderson & Shattuck, 2012, p. 16). With a strong emphasis on collaboration with practitioners in real-world contexts to solve real-world problems with innovative solutions, DBR aims to produce new “theories, artefacts, and practices” that can potentially impact learning and teaching in real-life contexts (Barab & Squire, 2004, p. 2). This is done through systematic iterative testing, evaluation and refinement (of both the design principles, and the innovative solution they generate) which is then used to inform future design, development, and implementation choices (Reeves, 2006).

DBR contains both a practical and theoretical focus. It strives to improve educational practice by understanding how learning occurs in context (Collins et al., 2004). It does this by first identifying an educational problem, then designing and implementing iterative cycles of an intervention to address the problem, and concludes with design principles, guidelines and theories of learning. This process is emergent and consists of four distinct phases (Herrington et al., 2010):

- Phase one involves the **analysis of a practical problem**. In this phase the educational problem is explored with both practitioners and researchers, so that the full scope of the problem is known, instead of solely being understood by the researcher.
- Phase two includes the **development of solutions** informed by literature, existing design principles and technological solutions. Existing literature is examined to locate theory, design principles and technological innovations that have addressed a similar educational problem.



- Phase three involves **implementation and evaluation** through iterative cycles of testing and refinement. Evidence is obtained to evaluate the effectiveness of the intervention. The evidence can be both quantitative and qualitative. After the evidence has been analysed modifications are made to the intervention so that it can be improved and further evaluated in the next iteration. Evaluation, analysis and modifications are repeated for each iteration.
- Phase four involves **reflection to produce design principles**. After the cycles of implementation, evaluation, and improvement of the intervention, the whole process is reflected upon to refine and produce design principles that can inform the development and implementation of future interventions.

In DBR the researcher adopts both the role of the researcher and designer. This means that the researcher drives the research, design, and practical implementation (F. Wang & Hannafin, 2005). As DBR is a flexible methodology, the phases presented may be repeated as many times as needed. This cyclic nature of DBR allows for the iterative process of exploration, design, data collection, analysis and refinement. This means that the intervention can be adjusted until the solution to the educational problem has been reached. This flexibility takes into account the ‘messiness’ of authentic learning environments, as DBR emphasises characterising situations rather than controlling variables (Barab & Squire, 2004).

### 3.2.1 Justification for using the DBR approach

It is this four phase approach of DBR that enables researchers to design, implement and evaluate an innovative solution for the complex, messy problem of HDR writing support and development. Research writing in the HDR context is complex, and messy, demanding the design of innovative approaches that both support and develop students’ research writing. In this case, I propose the extension of AcaWriter to support and develop students’ research writing (see section 2.3.5 for information on AcaWriter). The DBR approach enables researchers to investigate (phase 1) the educational problem so as to more effectively design innovative solutions (in phase 2), in this instance extensions to the AcaWriter tool. DBR supports iterative cycles of testing the learning design and the tool in authentic contexts, exploring how students use and benefit from the tool, and then refining the tool (phase 3). Hence, this approach facilitates the implementation and

evaluation of AcaWriter so that learning design features and design principles are documented and systematically improved. As DBR focuses on producing theoretical and practical insights, it allows researchers to reflect on the entire process to generate design principles that inform future work (phase 4). It is DBR's flexible, iterative, systematic approach that justifies investigating students' research writing experiences (research questions one and two) and designing, implementing and evaluating AcaWriter as a potential approach to support and develop HDR students' writing (so helping me to respond to research question three).

### 3.3 Learning design and conjecture mapping

As mentioned above, DBR requires that design principles are documented, tested and refined through each iteration. These can take a variety of formats, including learning design patterns (Goodyear, 2005), heuristic statements (J. van den Akker, 2010) and conjecture maps (Sandoval, 2014). In this research, conjecture maps were chosen as they illustrate the mechanisms that explain how design features can bring about particular effects, processes or outcomes (Bakker, 2018). Conjecture maps begin with a *high-level conjecture* which is a theoretically principled idea of how to support learning or achieve a particular learning goal. This conjecture is then *embodied* in the design, which includes a specification of tools, materials, activity structure, participant structure and discursive practices. The design features are anticipated to generate *mediating processes* also known as *mechanisms*, which include interactions and activities that lead to the desired intervention *outcome*. Documenting the design features can lead to insights about “how form and content of interventions contribute to the learning of teachers (theory of change) or students (theory of instruction)” and “without such insight there is no theory of improvement” (Bakker, 2018, p. 56). A conjecture map is a helpful methodological tool as it explicitly shows the link between design features and the intended mechanisms and outcomes, as well as guides the systematic testing of the innovation. Throughout the iterations of my interventions, I use conjecture maps to illustrate not only the learning design but show how they have evolved during the iterations (see Chapter 9). I use heuristic statements to document AcaWriter's initial design principles (section 7.4) and its development (10.4.3).

### 3.4 Mixed-methods approach

This DBR study used a mixed-method design, combining both qualitative and quantitative research methods to answer the research questions. Combining the two methods allowed for triangulation, which provides a more in-depth investigation of the research problem and phenomenon through multiple perspectives (Jick, 1979; Teddlie & Tashakkori, 2010). Qualitative approaches allow for deep exploration and insight of a problem, and even when the data sample is small, qualitative approaches can yield rich data and insights. In contrast, quantitative methods are used to generate numerical data so that attitudes, opinions and behaviours can be generalised, but quantitative data do not provide explanations as to what the results mean. A mixed-methods design bridges the divide between the two approaches as the strengths of each approach can make up for the limitations of the other (Creswell & Plano Clark, 2018), which is the reason this method was chosen in this study.

The data collected for this study was gathered during the three phases of the DBR process. Quantitative data consisted of Likert-scale and multiple-choice questions from survey responses, pre/post-tests scores, logs of students' interaction with AcaWriter, and student interaction data of the online course, automatically recorded on the Canvas<sup>3</sup> platform and H5P<sup>4</sup> interactives. Qualitative data included open-ended survey questions, students' writing drafts submitted to AcaWriter, a focus group and semi-structured interviews. The focus group and interview data were audio-recorded and transcribed verbatim. Collecting data from multiple sources provides a more comprehensive understanding of how automated feedback tools impact student writing and how they can be used to support research students with their writing needs. These methods were used at different times throughout the study. Explanations of each method are detailed in section 3.6.

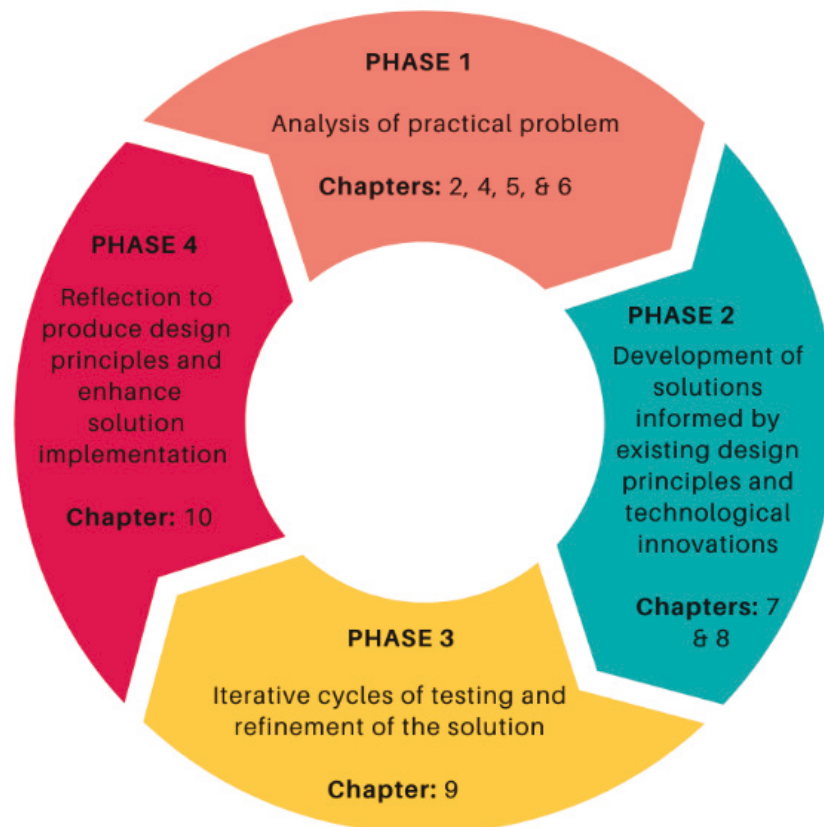
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<sup>3</sup> Canvas is a Learning Management System (LMS) that provides engaging, online, learning experiences through the use of interactive learning tasks.

<sup>4</sup> H5P is an open source interactive online tool that creates interactive content and activities that can be embedded in an LMS.

### 3.5 Design Based Research Sequence

Figure 3.1 presents the four phase DBR process that was followed in this research. The four phases are then discussed and details the studies conducted for each of the phases. Section 3.6 outlines the data collection strategies and section 3.7 presents the data analysis methods used throughout the studies.



**Figure 3.1 – The DBR sequence for this research**

#### 3.5.1 Phase One: Analysis of practical problems by researchers and practitioners in collaboration

A literature review was first conducted in this phase to understand the issues involved in research writing, as discussed in Chapter 2. Then, to further understand the issue from students' perspective an online survey was administered to research students. The survey was also used as a needs analysis to explore what kind of support students needed and to identify gaps in support. An explanation of how the study was administered and its findings are presented in Chapter 4. A longitudinal study was also conducted as part of this phase for a more in-depth understanding of students' research writing experiences,

discussed in Chapter 6. In addition to student perspectives, supervisors and graduate writing staff were interviewed to elicit their views on HDR research writing and are presented in Chapter 5.

### 3.5.2 Phase Two: Development of solutions informed by existing design principles and technological innovations

This phase consisted of developing initial design principles for the writing analytics tool and the intervention. The initial design principles were developed by synthesising findings from phase one of the DBR process and are presented in Chapter 7. The design of the tool and intervention was theory-driven drawing on literature from genre-based pedagogies, cognitive writing approaches, and best feedback practices. This theoretical framework is presented in Chapter 8.

### 3.5.3 Phase Three: Iterative cycles of testing and refinement of solutions in practice

In this phase the intervention with the writing analytics tool and learning design was trialled with HDR students and refined in response to their feedback gathered by interviews, surveys, observations and design reflections. Overall, in this study four iterations were conducted which included: the pilot conducted in iteration one; a one-off introduction workshop in iteration two; the intervention embedded into existing HDR workshops; and an online course. Various methods were used to evaluate the intervention and writing analytics tool which included: semi-structured interviews, surveys, revision analysis, and engagement and interaction data from AcaWriter and the online course. Phase three is discussed and explored in Chapter 9.

### 3.5.4 Phase Four: Reflection to produce design principles and enhance solution implementation

Finally, in phase four, the whole design and implementation process was reflected upon to produce final design principles and recommendations for the future design and implementation of a writing analytics tool for HDR students. The design principles and the recommendations are discussed in Chapter 10. In this phase implications of the findings from phase one to phase three are also presented as well as recommendations.

## 3.6 Data collection strategies

### 3.6.1 Surveys

Surveys were used throughout the study, for both exploratory purposes and for evaluation post intervention. As phase one was exploratory in nature an online survey was administered to gain a snapshot of how research students were learning scholarly writing, for example, what tools were they using and what websites they were visiting to help them with their research writing (Chapter 4). An updated version of the survey was also administered pre-workshops to gather more data about the research student cohort. Post intervention (for iterations 2 – 4), students were asked to complete a survey asking them to what extent the tool help them with their research writing and their perspectives of the tool.

### 3.6.2 Pre/post tests

Pre and post-tests were conducted in the first iteration, at the start and end of the workshops to measure student understanding of rhetorical moves after interacting with the writing analytics tool. A more detailed discussion on how pre and post tests were used in the study is provided in Chapter 9.

### 3.6.3 Logs of automated feedback requests and drafts

Interaction data was collected from the writing analytics tool for iterations 1 (9.2.3) and 2 (9.3.3). This included:

- frequency of individual students' request for feedback
- individual students submitted drafts
- revisions made to each submitted draft (revision analysis)

These data were collected so that I could see how the students were using the writing analytics. For example, how many times they requested feedback and what kinds of revisions were made to their texts. Students' drafts were collected via the AcaWriter to investigate students' uptake of the automated feedback and how their revisions impacted the quality of their writing.

### 3.6.4 Canvas and H5P Interaction data

An online course was created in iteration 4 as an additional approach to combat the educational problem. To explore if the online course's learning design was effective and appropriate for learning research writing, interaction data from the canvas site and H5P activities were collected as observation data. Interaction data via the canvas platform automatically records students' participation in learning activities. This data was collected so I could see how the course was being used and what activities the students were participating in. This data is further discussed in Chapter 9, section 9.5.

### 3.6.5 Focus group

As I wanted to explore participants' perspectives and experiences of the workshop and AcaWriter, a focus group was conducted at end of the first iteration (see Chapter 9). Focus groups are useful when exploring an issue, as they aim to elicit individuals' opinions, perspectives and understandings (Galloway, 2019). The fact that focus groups allow for discussion between individuals that helps to clarify their opinions and generate richer insights on the varying perspectives and experiences of the participants (Morgan, 1993). In other words, deeper insights are accessible, as the individuals are able to share and compare their experiences, by agreeing, disagreeing and asking each other questions, which would not be possible without the group discussion (Morgan, 1997).

### 3.6.6 Semi-structured interviews

Semi-structured interviews were chosen as they provide rich, empirical data about individuals' experiences, beliefs, reflections, and understanding of a phenomenon (Morris, 2015). This form of interview protocol is flexible enough to allow participants to raise issues that are important to them, but that the researcher did not anticipate (Braun & Clarke, 2013). Through the interviews I was able to pick up on non-verbal cues from the participants which allowed me to gain further understanding of the issue and probe for more information. By using this qualitative research method, I was able to gain insight into students' research writing experiences, students' perceptions and use of the writing analytics tool, and supervisors and graduate writing staff perspectives of research writing. In this research semi-structured interviews were conducted throughout the study (i.e. in iterations 1 to 3 of my DBR approach presented in Chapter 9).

### 3.6.7 Longitudinal Study

To gain a deeper understanding of student's research writing experiences and their experiences with supervisor feedback, a longitudinal study was implemented. The students were followed from February 2019 to January 2020. Interviewing participants over time allows researchers to gain insight into individuals' experiences as time moves on and "can uncover greater detail, depth and complexity of meaning of the interviewee's experiences" (Grinyer & Thomas, 2012, p. 3). Through multiple interviews I was able to build rapport and trust with the participants. This allowed the participants to share their challenges during their research writing journey and how they felt about the feedback they received from their supervisors. The students' experiences are discussed in Chapter 6.

## 3.7 Data Analysis

As this study adopted a mixed-methods approach a range of data analysis techniques were used. For the quantitative data, descriptive statistics and frequency counts were employed using excel. Thematic analysis, using an inductive approach was applied to the open-ended survey questions and the interview data. A revision analysis was conducted on students' submitted drafts to AcaWriter.

### 3.7.1 Descriptive statistical analysis

Descriptive statistics and frequency counts and distribution were used to analyse the surveys in this research, the pre and post-test conducted in iteration one, student engagement with AcaWriter in iterations one and two, and student engagement in the online course in iteration 4. The survey and engagement data of the course and AcaWriter were presented as frequency counts and percentages, and were displayed as tables or charts, which can be found in Chapter 4 and Chapter 9.

### 3.7.2 Thematic analysis

Thematic analysis was used to analyse the focus group (iteration 1), semi-structured interviews (iterations 1 to 3) and open-ended questions in the surveys (both the exploratory study presented in Chapter 4 and iteration 4). All the data were coded using NVivo. I first familiarised myself with the data by rereading transcripts and reading over the survey responses for each study, as suggested by Braun and Clarke (2006). I then generated initial codes by identifying segments in the data that I inferred as meaningful



to the phenomenon. While coding during this phase, I took note of repeated codes that formed patterns in the data set. Next, the codes were analysed for broad themes in the dataset. Some themes were extracted deductively, as they related to specific research questions, for example, what barriers did students' face in their research writing. Others emerged inductively, through analysing and comparing each participant's interview transcript to gain a shared understanding of the participants' experiences. Appendix A: Thematic Analysis of Longitudinal Study provides an example of the output of this process.

### 3.7.3 Revision analysis

A revision analysis was conducted in iterations 1 and 2 to examine student uptake of AcaWriter's feedback and what types of revisions the students made. A text comparison tool embedded in AcaWriter was used to analyse each draft submitted to AcaWriter. The revisions were analysed according to a revision taxonomy explained in more detail in Chapter 9 (9.2.3). The revision analysis was also conducted to determine whether AcaWriter's feedback uptake improved the quality of students' texts. Here the first and last draft was analysed according to a revision impact framework explained in Chapter 9.

## 3.8 Ethical considerations

Design-based research involves negotiation between research, the iteration of designs into contexts, and practice, working across multiple stakeholders. My position in this research is as a practitioner with experience of supporting academic writing, researcher and designer conducting this study, and PhD candidate with experiences of writing support and connections to others at the institution undertaking HDR study. Holding multiple roles creates issues as the researcher is "intimately involved in the conceptualization, design, development, implementation, and researching of a pedagogical approach" and therefore "ensuring that researchers can make credible and trustworthy assertions is a challenge" (Barab & Squire, 2004, p. 10). However, others argue that the researcher along with their "biases, insights, and deep understanding of the context" is the "best research tool" (Anderson & Shattuck, 2012, p. 18) as they have insider knowledge. Having multiple roles within this research and being an insider, in particular, being a doctoral student means that power imbalances and ethical dimensions need to be considered: the relationship with student participants and the relationship with supervisors.

### *The relationship with student participants*

Some of the student participants in the research were my peers and so issues of bias, influence, and interviewer effects may have been present. The relationship between several of the participants went beyond the traditional researcher-subject relationship, with some having social contact beyond the study. Sharing the status of a doctoral student meant students felt comfortable talking with me as the researcher about their challenges with their research writing. These relationships can support “familiarity, respect and rapport” (McDermid et al., 2014, p. 29) and provide rich insights, particularly when the topic is sensitive and emotive (Brewis, 2014). However having established relationships can also lead to issues. For example, they may be more forthcoming than they would be if they did not know the researcher (Brewis, 2014) or the participants may not be so forthcoming and in this case provide positive feedback regarding the tool. However, throughout the studies, the design of the interviews was such that particular experiences were explored, that is the participants’ research writing experiences, and their experiences and perception of the tool. This is evident in Chapter 6 where participants shared their challenges with research writing and Chapter 9 where participants felt comfortable enough to share their criticisms of the tool.

### *The relationship with supervisors and graduate research staff*

The supervisors involved in this research were recruited from my network at the institution. These pre-existing relationships can lead to similar issues to those described above, with the additional possibilities of power imbalances and vulnerability between the participant supervisor, and the researcher as a HDR student. This power imbalance introduces the issue of ‘the inferior’ (“non-knowledgeable, insider positions”) and ‘the superior’ and ‘the superior’ (“knowledgeable, outsider positions”) (Råheim et al., 2016, p. 4). During this research there were shifts between these two roles, as I the researcher and PhD candidate was knowledgeable in research writing and the challenges involved, but also an outsider as I am not a supervisor responsible for research students. My insider knowledge of the challenges involved in research writing and as an academic language and learning educator established my status as a ‘superior’ and affirmed the supervisors their right to discuss their supervisory experiences.

The relationship among participants in the study further introduces potential for disclosures between participants, as one of the supervisors interviewed also supervised

three students in the study. These relationships were managed through ensuring that no details regarding other participant's comments or experiences were shared (explicitly or indirectly). The supervisors' privacy were protected throughout the study. Privacy was protected for both parties during the studies and no details were shared with either party.

As a researcher researching my practice, I have a deep understanding of the contextual issues surrounding doctoral education and research writing. Being a practitioner in the field allowed me to build rapport with the staff members interviewed in this research.

The data gathered in this study were approved by the University of Technology Sydney's Human Research Ethics Committee under the ethics applications: ETH17-1819 and ETH18-2835. The most recent participant information sheets and consent forms can be requested by email<sup>5</sup>. The data collected and analysed in this research included survey questions, semi-structured interviews<sup>6</sup>, interaction data using AcaWriter and the online course, and students' drafts. The collection and analysis of these data pose low risks to the participants. The main concern is the potential risk of exposure of their data which could cause discomfort to the participant. To minimise the risk of disclosure participants' confidentiality was preserved by storing digital files on the researcher's password protected machine. Another concern was student intellectual property as they submitted drafts of their research to AcaWriter. Only the researcher and UTS technical staff had access to this data as strict authentication processes were in place. Participant consent was sought throughout this research which provided information about the study. Participants involved in this research were able to withdraw from the study anytime and could request their data to be excluded from the study. All data were de-identified and reported anonymously in publications.

### 3.9 Summary

This chapter has discussed and justified the research design and methodological approach adopted in this research. This chapter has argued that design based research is an effective approach to design, implement and evaluate educational innovation tools as it bridges the

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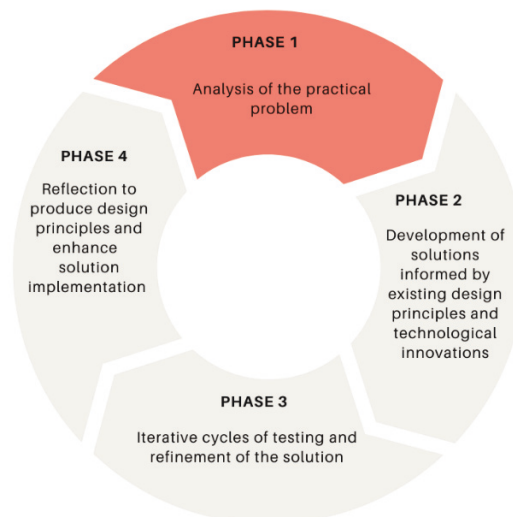
<sup>6</sup> The survey questions and interview schedules for iterations 2, 3 and 4 are provided in the appendices. For iteration 1 the interview questions are presented in the study in 9.3.3.

theory-practice divide. It has described the learning context, data collection strategies implemented, and the data analyses used throughout the four iterations.

# Chapter 4: Learning How to Write About Research - Tools, Resources, Training & Feedback

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This chapter presents the first analysis of the educational problem by exploring HDR students' research writing experiences. Specifically, this chapter provides insight on how students learn research writing that is what strategies, tools, and resources they used when research writing, and what barriers they face in their research writing process.



## 4.1 Introduction

This chapter presents and discusses the findings to research question 1: *How do HDR students learn research writing?* This exploratory first step set out to establish a survey-based snapshot of the linguistic diversity of HDR students at an Australian university, and the electronic tools, websites, books, resources and strategies they were using to assist them with their research writing. As there is limited research on students research writing experiences (see section 2.1.4), in particular how HDR students learn research writing, the survey also sought to identify the kind of revisions they needed to make when they were asked to resubmit manuscripts, from whom they sought help, and the kinds of writing support they thought would be beneficial for HDR students. This chapter also investigated *HDR students' research writing barriers* to gain a deeper understanding of

HDR students' research writing needs. Data were gathered through the online survey platform LimeSurvey.

#### 4.1.1 Methodology

Two surveys were conducted in order to collect as comprehensive a snapshot as possible (see Appendix B: Online Survey Version 1 and Appendix C: Online Survey Version 2 for copies of the survey). The surveys asked students a range of questions from the types of electronic tools, books and websites they use to help them with their research writing, to what kind of revisions were needed to their manuscripts when it was submitted for publication. The first survey was piloted with four students, then it was revised before it was sent to HDR students. As Design Based Research (DBR) is iterative and where data collection materials are evaluated throughout the study, I modified the original survey and two additional questions were added to establish explicitly what it is students struggled with in their research writing process<sup>7</sup>. The two additional questions asked included: what part of the writing process are challenging, for example, drafting, revising, editing, and what features of research writing are challenging, for example, building an argument, paragraph structure, and sentence structure. I anticipated that understanding these challenges would help me to design better interventions and design principles, and so to provide more effective research writing support and development for HDR students.

#### 4.1.2 Participants and data collection

Overall, 46 students participated in the two surveys. Fifteen students participated in the first survey and 31 students participated in the second survey. The first survey was advertised through various channels at the University of Technology Sydney (UTS). HDR students were invited to participate in the survey through an online newsletter dedicated to HDR students, a post on the university's Facebook HDR group where only HDR students from the university are members, an email sent to a student-led HDR group, and through word of mouth. As there was a low participation rate in the first survey, recruitment for version 2 of the survey differed to include students who registered and attended the AcaWriter embedded workshops (described later in Chapter 9) instead of

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<sup>7</sup> The two questions added and the answer options are adapted from Kallestinova's (2017) graduate writing survey.

advertising through the same channels in the first survey. Respondent demographics, research writing experiences, research writing barriers and the type of writing support students perceived as beneficial are presented in the following sections. These findings are then discussed in relation to the literature.

## 4.2 HDR Student Respondent Demographics

Of the 46 students who participated in the online surveys, 61% were female and 39% were male. Most of the students were studying full-time (74%) and 26% were part-time students. These statistics align with those of the Department of Education, Skills and Employment (2019) who report that 68% of HDR students in Australia were studying full-time in 2017 and 32 % were studying part-time, which suggests that the sample is representative of study load, even if N is small. Students aged between 26 to 30 (28%) and 31 to 35 (30%) were the most represented age group. Table 4.1 provides an overview of the respondents' ages. Twenty-seven participants had worked in academia before. The majority of respondents (46%) were commencing students and had been enrolled for less than one year and 30% of students were at Stage 1 (Confirmation of candidature)<sup>8</sup>. Later stage students were less represented in the sample, that is Stage 2 (13%) and Stage 3 (11%).

**Table 4.1 – Respondents age range**

<b>Age Range</b>	<b>Count</b>	<b>Percentage</b>
21 – 25	5	11%
26 – 30	13	28%
31 – 35	14	30%
36 – 40	3	7%
41 – 45	2	4%
46+	9	20%

<sup>8</sup> At this university candidature is divided into stages: Stage 1: Confirmation of candidature, Stage 2: Confirmation of advanced progress and Stage 3: Confirmation of readiness to submit your thesis for examination.

Table 4.2 presents the faculties at the university. The respondents were mostly from the Faculty of Arts and Social Sciences and the Faculty of Engineering and Information Technology. There were no respondents from UTS Business School or the Faculty of Design, Architecture and Building. Two students reported belonging to other faculties with one participant reporting that they belonged to the Faculty of Health and Law. The other participant was an HDR student at an international university but was a staff member at the university. Insight on the respondents' field of study is informative as some faculties may engage more with writing than others. Therefore, it is important to note that their engagement with or lack of writing may reflect their needs and responses in the surveys.

**Table 4.2 – Survey Respondents' Faculties**

<b>Faculty</b>	<b>Count</b>	<b>Percentage</b>
Faculty of Arts & Social Sciences	9	20%
Faculty of Engineering and Information Technology	16	35%
UTS Business School	0	0%
Faculty of Design, Architecture and Building	0	0%
Faculty of Health	6	13%
Faculty of Law	1	2%
Faculty of Science	4	9%
Graduate School of Health	3	7%
Faculty of Transdisciplinary Innovation	1	2%
Institute for Sustainable Futures	2	4%
Connected Intelligence Centre	2	4%
Other	2	4%

Of the 46 survey respondents, 30% reported English as their first language with 70% percent reporting a linguistic diversity of 24 other languages ranging from Oromo, Telugu, Burmese, Italian and Sindhi. Details of the students' linguistic diversity are



outlined in Table 4.3. Overall, these responses demonstrate that this HDR cohort is culturally and linguistically diverse.

**Table 4.3 – Respondents’ first language**

<b>Language</b>	<b>Count</b>	<b>Percentage</b>
English	14	30%
Chinese (Mandarin)	5	11%
Spanish	4	9%
Other	23	50%

### 4.3 Research writing practices and experiences

HDR students have access to a variety of writing tools and the following section establishes the tools, books, websites and resources they were currently using to help them with their research writing. The survey questions were multiple category responses, so corresponding frequency and percentage responses are noted. Questions that were open-ended were analysed to identify common themes in terms of the reasons that students used such tools and resources to learn more about students’ research writing practices. Note, if needed, the responses have been altered to make them grammatically correct.

#### 4.3.1 Electronic Tools

The survey participants were asked to choose from a list of electronic tools in the survey. If they had used tools other than those listed they were asked to provide the name of the tool. An overview of electronic tools used is presented in Table 4.4 and why they used the tools is presented in Table 4.5. The majority of the respondents (87%) did use electronic tools with the most common being Word’s spelling and grammar check (50%), then Grammarly (39%), and Google translate (46%). Respondents reported they used these tools mostly to assist them with their grammar and spelling, as shown in Table 4.5. It is worth noting that most of the tools used were for grammar and spelling, and English language, considering that there is a wide range of electronic writing tools that exist that focus on other features of writing, for example the Hemingway App and The Writer’s

Diet (see section 2.3.3 for more information these tools). While students are using such tools to help them with grammar and spelling, research writing is more than just grammar, as discussed earlier (see section 2.1.3).

**Table 4.4 – Electronic tools used by respondents**

<b>Tool</b>	<b>Count</b>	<b>Percentage</b>
Word (Spelling & Grammar check)	23	50%
Grammarly	18	39%
Google Translate	21	46%
No electronic tools	6	13%
Evernote	4	9%
Other	1	2%
Writefull	0	0

**Table 4.5 – Respondents reasons for using electronic tools**

<b>Purpose for using tool</b>	<b>Count</b>	<b>Percentage</b>
Grammar	26	57%
Spelling	31	67%
English language	16	35%
Expression	8	17%
Clear and readable	8	17%
Note-taking	4	9%

#### 4.3.2 Websites and Social Media

Respondents were also asked to choose which websites and social media channels they mostly used to assist them with their research writing. The majority (74%) did not use web sites or blogs. The Thesis Whisperer was the most used website, however it was only

used by 13% of the survey respondents. Table 4.6 presents the web related resources and respondents' uptake. Other websites and blogs identified were the patter blog, The Professor Is In, James Hayton – PhD, Tara Brabazon, and Xiaomuchong.

**Table 4.6 – Web resources used by respondents**

Web resource	Count	Percentage
No websites / blogs	34	74%
Thesis Whisperer	6	13%
Other	6	13%
#PhDchat	3	7%
Doctoral Writing SIG	1	2%

When asked to explain why they used those websites the respondents claimed that they used them for: *General PhD information, writing guidance and other student experiences*. Reasons why the respondents did not use web resources included: *unaware or unsure of using web related resources* and *confidence with their writing*. These themed responses are the result of the analysis of 46 individual comments across the two surveys.

***General PhD information, writing guidance and other student experiences***

Blogs and websites were used for “advice on common issues faced by PhD students” (Respondent 1). Respondent 27 identified that “I use these websites mostly to understand the PhD process (i.e., the life of a research student, rather than specifics related to the execution of a research project)”. These responses clearly indicate that students are seeking advice and guidance to understand more about the PhD process and suggest that there may be a lack of resources and support available at the institution to help them navigate through candidature. One participant described how they used blogs for information on the examination process, specifically examiner perspectives of writing. Respondent 14 reported that:

*“The blog I subscribe to talks about what examiners are looking for in terms of theoretical framework, for example which is looking at the writing process through the lens of what people want to see evident in the writing - rather than the writer disappearing down research rabbit holes just*

*because they are interesting and marginally relevant to the core questions”.*

Some respondents explained they used web resources to remind themselves that they were not alone in the writing challenges they faced, and looked to other students’ experiences to affirm their feelings. For example, Respondent 25 identified *“using #PhD Chat to help remind me that everyone has problems with writing”*. While another claimed, *“It’s particularly helpful for managing (or at least understanding) stress, knowing that others have faced similar hurdles”* (Respondent 27). These quotes echo that conducting and writing about research is a fraught and difficult process.

### ***Unaware or unsure of using web related resources***

Many of the participants stated that they were unaware of such web resources, claiming, *“I was never told of these websites”* (Respondent 5) or, *“I did not know that they exist!”* (Respondent 20). One participant explained that, *“I did not really get introduced to these tools [websites/blogs] early in my candidature so I just started working without”* (Respondent 10). These responses could explain why many respondents did not use web sites or blogs. They were unaware they existed. Others were unsure why they did not use such websites and blogs to assist them in their writing. It is important to note that while these online resources exist on a wide range of research writing issues and topics, many of the students (74%) did not use such resources which suggests that there needs to be an effective mechanism in place at the university to connect students to these research writing resources.

### ***Confidence with their writing***

Another reason that could explain respondents’ minimal use of web resources is that they saw themselves as confident scholars and had an existing level of confidence with research and writing, and so did not need to refer to them. Respondent 13 and 9 alike, demonstrate a level of *“sufficient proficiency”* and not *“see[ing] the need for them, since I have excellent writing and communication skills. I also have an MA in information management which provides excellent grounding in sophisticated search and retrieval. And as well, who has time to waste on blogs, when you could be writing?”*

### ***Other reasons for not using web resources***

One respondent explained that they read blogs and websites that were specific to their research field, rather than for writing skills. Distracting, waste of time, and a preference

for workshops and face-to-face discussions were additional reasons reported. Other reasons stated included not needing as of yet, not recommended, and lack of time.

### 4.3.3 Books

Books are another source of information about the research writing process, and so questions were designed to elicit what books HDR students are using and why. ‘How to write’ books were the most popular (35%), followed by dictionaries (35%) and thesauri (33%). Thirty percent of the participants reported not using books to help them with their research writing. Grammar books (2%) were least used, where the alternative grammar tools, instead were more accessible. Details of the books used are presented in Table 4.7.

**Table 4.7 – Books used by the respondents**

<b>Books</b>	<b>Count</b>	<b>Percentage</b>
How to write books	16	35%
Dictionaries	16	35%
Thesauri	15	33%
No books	14	30%
Academic writing books	7	15%
Grammar books	1	2%
Other	1	2%

An open ended question asked participants to explain the benefits of using such books. Seven key themes were identified as to why they used books: writing expectations, standards and guidance, style, enhancing vocabulary and expression, understanding, structure and examples. The respondents’ reasons for not using books were also categorised and are presented below.

#### ***Writing expectations, standards and guidance***

The respondents who used books to gain an understanding of what the writing expectations are at the HDR level reported using ‘How to write books’ and/or academic writing books. *“It is easy to see what are the standards and what is usually expected from*

*the PhD student writing*” claimed Respondent 2 whose views were echoed by Respondent 3 who believed, *“These [books] give me tips in understanding what is expected and help me benchmark that against what I provide”*. The benefits of using books was also identified to *“provide generic guidance on the writing”* (Respondent 11).

### ***Style***

Respondents mentioned the use of books to learn style elements with one explaining:

*“I have a background as a professional writer (journalism, marketing copy), so am confident with my written expression. These books, however, have been helpful for understanding the particular purpose of academic writing, and the rules one can employ to achieve this purpose”*

(Respondent 27).

A second respondent, 35, remarked similarly that, *“As a long term journalist and writer I mainly use books on academic writing to help adapt my journalistic style into an academic style”*.

### ***Enhancing vocabulary and expression***

A number of respondents commented upon their use of dictionaries and thesauruses for the purposes of enhancing vocabulary and improving expression: *“I have a limited vocabulary so these help me choose the words suitable for the context without repeating the same word too many times”* (Respondent 4). Respondent 32 admitted, *“I have a very limited amount vocabulary so I use a dictionary to enhance my vocabulary”*. While Respondent 8 claimed *“repetition is boring to read”*, and so *“a thesaurus helps with those ‘there must be another way to say this’ moments”*. Others explained using thesauruses for *“refining / improving use of vocabulary”* (Respondent 35) and to *“...use words most effectively, to say precisely what I mean and so my use of language is evocative yet academic”* (Respondent 9).

### ***Understanding***

The use of books (dictionaries and thesauruses) to help with their reading, rather than their writing was also mentioned, *“depends what you mean by ‘your writing’*, according to Respondent 8, stating further that *“the first part of ‘your writing’ is ‘your reading’. I cannot get through most academic papers without using an online dictionary.”* Other respondents explained how they used these resources to *“help in checking meanings of words in context”* (Respondent 11). A respondent who has English as second language

emphasised the “...need to use a dictionary to understand complex expressions in English, a Dictionary is a good thing I can use for that purpose” (Respondent 20).

### ***Structure and examples***

Respondents also mentioned the use of books for guidance on structuring their papers and thesis. They explained these books provide examples, models and templates, and so, “...are a helpful guide to giving me structure and direction by prompts of headings that are important to include” (Respondent 3). Respondent 40 and 15 both confirm the value of books as they provide an “*idea of the thesis structure*” and “*helpful suggestions*”.

### ***Reasons for not using books***

While the majority of respondents reported they used books and substantiated their reasons, a number ( $n = 14$ ) reported they did not use books for reasons such as: time, confidence, and using exemplars.

### ***Time***

Respondents 48 and 49, both explained “It takes time to open a book while you are focusing on writing you articles” (Respondent 48) and that “using tools is easier than reading books” (Respondent 49).

### ***Confidence***

Respondents who did not use books because they were confident with their writing, expressed similarly, that they feel, “...quite comfortable with my writing techniques” (Respondent 10) and that, “I think I have sufficient proficiency” (Respondent 13), or that “I haven't had any trouble with my thesis writing as of yet” (Respondent 5).

### ***Using exemplars***

Some respondents explained that instead of using books to learn more about writing, they preferred to read articles and theses and try to adopt what they had read into their own writing. Respondent 22 stated, “I have not yet used any of the mentioned book[s] as above since I am mostly building my writing skills by trying to apply what I read and continuously improvise the draft until it looks reasonable to me” (Respondent 22). A similar response confirmed, “I have not read any books about writing. I like to read examples from other people's writing and work out a way to do the same thing in my own way” (Respondent 37).

#### 4.3.4 Workshops

The respondents were also asked if they attended the workshops at the university<sup>9</sup>. Only 45 respondents answered this question with 78% reporting they attend the workshops. Thirty-one students were asked why they attended the HDR workshops. Some of the responses included: *“I wanted to improve my skills”* (Respondent 24), *“to build good writing habits from the beginning of my research project”* (Respondent 28); *“meeting different people and sharing their thought process”* (Respondent 50) and *“I want to take advantage of the resources offered. Even though I'm confident with many parts of my writing, there's a good chance I don't know what I don't know!”* (Respondent 27). Twenty-two students reported that they did not attend HDR writing workshops with some of the reasons being: *“I have only just started, so plan on attending when the opportunity arises”* (Respondent 25); *“I have not yet had the opportunity to attend a full writing workshop till now”* (Respondent 22); *“no time”* (Respondent 41) and *“I [did] not know about it”* (Respondent 49). Others expressed that *“the workshops were only for a few days and not very helpful”* (Respondent 30) and Respondent 46 explained that:

*“Most are tailored to international students or basic language skills (when I am a native speaker who is confident in English and could use help with finer specifics which I research myself as required). If there were more advanced classes available or morning boot camps sessions made accessible I would happily try them”*

While workshops seem to be a popular resource to learn research writing, for some students the workshops offered are too general or basic to meet their needs.

#### 4.3.5 Revisions needed after submitting to journal

One survey question was used to identify if respondents had submitted a manuscript (journal articles, book chapters or conference papers). This question served to identify the areas of research writing support HDR students may require. Of the 46 respondents, 45 responded to the question with just over half (56%) reporting the submission of a

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<sup>9</sup> For 31 students the survey was given to them prior to or during a workshop. Therefore, some of the responses take into account that they have not yet attended a workshop, that they will attend or that this was their first workshop.



manuscript. These respondents were then asked to identify from a list, the kind of revisions needed before the manuscripts were accepted, which are presented in Table 4.8. The additional two revision types the respondents stated were: revising the discussion, and comments related to the topic.

**Table 4.8 – Revisions needed before acceptance ( $n = 25$ )**

Revision Type	Count	Percentage
Revising Literature Review	11	44%
Grammar	11	44%
Language	10	40%
Revising Data Analysis	9	36%
Revising Methodology	7	28%
Rewriting Whole Sections	3	12%
Other	2	8%

#### 4.3.6 Who did they ask for help

These respondents were then asked to identify from whom they sought help to assist with the revisions and/or writing of the manuscript (refer to Table 4.9). Supervisors (84%) were reported as the most common person respondents asked for help, a response consistent with other research (Aitchison et al., 2012). Forty percent of respondents reported they also asked their friends, followed by university staff members (20%) for help. A postdoctoral fellow was also used by one respondent, with the low number possibly due to the fact that not all research groups employ these early career researchers. When respondents were asked the aspect of research writing the person/s helped them with, it was writing structure (60%), grammar (56%), and cohesion and flow (56%) that were most reported. Forty-eight percent of respondents reported they received help with content, and 44% reported that they received help with their expression. One participant reported that they received help with their argument.

Table 4.10 outlines the types of help students received, which highlights that students do need more help with the writing of their research than they currently have access to via university writing support resources.

**Table 4.9 – Who respondents sought help from (*n* = 25)**

<b>Person</b>	<b>Count</b>	<b>Percentage</b>
Supervisor	21	84%
Friends	10	40%
University staff member	5	20%
Academic literacies staff (Writing /Language Support Staff)	3	12%
Family	2	8%
Professional editor	2	8%
Other	1	4%

**Table 4.10 – Writing help respondents' received (*n* = 25)**

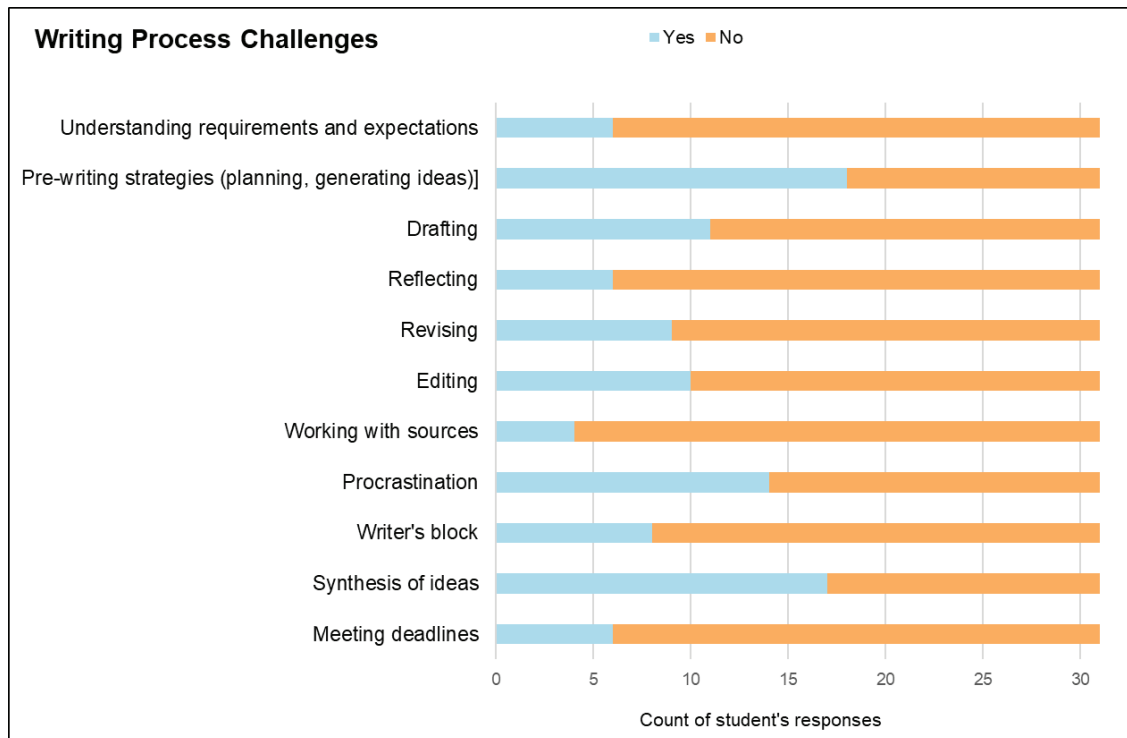
<b>Writing assistance</b>	<b>Count</b>	<b>Percentage</b>
Structure	15	60%
Grammar	14	56%
Cohesion / Flow	14	56%
Content	12	48%
Expression	11	44%
Spelling	5	20%
Other	1	4%

#### 4.4 Difficulties students have with research writing

Respondents ( $n = 31$ ) to the second version of the survey identified the challenges they faced in their writing process, such as generating ideas, reflecting, revising and editing, as well as the writing features (grammar, style, coherence) they found difficult.

##### 4.4.1 Writing Process Challenges

Figure 4.1 presents the list of research writing process tasks respondents selected. Eighteen respondents (58%) reported that pre-writing strategies were challenging. This response suggests that students need additional support and scaffolding to help them plan and conceptualise their ideas before they start writing. Drafting (35%), reflecting (19%), revising (29%) and editing (32%) were difficult for some respondents. Forty-five percent of the respondents indicated that procrastination was problematic, and just over a quarter of the respondents (26%) found writer's block difficult to process. Synthesis of ideas (55%) was also reported as a challenging aspect of the writing process. All of the participants reported one or more of the writing process tasks as challenging, except for Respondent 30, who explained that because they are a new student they “...*might need help in all the processes*”. This comment suggests that students who are new to candidature and have not started writing, may not know what writing process challenges they will face.

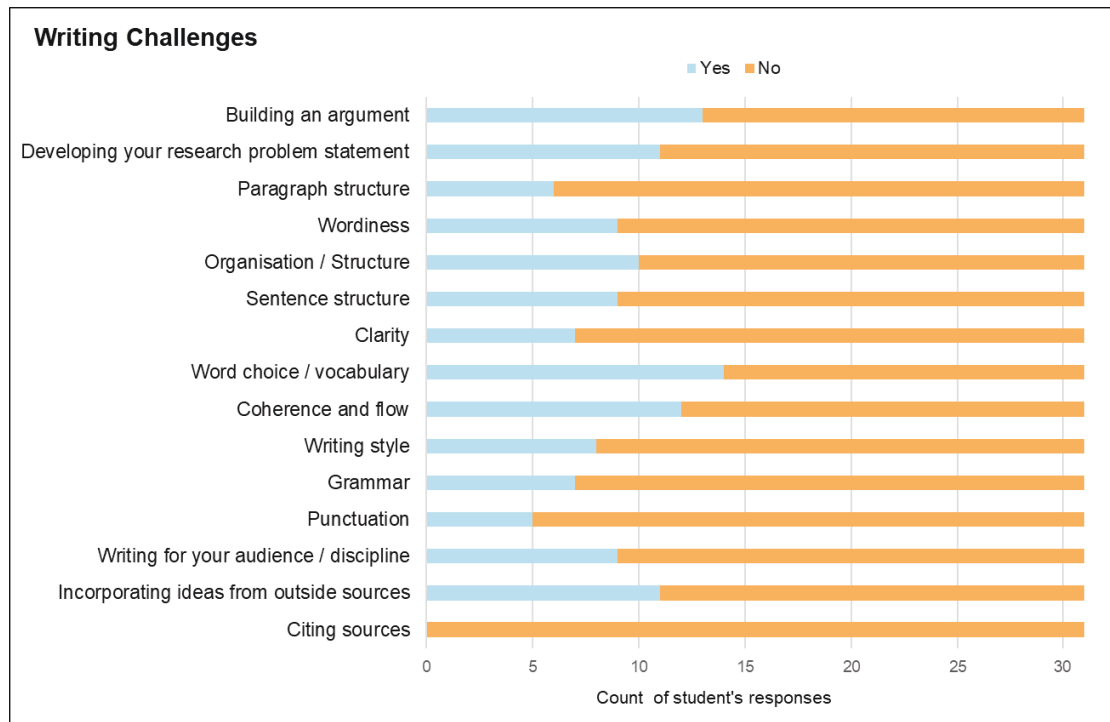


**Figure 4.1 – Participants’ Writing Process Challenges**

#### 4.4.2 Writing Features Challenges

Writing is a complex process (Hayes & Flower, 1980). While the data in Figure 4.2 is presented according to the survey question, student responses are discussed numerically from most to least responses, demonstrating the most challenging aspects of research writing. So, when exploring the writing features respondents struggled most with, respondents reported it was word choice / vocabulary (45%), followed by building an argument (42%), and then coherence and flow (39%). While all the respondents reported that they had no difficulty with citing sourcing, eleven respondents (35%) reported incorporating ideas from outside sources to be difficult. Just over one third (35%) indicated that developing the research problem statement was challenging with an almost equal number (32%) finding organisation / structure problematic. Nine participants (29%) indicated that writing for their audience / discipline was difficult, as well as sentence structure and wordiness. Eight respondents (26%) found writing style challenging. Grammar was also problematic for some respondents (23%). Paragraph structure was also identified as challenging for some respondents (19%) when writing about their research. Out of all the respondents, only two reported that they had no difficulty with these writing

tasks. The same respondent who reported that they had no challenges in the writing process explained “since I'm a new student, I might be facing with all the challenges listed until I go through the steps and learn to handle them all” (Respondent 30).



**Figure 4.2 – Participants’ Writing Challenges**

#### 4.5 Writing support students would like

Respondents were also asked to identify the type of writing support they thought was beneficial for HDR students. This open ended question gave respondents the opportunity to express what it is in terms of writing support they felt would be needed during candidature. The responses were coded inductively and the themes that emerged during this analysis include, *writing training*, *feedback*, and *knowledge of tools*.

##### 4.5.1 Writing training

Workshops were the most common type of support identified by respondents, however opinions about the format of these workshops differed. For example, Respondent 7 requested “*Workshops on critical writing to enable students to criticize available literature and previous studies and then to improve their own writings and papers*”. Another, Respondent 25, suggested workshops and “*lessons on structure and*

*sentence/paragraph structure. The very basic fundamentals of these were never taught to me during undergraduate*”, while *“training in writing, grammar and structure”* (Respondent 31) were also called for.

Several participants did identify the need for *“Workshops for English non-native speakers”* (Respondent 34), and even workshops that provide *“training on generating ideas, English language for academic writing, [and] paraphrasing...”* (Respondent 48) were requested.

Other workshop topics identified included reading, writing sections of research articles, thesis writing and publishing, general workshops, and opportunities for students to share their experiences. Online resources and training modules were also mentioned by two students demonstrating that convenience and ease of use is also important for students. All these responses demonstrate that students writing needs are different, with specific topics, and that generic workshops might not be as beneficial for HDR students when writing about their research.

#### 4.5.2 Feedback

Feedback on writing was established as beneficial, with some requesting they *“Would like to have individual 1:1 consultations where a chapter or less can be reviewed and suggestions made on structure, cohesion, academic writing tone, expression etc. This should be readily available multiple times during the writing of a thesis”* (Respondent 12). Respondent 22 identified, *“personalised feedback and guidance”* as being critical to the research writing process. While Respondent 20 identified, *“One-on-one consultations could be very helpful, most of the time ideas are very good but it is very difficult to write them down”*. Respondent 35 described the benefits of giving and receiving feedback through academic writing groups, where, *“as a fiction writer I go to a writing group where we read each other's work and support / critique. Would be helpful for academic writing too”*.

#### 4.5.3 Knowledge of tools

Three participants recognised that writing support tools would be helpful though were unaware of what was available. For example, Respondent 10 suggested the *“Introduction to support tools early in the candidature. Either via supervisor or via a compulsory writing course”*, or workshops on *“...how to use software to improve the editing process”*

(Respondent 43). Other respondents wanted “*Training on Evernote, and others supporting software for writing*” (Respondent 48).

## 4.6 Discussion

This exploratory phase set out to identify how students learn research writing, the challenges they face in the research writing process and the support students felt would be beneficial during candidature. This understanding was considered necessary for the development of appropriate interventions and tools that develop students’ research writing processes. As there is increasing pressure for students to publish during their candidature and the fact their award is based on a 60,000-90,000 written document, it is therefore, essential to provide students with effective writing development and interventions. A majority of the respondents, both non-native and native English speakers, used resources such as such as electronic tools, websites / blogs, and books to help them with their research writing. However, the majority of the respondents were non-native English speakers and were enrolled in the Faculty of Engineering and Information Technology.

Out of all the types of resources available to students to help them with their research writing, electronic tools were used the most by the respondents. As detailed in section 4.3.1, Word’s spelling and grammar check, Google Translate and Grammarly were used the most. This finding highlights that students may need additional support when it comes to grammar and English language. Google Translate and Grammarly were mostly used by non-native speakers. These tools were mostly used by these respondents to fulfil surface level writing needs, such as grammar, spelling and expression. While many of the non-native English respondents used these tools the most, native speakers also used these tools. The high use of tools could be due to their ease of use and access. As these tools are either online or digital, students are able to access them easily and readily. While no one used Writefull and only a small minority used Evernote, this could be because students were unaware of these particular tools. Overall, the high use of electronic tools compared to the other resource types, suggests that students do use resources that are easily and readily available to them.

While I assumed that most HDR students would use websites, blogs and social media to assist them in their research writing, as these resources are also easily and readily accessible, only a small minority used such resources. And, while some respondents

explained that they did not use web resources because they had sufficient proficiency in writing and research, others claimed that they did not use them because they were unaware that such resources existed. This lack of awareness suggests that there are not systems in place to introduce students to useful web resources and blogs when they commence candidature. This lack of awareness could explain why many students had not heard of The Thesis Whisperer, a blog popular for HDR students, supervisors, and researchers with over 100,000 followers, which covers research writing and HDR candidature. It is likely that institutions assume HDR students know where to find quality, reliable resources to help them during candidature. This assumption can disenfranchise some students, especially those who may need extra support not provided by the institution. It is important that institutions provide the appropriate infrastructure (both formal and informal), so that they can support students achieve their research and writing goals. At the time of this research the research writing online resources available to students, provided by the Graduate Research School who provided centralised research writing support, was an online Blackboard site with resources (PowerPoint slides, handouts) from the workshops<sup>10</sup>. Ultimately, institutions, need to provide alternative approaches to supporting their students so that students can access high quality resources and support quickly, readily and easily, when they need it.

In contrast to web resources, books were heavily used by respondents particularly ‘How to write’ and academic writing books to help them learn research writing. Some respondents explained that they used such books to understand the writing standards expected of them during candidature, for academic writing style and advice on structure, for templates and examples. However, the concern here with this approach to learning about research writing, is that some of the advice given in such books may oversimplify undertaking a research project and writing the dissertation (Kamler & Thomson, 2008). For example, Kamler and Thomson (2008, p. 507) explain that such books, “offer a rigid model of the dissertation that follows a set format and style” and that grammar is explained as a set of rules for correcting doctoral writing without guidance on “context, genre or discipline” (p. 511). The fact that many respondents are using such books

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<sup>10</sup>An initial scan of the available institutional resources indicated that the primary contexts were the official GRS LMS space, which hosted the PowerPoints and activities used in the central scheduled workshops.



demonstrates a lack of information and guidance available to students about the complexity of conducting research and writing during candidature. While these books may offer students a ready, quick fix in their learning, the focus needs to be placed on providing students with on-going writing development, and development that takes into account the complexities of writing such as identity development, genre and writing for their discourse community (see section 2.2.1 for a definition of discourse community), which varies tremendously from the arts to science to engineering and IT. Research writing is a situated practice which means that HDR students need to learn how to negotiate these different sites of practice. The fact that they are turning to these books suggest that these books may be filling a need and that they gain value from such books. It could be argued that students are using these books because they know where to find them, and once students have the books they can refer to them whenever they need to. This behaviour suggests that students prefer to use resources that are easily accessible to them and meet their writing needs.

Confidence in writing and research was a recurring theme as to why respondents did not use some of the resources listed to help them learn research writing. While these students may be confident with their writing so far, they may need help later on during candidature. Research writing through candidature is a continuous journey, in which there will be a range of opportunities and experiences where students will be called on to write a variety of documents (research articles, confirmation report, conference proceedings, and thesis). It is therefore important to provide students a range of ongoing writing support throughout their candidature. Time constraints was another factor as to why students did not engage with the resources. That is, they did not have enough time to read and learn about research writing. This shows that students are time poor and do not have enough time to conduct research and at the same time, learn to become proficient writers in the small time-frame that they have to complete their thesis. Therefore, writing interventions need to be available when students need help, or just in time when students need it, which would minimise their need to go afar to seek help.

As was discussed in Chapter 2, writing for publication is a significant endeavour for both students and institutions, as publishing during candidature can influence students' career prospects post degree and an institutions' research reputation and funding. It is not surprising that more than half of the respondents had submitted a manuscript, as there is now more pressure to publish during candidature than after (see sections 1.1 and 2.1). As

Aitchison and Guerin (2014, p. 3) state “writing for publication is a value adding activity that reaps high returns”. Where participants reported needing to revise manuscripts, the types of revisions varied. While some needed to revise and focus on surface level features such as grammar and language, others were asked to amend whole sections, or revise the discussion, literature review and methodology sections. This variety of revisions show students’ research writing needs are different, with the extent and variety indicating additional types of support is necessary if students are to be also publishing throughout their degree and submitting a thesis. The assistance the respondents received also varied and in fact ranged from structure, cohesion and flow, grammar, expression, spelling and content to building the argument. This diversity of writing assistance shows that students’ needs are unique and suggests that a more tailored and personalised approach to providing research writing support is needed.

A majority of the respondents cited that they sought help from their supervisors with their revisions, as was also evidenced in Aitchison’s (2012) study on HDR students’ learning practices. This result demonstrates that supervisors are key in helping students learn research writing. As doctoral enrolments continue to grow (Department of Education, Skills and Employment, 2020; McGagh et al., 2016), supervisors will be expected to support more students. Academics who supervise HDR students already have a high workload, as most are expected to coordinate and teach subjects and courses, supervise honours and master’s students, perform administrative activities, and work on their own research. This increase of doctoral enrolments and the continuing pressure of supervisor workloads means that current models of research training need to adapt to better support both supervisors and students.

Research writing is challenging for HDR students. This is not new information. Researchers have claimed for years that students struggle with research writing, for example, students have difficulty identifying and learning complicated linguistic practices (Aitchison et al., 2012), are unfamiliar with disciplinary writing conventions (M. A. Maher et al., 2014), and find research writing stressful (Russell-Pinson & Harris, 2019). The findings from this study reinforce this notion, as students reported to have a variety of challenges when it came to research writing. These challenges varied from discourse levels of writing such as building an argument to surface level features. This difficulty with surface level features could explain why language and grammar resources were the most sought resource respondents used. It could also indicate that these

respondents are non-native English speakers and struggle to articulate their claims and express themselves in English. The data suggests that English language support is an additional type of support needed throughout candidature for some non-native English speakers. The challenges experienced by the respondents also included aspects of the writing process, such as planning and developing ideas, reflecting on their writing and dealing with writer's block. These findings indicate that writing support for students should also include strategies on how to undertake the various components of the writing process. The challenges identified by the participants show that a one size fits all approach to research writing support does not meet the unique and complex needs of students.

Although research is writing is difficult, the findings from the data suggest that the majority of students look for help when they need it, targeting their immediate needs. This notion is supported by the two respondents (27 and 35) who are both professional writers, but still sought writing resources to help them with their scholarly writing. However, some students are not aware of the resources available, as the findings of this study has shown. As many students are left on their own when it comes to writing (Aitchison et al., 2012), they may find resources that are not of high quality which may impede their learning. But, the fact that students seek help when they need it provides universities with an opportunity: they could provide more specific and timely support that aligns with the difficulties that their students are facing.

Workshops are a main form of support for the students, as many students attended the workshops on offer at the university. While some universities provide more specific tailored research writing workshops, many institutions provide generic 'how to' workshops, as was provided at this university. These generic workshops are beneficial, as argued by Carter and Laurs (2014, p. 9) because they can "complement discipline-specific engagement" and provide a "complete scaffold for novice researchers". However, even the data from this initial survey suggests that students' needs are unique, so in addition to generic workshops, specific or tailored workshops at advanced and beginner levels of writing are warranted to meet the diverse needs of students. The findings here reinforce the notion that a one size fits all approach to research training does not cater to students unique and complex needs, and that a more comprehensive approach to research training is needed.

The individual needs for students were also reiterated when they described the kind of writing support they felt would be beneficial. While some students felt that general

workshops were beneficial, others noted specific workshops, for example, workshops where they critiqued literature in order to improve their critical writing skills, lessons on structure, and English language for academic writing. These responses emphasise that students have a range of needs, therefore additional writing support is needed. A more comprehensive model of writing support that caters for the variety of students' needs is warranted.

Receiving feedback on writing is critical in developing and learning research writing. Feedback allows students to reflect on their writing and why they have written what they have. Students identified the value of receiving feedback and desired more feedback on their writing from someone other than their supervisor. Students do not always receive immediate feedback on their writing and do not always have the opportunity to debrief the feedback they have received with their supervisor. One-on-one consultations with academic language and learning educators not only provide students with feedback on their writing, but can also offer students a safe place to discuss the feedback they receive and how to action the feedback given by their supervisor. Individual consultations also allow for more personalised, specific, timely feedback. They also facilitate the ongoing writing development that students need to in order to write their thesis and complete their degree. The university where this survey took place does offer one-on-one consultations, however, it seems that many students may have been unaware that this support existed. Furthermore, only one consultation was offered at each stage of candidature, which does not provide ongoing writing development. With only one person offering one-on-one support, the support of these consultations was necessarily limited despite an obvious student need. This limited support means that new and innovative ways of providing, timely, personalised feedback are needed.

#### 4.7 Limitations of this study

While the data presented in this chapter provided an initial insight on students' research writing experiences, it is important to acknowledge the small sample size of 46 respondents. Studies that invite volunteers are often subject to potential bias. Responses to the survey were from respondents who were in their early stages of candidature, full time students, many were non-native English speakers, and most enrolled in the Faculty of Engineering and Information Technology.

The data presented here is scoped in terms of presenting students' individual perceptions of their research writing experience from one Australian university and may not be generalizable, particularly when the Australian graduate research context differs from other countries in terms of funding, governance and graduate program structure. Despite these limitations, my findings have contributed a rich new insight into how HDR students learn research writing and their research writing practices which is an important first step for an area with limited scholarship.

#### 4.8 Summary and implications

This chapter establishes that HDR students learn research writing in a variety of ways, from electronic tools to books, websites and workshops. This finding extends the literature and understanding of HDR students' research writing practices by providing additional evidence about *how* HDR students learn research writing. As established in section 2.1.2, limited research exists on how students learn research writing. Students, whose needs are individual and complex seek help predominantly from their supervisors for their research writing needs, confirming previous literature. This research established that a one size fits all approach may not cater for students' individual needs or indeed teach them research writing strategies or skills they need, particularly when students find various aspects of research writing challenging. This means that it is important to regularly evaluate the support, resources and services offered to research students. This study has established that a holistic, systematic and comprehensive approach to providing research writing support and development is needed; one that provides resources and services to meet the unique needs of students, from novices to more advanced students. As HDR students are now under pressure to produce research outputs in a shorter time frame, the data shows a need to change the current support models for students, to have access to a range of support they need, when they need it, across their research writing journey.

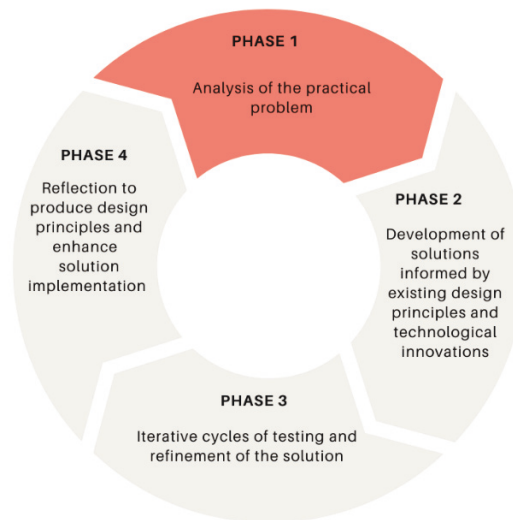
Undertaking studies such as this one also demonstrates that investigating students' research writing challenges and experiences is helpful in understanding the student cohort and their needs. The information utilised from a needs analysis, similar to this study, can help inform the types of support, services and resources needed to effectively support students' research writing development.

Feedback is critical to learning research writing and providing more personalised, timely feedback could help meet students' individual and complex writing needs, while also providing just in time support. While this type of support has traditionally been delivered by one-on-one consultations with an individual (typically an ALL educator), this is an expensive solution, and often not utilised by all HDRs. The opportunity to develop a different form of delivering this just in time support is presented in Chapter 9 where I investigate the potential for using writing analytics as an alternative method for delivering this just in time support.

Significantly, this chapter has established the foundations for the Multi-level Model of Research Writing Development (MMRWD) framework (see section 10.2.2), a multi-level system of support that combines both self-access resources and facilitated interventions to meet the diverse and complex needs of all HDR students. Section 2.2 highlighted that although models such as the Multi-layered Model of Language Development Provision (MMLDP) exist for writing development, there is not a model for HDR writing. What this chapter shows is that that a variety of research writing support is needed for HDR students to address their diverse needs. The MMRWD is referred to throughout the thesis, with the full model presented in Chapter 10 section 10.2.2.

# Chapter 5: Supervisor & Graduate Research Staff Perspectives

This chapter continues the analysis of the education problem (phase one of the DBR cycle). The previous chapter examined HDR students writing experiences in terms of how they learn research writing, the challenges they faced in the research writing process and the support they felt would be beneficial during candidature. This second exploratory chapter presents HDR supervisors and Graduate Research Staff perspectives on research writing during candidature. In particular, their perspective of research writing, how HDR students learn research writing, the pedagogical assistance they provide to students and the challenges students face during the research writing process. The chapter also presents supervisors and Graduate Research Staff perspectives of writing analytic tools to assist students with their research writing development.



## 5.1 Introduction

The next step in the exploratory phase was to gain a deeper understanding of HDR supervisor and Graduate Research staff perspectives on research writing during candidature. I sought to achieve this by interviewing supervisors and graduate research staff from the same institution as the survey respondents. While there is growing scholarship on HDR research writing, little is known about how supervisors support their students' writing needs and how they teach their students research writing. Understanding

these perspectives and the difficulties encountered offers another lens in examining the educational problem and what kinds of interventions could be designed to help both supervisors and students in the learning and teaching of research writing.

### 5.1.1 Methodology

Semi-structured interviews were conducted with supervisors and graduate research staff with roles aiming to assist HDR students in the learning of research writing. During the interview the participants were given two texts as a stimulus to analyse and provide feedback.

### 5.1.2 Participants

Supervisors ( $n = 4$ ) interviewed for this study were both novice and experienced, with supervision backgrounds ranging from two to ten years. One supervisor had only supervised honours and masters level students. The graduate research staff interviewed ( $n = 2$ ) had similar backgrounds: three to ten years in an academic literacies role. All the supervisors were from STEM related faculties, except one who came from the arts and social science faculty, but had a STEM background. The supervisors were recruited through existing networks within the faculty.

### 5.1.3 Data collection and analysis

The six semi-structured interviews lasted for approximately one hour (the interview guide is provided in Appendix D: Supervisor & Graduate Research Staff Interview Schedule). The interview data were audio-recorded, transcribed verbatim and then analysed thematically, coding the data for common patterns and themes. Key insights associated with the specific research questions and interview questions were extracted deductively, while other insights emerged inductively by comparing the interview data. Themes addressing the research questions as well as additional insights pertaining to HDR research writing are discussed in the following section.

## 5.2 Findings and discussion

### 5.2.1 Writing is critical

Writing is a critical skill for HDR students, a skill confirmed by both supervisors and graduate research staff. Supervisors acknowledged the criticality of writing, arguing:



*“100%, writing is all I care about. Because eventually they will never finish their PhD if they can’t write. They can do research, they can collect data, they can be very enthusiastic, they can be brilliant, they can be intelligent, they can be everything, but if they don’t write they’re not going to graduate”.* (Supervisor D)

One supervisor highlighted how issues with writing impacted the supervisor-student relationship, identifying that *“if they don’t know how to write...it’s very difficult for the supervisor because the supervisor ends up writing the things and it being not a good relationship”* (Supervisor A). Writing was also considered important for the research writing process as it developed critical thinking skills, structured ideas, and spoken skills.

### 5.2.2 Lack of knowledge of how students learn research writing

While some of the supervisors reported that student’s blogged, referred to YouTube and books to learn research writing, they were unsure of how their students *actually* learned research writing. *“I don’t know”* was a common response along with *“I’ve never explored”*, *“just by doing it”*, *“...wing it”* and *“painfully”*. Though all supervisors considered writing, and writing well a critical skill in completing a research degree, they may not have considered how their own students were learning this critical skill. This lack of knowledge is also evident in the literature with very few studies investigating how students learn research writing (Aitchison et al., 2012). Investigating and unpacking of how students learn research writing, could help supervisors and institutions understand the very issues students face so that they can provide a proactive approach to support versus a reactive approach. Engaging in conversations about writing and how students are learning research writing allow supervisors to act before students’ writing challenges become an issue that they then have to fix.

### 5.2.3 Difficulties in teaching researching writing

#### ***Language***

Supervisors and graduate research staff reported a variety of writing challenges when reviewing students’ writing. Supervisor D found repeated mistakes frustrating, while Supervisors B and C reported language issues as a difficulty they encountered. Language issues did not just impact the students’ writing, but also impacted other areas of their candidature as Supervisor B explained:

*“...both of my students have significant language issues because it’s, English is not their first language, um so they take some, some parts of the writing are issues do with their understanding of language and other parts of the problems are their issues with their understanding of research. Together that makes for not much fun”.*

Literature on both doctoral experiences for English as an additional language (EAL) students and EAL supervisors have established that language issues are challenging for both supervisors and students (Aitchison et al., 2012; Strauss, 2012). EAL students are already faced with the challenges that come with writing a thesis in another language, and then are expected to understand the cultural and academic expectations required of them (Laufer & Gorup, 2018). Lack of understanding academic and cultural expectations can impact student writing. Guidance on navigating academic and cultural expectations when it comes to writing is often not explicitly provided to students. Supervisor C addressed language issues with their students by finding *“someone else they can see for help with the actual English expression, and then I can concentrate more on the ideas”*. However, the university’s centralised English language support (named the Higher Education Language and Presentation Support - HELPS) was only available to undergraduate and post graduate coursework students. This lack of English language support for HDR students has since been addressed by the university and HDR students now have access to English language support. This addition of English language support demonstrates that students have diverse needs and that a systematic, comprehensive approach to research writing support is necessary. An example of a systematic and comprehensive approach to research writing is discussed in Chapter 10 section 10.2.2.

### ***Time***

Time was another challenge for supervisors when it came to reviewing student work. Supervisor D stated that *“Time, is my only problem”* and that it was *“hard for someone with no time to parse”* student writing, explaining it took her eight hours to review just one of her student’s work, which was done in her personal time, over the long weekend. Limited time was one reason why Supervisor A did not know more about his students’ research writing process. These two examples reinforce the fact that the scarcity of time is not only impacting supervisors’ workload, but also affecting the quality of supervision students receive (see Chapter 6). Time is an established issue for supervisors in providing

feedback (Aitchison et al., 2012; Carter & Kumar, 2017), yet additional types of support for either students or supervisors is yet to be provided.

### ***Medium of text***

Another difficulty that some supervisors reported was the medium in which student texts were created. For instance, Supervisor A explained that revising and providing feedback in Latex was hard and confusing, and difficult tracking comments. Supervisor C found revising students' work in Word using track changes problematic because she would tend to over edit and correct her students' work by "*looking for the missing preposition or the commas in the wrong place...I tend to want to fix it for them rather than giving them a job to go away and fix it and bring it back*". Both Supervisors A and C preferred reviewing their students' work on paper (hardcopy), but Supervisor A importantly noted that providing feedback via hardcopy was harder as there was limited space to provide feedback.

### ***Feedback***

The impact of the feedback provided was also a concern. For example, being overly positive and enthusiastic in her feedback was a difficulty reported by Supervisor C who tended to over praise her students because she knew some students "*struggled to put words on the page, and they need[ed] some encouragement*". But being overly enthusiastic with her feedback meant that students did not know "*where the bar was*" and "*so won't improve and get to that [standard of writing]*". Supervisor A found it challenging to provide feedback that would not offend his students. While some students found his feedback agreeable, others took it personally and did not know how to negotiate their feedback. These examples all demonstrate the complexity of providing feedback and the complexity of the research writing process where students' work is not just words on a page but an extension of their identity (Kamler & Thomson, 2014). Finding the balance between providing encouragement, being positive and polite, and giving constructive feedback appears to be difficult for supervisors.

## 5.2.4 Varied pedagogical approaches to research writing

### ***Feedback***

Providing feedback on student work was the main avenue for teaching research writing. Supervisors provided both written and oral feedback on student work. Oral feedback,

according to Supervisor B, was provided when there were more global, structural issues with the text:

*Usually I work through and say... you're trying to say this, but that doesn't work. And you're saying it in the wrong place. That's one big thing I focus on. Because I think in a research report, the writing for IT anyway, the writing shouldn't matter that much. It's the way that you structure your thinking that should matter.*

While the supervisors did not explicitly explain in detail what kind of feedback they provided, Supervisor A reported he always tried to provide suggestions and alternative sentences, sometimes rewriting student sentences even though he knew it would be “*frustrating for some students*”. Importantly, most of the supervisors expressed that how they supported their students in research writing was based on the individual needs of the students.

### ***Exemplars and examples***

Most supervisors used examples and exemplars to teach their students, with Supervisor B giving his students papers from his discipline so that students could “*conform [their] work to the types of terminology and patterns of structure of these types of papers*”. Supervisor C used exemplars to differentiate between descriptive and critical writing for literature reviews, a common problem area for students. And, when Supervisor D did not know how to teach writing about qualitative data, in particular the synthesis of findings, she used examples to show them how it was done. Supervisor D and C also encouraged their students to read theses in their discipline to better understand what was expected of them. Supervisor C explained that she “*...often begun a [unclear] by taking a thesis off my shelf and saying read this, you know. Because when you start, how many PhD theses has anyone read?*” Supervisor D utilised the finished products of her students and gave them to new candidates. She expressed that it was important to give students “*some sort of hook to say like you know, oh ok, I can do that*”. Supervisor D also encouraged sharing between her students by having monthly group meetings where she expressed to her students “*you all have to help each other out, to give examples to each other*”. This encouragement of sharing amongst students was only identified by the two supervisors.

### ***Writing for publication***

Participant A preferred his students “*write for an actual paper*” because he thought “*that’s the best way to learn*”. He would get his students to write short pieces of texts, like conference papers, as it was motivating for both him and the student to write together and publish. He also chose this technique so that students could experience the peer review process and so that the paper could then be included in the students’ thesis. Participant D also expressed that writing publications was essential for students during candidature and “*force[d] them to publish something every year*”. She felt the peer review process was an important learning opportunity, empowering students to take ownership, and explaining:

*“the peer review [process] gives them an opportunity to think and make decisions for themselves, to say no this is my research this is how I am going to do it...I am an expert on this, I really studied this and this is how I think I have to do it, so in a way not necessarily change, take a stand and support it and justify it, not just put it out there, so in a way yes I think peer review from outside the supervision team into the real world, blind peer review, really helps them understand their writing and you know improve it.”*

### ***Other strategies***

Supervisors use a range of strategies to help students in their research writing process. For example, to help students tell their research story, Supervisor C asked her students to write in first person in their initial drafts. When students had difficulties with cohesion, Supervisor A would ask their students to create a scaffold of their work by using bullet points and titles for each paragraph. For those struggling with writing, Supervisor B would focus on carefully presenting concepts graphically and then use the graphic to guide the writing. Supervisor D felt that understanding how to revise your own work was an important skill and tried to teach students to view their work objectively, facilitating this process by encouraging students to print their work and read it outside and aloud, so as to ‘see’ and ‘hear’ what needed improving. Supervisor D was the only supervisor to mention the importance of revising and building this skill. Referring students to books, websites and other resources were mentioned by all supervisors, except for one.

### *Lack of institutional training of providing feedback*

The supervisors reported that they had no training on how to teach writing, or had been given advice on how to provide feedback on student writing, except one, with minimal training. This issue raises a critical question of how do supervisors know the strategies they are using and their feedback practices are in fact, best practice. Most supervisors used their personal experiences of writing and being supervised as their guide for teaching writing. This lack of training identifies a need for formal opportunities to learn more about effective practices in teaching research writing. Such planned training could enable supervisors to overcome the many challenges they identified, and stated above, in the process of supervising the writing process of their research students. However, it is noted that supervisors are already extremely busy with their workload, as previously established (5.2.3, 2.2.4), which warrants the need for different forms of training for supervisors.

#### 5.2.5 Graduate Research Staff Perspectives

The Graduate Research Staff (GRS) interviewed provided feedback to HDRs in a similar manner to supervisors, mostly written, and sometimes in person, depending on the students' situation. However, the focus of their feedback and teaching research writing was different. GRS E explained they taught students research writing by first explaining the structure of sections and their purpose, and then focusing on the argument and actual writing. GRS F took a similar approach, looking at the macro and micro level of texts. They also took a text analysis approach which examined the moves in the writing within disciplines. Their aim was to “*get them to become discourse analysts in a sense*”, a strategy widely used in other research writing programs (Paltridge & Starfield, 2007; Starfield & Mort, 2016). As limited support exists to teach students to become discourse analysts, additional support and resources are needed, so that students can learn to become discourse analysts. One such approach is presented and discussed in Chapter 8 and Chapter 9.

When it came to difficulties reviewing students' writing, GRS F explained that managing students' insecurities, and being aware and considerate of students' affective needs, was very important. They explained that feedback from supervisors “*can be very negative*” having seen poor forms of feedback like “*your English is bad why are you doing research*”. It seems the students who sought help from GRS F often had negative experiences with supervisor feedback, so GRS F made the point of being an active

listener, providing encouragement and engaging with the text by eliciting information about the text from the student and providing constructive comments and suggestions.

#### 5.2.6 Perceptions of writing analytics tools

Both supervisors and graduate research staff were asked their perspectives on writing analytics tools and if they would use such tools with mixed responses. Only one supervisor and one graduate research staff member thought that such tools could be useful for students. Others were unsure or did not know enough about such tools to use them, questioning their sophistication and accuracy. One supervisor noted that other automated feedback tools such as Grammarly are not always accurate. One supervisor who was familiar with the writing analytics tool, AcaWriter, was unsure about the use of such tools. He expressed it was critical that the automated feedback be based on a personal or student model to take into account student feedback literacy. This means that it is important to consider students' experiences with writing (such as the texts they are composing and the difficulties they encounter) and feedback when designing such a tool.

#### 5.2.7 Challenges students face in their research writing

Supervisors identified the most common challenges for students as: structure; being aware of their audience; telling their research story; and English language. Clarity, use of terminology, voice, referencing, and holding ideas in one's head were other challenges reported. The graduate research staff also expressed the views that language, structure and audience were common issues that students faced. This corroborates similar challenges reported in previous studies (Aitchison et al., 2012; M. A. Maher et al., 2014).

#### 5.2.8 Lack of meaningful support for HDR students

The challenges mentioned above are not new, yet there is a lack of systematic, consistent, comprehensive research writing support to meet the diverse needs of HDR students. As established in Chapter 4 (4.4) students' needs are varied and complex. While some students receive effective research writing support via their supervisors that will meet their needs, others do not. Some students may need more support than supervisors have time to provide, and some supervisors may not have the expertise required to support their students. The Graduate Research Staff and one supervisor reported very clearly that candidates need more writing support. While GRS E went on to say that "*I just think...we are getting people in the door without considering their suitability*", GRS F explained

that some students do not have the language skills needed to complete a research degree, with some students entering a HDR program with an IELTS score between 6 and 6.5<sup>11</sup>. Their solution then was a 10 week compulsory research English course. Similarly, GRS E suggested compulsory writing courses for HDR students, but also indicated that the PhD student workload and the short time frame to complete a PhD meant making time to attend such a course difficult. While some faculties require students to attend compulsory unit bearing courses that have a focus on research writing, Supervisor B stated that “*for good students it’s completely unnecessary and for bad students it’s completely essential*” and explained that compulsory courses do not meet the diverse needs of students:

*The thing is, what tends to happen with compulsory courses and stuff like that, it never covers their particular problems, and at this level you don’t want them wasting time on things that don’t cover their particular problems. Because they know what to do, usually, they just need to do it, um and if you tell them to do all this other stuff as well, they go oh well you obviously don’t care about the thing that I actually need to do so I’ll just hang out for a while and do this other thing. Big problems with subjects, trying to design subjects that actually assist HDR students directly with what they need.*

The comment above demonstrates that a one size fits all approach to research writing does not address the complex and individual needs of students. A more comprehensive approach to research writing support that caters for students’ individual needs is required. Supervisor D felt that the Australian doctoral system “*handicapped*” students as three years was a short amount of time to complete a PhD and students had to “*hit the ground running*”. She explained that there was not much support on offer at the institution, other than generic centralised writing workshops, occasional writing workshops in their faculty, and some editing support. She expressed frustration with the lack of writing development opportunities and that it was unsustainable that only one main person was providing HDR

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<sup>11</sup> The International English Language Testing System (IELTS) score is used by many universities as an entry requirement into university programs. An IELTS score of 6 is considered a ‘competent user’ of English: “The test taker has an effective command of the language despite some inaccuracies, inappropriate usage and misunderstandings. They can use and understand fairly complex language, particularly in familiar situations” (IELTS, 2020)



writing support across the university. Her suggestions for research writing support was to have HDR writing groups to help students with their writing, a strategy that has proven useful in assisting candidates in the research writing process (see section 2.2.2), as well as a Research Writing Centre. What this seems to show is that there is tension between the support offered by the university and the support that is needed and wanted. While the centralised and faculty based workshops provided by the university may seem like adequate support for students, this type of support takes a one size fits all approach to research writing without considering the individual, complex needs of students, and supervisor needs. The Multi-level Model of Research Writing Development (MMRWD) framework discussed briefly in Chapter 4 and in more detail in Chapter 10 (section 10.2.2) is an attempt to provide a systematic and comprehensive approach to research writing addressing students diverse needs.

### 5.3 Limitations of this study

While this study established the perspectives of supervisors and graduate research staff when it came to research writing and research writing support, it is important to note its limitations. Only a small number of supervisors from the same institution were interviewed. Additionally, most of the supervisors interviewed were from a STEM related faculty which provides a perspective bound to this discipline. While this is a small sample size, their perspectives are similar to those previously reported in the literature (Chapter 2 sections 2.1.3 and 2.2.4). Additional research is needed to fully understand supervisor perspectives from a range of disciplines.

### 5.4 Summary and implications

This chapter has established that supervisors and graduate research staff in this study perceive writing as a critical component in research degrees. What this chapter has also established is that supervisors seem to be are unaware of how students learn this critical skill and while they provide writing instruction through various strategies, all supervisors experienced difficulties in teaching research writing. The lack of time and dealing with language issues were some of the challenges they encountered. The fact that supervisors lacked training on how to teach research writing and best practices on providing feedback needs to be recognised. HDR students are still facing the same challenges with a limited, one size fits all approach to meet their needs. The GRS staff approached the teaching of

research writing and feedback differently, with one staff member explaining that they took a text analysis approach to teaching research writing with aim of teaching students to become discourse analysts. Teaching students to become discourse analysts is one of the aspiration of the writing analytics tool presented in Chapter 8.

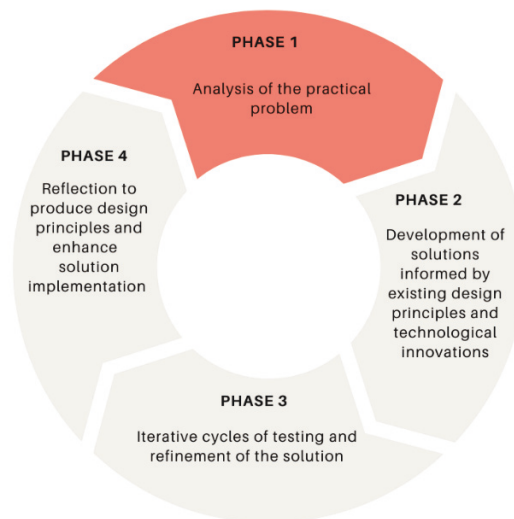
This qualitative analysis of supervisory and GRS team experiences identifies several challenges that further motivate investigating the potential of writing analytics as an aid to assist both supervisors and students in the teaching and learning of research writing:

- the supervisors lacked the time to review and give feedback on poorly written pieces;
- while the GRS writing team possessed the formal knowledge to teach writing concepts, the supervisors felt less confident or did not have the expertise to properly support their students;
- the interviewees were not all knowledgeable or confident about automated writing feedback tools;
- HDR students vary widely in their writing needs, and the provision of writing training varies widely across faculties, making personalised support difficult to provide at any scale.

The little literature on HDR writing that is available corroborates these findings as typical. Consequently, writing analytics capability embodying a model of academic writing grounded in sound scholarship and pedagogy, which can offer timely, formative, encouraging feedback to students on their drafts in a personalised, contextual manner, holds promise.

# Chapter 6: Students' Research Writing Experiences

This chapter presents the final analysis of the educational problem (phase one of the DBR cycle). This third, in-depth exploratory study establishes the difficulties students encounter in their research writing and their perspectives on supervisor feedback. While Chapter 4 provided a snap shot of student's research writing challenges and practices, this chapter presents a richer account of students' challenges and their research writing experiences. Writing is critical for higher degree research students and identifying student perspectives on the feedback they receive during their candidature serves to understand how supervisor feedback impacts their writing journey. In doing so, this chapter firstly presents students' writing experiences during candidature, including the difficulties they faced, the strategies they used to overcome their writing difficulties, and students' perceptions towards supervisor feedback.



## 6.1 Introduction

Writing is a process that develops over time. This means that a full investigation of how students fare in learning research writing during their candidature requires a longitudinal approach. This study sought to explore students' research writing experiences in terms of the feedback they received, the barriers they faced and the strategies used and found to help them overcome their research writing challenges. Exploring these experiences over

time can better aid the design and development of interventions, resources and writing tools for HDR students. This chapter presents and discusses the findings to research question 1: *How do HDR students learn research writing?* and research question 2: *What are HDR students' research writing barriers and what are their experiences in terms of supervisor feedback?* Insights on student learning experiences and perspectives on feedback can guide educators to create learning tools, design principles and enhance existing tools and resources to develop students' researching writing skills, particularly when limited educational tools exist that are specifically designed and developed for HDR writing. In addition, students' experiences with supervisor feedback could also improve supervisors' feedback processes.

## 6.2 Methodology

A longitudinal qualitative approach was adopted in this study to capture students' individual experiences over time. Qualitative longitudinal research is a rich methodology to explore the “dynamic nature of people's live” as they unfold in real time (Neale, 2019, p. 1). A longitudinal approach provides insight into “how people narrate, understand and shape” their life experiences (Neale, 2019, p. 1). Instead of providing a snap-shot of students' research writing experiences (Chapter 4), a longitudinal approach offers a more in-depth look into students' experiences of research writing. As the research writing journey for HDR students remains a black-box, the value of conducting a longitudinal study provides a rich insight into their research writing practices and their experiences over time. This approach allows the research writing journey to be defined through the students' experiences. By following students over time, I was able to document: the writing challenges they encountered, the strategies they implemented and the support they accessed to assist them with their research writing challenges, the various types of supervisor feedback they received, and their perspectives and impact of the feedback.

### 6.2.1 Participants

The participants for this study were recruited from the studies conducted in Chapter 9 (see sections 9.2 and 9.3). Some students who had participated in the studies were invited to participate in a follow up study. To acknowledge students' generosity in agreeing to participate in the study, they were offered feedback on a section of their research writing by the researcher.

Four students participated in the study. Three were international students and one a domestic student with English as an additional language. All four were completing their doctorate in a STEM discipline. Two were at the beginning of their candidature (within the first twelve months) and the other two were in the final twelve months of candidature, writing their thesis.

### 6.2.2 Data collection and analysis

Semi-structured interviews were conducted for this study over a period between February 2019 and January 2020 with a total of 14 interviews conducted<sup>12</sup> (see Appendix E: Longitudinal HDR Students Interview Schedule for the interview guide). The interviews were originally designed to take place during key milestones with the students, however this was difficult to determine, and therefore, the researcher periodically contacted the students for an interview. To capture a range of different experiences, such as the writing process and the review process, there was variation between when the interviews were held. Due to students' availability there were also variations in the number of interviews conducted with each participant (see Table 6.1). During this time the students were working on conference papers, their confirmation report (first year students) and their final thesis (final year students). All the interviews were transcribed using a professional transcription service and were analysed thematically as detailed in Chapter 3 section 3.7.2.

**Table 6.1 – Interview data summary**

<b>Participant</b>	<b>Number of interviews</b>	<b>Months interviewed</b>	<b>Year of candidature</b>
1	4	February - December	Year 3
2	3	February - November	Year 3
3	4	June - November	Year 1
4	3	August - January	Year 1

<sup>12</sup> This longitudinal study was occurring alongside the other studies in this research.

## 6.3 Findings

### 6.3.1 Students' research writing challenges

#### *Discourse features*

The interviews with HDR candidates during the course of their first and third year research journey established the challenges they faced in their writing journey as being “*Everything!*” (Participant 2, year 3, and Participant 4, year 1). Students struggled particularly with discourse features, the building of an argument, organising and connecting ideas, writing coherently, writing paragraphs, and writing particular sections of their document. Participant 2 (year 3) detailed these struggles as being: “*...to structure like [the] paragraph...build the argument and then move from that part to another one.*”

Participant 3 (year 1) echoed this struggle of building the argument claiming:

*...it involves not only being precise and having succinct arguments but also placing those arguments strategically so that the whole purpose of the literature review is brought out, like, what I am trying to indicate... Connecting all the individual arguments to form the bigger argument, yes, that's one thing.*

These comments suggest that the notion of building an argument is difficult to grasp and achieve for HDR students, confirming previous studies (F. Hyland, 2016; Kiley, 2009; Kiley & Wisker, 2009). Faculty perspectives on the characteristics of quality dissertations described poor theses as having a weak argument (Lovitts, 2007) with examiners searching for a logically structured argument (Kiley & Mullins, 2006). The evidence presented in these prior studies, and the findings highlighted here in this study demonstrate the need for additional support when it comes to writing a well-structured argument.

Successful scholarly writing demands that students transform into scientific storytellers (M. A. Maher et al., 2014). Such a transformation in terms of making a larger sense of their research and creating a research story was highlighted as a challenge for two of the students:

*...because I think, my issue with writing the literature review is, I really don't have the full play...And especially in terms of presenting it. I do have it in bits and pieces...but actually putting into appropriate flow, with a*

*bigger picture in mind is what I'm still struggling [with]...it's because there [are] too many probably topics or not...Or yeah, there too many topics and I'm not finding or I'm not able to think of a very good narrative that would, that would basically, make a nice flow between all the topics."*  
(Participant 3, year 1)

Participant 1's (year 3) struggle was similar in terms of creating a research story:

*"It is hard to write without thinking that the whole thesis should look like it is one document. Because you're writing in sections and I think in the end, it will look like I'm just placing sections together then I would just write something in the middle to connect them. Thinking at the same time when you're writing that you have those sections to... You have to flow through them.*

**Researcher** *So, you have to create a story.*

**Participant 1** *Yes. It has to look like a story and that will be easier to read. Which is not that many people will read the thesis, but it is hard to create that story when you have to comply with the standards. And usually the standards is, the sections must contain this information, and it's up to you how you want to manage that. If I don't have to write words or my vocabulary not that good enough, it will look like just a huge report.*

The responses in this study show that telling their research story is challenging, both at the final, and beginning stages of candidature. Previous studies also identified the challenge students face in creating their research story (M. A. Maher et al., 2014). Becoming scientific storytellers is an important skill to develop, and it is expected that a thesis will "tell a compelling story" (Winter et al., 2000, p. 36), and that "the student takes you on a journey" (Mullins & Kiley, 2002, p. 379). The responses above also demonstrate the value of interviews, as the students are able to articulate their difficulties which provides a rich narrative of their experiences, in contrast to the survey data presented in Chapter 4.

When it came to writing for their discourse community the same two students expressed this difficulty as being especially true when their research combined two disciplines. Participant 1 (year 3) experienced tension between two disciplines with the problem being:

*I haven't seen so many theses where they combine work from social sciences and work from very technical parts. Those two worlds, usually they are writing in a different style. When I have to talk from the social perspective, I [am] usually more comfortable with that because most of the paper[s] that I use [are] writing that style. And the technical parts are really hard to explain using the same... I'm trying different styles on, do I keep this section as very technical, which is what I need? Or do I keep it as a social qualitative research part? That's part of the challenge. It's not about the research... It's about how do you actually learn how to merge both styles, or do I have to come up with a new mixed style for this, or where can I find one example like this? And it's really hard to find an example that mixes both. Usually it's two completely different things.*

The comment above demonstrates that research writing is far more complex than just a set of skills. It is a social practice where students make meaning and produce knowledge for their discourse communities (Kamler & Thomson, 2014). This challenge is not new in doctoral writing research, where writing for their discourse community has been reported as challenging (Aitchison et al., 2012; M. A. Maher et al., 2014). It is feedback that inducts students to their discourse community (Hyatt, 2005; Kumar & Stracke, 2007), providing information on disciplinary knowledge, community expectations and discursive practices (Basturkmen et al., 2014; K. Hyland, 2009). However, for Participant 1, it seems that their supervisors may not have had expertise in this interdisciplinary field making it important for students to have access to tools, or experts who can provide feedback on disciplinary writing conventions.

### ***Language and style***

Students also identified struggles with stylistic and linguistic features of writing, particularly their vocabulary, where not having an extensive vocabulary was challenging (third year students). While Participant 2 (year 3) identified as being “*not very much worried about vocabulary*”, they did go on to explain that:

*I [would] like to expand my vocabulary because I think that even though that if I compare my vocabulary from the very beginning of my PhD, until now, I think that it has improved, but I think that I need more, like, vocabulary and...improve my writing style, I think.*



Research writing and writing a thesis entails presenting and highlighting the contributions of one's research and ideas. So when it came to explaining their research for the educated layperson, two students reported difficulties in finding the appropriate language to use, especially when the research was quite technical. For example, Participant 3 (year 1) questioned: *“So some of my research work actually kind of focuses on very specific mathematical research works, and also in machine learning. So, so, how, how do I present those technical stuff in a very kind of a layman's terms?”* Even Participant 1 (year 3) identified: *“The most difficult thing is to find the right words, a common language, for complex ideas for everyone to understand since the topic can be used for people outside this research field.”* The comments above show that not having a rich vocabulary can present difficulties in the research writing process, a finding similar to other studies where vocabulary was reported as problematic for non-native English speaking students (Bitchener & Basturkmen, 2006; F. Hyland, 2016). While vocabulary may be overlooked when it comes students' writing needs, it appears that more support is in fact needed. To further reiterate this point, a study looking at Hong Kong Chinese academics also found that not having an extensive vocabulary hindered their writing (Flowerdew, 1999).

While discussion of writing and giving feedback on writing may seem to always start with grammar, only one of the students expressed difficulty with grammar claiming:

*Grammar. It's always difficult...So sometimes I want to say something more elaborated, I don't know how to say it because I have, like, the basic grammar, but I want to do something more, you know, nicer and very well written.* (Participant 4, year 1)

As only one of the students mentioned grammar as an issue, this suggests that grammar was not perceived to be a major writing challenge for the other students in this study, as was found in previous studies (F. Hyland, 2016), where grammar was not ranked as challenging compared to more discourse level features of writing such as argumentation.

### ***Additional writing challenges***

These discourse and stylistic challenges are not the only challenges students encounter in their writing. For example, Participant 3 (year 1) reported the difficulty in writing effective captions. Summarising and writing concisely was another challenge for students in the first and second year of their research and writing journey (Participants 1, 3 and 4). When it came to difficulties encountered in their writing process, *starting* was mentioned

as being difficult by both third year students and one of the first year students. Writing is a process, it is iterative and has steps and should aid thinking, but students explained they had difficulties starting. Participant 1 (year 3) explained:

*The most difficulty thing is that... You don't actually know exactly what are you doing in each section, so it is hard to write the first part without having an idea of how it would look like at the end. So, writing a section like, this is what I did during my studies. This is really hard to write.*

Participant 2 (year 3) agreed the difficulty is:

*...usually when you start...Because you don't know how to start. You don't know what about, I mean, what to write in the first sentence, what to, yes, that big first sentences that will open the other sentences of the other paragraphs, it's really hard to do it at first instance.*

Echoing their responses Participant 4 (year 1) identified the writing challenge existing, even when it came to planning:

*So first the stage for me, it's really difficult...especially when you are just starting, because sometimes you don't know what's going to be the scope of your article. So maybe you have a future idea, but at the end the article is going to be just on something small, so that's the difficulty I found.*

Participant 4's comment about the challenges of the writing process explained that because it was early on in their candidature it was difficult to organise their ideas:

*...because, you know, maybe at this stage it's difficult because I don't have a clear idea of my research project, not yet. Of course, I already know what kind of things I want to do. But I'm still hesitating about what main topics I'm, I'm going to include. So that makes [it] difficult when you don't know exactly what you are going to write about. It's very difficult to try to write your ideas. Because you start, like, writing general ideas and you're losing the main idea that you want to write. So, as long as you have... In your mind clear what the purpose of the document is... That's easy...*

And, while Participant 4 (year 1) was at the early stage of their research writing journey, the data indicate that these issues of organising ideas will continue throughout the candidature, as Participant 2 (year 3) explained:

*I think that my problem is that sometimes my ideas are not well organised...And that makes make it hard for me to, you know, to write like paragraphs, sentences, a whole section, a whole chapter. So, but maybe that's my problem, right, because if I don't have, all the ideas that I want to write in a very clear and structured way, then it will be hard for me to start.*

Clearly, writing a large piece of text such as a thesis or journal article is challenging, and it is obvious that for many doctoral students writing large pieces of text like the thesis or confirmation document<sup>13</sup> will be the first time writing such a document. Research writing can be a lonely experience, even more so if students do not have regular access to other students. So I found it unsurprising when students identified feeling lost, getting stuck or finding it difficult to keep on track. For Participant 1 (year 3) this was especially true, “*for a thesis it's like you get lost because it's so big.*” Participant 3 (year 1) had similar feelings of being lost, explaining that while they were able to start writing, they became “*lost in ideas on how to proceed and how to connect things, and then bring it to a finish.*” Similar findings of being lost in the research writing process by both academics and students have been previously reported (Wisker & Savin-Baden, 2009). While these feelings of being stuck and lost may be perceived as a negative experience by the doctoral students, it seems that getting through this ‘stuck’ phase is a necessary process of transformation and development which can “release writing energies” (Wisker & Savin-Baden, 2009, p. 240). Being ‘stuck’ can also be viewed as facing a threshold concept, perhaps unknown to the student. It is necessary then to help students identify these moments and concepts since it is only by understanding these concepts that students can successfully crossover the conceptual threshold and become better scholars and researchers (Wisker & Kiley, 2017). Providing students with strategies to crossover these threshold concepts they encounter during their research journey is necessary for them to succeed.

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<sup>13</sup> The confirmation document is a detailed research proposal that HDR students must submit and pass in order to confirm their candidature. It is generally submitted during the first year of candidature. It contains an extensive literature review, as well as the methodology that will be used and a time-line of the proposed research.

While writing a large piece of text such as a thesis or journal article is challenging in itself, the first year students found adhering to paper and document length equally challenging because:

*...they said, you just need to use ten pages, or six pages or whatever. And then that makes you think double. Because sometimes you just write. And when you don't have like a limitation, you just write. But then you notice that you are exceeding that limitation... That limit of pages. So you need to read and remove things and re-edit... Or try to say the same, but with less words. So that's also very difficult. (Participant 4, year 1)*

And while Participant 4 (year 1) found it difficult, Participant 3 (year 1) found it stressful adhering to length requirements indicating:

*...my one, big concern is, how, how do I write, especially for the stage one. So, now what I've started feeling is, I can write, like on a topic... But when it comes to, specifically to the stage one report that we're expected to write... the fact that it has to be quite lengthy or at least 30 pages. I think that kind of makes me in a bit of a stressful situation where in the event of trying to write it very succinctly and elaborately.*

It was obvious that time was a major concern for these students. Participant 1 (year 3) was worried that they would not “*be able to finish on time if they just keep changing my stuff*”; Participant 2 (year 1) was “*scared*” that they would “*need more time to finish*” if there were more revisions needed; Participant 3 (year 1) was concerned about how they would “*meet the deadline*” of their confirmation document; Participant 4 (year 1) on how much time they had to spend on writing and therefore not enough time to do everything else like, “*doing experiments, running interviews... Some of my concern is I need to write faster so that I can report everything that I am doing.*” Given the time-pressure all students reported, it is critical then to provide resources, strategies, and tools that assist students to timely completion.

### 6.3.2 Students' research writing strategies

#### ***Writing Resources***

The on-going interviews also established the strategies that these students put in place to overcome the challenges and concerns they faced in their writing. The most common for three of the students involved the use of paper and online resources, particularly those

that contained explicit examples. Such explicit resources seemed to provide students with “*examples of what kind of sentences I should use...To introduce my context, or to talk about my background...*” (Participant 4, year 1). The Academic Phrasebank website (The University of Manchester, 2022) was used by both third year students. Participant 2 (year 3) found this resource useful, providing “*templates, specific words*” to use in their writing. Explicit examples were “*really useful*” for Participant 1 (year 3), especially “*when you don’t have the vocabulary like that. It gives you a standard to [follow], this is how people write.*” Sentence examples seemed useful for variety, particularly when “*you want to say the same thing but in a different way. You just grab one of those.*” Both third year students agreed that examples help them start their writing. Participant 1 also used quick and easy writing guides as a heuristic that were found online, with acronyms such as PEEL and STICK<sup>14</sup>, as they “*wanted something that [they] can just go back and see again every time...and read...those descriptions.*” These two writing resources were used by Participant 1 (year 3) to help structure their writing. It is important to note that it was the third year students who sought these external online resources. It is highly likely that through their research journey they have a greater awareness of the role that writing plays in research. After all, *research is writing* (Kamler & Thomson, 2014). The responses here indicate that the research writing journey is continuous and does not just stop at a point in time during candidature and that continuous support is needed throughout candidature. By investigating how the students were learning research writing and identifying what types of resources are useful for them allows institutions to identify what kind of support, resources and tools best support research students in developing their research writing and providing research training over time.

### ***Exemplars***

Collecting exemplars, such as published theses and papers, is a strategy students use to help them with their writing. Exemplars are an important learning tool as they provide students with scaffolding. Participant 1 (year 3) read other theses similar to their research to help structure sections of the thesis. Similarly, Participant 2 (year 3) sought exemplars on reporting qualitative data and for sentence structure. When exemplars were used to

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<sup>14</sup> PEEL stands for: Point Elaborate Evidence Link. STICK stands for: Structure Think Information Check Know

help students explain difficult concepts and write about their topic they described the process as being: “...what I usually do is try to read the papers and see how they explain kind of the same problem. And try to mimic that, actually. That’s how I kind of, I try to do by myself” (Participant 2, year 3). Similarly, Participant 3 (year 1) went back and critically read articles, “noting down how certain authors present similar [topics] ...how has it been presented...and using that same kind of approach, too.” Odena and Burgess (2017) reported similar findings where students with English as a second language copied phrases from journal articles into their writing.

While, exemplars and examples were useful in students writing processes Participant 2 (year 3) stated that it “takes a lot of time trying to find the right examples and then try to figure out how to explain that”. They also explained how it was easy to get drawn into looking for more resources:

*...I think that it’s helpful, but not always actually because then you need to find a point where you said, stop looking at more information and then just do something. Because usually you can take a lot of time to start digging to find like the writer’s structure that you are looking for, or maybe you’ll start looking at different theses or papers, and then you figure out that maybe that’s not what you want, or maybe yes, they are very good examples, and then you start looking more and more.*

It appears that exemplars are important for solving research writing issues as they offer different strategies on how to solve their research writing issue. Research writing educators use exemplars in their teaching to expose students to a wide range of example theses. These texts are deconstructed to help students understand how they are composed and standardised/institutionalised, presenting students with a variety of approaches to create their own thesis (Paltridge & Starfield, 2007; Starfield, 2003). As Participant 2 (year 3) explained it can be time consuming searching for the right exemplars and difficult to implement in their own writing. Deconstructed annotated texts help students achieve their writing goal, so having access to these resources easily and readily is critical.

### ***Planning***

Planning was a common strategy for students seeking help with their research writing, especially when it came to organising their ideas. Participant 4 (year 1) explained:

*What I'm doing now is, I just trying to define a structure from the beginning. So I start with the big titles, to understand more or less what I'm going talk about and how I'm going to connect that. Then I'm going into the paragraph detail. So I start, let's say, like, writing bullet points...to plan what I'm going to write about. And...it's very helpful.*

Participant 3 and 4, both first year students commented that they liked to use to pen and paper in their planning process. Participant 3 (year 1) explained that:

*What I'm trying to do is list these arguments individually, and then probably with a paper and pen see where how do I connect this so that I am able to bring out the main and the most important argument, which talks about all these different areas. So, if you think about a Venn diagram, how do I represent it in writing is what I'm actually trying to do as a strategy.*

While, HDR students spend the majority of their time thinking and writing via a computer, it is worthy to note that pen and paper, and drawing (shapes, arrows, symbols) provide greater benefits when it comes to conceptualising ideas (Mueller & Oppenheimer, 2014; van der Meer & van der Weel, 2017). It is unusual for beginner writers of research to both identify and declare the value of such a process, reinforcing the notion that student needs are different, and students' ways of learning differ. Optimal learning needs to be facilitated in a variety of ways, a one size fits all approach does not cater for individualised learning needs, which makes it critical for research writing educators and institutions to provide a wide range of strategies to support students during candidature.

### ***Writing***

“*Keep writing*” (Participant 4, year 1) was identified as a common strategy to improve their writing by three of the participants. Participant 1 (year 3) stated they would “*just write as much as possible and try to get feedback*”. The students had assumed that writing more was a key strategy to improve their writing and it was Participant 3 (year 1) who explained how writing more, smaller pieces would help them do so:

*...like, a synopsis of the topics, because that helps you understand the topics as well as all the arguments that fall within that category. This is one way I'm trying to improve, so writing a synopsis of different concepts, and then writing the overall literature review.*

While writing more will produce more words and content, *just writing*, writing that is without purpose or guidance may not lead to quality writing or achieve the students' overall writing goal. Additionally, students need feedback in order to improve their writing, so the strategy of "*keep writing*" will not necessarily develop their writing. Participant 4 (year 1) for example had identified that feedback was necessary to improve their writing and adopted a strategy to write more publications so as to facilitate receiving feedback from co-authors and supervisors, and helping to advance their writing skills:

*...it's also a strategy because, as part of the, team to write those articles, I'm going to have, like, people which is very nice by English, and they're going to tell me, like, if I'm missing something or if I have to correct something. So it's like to have a teacher while you're writing for a conference or something, so that's, like, my strategy, keep writing.*

While Participant 4 was fortunate their supervisors were supportive of them writing publications, other students are not so lucky and are often "left to their own devices" to work out themselves how to publish their research (Kamler, 2008, p. 283). So although continuing to write and writing for publication is a strategy for students to improve their writing, not all students will have support from their supervisors. This means that additional support is needed for students to publish. Additional support where timely feedback can be provided would help students publish their research.

### ***Research writing books***

While writing advice books are readily available to students via the internet and in the university library, only two students in this study (i.e. 50%) used such resources to guide their writing process, even though many students in Chapter 4 (section 4.3.3) reported using books to help them with their research writing. The other students did not mention using books, perhaps because students are busy and "*have ten other books that I have to read for my research*" as Participant 1 (year 3) explained. Participant 2 (year 3) actively searched for writing support via amazon because "*I kind of knew what I should write in the introduction but because every subject is different, I was trying to understand like the structure, mainly.*" When Participant 2 (year 3) consulted the book while writing their thesis, they described it as a process of "*I tried to read it and then try to map it with my thesis and with my research. Then I try to write it or try to modify certain stuff.*" While Participant 2 (year 3) sought writing support through books, Participant 3 (year 1) was given a writing book by their supervisor as they were "*struggling to write*". It appears



Participant 3 (year 1) needed additional support, perhaps more than the time that was available to them from their supervisor. Participant 3 (year 1) did find the book helpful as it explained “*how best to write*”, how critical reading impacts writing, the need to consider real world problems, how to connect their technical applications back to their research contributions, and provided examples. Although writing advice books may seem helpful to students as they provide advice, linguistic resources and templates, Kamler and Thomson (2008) have established that they often neglect the complexity and anxiety involved in research writing, as highlighted earlier in the discussion of why students use books (Chapter 4 section 4.6). In the study presented here, the two students who found the books helpful claimed that they provided guidance and examples to follow in their own writing. However, in a subsequent interview Participant 2 (year 3) was unsure if the books they used were helpful and explained how perhaps they found the books useful because they worried about their writing and needed something tangible to help them get through this phase of writing:

*I don't know, I think that. I don't know sometimes I don't know if it is because you're desperate, but in my case I think that when I am like very desperate, I find that part of it okay. For example, the book... Then I take that book, now as my main source of information. Because, I was desperate for addressing a specific problem that I have in my writing, and I found it very helpful... But, maybe it's not like really, really helpful, but because I am desperate I need to follow something. I need to attach to something and then continue with my writing.*

The question to ask here is, especially in the case of Participant 2 (year 3), is why they sought out books, instead of discussing their problem with their supervisors, and for Participant 3 (year 1) why were they given a ‘how to’ writing book by their supervisor. Supervisors recognise the value and need to write well, however they often do not have the time to adequately support their students due to their increased workloads. It is possible that advice books are being provided because time may be an issue for this supervisor. The issue of time and workload has been raised elsewhere by Kamler and Thomson (2008) who challenged the “work intensification and performativity regimes of universities” and that “advisors have less time and are more focused on doctoral completion rates” (pp. 508 – 509). Potentially students are uncomfortable asking supervisors for additional help, help that is not necessarily content related and help for a

skill that perhaps the student feels they are expected to have, particularly when students have reported they go to books and online resources and not their supervisors for information on how to write. Participant 2's comment about the need for a book to support their writing journey, for whatever purpose, would indicate students really do need support, and that they cannot quite identify the type of support that best suits them. Perhaps, then there is a need to understand, not only how students learn research writing, but what barriers they face in their writing journey and so identify what support best suits them.

### ***Other research writing strategies***

While examples, exemplars, planning, writing and books were common strategies to help these students with their research writing skills, other strategies were also identified. For example, Participant 3 (year 1) indicated that "*mindfulness*" was helpful to "*approach it [writing] with a new fresh perspective*". Recent research indicates that mindfulness is an effective strategy to help minimise depression and enhance self-efficacy for doctoral students (Barry et al., 2019). Participant 1 (year 3) found explaining their research to others useful as it helped them to learn how to explain their research concisely. Printing multiple articles and highlighting important sections and then writing about them was pointed out as a useful strategy by Participant 4 (year 1). This is an effective strategy for synthesising information and ultimately building an argument. Participant 4 (year 1) also used online tools such as Grammarly and Google translate to help with English language development. Participant 3 (year 1) identified the value of using the Context Question Objectives Contributions and Evaluation (CQOCE) thesis diagram (Prieto, 2019), similar to a concept map, to help understand their research as they "*didn't have a clear picture of what [they were] writing*" and to build their argument. Diagrams such as these are helpful to conceptualise research (T. Ellis J. & Levy, 2008). To help manage their research and references Participant 3 (year 1) started using a referencing management system as they were manually typing in their citations, a time consuming process. The responses here demonstrate that student needs are unique and that students use a variety of strategies to help them through their research writing journey. Understanding these strategies on much a larger scale could guide institutions in the development of more comprehensive interventions, resources and services to support students during candidature.

While some students attend writing workshops in the hope to improve their writing, they do not always find them useful. The writing workshops that the students in this study attended were centralised generic workshops offered by the graduate research school. Participant 4 (year 1) revealed they *“found that this was, like, repeating everything that I have heard the previous semester. So it was not useful...”* They did identify that the, *“...one key idea that I learn from that lesson...was, like, for each paragraph, you just have to talk about one idea.”* Participant 3 (year 1) was expecting *“a workshop where I could, spend more time on the draft”* and *“...since the trainer didn’t have too much time we couldn’t discuss [the draft]. So, it was not effective.”* Although it has been argued that generic workshops provide a scaffold for candidates, particularly beginner scholars (Carter & Laurs, 2014), limited data is available on the effectiveness of such workshops. While the comments presented are only that of two students it is necessary for institutions to evaluate their workshops and their institutional context (Link, 2018). Evaluation, reporting of data and reflection on practice is vital to provide candidates the most effective support, because, as can be seen by the comments above, the writing support offered might not accommodate the diverse learning needs of HDR candidates. The comments above also reiterate Chapter 4’s findings that current research writing support models do not cater to students’ needs, and that a generic one size fits all approach to research training does not meet students’ individual and complex needs.

To feel less overwhelmed on starting their thesis Participant 2 (year 3) copied and pasted in parts of their publications in the relevant sections so *“that the document wasn’t empty at all”* to make them feel that there was *“some kind of progression here.”* This useful strategy was given by their supervisor, though not all supervisor suggestions were perceived as useful. Participant 3 (year 1) spoke about following their supervisor’s advice to *“work on different sections”* to get *“a more broader idea of what I’m speaking... And...have an idea of how to connect section two with three, and things like that...”* However, in the subsequent interview they explained that this strategy was not helpful and instead they were going to:

*...dedicatedly finish a section instead of trying to write many sections finally, which often is one of my advice from supervisor because I have to be working on all different sections apparently. I feel that really didn’t work out well. So, better is finish one section at a time and then move on to the other. Or at least finish some, like a sufficient amount of a section*

*and then only move to something else. So, this is the strategy I'm thinking of to implement.*

Participant 3's comment demonstrates agency in their writing journey as they begin to consider what their learning needs are and what strategies are most useful for their progress. It would be beneficial for Participant 3 to explain to their supervisor their learning needs and why such strategies are not useful for them. I suspect, however, that such a conversation is difficult for students to navigate nor have the skills to do so.

### 6.3.3 Supervisor feedback: was it good, bad or ugly?

Supervisor feedback is critical in developing students' research writing skills and doctoral success. The students in this study relied heavily on their supervisors for their writing support. The interview data revealed that supervisors were the main source of feedback for the four participants when writing their documents, except when writing a publication with multiple authors or when their document was submitted for review<sup>15</sup>. It seems that the students in this study may have assumed that they could only receive feedback from their supervisors. In exchange for participating in this study students were offered help with their writing, however, only Participant 1 and 2 took up the offer of receiving feedback from the researcher. It is worth noting that there was no mention of asking their peers for feedback as a strategy for dealing with their writing difficulties, or as a strategy to improve their writing. This lack of interest or knowledge of peer review is worth highlighting, as peer review and writing groups have been confirmed as effective strategies to assist students with their research writing (Aitchison, 2009; Aitchison & Guerin, 2014; Caffarella & Barnett, 2000). While writing groups may not have been established in this faculty, critiquing and receiving feedback from fellow students can help students with their research writing. As students depend on supervisor feedback for assistance and improvement in their research writing, it is critical to analyse the type of feedback students received, the value and quality of supervisor feedback as well as students' expectations. Supervisor feedback included for example, comments about their arguments, captions, organisation of ideas, content, structure, their narrative, grammar,

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<sup>15</sup> This includes feedback from reviewers as well as a panel review of their documents. For example, the stage 3 milestone process requires students to submit a draft of their thesis for review by a panel of experts.

paragraphs, referencing, reporting literature, moves, style and discourse community expectations. Some students also received advice on how to approach their writing.

While the supervisors provided students with feedback on the writing aspects mentioned above, it appeared that some of the students may have believed that their supervisors were the only ones available and responsible to help them with their research writing. This notion may also imply that the writing support available at the university may not be adequate for meeting the needs of this student. This means therefore, that it is essential to better understand students learning needs and identify what resources would support them best at different stages of their candidature, so that a variety of models of support are accessible, readily available, and are just in time, so that research writing support is not left solely to the supervisor.

The majority of students had instances where they found supervisor feedback confusing and frustrating, confusion when there was more than one supervisor involved, and especially so when one supervisor was unable to attend supervisory meetings: *“If you don’t have the two of them in the same room at the same time, it’s very, very confusing”* (Participant 2, year 3). Participant 4 (year 1) explained how receiving feedback on areas which they had already revised was sometimes frustrating:

*...sometimes I receive feedback and I try to solve any comment or whatever. And they said, it’s still not solv[ed] that so you need to keep working. So, I keep working because we have a deadline. But it could be also frustrating I have to say. Sometimes when, when you receive feedback and you try to do something but then you receive feedback and they say, it’s not enough, and you have to keep working and working and working. Sometimes it’s frustrating.*

The quote above illustrates that the student may not understand the iterative nature of writing. Writing is a process. Writers go through multiple stages of revision. For many beginner research students it is not made clear that writing is rewriting. It is assumed that students understand the writing process, however, for novice scholars, this could be a new concept for them. It is necessary for students to be made aware that writing is a fraught process even for successful writers. In this case it seems that the student needed additional guidance to achieve the writing goal. Supervisor feedback was also confusing and frustrating, demonstrated here, when supervisors provided feedback on the fly:

*Sometimes I found that they don't read the [whole paper]. They read at the same time that they're commenting but they don't read the whole paper. So, I have seen just comments of, 'hey did you explain this?' 'Why are you not explaining this?' And then a comment down saying like, 'oh you explain it like this okay.' Why [did they] put the comment there? ...If it is just [their] own thinking at that moment, I think it, it doesn't help me as feedback...And sometimes the things that they're requesting at the end are different than the comments that they request at the beginning. So, it's like they have their own dialogue with them[selves]. And I have to figure it out if [they] solved [their] own questions. (Participant 1, year 3)*

It seems here that there is at least the perception of a mismatch in expectations around how to provide effective feedback, and that this has not been negotiated between the supervisor and student. This raises the question as to the students' expectations of the supervisors' feedback. Feedback on the fly could also be due to supervisors' not having enough time to read through the students' work and then provide more meaningful feedback. It is evident in this case that there needs to be more forms of support for both the student and the supervisor, and forms of support that consider supervisor time constraints. Such support could be in the form of tools and resources, for example, the automated feedback tool, *Research Writing Tutor* (RWT) discussed in Chapter 2 (section 2.3.4). Automated feedback tools provide structured feedback on students' writing while at the same time help students learn discourse writing conventions, in particular the 'moves' needed in their text. Automated feedback tools would decrease the amount of confusing feedback students receive as they would have already improved their writing.

### ***Unhelpful supervisor feedback practices***

While some supervisors provide constructive feedback and guidance to their doctoral students, research has found that supervisor feedback is not always perceived as constructive or helpful. It is often perceived as vague, confusing and difficult to decipher (Paré, 2010, 2011). The students interviewed for this research identified similar perceptions of receiving general, ambiguous feedback. Participant 1 (year 3) reiterated:

*I have seen...very often where, maybe it's close to the deadline. Like a general comment like, I don't get it... What do you mean with this sentence? So, so what, well that's what I mean. The thing that I wrote,*

*that's what I mean... So, please be more specific. Like, what is [it] that you don't get?*

As above, this suggests a lack of shared language and expectations for feedback in students' research writing development, reinforcing the need identified in section 6.3.3. The following statement from Participant 2 (year 3) echoes this need, suggesting that often although supervisors and students struggle with limited availability, feedback is an iterative process involving discussion:

*[Supervisor 1] add[ed] me a comment saying, oh this is too vague. You should unpack the word model. But then I can't understand what he means for unpacking. What he wants me to add there, I don't have any kind of idea? So yes, I need to ask him like what does he mean by that, so I need to have a meeting with him and then ask him specifically.*

Some students explained the need for feedback on the feedback, like Participant 3 (year 1) who required more feedback so that they could understand the original feedback to progress with their work: “...there needs to be some additional feedbacks on top of that feedbacks to actually make me work better on the... feedbacks which my supervisor has given.” The comments presented above further confirm that more models of support are needed during candidature. Models that not only support student needs, but better support supervisors' roles in guiding students in the writing process and becoming members of their discourse community. As many supervisors lack explicit writing knowledge and students find supervisor feedback confusing, one form of support to assist both supervisors and students would be to develop a shared language when talking about writing. An example of such a shared language could be in the form of ‘moves’ discussed in more detail in Chapter 8 section 8.1.2.

As the students in this study experienced a mismatch in expectations when it came to feedback, a shared set of expectations between students and supervisors should be negotiated. While most universities encourage student and supervisors to discuss their expectations at the beginning of candidature, this practice is mostly based on the student-supervisor relationship, without a specific focus on feedback. And, while tools exist to help students and supervisors clarify these expectations, they too are generic, do not “emphasize the fundamental role of feedback” nor consider the “literature about the role of feedback in the supervision process” (Stracke & Kumar, 2020, p. 267). A tool specifically focused on feedback expectations, like Stracke and Kumar's (2020, p. 267)

feedback expectation tool (FET) encourages “dialogue on feedback between supervisors and candidates” and concentrates exclusively on “transparent feedback practices”. The data from this study suggests that such a tool would be helpful in clarifying and negotiating feedback expectations.

While constructive criticism from supervisors is necessary in doctoral writing, one participant reported that *“I just get criticised but they never actually propose solutions”*, a process where feedback, which only criticised their work, evoked negative emotions: *“So now that I got feedback again, instead of telling me what to do he’s just telling me what he thinks is wrong and blame[s] me that I’m not writing [at] a doctoral level.”* Negative emotional responses to critical feedback were apparent when Participant 2 (year 3) expressed that constructive comments were useful, but not *“harmful comments”* and *“...maybe they need to find a way to give you good feedback, like not to harm my feelings...”* Participant 1 (year 3) felt that criticism on its own was not going to help their writing. Participant 1 expressed that they needed balanced feedback where it contained suggestions and explanations.

Contradictory comments were perceived poorly by Participant 2 (year 3). Contradictory feedback made them feel that *“instead of going forward”* they were going backwards as they were *“discussing things from the past”* that they had already discussed (Participant 2, year 3). Contradictory feedback also made Participant 2 doubt their writing, that they had to go back and reflect whether what they had written was right or wrong.

Receiving supervisor feedback is an emotional process, and supervisors need to be aware of this and take care in the feedback process. Supervisors do guide students in their research journey and it is through writing that they enculturate their students into the discourse community. While most supervisors provide feedback with the intention to help students develop their writing, the following student responses demonstrate a view to the contrary, that students perceive the feedback as criticism. This emotional process is explained by Participant 2 (year 3):

*...sometimes it’s [feedback] very emotional because the feedback that you receive and depending on how, what are the comments that you receive, you can feel then very sad, or you know, like frustrated...I usually receive the feedback, and then I need to prepare to read that feedback. I know that they are not giving me that because they are really bad people... But...it’s hard to separate your professional skills with your personal skills. So, you*



*think they are talking to you because you are...maybe not too good enough, but that part that makes you different from the professional and the personal... It's hard you know to manage because I am thinking they are talking to me as a person. But, actually no, they are talking to me as a professional, as a researcher, but it's hard. It's hard to not get too emotional from that, and it has been really hard for me, that part.*

Participant 2 (year 3) is suggesting that students may need to develop feedback preparation skills and negotiation skills to manage the emotions associated with receiving supervisor feedback. While Xu (2017) implies that negotiating feedback with supervisors creates agency, not all students have the skills needed to negotiate feedback. One participant found the negotiating process a “...battle...It's supposed to be us against them but it's me against them and the people”, going on to explain that they did not know or have the tools or the resources to know how to negotiate feedback: “I have to work on negotiating with people that has given me feedback. So that's something I don't actually know where to find resources... So I [had] to learn how to negotiate things”. Without feedback preparedness skills, or tools to guide students on negotiating feedback, students may feel they need to agree with all supervisory feedback. Indeed, that is how Participant 1 felt in an earlier interview. When asked if Participant 1 agreed to all the feedback received, they replied, “Well, I have to accept all the feedback.” Participant 3 (year 1) seemed to also lack agency when it came to discussing their feedback with their supervisors:

*Yes, but...disagree in the sense, I did accept it but I'm still unclear and I'm looking for more feedback that would help me rather than saying, disagreeing I'm still waiting for feedback that's more specific and helpful.*

Not all HDR students are comfortable negotiating feedback with their supervisors, for a range of factors including challenges in negotiating power dynamics, personal interrelationships, a lack of training or experience, and intercultural differences of professional relationships with superiors and people in high positions. For example, a study investigating Chinese doctoral students' experiences with supervision at an Australian university found that the students' “believed that students should never challenge the supervisor's ideas” (S. Chen et al., 2003, p. 6). Similarly, international students from Africa and South America reported that they found it difficult to be assertive and disagree with their supervisors (Winchester-Seeto et al., 2014). The

interviews conducted in my study also suggest that students may find it challenging dealing with their supervisors due to cultural hierarchy differences.

It seems that cultural hierarchy differences could also influence students in terms of their capacity or willingness to ask their supervisors for guidance. It is in the student's best interest to ask for explanations and guidance when feedback is unclear or when there are changes needed. Such conversations provide a rich textual analysis and understanding of writing conventions within their discourse community which is why a shared language about writing would help both students and supervisors. Paré (2010) argues that students should ask for explanations when it comes to feedback, as students will become better researchers, teachers and writers. However, as explained above not all students feel comfortable engaging in such conversations. The students interviewed in this study often wanted more from their supervisors, but they did not mention whether they spoke to their supervisors about their needs. It is unknown how students respond to feedback they do not understand without asking for clarification. While Participant 2 asked for clarification when they needed more information on “*unpacking*”, they describe here, the process they went through when they received ambiguous feedback:

*And, some comments are like that, like it is too vague. But yes, why is this too vague if in my mind, it's perfect. You know? And then, I need to go deeper into those comments... First, I need to figure out what is the comment about, what he is trying to tell me. And then I need to figure out how to fix that, so it's like a two-step process trying to understand the feedback. Because sometimes it's not really clear.*

It seems that many of the students felt they were left to figure things out on their own. There seems to be a gap between supervisors thinking they have left clear feedback for the student to act on, and the student being unclear on how to action the feedback. While Participant 2 (year 3) was able to ask for clarification, the remaining students did not indicate whether they sought more information or guidance from their supervisors. As, Participant 4 (year 1) was fortunate to be writing a publication with multiple authors in addition to their supervisors, they sought help from the co-authors when they were unsure of how to proceed:

*But, you know, the good thing is, as we are a big team writing this, when someone give[s] me general feedback, I can ask to someone else, and that someone else can help me to understand [how] should I do it.*

For the students who only have their supervisors for feedback it is clear they wanted and needed additional guidance and clarification on their work:

*“I would prefer probably live discussion... on my writing. So, like, looking actually like reading my paragraph like one to one with my supervisor and trying to see, why did I miss certain concepts or how could I have placed certain other concepts in relation to a topic. Things like that. So, I feel a more live discussion is required... So, an example of an instance. It may not be very elaborate but something as additional comments where you could say... This paragraph could have been written in this way and these sentences or these ideas could have [been] placed probably much earlier with an example. So, that makes me, would actually help me, reflect better than trying to sit and ponder over how could I do it.”* (Participant 3, year 1)

The evidence presented above demonstrates that the students needed additional guidance. However, previous research has shown that international students found it challenging to seek guidance from their supervisors, approach their supervisors, and merely, talk to their supervisors (Winchester-Seeto et al., 2014). It is clear that additional research writing support models are needed to support HDR students and supervisors to negotiate feedback. Learning designs that foster learning research writing that is more comprehensive and holistic, using a shared language may build on a model that relies on supervisors for feedback and support.

Receiving timely, ongoing feedback on writing is a critical part of HDR writing and the writing process (Caffarella & Barnett, 2000). While students learn and improve their writing by reflecting and revising their work, based on the feedback they have received, participants in their final year reported that they did not always receive timely, ongoing feedback:

*Sometimes I have been like I didn't get any feedback for one more month...*  
(Participant 1, year 3)

*But, the other part that's been really hard for me is to receive the feedback from my supervisors. So, I found it like very difficult, firstly because sometimes it's not timely feedback. So, I need to wait maybe for one or two*

*weeks in order to receive some kind of feedback in each chapter.*  
(Participant 2, year 3)

The two students felt that not receiving ongoing, timely feedback was wasting their time, as they not only had to wait before they could continue writing, but when they continued without feedback, there were substantial changes that had to be made:

*I never got some feedback so I just keep writing. And that was the problem was I realized that the things that we talk about, like last month, doesn't fit with what we're trying to achieve. Then I have to change everything, so it's like wasting the time that we get.* (Participant 1, year 3)

For feedback to impact learning it needs to be timely so that students are able to plan and achieve the desired goal. However, supervisors are increasingly under pressure to publish and build their research profile due to new institutional demands (Aitchison & Guerin, 2014). Supervisors are increasingly time poor as they have increased teaching loads (Kamler & Thomson, 2014) and now manage administration duties. This increased work load has impacted the supervisory process with less time to devote to students and their writing. This means that new support models need to consider the institutional pressure that supervisors are under, so that they support both students and supervisors.

Rewriting sentences without explanations was perceived unhelpful. Students need to know what is wrong with their sentence and why it was changed. The students who experienced this form of feedback wanted to learn and understand what was wrong so they could improve their writing. In the case of Participant 2 (year 3) there seemed to be an expectation for them to go back and review the changes, to determine why it was revised, which Participant 2 found very unhelpful and time consuming: “...when they rewrite the things that I already wrote. That's not really helpful... they don't explain, they just change things. And they expect that I will review in a very detailed way, those changes.” While supervisors use this as a feedback strategy, Participant 2 (year 3) found the expectation of reviewing changes from multiple documents an unhelpful way of learning particularly when there is no opportunity to ask questions or provide input about the changes: “what can I do or say? Just observe whatever they're doing?” A lack of time and meeting tight deadlines was one of the reasons students reported supervisors rewriting sentences without any explanation. Participant 1 (year 3) explained that their supervisors: “...don't have the time to actually give me details of what is wrong. So, they

*just say, let me fix it. They change it.*” Participant 1 felt that the supervisors did not have enough time to teach and develop their writing.

Rewriting students’ work without explanation can impede students’ research writing development as they will not understand why a sentence has been changed or learn how to resolve the issue. Providing guidance and scaffolding is far more constructive for students as they can see and understand what is needed to achieve the desired goal, and apply similar strategies to the remainder of their writing. In this approach students are able to see *where they are going, how they are going, and where to next* (Hattie & Timperley, 2007) (the following chapter provides a detailed explanation). This type of feedback promotes self-regulation strategies and provides learning opportunities. Rewriting students’ sentences does not allow students to recognise the writing goal nor how to achieve it, and without guidance they will not be able to identify how to improve or develop their writing (Carter & Laurs, 2017), for next time.

Rewritten and heavily edited sentences impacted Participant 2’s (year 3) confidence which diminished the more their work was edited by their supervisors. This form of feedback can be seen to be impacting the student’s identity as a scholar, as they questioned their capability of writing the thesis:

*I had the experience of writing papers with my supervisors. But mostly, they have been editing my stuff. I am not sure if I have that ability at this moment. And I don’t know if this document, this thesis will prove that I am capable of doing this.*

Participant 1 (year 3) felt that they needed more time and more guidance to be able to improve their writing: *“in the end they just give me general comments about what I should do but they just fix the paper. They don’t allow... They don’t give me the time to actually fix it...”* Aitchison et al. (2012, p. 442) describe rewriting student sentences as “less-useful feedback practices”, as it removes “ownership from the writer” and negates the “student’s voice by overwriting their work”. While it is understandable that supervisor rewrite sentences to meet deadlines and do not have the time to provide scaffolded feedback, it is evident that this type of feedback can “frustrate student learning giving rise to resentment and strained student-supervisor relationships” (Aitchison et al., 2012, p. 442).

### *Helpful supervisor feedback practices*

Research confirms that personalised, constructive, ongoing feedback is significant in developing students' as writers and scholars (Caffarella & Barnett, 2000). So when determining the most helpful feedback, the students overwhelmingly identified that it needed to be constructive. Constructive feedback is feedback that identified phrases or ideas that lacked clarity, and importantly then provided solutions to solve the writing problem. Here Participant 1 (year 3) explains:

*I don't find it useful when someone says, you should take a look at the paragraph, it sounds weird, just make it flow. But if I get a specific like, this part is fine, I understand the idea. But the way you conclude the paragraph or the way you start with a different idea in the next one, it's really hard to follow for someone else...*

This comment above demonstrates that the student wanted to understand the desired result from the supervisor, along with explanations on how to achieve it. The student's description of helpful feedback is similar to that of Hattie & Timperley (2007, p. 86) where they describe effective feedback as reducing the gap "between current understandings and what is desired". Students' spoke positively when they received feedback like this:

*Once, [Supervisor] gave me one [helpful feedback] for the results and the analysis of the results. He gave me like a very good comment about the structure of the paragraph. He said like, in these examples you should use this. First, talk about this, then talk about this. And then, you know, like a template for each paragraph. And that's good because then I can learn from that and then I can try to, you know, use that for the rest of the chapter. (Participant 2, year 3)*

*My co-supervisor is different...When he says something is weird, but not wrong...he proposes how to fix it. And his comment is, I think this is very weirdly phrased. Maybe we can use this word and he adds the thing that he has in mind. How can you make that fit in there? And then I do my job and to re-write that I use these words. Perfect. (Participant 1, year 3)*

*You know, [Supervisor's] feedback is very useful because, apart from telling me that I am missing something, he also is giving me examples. So when he gave me feedback, [he wrote], and he loves to write a lot, so his feedback is, like, very complete in terms of, this is missing and you can do it this way. So that [gives] me guidance on how to improve my writing.*  
(Participant 4, year 1)

Helpful feedback includes receiving positive comments from their supervisors instilling confidence, encouragement and reassurance of their writing ability (Kumar & Stracke, 2007). Students collectively and clearly stated their preference for supervisor feedback that is explicit, contained examples, and included positive comments. Positive feedback brought out positive emotions from the students. Even a simple note by supervisors pointing out sentences they considered good was “like[d]” by Participant 1 (year 3), positive comments made Participant 2 (year 3) feel like they were “doing a good job”, and Participant 3 (year 1) who was similarly “happy” when they received positive comments from their supervisor. The findings presented here demonstrate that positive feedback increases student morale and confidence. This is congruent with previous research where positive feedback was found to increase confidence, produce feelings of acceptance and achievement (Kumar & Stracke, 2007), provide motivation (Stracke & Kumar, 2016), and membership to their discourse community (Stracke & Kumar, 2010). While it has been established that providing constructive criticism is essential for students to develop their writing, it is also necessary for supervisors to acknowledge when students have successfully achieved a writing goal, and in essence done something well.

Receiving feedback on small sections of writing was considered more helpful than whole chapters for two students. Participant 1 (year 3) felt that receiving feedback like this was wasting their time, and meant having to go back and rewrite a lot of what had been written:

*I found that even if I just have one page...that can be used as an example to write the following, that is more useful than writing six pages...That means I would have to change the other one[s] but I have already spent a lot of time writing the other ones.*

Participant 3 (year 1) explained that receiving feedback on smaller sections would be a more useful way to learn research writing. They explained that when they received feedback it was expected that they worked on it, but at the same time they were also expected to write another section which meant they were “not actually able to really

*discuss...those feedback with [their supervisor], because by that time the feedback start[ed] piling up.*” They expressed a need for detailed discussions on small sections of their writing, so they could then action immediately, that this process of ongoing feedback would be helpful in improving their research writing. The quotes presented here suggest that students benefit from receiving feedback on smaller sections of writing to begin with rather than complete sections or complete drafts. Writing effectively requires on-going development and effective feedback. It seems that the students here would benefit from targeted feedback on shorter sections so that the students can understand what is required of them which then leads the student to use strategies to achieve the desired result while developing their research writing skills.

#### 6.4 Limitations of this study

This study has presented HDR students’ perspectives to research writing during their candidature, which is subject to several limitations. First, only four students were interviewed, and they were all from the same faculty. Second, the students also shared some of the same supervisors. The findings, therefore, are limited to faculty context which means that the findings only presented the perspectives of these students and may not be generalisable. Third, researcher effects may have influenced participants’ responses, particularly as I am a PhD student interviewing my fellow peers.

#### 6.5 Summary and implications

This chapter established that the HDR students found research writing difficult throughout all stages of candidature. Students struggled with various elements of writing, in particular discourse level features of writing. Other difficulties included vocabulary, grammar, organising ideas, and starting their writing. This study demonstrated that student needs are individual and complex, and reiterates Chapter 4’s findings that a one size approach to research training does not meet the diverse needs of students and that a more comprehensive form research writing support is needed, such as the Multi-level Model of Research Writing Development (MMRWD) discussed in more detail in Chapter 10 section 10.2.2.

The students predominantly relied on online resources to overcome the difficulties they encountered during their writing process, using exemplars and explicit examples. Only some of the students referred to books, and the year one students found planning an



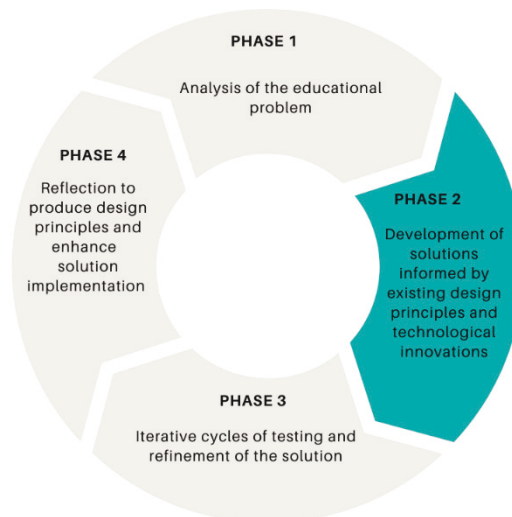
effective strategy to organise their ideas. Writing was a key strategy to improve their research writing, however writing without feedback will not necessarily develop their writing. Other strategies to improve their research writing included mindfulness, talking about their research with others, using electronic tools such as Grammarly, among others. This longitudinal investigation on how students learn research writing has provided insight into the strategies that students use to overcome their research writing challenges throughout two distinct stages of candidature. Research of this nature provides institutions an opportunity to identify the types of support students need and develop additional resources and services.

Students' expectations of feedback and their perceptions of feedback were also presented, identifying the process of receiving supervisor feedback as an emotional process, frustrating, confusing and unclear, with additional feedback often needed. Supervisor feedback that is confusing and vague calls for the need of a shared language between students and supervisors, when providing feedback. A shared language between the two parties would help supervisors describe what is needed in the text allowing the student to understand the changes required. An example of a shared language could be the use of 'moves' described in more in detail in Chapter 8). Unhelpful feedback practices also included criticism, rewriting sentences, and feedback that was not timely. When it came to helpful feedback practices, feedback with specific examples and suggestions were most beneficial.

Differences of feedback expectation between the students and supervisors was a distinct finding in this study. Additional tools and support are needed to facilitate and guide discussions on feedback expectations between students and supervisors, and reviewed regularly during candidature. While a tool on feedback expectations can set the expectations of feedback during candidature, it does not provide student strategies on how to negotiate the feedback they receive on their writing. Therefore, this chapter also raised shortcomings in terms of the training needed for students to negotiate the feedback they receive from their supervisors.

# Chapter 7: Developing Initial Design Principles

This chapter concludes phase one of the DBR process, that is the analysis of the educational problem; the current lack of resources and support to develop HDR students' research writing. In this chapter, a synthesis of the findings from Chapters 2, 4, 5 and 6 are presented. The chapter then presents the initial stages of the second phase of the DBR process: the development of solutions. Next, writing analytics is proposed as an approach to more effectively support students with their research writing. A proposed set of draft design principles are then presented to establish what a writing analytics tool should look like when employed in the HDR education sector.



## 7.1 Introduction

This chapter presents the bridge from phase one of the DBR process, the analysis of a practical problem, to phase two, the development of solutions. This chapter answers the first the section of research question 3: *How can writing analytics tools be designed, implemented and evaluated to help develop HDR students' research writing skills?* Namely, how can writing analytics tools be *designed* to develop and support HDR students' research writing. This chapter synthesises the findings from phase one to build the initial design principles focusing on students' research writing experiences. As established in Chapter 2 (2.4.1) learning design principles for learning analytics tools that

align with research writing and are student focused are limited. This chapter, therefore, presents the development of initial design principles that informs the design of the writing analytics tool AcaWriter for research writing. The draft design principles were developed through an examination of the existing literature on HDR students research writing experiences (section 2.1.2), research writing features (section 2.1.3), HDR research writing training (section 2.2) and the findings from Chapter 4, Chapter 5, and Chapter 6, in particular students' research writing challenges (4.4, 5.2.7 and 6.3.1), their research writing experiences and the strategies they employed to solve their research writing difficulties (4.3 and 6.3.2), their experiences with supervisor feedback (6.3.3) and the difficulties supervisors face when teaching and supporting HDR students (5.2.3).

## 7.2 DBR phase one findings

### *Students research writing challenges*

The exploratory phase of the DBR process found that research writing is indeed challenging for HDR students. The literature and the studies presented in Chapter 4, Chapter 5, and Chapter 6 established that research writing is challenging and full of emotion. Students lacked rhetorical awareness, were unfamiliar with disciplinary writing conventions, and were unaware of their audience (2.1.3). Coherence, developing an argument, vocabulary, and grammar were found difficult for students, especially when English is an additional language (2.1.1). Similar findings were presented in Chapter 4 (section 4.4) as the respondents reported rhetorical and discourse aspects of research writing to be difficult: building an argument, coherence and flow, developing the research problem statement, organisation and structure, and writing for their audience. Vocabulary, grammar, clarity, punctuation, sentence structure, wordiness, and paragraph structure were also identified as challenging for some respondents. The participants also reported that pre-writing strategies (for example, planning and generating ideas), synthesis of ideas, drafting, editing, revising, and reflecting were challenging aspects of the research writing process. Similarly, the studies presented in Chapter 6 (6.3.1) and Chapter 5 (5.2.7) showed that students struggled particularly with discourse features of writing, such as building an argument, structure, organising and connecting ideas, coherence, writing for their audience, writing paragraphs, writing particular sections of their document, and creating a research story. Other difficulties were also identified: clarity, use of terminology, voice, and language. Importantly, Chapter 6 (6.3.1) illustrated

that the research writing challenges that students face occur throughout their candidature, and are not fixed to one point in time. Overall the findings show that students' research writing needs are great and varied, and that they are individual and complex.

### ***Lack of institutional support for research writing***

The findings presented in Chapter 4 (4.3.6) and Chapter 6 (6.3.3) showed that supervisors are the main form of support for students when it comes to research writing. However, as it has been previously established supervisors are time poor and not all supervisors provide clear, constructive feedback, nor feel comfortable providing feedback on writing. And while research training and support is available for students, Chapter 5 (5.2.8) illustrated that support is limited as it does not meet students' individual, complex, research writing needs. As institutions continue to compete in the knowledge economy, it becomes increasingly important for them to provide additional forms of research writing support at scale. HDR students need support in both conducting their research and learning to become scholarly writers. A potential approach for scaling support for HDR students arises through the use of writing analytics.

### **7.3 How writing analytics can help**

The synthesis above has established that discourse level features of writing are challenging for HDR students. Learning to construct such discourse patterns requires ongoing writing development, and students are commonly poorly supported in this process. Writing analytics can provide high quality feedback, if done well, and can help students to reflect on the discourse level of their writing (see section 2.3.4). It supports students in critically evaluating their own work, as they consider the feedback received from the tool. However, HDR education has to date received limited attention from writing analytics (2.3.4, 2.3.6), a problem most likely due to the complexity involved in research writing. Texts created during the research journey (such as, journal papers, conference papers, abstracts and the thesis itself), do not conform to a standard essay like structure, and require students to creatively synthesize large amounts of information into new knowledge. Moreover, every thesis is by definition tackling a distinctive topic, unlike most assignment writing for courses.

As established in Chapter 2 section 2.3.4 writing analytics can help students with their research writing. Mover (Anthony & Lashkia, 2003) was developed to help students read and write scholarly texts in science and engineering by displaying the structures of

rhetorical moves in texts. However, Mover only identifies the moves found in existing texts, it does not provide feedback on how to achieve the moves in a writing task. Similarly, Research Writing Tutor (RWT) (Cotos, 2016) uses a rhetorical moves framework and provides students with automated feedback on the rhetorical moves in their writing on all sections of the research article. Research has shown that *RWT* has helped students learn the rhetorical moves in research articles suggesting that writing analytics tools can be used to scale up feedback in HDR education. Both tools provide automated feedback based on Swales (1990) Create a Research Space (CARS) model (see section 8.1.2 for a detailed discussion). AcaWriter provides automated feedback on the rhetorical moves in student writing and has been shown to develop students' academic writing. However, prior to the research reported here, feedback was provided at a more granular level than the CARS moves, without specific structural features highlighted; therefore a contribution of this work was to develop the mapping as indicated in Figure 7.1, which summarises the mapping to CARS moves developed. An analysis of the three tools (see Figure 7.1) has shown that these tools are able to identify rhetorical moves in texts (Knight, Abel, et al., 2020).

**Table 2.** Coding Schemes of Tools That Identify Rhetorical Structures

Mover	RWT	AWA/AcaWriter
Modified CARS model with three main moves and further steps: 1. Establish a territory. <ul style="list-style-type: none"> <li>• Claim centrality.</li> <li>• Generalize topics.</li> <li>• Review previous research.</li> </ul> 2. Establish a niche. <ul style="list-style-type: none"> <li>• Counter claim.</li> <li>• Indicate a gap.</li> <li>• Raise questions.</li> <li>• Continue a tradition.</li> </ul> 3. Occupy the niche. <ul style="list-style-type: none"> <li>• Outline purpose.</li> <li>• Announce research.</li> <li>• Announce findings.</li> <li>• Evaluate research.</li> <li>• Indicate RA structure.</li> </ul>	Modified CARS model with 3 moves, 17 steps: Move 1. Establish a territory: <ol style="list-style-type: none"> <li>1. Claim centrality.</li> <li>2. Make topic generalizations.</li> <li>3. Review previous research.</li> </ol> Move 2. Identify a niche: <ol style="list-style-type: none"> <li>4. Indicate a gap.</li> <li>5. Highlight a problem.</li> <li>6. Raise general questions.</li> <li>7. Propose general hypotheses.</li> <li>8. Present a justification.</li> </ol> Move 3. Address the niche: <ol style="list-style-type: none"> <li>9. Introduce present research descriptively.</li> <li>10. Introduce present research purposefully.</li> <li>11. Present research questions.</li> <li>12. Present research hypotheses.</li> <li>13. Clarify definitions.</li> <li>14. Summarize methods.</li> <li>15. Announce principal outcomes.</li> <li>16. State the value of the present research.</li> <li>17. Outline the structure of the paper.</li> </ol>	Rhetorically salient sentence types related to CARS steps: <ul style="list-style-type: none"> <li>• Summarizing</li> <li>• Background knowledge</li> <li>• Contrasting ideas</li> <li>• Novelty</li> <li>• Significance</li> <li>• Surprise</li> <li>• Open question</li> <li>• Generalizing</li> </ul> Mapped to CARS for the Research Introductions/Abstracts version of AcaWriter: Move 1: <ul style="list-style-type: none"> <li>• Background knowledge</li> <li>• Emphasis</li> </ul> Move 2: <ul style="list-style-type: none"> <li>• Contrasting ideas</li> <li>• Open question</li> </ul> Move 3: <ul style="list-style-type: none"> <li>• Novelty</li> <li>• Summary</li> </ul>

**Figure 7.1 – RWT, Mover, and AcaWriter comparison analysis (Knight, Abel, et al., 2020).**

While these tools provide feedback on the rhetorical moves in writing, they have not taken into consideration students' writing experiences with supervisor feedback, how they respond to it, and what kind of feedback students want and find useful during their research degrees.

#### 7.4 Initial design principles for HDR writing analytics tools

The findings presented in this synthesis demonstrate that HDR students do struggle with research writing throughout their candidature on different writing elements. I argue that new forms of writing development are necessary as HDR enrolments increase and cohorts become more diverse. I propose that writing analytics tools are a potential approach to provide this support at scale. Critically, for these tools to be effective in this context, various elements of the writing process, feedback and research students writing experiences need to be considered in their design. I present recommendations in terms of the form writing analytic tools should take so as to help students develop their research writing skills and join their discourse community, and ultimately succeed during their research writing journey:

1. *Automated writing feedback should ideally be constructive, specific, explicit and goal orientated*

The findings from Chapter 6 (6.3.3), corroborated by the literature (2.2.4), confirm that students do not always understand the feedback received from their supervisors or how to action it. The feedback generated should be clear, specific and actionable, so that students understand what is needed to revise and improve their text.

2. *Feedback language should be neutral*

The feedback provided by the tool should be neutral in tone, so that it does not evoke negative emotions from students. Some participants from Chapter 6 (6.3.3) expressed that sometimes the feedback they received evoked negative emotions. And, Graduate Research Staff F from Chapter 5 (5.2.5) explained that it was important to be aware of students' affective needs.

3. *Positive feedback should be included*

While constructive, formative feedback is needed so that students improve their writing, positive feedback that affirms that the student is doing well or is going in the right direction is also required (6.3.3). Research on feedback practices have revealed that

positive feedback can motivate students to continue achieving their learning goal and create greater interest in learning (Hattie & Timperley, 2007).

#### *4. Feedback should contain examples*

The participants from Chapter 6 (6.3.2) explained that they learned how to improve their texts by looking at examples. They did not always receive examples from their supervisors and so spent a considerable amount of time finding examples and understanding how to apply it in their writing. Writing analytics tools need to include examples with its feedback, so that students can see how to put the advice that they receive into practice. Additional information explaining the example and how to utilize it in their writing would also be useful.

#### *5. Feedback should cover a range of writing elements*

As illustrated from the participants in Chapter 6 (6.3.1) and Chapter 4 (4.4) students struggle with various writing elements. Writing analytics tools should provide both sentence level feedback, for example, cohesive devices, grammar if needed by the student, as well as discourse level feedback (structure, coherence, rhetorical function, building an argument and genre).

#### *6. Feedback should be timely*

The participants interviewed in Chapter 6 (6.3.3) expressed their need for timely feedback. Feedback from the tool should be instant. As well as providing immediate feedback on large and small texts.

#### *7. Complementary embedded resources (discipline specific & general)*

Embedded quality resources within the tool or links to annotated exemplars is also a requirement, so that students are not occupying their valuable time searching for resources. Participants from Chapter 4 (4.3.3) and Chapter 6 (6.3.2) reported that they used resources that provided examples, models and templates. Exemplars from a variety of disciplines should be incorporated so that students can see the writing conventions used in their discourse community.

#### *8. Repository of external resources*

A one stop shop of links to vetted quality external resources. As respondents in Chapter 4 (4.3.2) explained that they were unaware of the online resources available for research

writing, having quality resources stored in one place allows students quick and easy access.

#### 7.4.1 Summary and implications

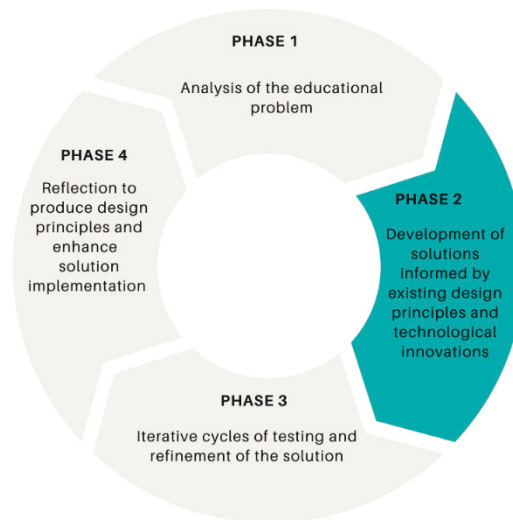
This chapter concludes the first phase of the DBR process by presenting a synthesis of findings that explored the educational problem that there is a lack of resources and support to develop HDR students' research writing. I then proposed writing analytics as an approach to help students with their research writing difficulties and develop their writing. Eight key recommendations were established to show how such a tool should be designed, if used in the HDR space. The next chapter presents the design and theoretical underpinning of creating such a tool.



# Chapter 8: Designing and Developing Writing Analytics for Research Students

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This chapter establishes the theoretical framework used in the design of phase two of this research, namely, a writing intervention to help Higher Degree Research (HDR) students with their research writing. The theoretical framework has shaped the learning design of the intervention as well as the writing analytics tool. The theoretical framework draws on genre-based pedagogies, specifically English for Specific Purposes (ESP) and Systemic Functional Linguistics (SFL), as well as cognitive writing theories, and the importance of feedback best and feedback practices. The key principles of each theory are examined in terms of how they have been implemented in the writing analytics tool and intervention. This chapter also presents the design process in creating a writing analytics tool for HDR contexts<sup>16</sup>.



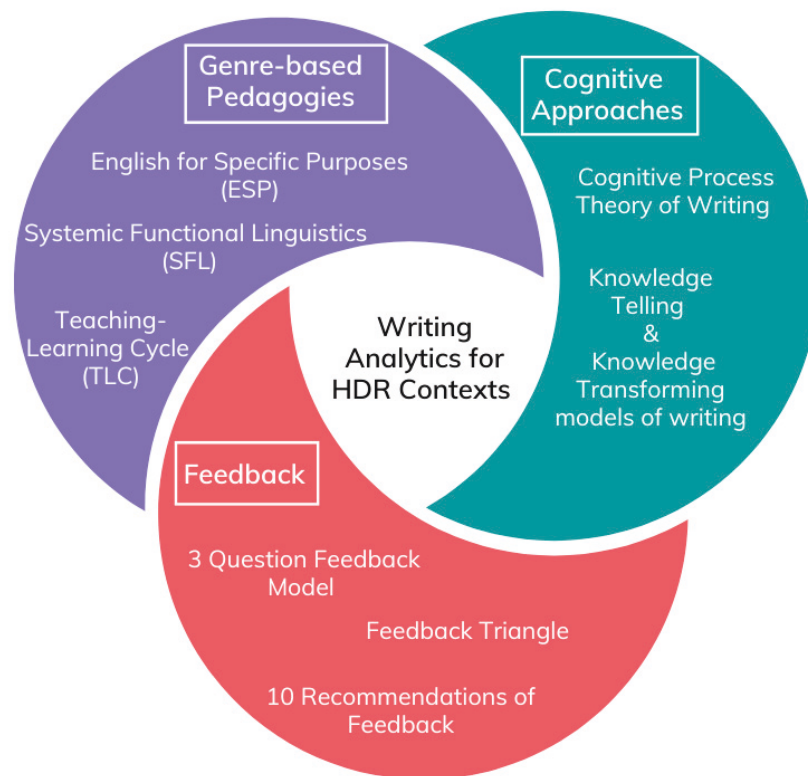
## 8.1 Theoretical Framework

The theoretical framework presented in this chapter addresses the second the phase of the DBR process: the development of solutions informed by literature, existing design principles and technological solutions. This chapter also answers the first section of

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<sup>16</sup> Parts of this chapter have been drawn from Abel et al. (2018)

research question 3: *How can writing analytics tools be designed, implemented and evaluated to help develop HDR students' research writing skills?* While Chapter 7 focused on students' research writing experiences to develop initial draft principles, this chapter examines existing theories to develop a theoretical framework for the design of the tool. Genre-based pedagogies, cognitive writing theories, and the importance of feedback and best feedback practices form the theoretical framework of the writing analytics tool.



**Figure 8.1 Theoretical Framework for writing analytics in HDR contexts**

### 8.1.1 Genre-Based Pedagogies

A genre-based approach to teaching writing looks at how language is structured in texts to achieve a communicative purpose in particular contexts (Swales, 1990). In other words, genre-based pedagogies focus on the social function of a text and how the social function informs the structure of a text and the language used; it involves “being explicit about the way language works to make meaning” (Cope & Kalantzis, 1993, p. 1). Genre-based pedagogies have been applied in HDR writing programs to teach students how to write

research articles and the dissertation (Starfield, 2003). The reason for this widespread approach is because a genre-based approach is a theoretically robust method to teaching writing, particularly when university classrooms have become more socially, culturally and linguistically diverse (K. Hyland, 2007). Such student diversity means that educators and teachers cannot presume that students' previous learning experiences will afford them with the writing and genre knowledge needed for their studies (K. Hyland, 2007). Genre-based approaches have also received substantial attention in the teaching and learning of language, especially in L2 (second language) classrooms, because of their emphasis upon the purposeful and socially situated nature of language. Hyland (2007) argues that genre-based pedagogies are beneficial for L2 learners because a genre approach to teaching writing is explicit, systematic, supportive, empowering, critical and consciousness-raising. Starfield (2003) argues that a genre-based approach is also relevant for native research students too, since it exposes them to the genre characteristics they need to master. Being explicit about the genre's characteristics helps students see how structure, language, grammar and vocabulary choices create meaning in a text. It is this explicit emphasis upon the way writing works to communicate meaning that allows students to bring together the language, content, context, and purpose of a text, in a critical and deliberate way. By empowering students with the strategies and skills that are explicit with this approach they can then tackle complex writing tasks, such as research writing and become more effective writers. It is for these reasons that a genre-based approach was chosen for both the intervention's learning design, and for the design of the writing analytic tool.

### 8.1.2 English for Specific Purposes

This research largely draws on English for Specific Purposes (ESP) as it focuses on a text's features as well as its communicative purpose and its social context (Hyon, 1996). ESP places great importance on communication within discourse communities (Swales, 1990), where membership of a discourse community is based on communicative purpose. In ESP, the communicative purpose is considered the rationale of the genre which shapes the structure of the discourse and influences content and style. ESP teachers identify the specific practices of discourse communities and how texts are used both within the community and beyond its wider social contexts. Identifying these specific practices and how community members use language in their texts through genre analysis, provides ESP teachers with an understanding of the rhetorical features required in texts, which in

turn provides an insight into the rhetorical characteristics that their students' texts must satisfy for entry into particular discourse communities. ESP attends not only to the linguistic features of texts, but aims to understand "why genres are shaped as they are, and how they achieve their particular goals" (Paltridge, 2012, p. 349), by looking at communicative purpose, context, discourse community and discourse structure. It is for this reason that this research takes an ESP approach, as it is important for HDR students to master the particular genres of writing recognised in their discourse community.

In ESP, genre is referred to in terms of communicative events, for example, conference presentations, business reports and research articles, which go through a series of stages called 'moves' and are realised by 'steps'. A 'move' is a "discoursal or rhetorical unit that performs a coherent communicative function" (Swales, 2004, p. 228). In other words, a move is a string of text that performs a communicative goal, which can be realised by one sentence or several sentences (steps). Moves are specific to their discourse communities and are used to facilitate their communicative purpose (Starfield, 2016). Genre analysis in ESP involves analysing the moves in a text, and is mostly based on Swales' (1990) rhetorical move framework. The genre studied the most using this rhetorical move framework has been the research article genre, predominantly the introduction section. Swales' (1990) *Create a Research Space (CARS)* model describes the discourse structure of the introduction section in research articles and explains the rhetorical and linguistic patterns authors make in their research article introductions. Swales (1990) analysed numerous articles from a variety of disciplines and argued that effective research article introductions followed three rhetorical moves:

- Move 1: Establishing a research territory
- Move 2: Establishing a niche
- Move 3: Occupying the niche

These rhetorical moves are comprised of sentences that explicitly state the communicative goal. For example, in **Move 1 Establishing a research territory** the author conveys to the audience that the research is important, central and relevant, with sentences like, *It is now widely recognised that feedback is critical in the writing process.* **Move 2 Establishing a niche** is where the research problem is stated or gaps in previous research are introduced, for example, *Despite the potential of writing analytics tools, little research exists on how automated feedback impacts students' writing.* **Move 3**

**Occupying the niche** states the goals of the author's research and/or paper, the solution, or results, for instance, *We present a pilot study that explores the impact of a writing analytics tool on students' writing process*. Many studies have validated the CARS model by analysing research article introductions from a variety of disciplines, such as, agricultural sciences (Milagros del Saz Rubio, 2011), computer science (Posteguillo, 1999), environmental sciences (Samraj, 2002), applied linguistics (Ozturk, 2007) and education (Loi, 2010).

The CARS model has been used widely to teach research writing in postgraduate contexts, specifically, to help students identify the rhetorical features of research article and thesis introductions specific to their discourse community (Cai, 2016; Starfield, 2003). It is a heuristic model and its relative simplicity makes it easy for students to understand and use. The model breaks down the moves of an introduction along with an explanation of each move, which allows students to identify the language features needed to achieve each particular move and communicative goal, and therefore better appreciate how to participate in their discourse community. The CARS model has been presented in numerous books, some aimed at supervisors to help teach writing to their students (Kamler & Thomson, 2014; Paltridge & Starfield, 2007), another to help academics publish (Thomson & Kamler, 2013), and others to assist HDR students with their research article writing (Swales & Feak, 2012).

The rhetorical move framework has inspired the creation of additional move frameworks for other sections of the research article, such as the methods section (Lim, 2006; Peacock, 2011; Zhang & Wannaruk, 2016), results section (Brett, 1994; Lim, 2010; D. Thompson K., 1993), discussion and conclusion sections (Holmes, 1997; Hopkins & Dudley-Evans, 1988; Parkinson, 2011; Ruiying & Allison, 2003; Swales & Feak, 2012) and the abstract (Cross & Oppenheim, 2006; Orasan, 2001; Swales & Feak, 2009). These studies show that a genre analysis using the 'move' concept is effective in understanding not only the schematic structure of sections of the research article, but how the moves are realised. Of particular relevance to this thesis, the CARS rhetorical moves has also been instantiated computationally in automated writing evaluation tools such as Research Writing Tutor, Mover, and AcaWriter (see section 2.3.4 and 7.3 for more details).

It is for these key practical, structural and heuristic reasons that I adopted the rhetorical move framework for this research. In particular, the updated 2012 CARS model (Swales & Feak, 2012) and the creation of an abstract move model was incorporated in designing

the writing analytic tool. A genre analysis using these models was also included in the learning design of the interventions to develop and raise rhetorical awareness which is critical in HDR research writing (detailed in Chapter 9).

ESP and the CARS framework provide the theoretical underpinning for the design of the writing analytics tool, however, it is also important to consider how to apply the use of the CARS framework in a learning environment. Therefore, we now turn to Systemic Functional Linguistics and the Teaching-Learning Cycle to see how applying CARS can be achieved in learning environments.

### 8.1.3 Systemic Functional Linguistics (SFL) and Teaching-Learning Cycle

Systemic Functional Linguistics (SFL) is a theoretical approach that sees language as a social semiotic system, that is, as a set of relationships between language and social context (Halliday, 1989). In other words, SFL views language as a functional resource for making meaning within social contexts (Halliday, 2007). Understanding how language is organised and used in different social contexts can therefore reveal their mutual influence, that is, how language influences social activity and how social activity influences language (Halliday, 1989). For example, a research article and a blog post on the same topic and by the same author display vastly different language choices, or *lexicogrammatical* features. The research article conforms to specific academic writing conventions (e.g. objective language, highly-specialised vocabulary), whereas the blog post, written for a general audience, is characterised by a more conversational style. Social setting is therefore intimately connected to meaning making by the language choices used to make that meaning. This relationship between the linguistic choices within a text and the context of situation is called *register*, and consists of three variables of language: *field* (the social activity and topic of discourse), *tenor* (concerns the relationship between the participants), and *mode* (concerns the role of language) (Halliday, 1989; Rose, 2012). In the previous example, the register variables can be described as:

- Field
  - Article: Research in biology
  - Blog: Research in biology
- Tenor

- Article: Expert communicating to other experts in the field
- Blog: Expert communicating to non-experts
- Mode
  - Article: Static publication, one-way interaction (author to audience)
  - Dynamic publication (may be updated/ edited), two-way interaction (readers can comment etc.)

Field, tenor, and mode, all therefore influence language use. Particular configurations of these register variables can be described as genres. Genre is seen here as broad rhetorical patterns of particular language choices; for example, recounts, narratives and expositions, all contain distinct language choices and structures. It is these distinct language choices which make them recognisable as distinct genres.

Using the theoretical underpinnings described above, the Sydney School developed the Teaching-Learning Cycle (TLC) (Rose & Martin, 2012), a pedagogical framework which outlines genre based instruction. The TLC allows students to actively engage with texts as it interrogates a text's language features as well as its social purpose. This explicit scaffolding allows students to become more confident with text types, and to be given "independence and encouraged to negotiate text structure and content" (Johns, 2002, p. 5). The TLC consists of three stages: *deconstruction*, *joint construction* and *independent construction*. The first stage, deconstruction, involves building the field and setting the context, which includes explaining the text's purpose and its social context (field, tenor and mode). During this stage texts are modelled and analysed to identify their schematic structures (how the text is organised) and their language features as well as identifying any variations. The second stage, joint construction, is where the students jointly construct a text through guided practice and learning activities. In the final stage students draw on the understandings of the genre and language developed in the previous stages to independently construct the text and ask for guidance from the teacher when necessary. Throughout the three stages the relationship between language, meaning making and genre are discussed. The cycle is not a fixed procedure and gives teachers room to adjust learning activities and enter the cycle that appropriately meets students' needs or revisit visit earlier stages.

The TLC has informed the design of the learning interventions in this research, as this pedagogic framework aims to engage students in the meaning making process of texts, making them aware of the social purpose, structure and linguistic features of a text, all important aspects when learning to write in a new genre. The cycle also allows for repeated opportunities of engagement with a genre and its text, so that students have multiple opportunities “to engage in activities which require them to reflect on and critique their learning by developing understandings of texts, acting on these through writing or speaking, reviewing their performance, and using feedback to improve their work” (K. Hyland, 2007, p. 160). It is for this reason that the TLC was adopted in the learning design of the interventions.

## 8.2 Cognitive approaches to writing

While the genre approach looks at the textual features used to compose a text, it does not consider how students go about writing their texts. To help develop the writing skills of HDR students and teach research writing it is also important to understand the *cognitive processes* involved when they write. However, writing is itself a very complicated process (Flower & Hayes, 1977), and more than a set of skills (Curry & Hewings, 2005; Kamler & Thomson, 2014; Wellington, 2010), which makes it both difficult to teach, and hard for HDR students to learn. The cognitive process theory of writing (Flower & Hayes, 1981; Hayes & Flower, 1980) is an account of the process through which people write, and has been an influential model for researchers to understand the writing process. The cognitive writing process approach focuses on the important processes that writers do when producing a text: *planning*, *translating*, and *reviewing*, within which are sub-processes. Planning involves the sub-processes of generating ideas, organising ideas and goal setting. There are no sub-processes in translating, as it is essentially the act of writing, the putting of ideas from the planning process into sentences and paragraphs. Reviewing encompasses two sub-processes: evaluating and revising, through reflective reading. It is important to note that writers do not go through these processes in a rigidly serial manner, rather, they may occur at any point in the act of writing.

Cognitive writing theorists offer insights into the differences between novice and expert writers. Flower and Hayes (1977) describe these differences as two types of writing, *writer-based prose* and *reader-based prose*. *Writer-based prose* is ego-centric, meaning that the writing reflects the writer’s internal discovery process, typical of novice writers



(Flower & Hayes, 1981). It is, essentially elliptical prose, difficult to translate and understand. The text is written without reflecting or thinking about the audience and the writing is expressed more like thoughts on a topic. *Reader based-prose*, on the other hand, goes through transformations as the writer revises and restructures their thoughts and writing to achieve the communicative goal. The writing takes a rhetorical structure, instead of the writer's discovery process, as the writer "creates a shared language and shared context between writer and reader" (Flower, 1979, p. 20). Reader-based prose is what experienced writers produce, as they take into consideration the reader and revise their thoughts and writing, so that it has a purpose and "meets the cognitive needs of the reader" (Flower & Hayes, 1977, p. 459). Similarly, Bereiter and Scardamalia's (1987) *knowledge-telling* and *knowledge-transformation* models describe the differences between novice and expert writers. Novice writers adopt a knowledge telling approach when writing about a topic. Knowledge tellers tend to list ideas where each idea prompts the next. They present their knowledge on a topic without thinking about the situational context or the readers, and do not revise heavily, nor adjust their writing to meet their readers' needs. In contrast, expert writers transform knowledge (knowledge transformers), as they are actively problem solving. They continually reflect on the writing process and shape their writing to achieve the communicative goal and meet the needs of the reader.

A key principle of the writing process approach is the iterative nature of writing and the importance of revision (Bereiter & Scardamalia, 1987). Revision in the process approach is recursive and can take place at any time during writing (Curry & Hewings, 2005; Flower & Hayes, 1981). It is in this revision process that writers evaluate their writing through reflective reading. It is here that students reflect and determine whether the written text matches their own intended mental representation through detection and diagnosing problems (Flower et al., 1986). This process is important as writers "rework thoughts and ideas" which "may powerfully affect writers' knowledge" (Fitzgerald, 1987). Experienced writers revise heavily and employ self-regulation strategies (Bereiter & Scardamalia, 1987), seemingly detecting and diagnosing problems automatically to seek a solution (Flower et al., 1986).

Novice writers, on the other hand, tend not to display these capabilities (Bereiter & Scardamalia, 1987). Bereiter and Scardamalia (1986, p. 277) advise "that an important barrier to the development of novice writers' competence is lack of an executive structure

for applying evaluative, diagnostic, and remedial abilities”. However, they argue that these self-regulation capabilities can be learned, facilitated through procedural intervention, that “simplified routines and external supports can help students through the initial stages of acquiring more complex executive processes” (1987, p. 363). Therefore, in order for students to gain the high-level problem-solving skills required to produce effective writing, and move from knowledge-telling to knowledge-transforming, they need readily available external writing support to help facilitate the revision process.

It is in this regard that automated feedback could help students detect and diagnose problems, by helping them to establish whether their written text corresponds with their mental representation. The inclusion of feedback in the revision process can also improve the quality of texts (Bereiter & Scardamalia, 1986). Since we know that “when revision is encouraged, not as a punishment but as a natural process in the exploration of the text to discover meaning, then basic writers become motivated to revise” (D. M. Murray, 1982, p. 89). It is the inclusion of automated feedback in the writing process that reinforces the drafting process. For these reasons this research also draws on writing process theories as the sub-processes involved in revision are an important part of the writing process.

### 8.3 Importance of feedback & best feedback practices

Feedback is essential in enhancing knowledge and skill acquisition. It is commonly defined as information provided by teachers, peers, educators or external agents regarding a student’s performance (Hattie & Timperley, 2007). Feedback has also been defined as a process in which learners obtain information about the quality of their work, as well as the similarities and differences between their work and the applicable standard, so as to improve their work (Boud & Molloy, 2013a). Adhering to these definitions, and in order for students to improve their performance, students must be able to understand the standard or objective they are aiming for, compare their level of performance with that standard and apply appropriate action to close the gap (Sadler, 1989). Effective feedback must therefore provide students with information that fills the gap between their current performance and what is being aimed for. This information should prompt self-regulation to assist students in making evaluative judgements - i.e., assessments of the qualities of their work – that they can act on (Boud & Molloy, 2013b; Sadler, 1989). Sadler argues that students can develop these self-regulating skills when provided with a “direct and

authentic evaluative experience”, namely guided and direct information presented by the ‘knower’, which assists them in becoming independent, self-monitoring students (Sadler, 1989, p. 135). Being able to make evaluative judgements during their actual performance is a key competency in students’ improvement in a task (Sadler, 1989).

Students need to be able to evaluate their own work in order to become independent, self-regulated learners. Automated feedback provides students with the opportunity to engage in such authentic evaluative practices. Students are able to compare their writing with the feedback from the writing analytic tool. Feedback from the writing analytics tool can facilitate this process as students are able to seek feedback at any time during the writing process. This is critical for HDR students who do not follow a class timetable and do not always receive timely feedback from their supervisors. Previous research has shown that automated feedback helps students develop their evaluative judgement and judge their writing according to both the feedback, as well as their own knowledge about their discipline and genre (Knight, Shibani, et al., 2020; Shibani, 2019). While most writing analytics research has focused on undergraduate and postgraduate coursework students, in principle, this process should also help to develop HDR students’ self-regulation skills, assisting their growth as independent scholarly writers.

In the context of HDR students, feedback on their research writing is crucial in producing a quality thesis and writing publications. It is through supervisor feedback that students recraft their drafts and make new discoveries in the process (Kumar & Stracke, 2007), thus enhancing their knowledge and improving their writing. Feedback in this educational context also facilitates critical thinking skills as students pause and reflect on the comments they have received and make modifications. However, it is well established that supervisors, the main source of feedback, do not always provide clear, understandable and actionable feedback (Aitchison et al., 2012; Paré, 2010, 2011). It is also well established that supervisors do not always have the time to provide timely feedback to their students (Carter & Kumar, 2017). And rather than just being corrective, supervisory feedback should be actionable, providing information specific to the task and the student’s performance, so filling the gap between their performance and the task objective (Hattie & Timperley, 2007; Sadler, 1989). Therefore, there is a relationship between students’ writing goals and feedback. This relationship is complex, because in the case of HDR students, supervisor feedback might not address the student’s current performance and writing goal, similar to the findings of Paré’s (2010, 2011) studies on supervision

feedback. Therefore, the feedback provided by the writing analytic tool must be clear, understandable, actionable and prompt.

Best practice when it comes to giving feedback has been offered by Hattie and Timperley's (2007) feedback model which proposes that feedback should answer these three questions: *How am I going?*, *Where am I going?*, and *Where to next?* and that each question operates at four levels: *task*, *process*, *self-regulation*, and *self*. They argue that feedback effectiveness depends in part on the level that the feedback operates and that feedback across these levels has varying effects. In the case of writing, this model suggests not only providing corrective feedback on the text, but also feedback that suggests how students can improve their text, which closes the gap between where they are and their writing goal. Alternatively, the Yang and Carless (2013) feedback triangle, a framework for effective feedback contains three levels of feedback: *cognitive dimension* which relates to the content of the feedback that is the explanation of a theory or strategy; *social-affective dimension* which considers the social and interpersonal negotiation of feedback – how students respond emotionally to the feedback and how their emotions influence their learning; and, the *structural dimension* which focuses on how the feedback process is organised and managed, including the timing, delivery and modes of feedback. These three dimensions are argued to be interrelated where each dimension impacts the others. One dimension can be endorsed or hindered by the feedback in the other dimension. This interconnected perspective of feedback confirms just how complex feedback can be.

This three level framework differs from that of Hattie and Timperley (2007) as it considers how the provision of feedback by educators and the institution impacts the effectiveness of feedback. In HDR education the structural dimension and social-affective dimension are significant, particularly when the main source of feedback is supervisors, and studies have shown how supervisory feedback can impact students' negotiation of feedback. Kumar and Stracke's (2007) analysis of feedback on a PhD thesis identified that expressive feedback, feedback that contained criticism, praise and opinion was most useful in the research writing process as it encouraged self-regulated learning. Carter and Kumar (2017) state that supervisory feedback should contain both evaluative commentary and suggestions for improvement. The feedback given should not just critique the student's draft, but provide the student ways to develop their writing and improve their skills. They argue that this feedback process helps students develop their self-regulation

skills and become independent learners. Another study by Nicol (2010) outlines 10 recommendations for best practice, claiming that feedback should be:

- **understandable:** articulated in a way that is easy for students to understand;
- **selective:** only two or three key areas should be commented on that explain to students how to improve;
- **specific:** related directly to instances in the students' work where the feedback can be applied;
- **timely:** provided to students within a reasonable time frame so that they have enough time to reflect and improve before the next submission;
- **contextualised:** taking into consideration the learning goals and context
- **non-judgemental:** concentrated on the learning goals and being informative rather than evaluative;
- **balanced:** commenting on both areas for improvement and the positive aspects of the work;
- **forward looking:** providing suggestions on how students can improve subsequent submissions;
- **transferable:** emphasising strategies, skills and self-regulation practices, not only knowledge content;
- **personal:** referring back to the students' previous work and what is known about them.

These good feedback practices are aimed at teachers, educators and supervisors. While it is not possible to implement all of these feedback practices into an automated feedback tool, it is possible to implement most of them. Table 8.1 illustrates how the initial design principles developed in Chapter 7 (7.4) align closely to Nicol's (2010) recommendations.

**Table 8.1 – Synthesis of best feedback practices and initial design principles**

Design principle	Research best practice warrant (Nicol (2010))
1. Automated writing feedback should be constructive, specific, explicit and goal orientated	<p><b>understandable:</b> articulated in a way that is easy for students to understand;</p> <p><b>selective:</b> only two or three key areas should be commented on that explain to students how to improve;</p> <p><b>specific:</b> related directly to instances in the students' work where the feedback can be applied;</p>
4. Feedback should contain examples	<p><b>contextualised:</b> taking into consideration the learning goals and context</p>
5. Feedback should cover a range of writing elements	<p><b>forward looking:</b> providing suggestions on how students can improve subsequent submissions;</p> <p><b>transferable:</b> emphasising strategies, skills and self-regulation practices, not only knowledge content;</p>
2. Feedback language should be neutral	<p><b>non-judgemental:</b> concentrated on the learning goals and being informative rather than evaluative;</p>
3. Positive feedback should be included	<p><b>balanced:</b> commenting on both areas for improvement and the positive aspects of the work;</p>
6. Feedback should be timely	<p><b>timely:</b> provided to students within a reasonable time frame so that they have enough time to reflect and improve before the next submission;</p>
7. Complementary embedded resources (discipline specific & general)	
8. Repository of external resources	

Design principle	Research best practice warrant (Nicol (2010))
	<b>personal:</b> referring back to the students' previous work and what is known about them.

It is important to note that for an automated feedback tool to support HDR students' research writing skills, the underlying premise must be that effective feedback should go further than enhancing students' knowledge and skills. It should help develop students' self-regulation practices. Therefore, the feedback designed for the writing analytic tool developed in this research aims to develop students' self-regulation skills, by incorporating best feedback practices (which will be discussed in detail in section 8.5).

#### 8.4 AcaWriter's original analytical parser

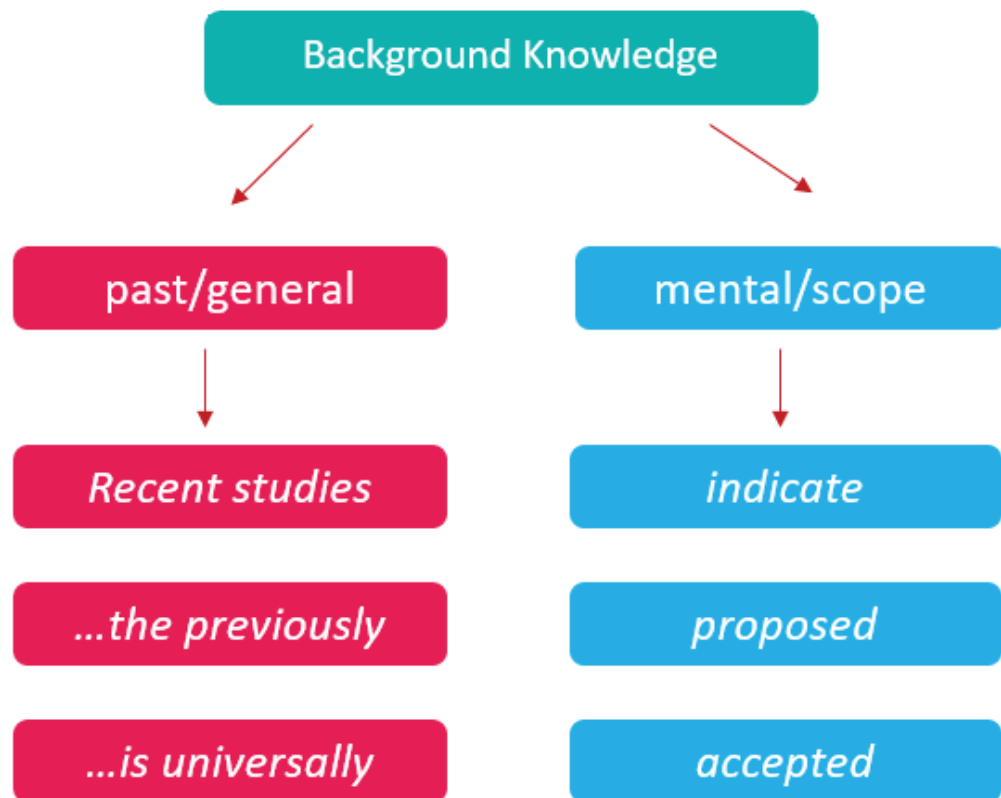
As mentioned in section 2.3.5, prior to this research, a writing analytics tool called AcaWriter<sup>17</sup> was developed to help students improve their academic writing skills (Knight et al., 2016, 2020; Shibani et al., 2017). AcaWriter provides automated feedback on students' texts by using Natural Language Processing (NLP) techniques to analyse text and identify rhetorical moves in texts. These rhetorical moves can be assigned to particular genres of writing, which are represented by salient sentences.

AcaWriter uses a rhetorical parser that identifies sentences that signal rhetorical moves by identifying discourse patterns. It does this by employing a concept-matching method (Sándor, 2007) to detect rhetorical metadiscourse (8.1.2). This approach models syntactic relationships between words and expressions in written work, to match these against pre-defined patterns of constituent concepts that define the rhetorical discourse function. Figure 8.2 is an example of how the rules are employed to detect rhetorical metadiscourse associated to the rhetorical move *background knowledge*. For example, the rhetorical move *background knowledge* is defined as a combination (in either sequence) of two concepts: (1) background, and (2) knowledge and the words and expressions that

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<sup>17</sup> AcaWriter is open source software and available here: <https://cic.uts.edu.au/open-source-writing-analytics>

instantiate these concepts. Thus, *background knowledge* comprises the concepts (1) *background*, which includes the constituent concepts *past* and *general* (instantiated in the words or expressions: *Recent studies*, *...the previously*, *...is universally*) and (2) the constituent concepts related to *knowledge* such as *mental* and *scope* (*indicate*, *proposed*, *accepted*). AcaWriter identifies rhetorical moves in texts by using a set of specific syntactic dependencies and co-occurrence rules. Figure 8.3 shows how this concept matching framework is instantiated in texts (Sándor, 2018).



**Figure 8.2 – Concept matching framework example of background knowledge**



Recent studies indicate that ligands of the peroxisome proliferator - activated receptors - gamma (PPAR-gamma) alter cardiac remodeling during chronic ischemia.

AMH promoter sequence variations or the previously proposed SF3a2-AMH fusion co - transcripts cannot be responsible for aberrant AMH expression leading to Mullerian duct degradation.

Vascular endothelial growth factor (VEGF) is universally accepted as a primary factor in the regulation of vessel patency in vascular networks throughout the body and including the retina.

### **Figure 8.3 – Representation of concept matching framework in texts**

When AcaWriter detects the rhetorical moves, an analytical report is generated where the rhetorical moves are tagged and highlighted (see Figure 8.4). The highlighted sentences prompt students to reflect on what they have written. When I started this research, this was the only form of feedback provided by AcaWriter. This form of feedback is limited, as it only highlights and identifies the text's rhetorical moves and does not provide students with guidance on how to improve their texts. As established in Chapter 6 (6.3.3) and Chapter 7 (7.4) students wanted feedback that explained to them how to improve their text. The discussion on best practices of feedback (section 8.3) also argues that effective feedback should fill the gap between their current performance and their writing goal with explanations how to achieve the goal.

#### Analytical Report

- P** A perspective or stance
- E** Emphasis to highlight key ideas
- S** Summarises or signals the authors goals
- N** Novelty improvements in ideas and methods
- C** Contrast: Disagreement, Tension, Inconsistency
- B** Background: generally accepted work
- S** Surprising
- Q** Question
- T** A trend or tendency related to ideas approaches and methods

**E** Understanding students' learning dispositions has been a focus for research in education for many years. **C** A range of alternative approaches to conceptualising and measuring this broad construct have been developed. Traditional psychometric measures aim to produce scales that satisfy the requirements for research; however, such measures have an additional use to provide formative feedback to the learner. **S** In this article we reanalyse 15 years of data derived from the Effective Lifelong Learning inventory. We explore patterns and relationships within its practical measures and generate a more robust, parsimonious measurement model, strengthening its research attributes and its practical value. **E S** We show how the constructs included in the model link to relevant research and how it serves to integrate a number of ideas that have hitherto been treated as separate. **N** The new model suggests a view of learning that is an embodied and relational process through which we regulate the flow of energy and information over time in order to achieve a particular purpose. Learning dispositions reflect the ways in which we develop resilient agency in learning by regulating this flow of energy and information in order to engage with challenge, risk and uncertainty and to adapt and change positively.

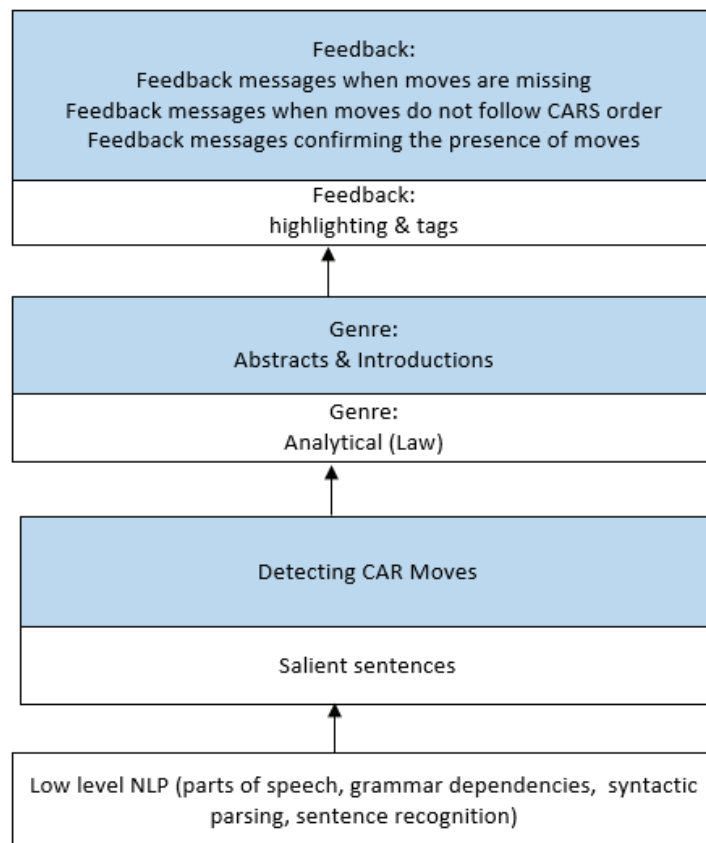
**Figure 8.4 – AcaWriter’s analytical report was the sole form of feedback provided to students prior to this thesis.**

It should be made clear that AcaWriter has no subject-matter knowledge, focusing solely on *how students make their thinking visible* through rhetorical moves, rather than *judging the substance* of that thinking. This remains the responsibility of the student and supervisor. Detecting the presence/absence of domain keywords, concepts, authors, theories, places, events and so forth in text is in fact a relatively straightforward technical challenge, if lexicons, professional classification schemes or even ontologies are available for a given field. It should also be noted that AcaWriter is not commenting on the accuracy or truthfulness of writing and cannot completely replace human readers. AcaWriter’s focus is solely on rhetorical moves.

### 8.5 Designing AcaWriter for HDR contexts

This research created a parser focusing on research writing which was an extension of AcaWriter. The evolution of AcaWriter for HDR contexts was a collaboration between a computational linguist, two programmers and an academic language and learning educator (the researcher). This research advances the capabilities AcaWriter in three respects. Firstly, when I began this research, preliminary work with the tool had only been conducted in undergraduate contexts (Gibson et al., 2017; Knight et al., 2018; Shibani et al., 2017). It had not been applied to the HDR writing context. This research, therefore, extends previous work on AcaWriter into this distinctive new context. Secondly, a “CARS parser” (Figure 8.6) and “Abstract parser” (see section 9.5.2: Figure 9.20 and

Figure 9.21) were created to make it applicable for HDR students, aligned with the concepts used to train them (both face-to-face and online). Thirdly, the quality of feedback provided by AcaWriter has been significantly extended beyond simply highlighting salient sentences containing rhetorical moves, to providing actionable feedback messages, and examples of sentences to illustrate each rhetorical move. Figure 8.5 – shows this new functionality in blue and Figure 8.6 shows the new interface design utilising the CARS framework for HDR students.



**Figure 8.5 – Summary of new functionality added to AcaWriter as a result of this thesis.**

**NOTE:** Computers don't understand writing like humans. So, AcaWriter may highlight rhetorically good sentences that actually make no sense, or leave un-highlighted a sentence that you feel is really good. It's fine to disagree with the feedback — but it's also your job to check your facts!

Analytical Report	Feedback	Resources
Move 1: Establishing a research territory		
<ul style="list-style-type: none"> <li>E Emphasis of a significant or an important idea</li> <li>B Background information and reviewing previous work</li> </ul>		
Move 2: Establishing a Niche		
<ul style="list-style-type: none"> <li>C Contrasting idea, tension, disagreement or critical insight</li> <li>Q Question or gap in previous knowledge</li> </ul>		
Move 3: Occupying the Niche		
<ul style="list-style-type: none"> <li>N Novelty and value of your research</li> <li>S Summary of the author's goal or nature of the research, or structure of the paper</li> </ul>		
<p>E C From a human-centred computing perspective, the end-user's interpretation of these visualisations is a critical challenge to design for, with empirical evidence already showing that 'usable' visualisations are not necessarily effective from a learning perspective. Since an educator's interpretation of visualised data is essentially the construction of a narrative about student progress, we draw on the growing body of work on Data Storytelling (DS) as the inspiration for a set of enhancements that could be applied to data visualisations to improve their communicative power. S We present a pilot study that explores the effectiveness of these DS elements based on educators' responses to paper prototypes. E B It is now widely accepted that timely, actionable feedback is essential for effective learning. In response to this, data science is now impacting the education sector, with a growing number of commercial products and research prototypes providing "learning dashboards", aiming to provide real time progress indicators.</p>		

**Figure 8.6 – AcaWriter’s updated user interface incorporating the new CARS-based design features for HDR students**

The CARS parser focused on the Introduction and Abstract sections of research articles. These two sections were chosen as they are critical components of research writing. The abstract is the first section that is read by reviewers and researchers, and it is generally at this point that readers choose to read on further or ignore the article. This means that abstracts are under meticulous examination. It is here where writers gain the attention of readers, persuade readers to keep on reading, state their claims up front and portray that they are “competent community members” (K. Hyland, 2000, p. 63). The introduction to a research article is also critical as authors establish the contribution and significance of their research and compete for reader attention (Paltridge & Starfield, 2007; Swales & Feak, 2012). Ultimately, all HDR students must write an abstract and introduction in their

thesis, and many students will aim to have research articles published before finishing their degree. The CARS parser aimed to provide formative feedback specifically on the rhetorical moves made in Introductions and Abstracts.

The detailed rationale for how the additional innovations in AcaWriter were designed is now presented.

### 8.5.1 Part one: Mapping the moves

Unlike AcaWriter’s analytical parser, the CARS parser mapped low level sentences, classified and tagged as rhetorical moves, into higher order categories (CARS moves 1-3). This aligned the language of AcaWriter’s feedback with the language used to teach HDR students, a modelling process that had not been previously accomplished. To create the CARS parser, the moves in AcaWriter’s original analytical parser (see Table 8.2) were mapped to match the CARS moves identified by Swales and Feak (2012) (Table 8.3).

**Table 8.2 - AcaWriter's Rhetorical moves, tags & examples**

<b>Rhetorical move</b>	<b>Tag</b>	<b>Example</b>
Question	Q	Current data is insufficient to conclude that.....
Background	B	Recent studies indicate that.....
Contrast	C	In contrast with previous hypotheses...
Emphasis	E	Studies on x have provided important advances...
Novelty	N	This model provides a new approach to...
Surprise	S	This discovery of x suggests intriguing.....
Trend	T	New models of x are emerging....
Summary	S	In this paper we show how....

**Table 8.3 - CARS Moves mapped to AcaWriter's moves (adapted from Swales & Feak 2012)**

CARS Rhetorical Moves	AcaWriter Tags
Move 1 – Establishing a research territory:	E - Emphasis
by showing that the general research area is important, central, interesting, problematic, or relevant in some way (optional)	B - Background
by introducing and reviewing items of previous research in the area (obligatory)	
Move 2 - Establishing a niche:	
by indicating a gap in the previous research, raising a question about it, or extending previous knowledge in some way (obligatory)	C – Contrast Q – Question
Move 3 - Occupying the niche:	
by outlining purposes or stating the nature of the present research (obligatory)	S – Summary
by listing research questions and hypotheses (optional)	N – Novelty
by announcing principle findings (optional)	
by stating the value of the present research (optional)	S – Summary
by indicating the structure of the research paper / thesis (optional)	

Not all of AcaWriter's moves were relevant, so they were removed. Out of the 8 original AcaWriter tags, 6 were kept. AcaWriter's tags were mapped to the CARS moves by looking at the communicative functions of the AcaWriter moves and comparing them to the three CARS rhetorical moves. The validity of the mapping was established by first performing a discourse analysis of several research article introductions and abstracts, and then testing the emerging CARS parser to see that it found the same moves. While the parser was not perfect, it was deemed to have adequate accuracy as the emerging parser was then used to analyse the Elsevier STEM corpus, with sentences checked to see

which were tagged and whether they matched the CARS moves (Elsevier, 2015; Knight, Abel, et al., 2020).

### 8.5.2 Part two: Designing the feedback rules

Feedback rules were created to provide more specific feedback to students. Table 8.4 presents all the rules that were developed for the CARS parser and Abstract parser (see section 9.5.2 for the Abstract parser). Rules were created to identify when moves were detected in the text (via the highlighting) and when moves were missing which included a feedback message how to achieve the move (see section 8.5.7 for more information on the feedback messages). These rules were added so that students could identify which moves they successfully included in their texts and which moves were missing. As Swales and Feak (2012) suggest that Moves 1 to 3 should follow consecutively, a rules system was developed to provide feedback when moves were in the wrong order. AcaWriter’s original parser did not have absence, sequencing or dependencies rules which makes these additional rules a novel contribution to the tool.

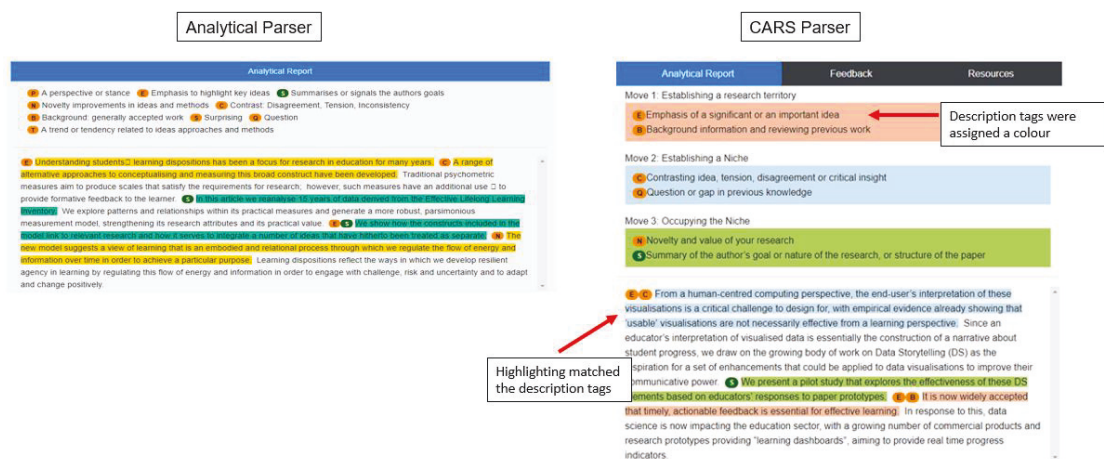
**Table 8.4 - Feedback rules taxonomy**

<b>Feedback rule</b>	<b>Description</b>
Presence or absence	Detect if a move is present or missing from the text
Position	Detect where a move is located in the text
Sequencing / ordering	Detect whether moves follow a particular order
Dependencies	Detect whether a move/s is present in the text, but another move was not

### 8.5.3 Part three: Designing the user interface (highlighting)

For AcaWriter to be useful for HDR research writing, changes were made to AcaWriter’s analytical user interface, in particular the highlighting and colours used. The design principles for creating the CARS parser were derived from genre-based pedagogies (sections 8.1- 8.1.3). In the CARS parser each AcaWriter tag was assigned a colour that corresponded to the CARS rhetorical move that they were mapped against (8.5.1). The description tags were also assigned the same colour so that students would be able to see that the sentences highlighted matched back to the CARS model. This new design element

improved AcaWriter’s user interface as students could now easily see which sentences belonged to which move. In AcaWriter’s analytical parser the description tags are not assigned a colour. In addition, all the rhetorical moves that appear in the text are highlighted in the same colour with the exception of the Summary move. Highlighting all the rhetorical moves in the same colour can be confusing for students as they may not know how to interpret the highlighting. Figure 8.7 shows the differences between the Analytical parser and the CARS parser interface.



**Figure 8.7 – Comparison of AcaWriter’s Analytical Parser and CARS parser user interface**

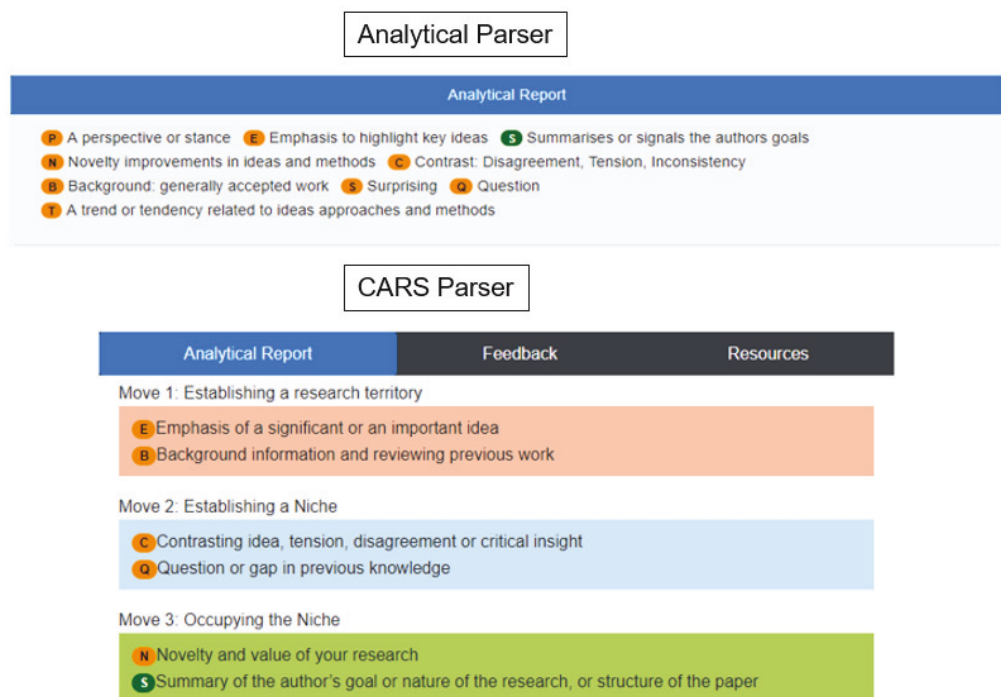
By identifying and highlighting the CARS moves, students receive visual indicators of the properties of their writing at the time of submission to AcaWriter, supporting them in the first of Hattie and Timperley’s (2007) feedback model question, *How am I going?* Highlighting the moves in students’ text encourages students to analyse and think critically about their writing, in effect, guiding them to perform a genre analysis. Students are able to see whether or not AcaWriter identified the moves in their writing. The students are also encouraged to think critically about AcaWriter’s feedback, as it is a machine rather than a human reading the writing.

#### 8.5.4 Part four: Designing the user interface (language)

AcaWriter’s description tags were also modified to reflect the language used when describing the rhetorical moves in the CARS model. Low level language from the tool was changed to high level language so that they were meaningful to the students. See



Figure 8.8 for a comparison of the language used in the parsers. For example, *Background: generally accepted work* was changed to *Background information and reviewing previous work*, and the AcaWriter tag *Question* was changed to *Question or gap in previous knowledge*. These changes were incorporated so that it would be easier for students to understand the AcaWriter tags and the types of sentences they reflected in the context of writing abstracts and introductions. The changes were implemented so that the tool was aligned with the topic students would be taught, that is writing abstracts and introductions. How students are being introduced to a topic should be reflected in the tool. When this research first began AcaWriter’s analytical parser was not aligned to topics and genres that students were being taught (Knight et al., 2018). Aligning the tool to students’ learning context and the genres they are writing makes the writing analytics tool for meaningful for students (Shibani, 2019).



**Figure 8.8 – Comparison of language used in AcaWriter’s Analytical parser and the CARS parser**

### 8.5.5 Part five: informing students of AcaWriter’s limitations

As NLP techniques are not sophisticated enough to read language the ways humans do, it is necessary to inform students of this limitation. Therefore, a warning message from

AcaWriter’s original interface was placed at the top of the feedback to alert students that AcaWriter is not perfect and may not always correctly identify the moves in their writing, see Figure 8.9. Explaining the limitations of the tool also mitigates expectations of the tool, so students understand that the tool is not perfect and there is not a mismatch in expectations as experienced by the participants in Chapter 6 when it came to supervisory feedback. This design feature also follows a design principle proposed by Kitto et al. (2018) to “embrace imperfection” in machine intelligence when deployed to assess complex competencies: reflecting on whether automated feedback is correct, and having the confidence to “push back”, is itself a pedagogically valuable activity.

NOTE: Computers don't understand writing like humans. So, AcaWriter may highlight rhetorically good sentences that actually make no sense, or leave un-highlighted a sentence that you feel is really good. It's fine to disagree with the feedback — but it's also your job to check your facts!

Analytical Report	Feedback	Resources
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Move 1: Establishing a research territory

- E Emphasis of a significant or an important idea
- B Background information and reviewing previous work

Move 2: Establishing a Niche

- C Contrasting idea, tension, disagreement or critical insight
- Q Question or gap in previous knowledge

Move 3: Occupying the Niche

- N Novelty and value of your research
- S Summary of the author's goal or nature of the research, or structure of the paper

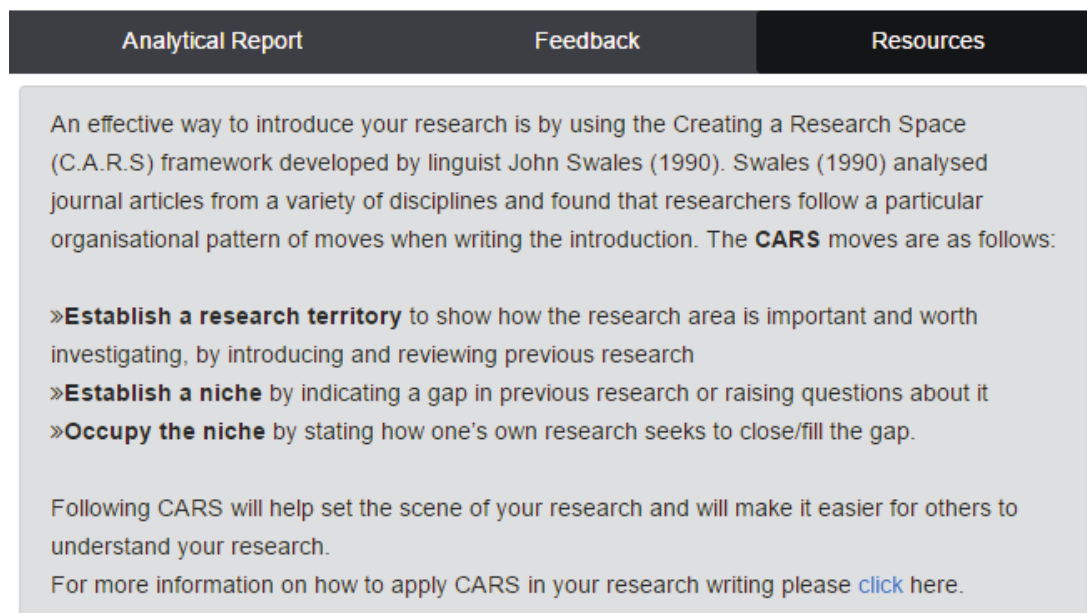
E C From a human-centred computing perspective, the end-user's interpretation of these visualisations is a critical challenge to design for, with empirical evidence already showing that 'usable' visualisations are not necessarily effective from a learning perspective. Since an educator's interpretation of visualised data is essentially the construction of a narrative about student progress, we draw on the growing body of work on Data Storytelling (DS) as the inspiration for a set of enhancements that could be applied to data visualisations to improve their communicative power. S We present a pilot study that explores the effectiveness of these DS elements based on educators' responses to paper prototypes. E B It is now widely accepted that timely, actionable feedback is essential for effective learning. In response to this, data science is now impacting the education sector, with a growing number of commercial products and research prototypes providing "learning dashboards", aiming to provide real time progress indicators.

**Figure 8.9 – Warning message included in the CARS parser**

### 8.5.6 Part six: Incorporating a resources tab

A resources tab was also added to the user interface so that students could have access to more information about the CARS framework and access to resources to help them apply the CARS moves in their work. This addition aligns with design principle seven -

complementary embedded resources (see section 7.4 and Table 8.1). AcaWriter’s analytical parser did not have a resources tab. This addition is a novel contribution to the tool.



**Figure 8.10 – Resource tab for the CARS parser**

### 8.5.7 Part seven: Designing actionable feedback

Automated feedback messages were also added to the CARS parser so that students could receive clearer guidance on what to revise after submitting their draft to AcaWriter. The feedback messages explained what was needed to improve the text in regards to the rhetorical moves along with suggestions. The addition of feedback messages with explanations, suggestions and examples, applies design principle one - *Automated writing feedback should ideally be constructive, specific, explicit and goal orientated* (see section 7.4 and Table 8.1). The addition of feedback messages advances the tool, as AcaWriter’s analytical parser only identified and highlighted the rhetorical moves in students’ writing, providing no such guidance.

Towards the end of the pilot phase (iteration 1) slight changes were made to the feedback messages so that they were easier to read. For example, “and(or)” was changed to “or”, and parentheses were included so that the move information would be added information and not part of the sentence. Slight language changes were made to the feedback

messages. The initial feedback message designed stated “AcaWriter suggests” this was changed to “Go back and check”. These changes are presented in Feedback message 1 and Feedback message 2.

### **Feedback message 1**

You have indicated the research gap and(or) written about your research problem - Move 2 Establishing a nice (C or Q sentences) before explaining how your research topic is relevant and important which is Move 1 (E or B sentences). It’s better to give some background information on your research topic before jumping straight into your gap and research problem. AcaWriter suggests moving Move 1 Establishing the research territory (E or B sentences) before Move 2 Establishing a nice (C or Q sentences).

### **Feedback message 2**

You have indicated the research gap or written about your research problem [Move 2 Establishing a niche (C or Q sentences)] before explaining how your research topic is relevant and important [Move 1 (E or B sentences)]. It’s better to give some background information on your research topic before jumping straight into your gap and research problem. Go back and check if Move 1 Establishing the research territory (E or B sentences) is before Move 2 Establishing a niche (C or Q sentences).

The final feedback messages for the design of the tool for iteration 1 are presented in Table 8.5. Figure 8.11 shows an example of the feedback message provided by AcaWriter.

**Table 8.5 – CARS parser feedback rules and messages (Iteration 1)**

<b>Feedback rule</b>	<b>Feedback message</b>
Move 2 before Move 1	You have indicated the research gap or written about your research problem [Move 2 Establishing a niche (C or Q sentences)] before explaining how your research topic is relevant and important [Move 1 (E or B sentences)]. It’s better to give some background

Feedback rule	Feedback message
	information on your research topic before jumping straight into your gap and research problem. Go back and check if Move 1 Establishing the research territory (E or B sentences) is before Move 2 Establishing a niche (C or Q sentences).
Move 3 before Move 1	It seems you have stated how your research fills the gap or solves the research problem [Move 3 – Occupying the niche (S or N sentences)] before you have given background information on your research [Move 1 - Establishing the research territory (E or B sentences)]. It is more effective to state how your research fills the gap or solves the research problem at the end of your introduction, as this is an effective transition into the next section of your paper.
Move 3 before Move 2	It seems you have explained how your research fills the gap or solves the research problem [Move 3 – Occupying the niche (S or N sentences)] before you have indicated the gap or explained your research problem [Move 2 Establishing a niche (C or Q sentences)]. It is more effective to indicate the gap and explain the research problem before you state your solution and aim of your study. Go back and revise your text so that Move 3 – Occupying the niche (S or N sentences) is after Move 2 Establishing a niche (C or Q sentences).
Move 1 missing	It looks like you are missing Move 1 – Establishing a research territory (E or B sentences). Here you should show how your research topic is relevant and important by introducing & reviewing previous research on your topic. For example, recent research indicates that the effects of climate change have.... (for more examples head to the resources tab)
Move 2 missing	It looks like you are missing Move 2 – Establishing a niche (C or Q sentences). Here you should indicate the gap and state the research problem, by explaining how previous research is incomplete or that there are aspects of the research topic that still needs investigating. This can be done by using sentences like these: However, these

Feedback rule	Feedback message
	studies have failed to recognise that...., Limited research exists on....., Despite earlier studies the effects of x remains unclear. (for more examples head to the resources tab)
Move 3 missing	It looks like you are missing Move 3 – Occupying the niche (S or N sentences). Here you should state how your research fills the gap or solves the research problem mentioned in Move 2. You can do this by stating the aim and purpose of your research. For example, this goal of this study, this research shows that..., the purpose of this investigation....(for more examples head to the resources tab)

Get Feedback & Save Download PDF

Analytical Report	Feedback	Resources
Thank you for submitting your draft to AcaWriter. Quality writing comes from revision. Research shows that writing drafts and revising your text helps improve the quality of your writing.		
Remember AcaWriter is a machine – so it may not highlight all your moves correctly and could give you incorrect feedback. So, don't be afraid to disagree with the feedback, if you believe you have included all three moves in the correct order.		
<p>❗ You have indicated the research gap or written about your research problem [Move 2 Establishing a niche (C or Q sentences)] before explaining how your research topic is relevant and important [Move 1 (E or B sentences)]. It's better to give some background information on your research topic before jumping straight into your gap and research problem. Go back and check if Move 1 Establishing the research territory (E or B sentences) is before Move 2 Establishing a niche (C or Q sentences).</p>		
<p>❗ It looks like you are missing Move 2 – Establishing a niche (C or Q sentences). Here you should indicate the gap and state the research problem, by explaining how previous research is incomplete or that there are aspects of the research topic that still needs investigating. This can be done by using sentences like these: However, these studies have failed to recognise that...., Limited research exists on....., Despite earlier studies the effects of x remains unclear. (for more examples head to the resources tab)</p>		

**Figure 8.11 – The addition of AcaWriter feedback messages to help students interpret the highlighted sentences in their draft**

These improvements and amendments to the tool mean that when students submit their writing to AcaWriter for feedback, the feedback provided is clear, understandable, actionable, specific, transferable and timely, all characteristics of good feedback as discussed in section 8.3. AcaWriter's feedback also aligns with Hattie and Timperley's (2007) remaining two features of their feedback model, *Where am I going?* and *Where to*

*next?*, as students are prompted to revise their text specifically related to each move, with suggestions on how to improve their sentences. This feedback closes the loop between where students are and their writing goal, in this case to write an introduction or abstract. Students are able to experience the recursive nature of writing guided by feedback to help them achieve their writing goal. Including feedback messages encourages self-regulation practices, as students are encouraged to look back on their writing and evaluate it according to the feedback message. The feedback messages also facilitate the revision process and encourage re-drafting which is an important part of the writing process, and can improve students' text as discussed in section 8.2. The tone of the feedback was deliberately designed to be neutral, so that students did not feel criticised and therefore not evoke negative emotions. The feedback language designed for the tool applies design principle two – *Feedback language should be neutral* (see section 7.4 and Table 8.1).

As AcaWriter is a web-based system, HDR students are able to submit writing for feedback whenever they need it and receive feedback in real time. This application of instant feedback aligns with design principle six – *Feedback should be timely* (see section 7.4 and Table 8.1). Twenty-four/seven instant feedback on writing is clearly humanly impossible. This in principle is a significant change in the HDR student experience. While, AcaWriter cannot replace the role of supervisors, it could however release them from having to comment on missing rhetorical moves, so they can focus on other aspects of the text and supervision.

## 8.6 Summary and implications

This chapter established the theoretical framework in the design of an automated writing intervention to support HDR students with their research writing. It has provided a rationale as to why these theories have motivated the learning design of the interventions and the design of AcaWriter for research writing. Specifically, it explained how ESP raises students' rhetorical awareness through genre analysis and provides students an understanding of the rhetorical moves in texts and its relationship to its specific discourse community. Additionally, it explained that the TLC cycle was adopted because it provides an explicit pedagogical framework to interrogate texts through first modelling and deconstructing texts with the aim of scaffolding learners to then independent construction. Further, connections were made between the process approach, effective feedback practices and writing practices. The process approach to writing encourages and

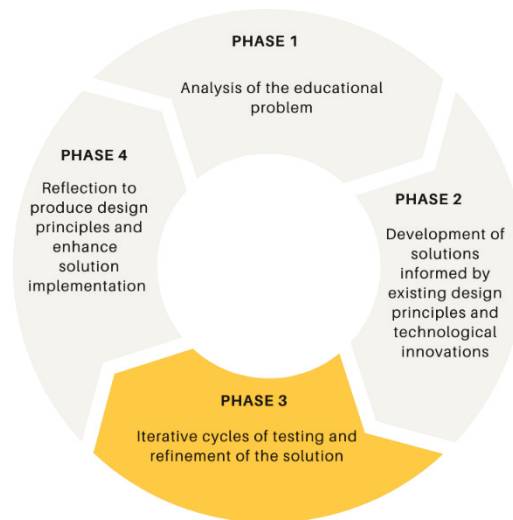
reinforces the revision and drafting process, an important activity that helps develop students' self-regulatory practices. Effective feedback practices are applied so that students not only receive information about their current performance, but also information that develops their self-regulatory practices to close the gap between their current performance and their learning goal. Finally, the design rationale for a version of AcaWriter tuned for research writing was presented, explaining how principles from the above theories were incorporated in the way that lower-level sentence types were modelled as high-order CARS-based moves, with numerous extensions to the user interface in order to reflect the insights from theoretical models of writing, and writing pedagogy.

The following chapter details the different ways in which AcaWriter was piloted in the HDR context.



# Chapter 9: Implementing Writing Analytics in Research Writing Contexts

This chapter presents phase three of the design based reach process, namely the implementation and evaluation of the technological solution through iterative cycles of testing and refinement. Phase one explored students research writing experiences and led to phase two, creating the initial design principles building on to the design and development of the technological solution, AcaWriter. AcaWriter is a writing analytics tool designed to support students with their research writing. This chapter presents the four iterations of designing, implementing and evaluating AcaWriter for HDR contexts. Each iteration explains the learning context, documents the design patterns, and presents the data collection, analysis and findings. Each iteration ends with design reflections describing how the findings and reflections were used to inform the next iterations<sup>18</sup>.



## 9.1 Introduction

This study aimed to design, implement and evaluate HDR writing interventions that incorporated a writing analytics tool at the University of Technology Sydney (UTS). This study answers research question 3: *How can writing analytics tools be designed,*

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<sup>18</sup> Parts of this chapter have been published in Knight et al. (2020).

*implemented and evaluated to help develop HDR students' research writing skills?* Four iterations of the intervention were conducted. Figure 9.1 presents an overview of the intervention's design iterations. As described in section 2.2 the Australian higher degree research context does not require students to undertake coursework. Therefore, each institution provides their own research training program, which generally includes research writing related workshops. HDR writing programmes vary across institutions and faculties. While some faculties may incorporate a compulsory research writing coursework unit or offer optional writing development programs, others do not, and rely solely on the institutions centralised HDR writing support programmes.

AT UTS HDR training is based on a centralised model where HDR training is provided by the graduate research school. However, some faculties and schools also provide both compulsory and voluntary HDR training programmes. The workshops offered by the graduate research school are offered once, spread out over each of the two main semesters, with two 3-day winter/summer schools comprising all of these workshops during the semester break in an intensive mode.

As discussed in section 2.1.2 research writing is difficult to learn. The interventions in this study aimed to investigate whether writing analytics could assist in providing additional research writing support, specifically learning the rhetorical moves in research writing (see section 8.1.2 for a detailed discussion on rhetorical moves). The interventions focused on the abstract and introduction sections of research articles where the writing analytics tool AcaWriter was used. These two sections were chosen because they are both significant part-genres in research articles and dissertations as discussed in section 8.5. They were also chosen as the length of the sections are feasible for data analysis.

Currently, a lack of technological tools exist that focus on helping HDR students with their research writing as mentioned in section 2.3.4 and there is a lack of explicit pedagogical frameworks available for HDR writing support as discussed in section 2.2. The design iterations presented in this chapter examine how writing analytics tools can be used to support research writing pedagogy. Explicit learning design patterns in the form of conjecture maps are presented to illustrate how writing analytics tools can be implemented in research writing pedagogy. The interventions were conducted both independently of the graduate research school's writing programme, as well as embedded in their writing workshops. Iterations 1 and 2 were conducted independently, whereas iteration 3 was embedded in a one-off abstract workshop and in summer and winter

school. Overall, six workshops were conducted. Iteration 4 took the form of a self-paced online course. The following sections describe each iteration of the interventions in detail.



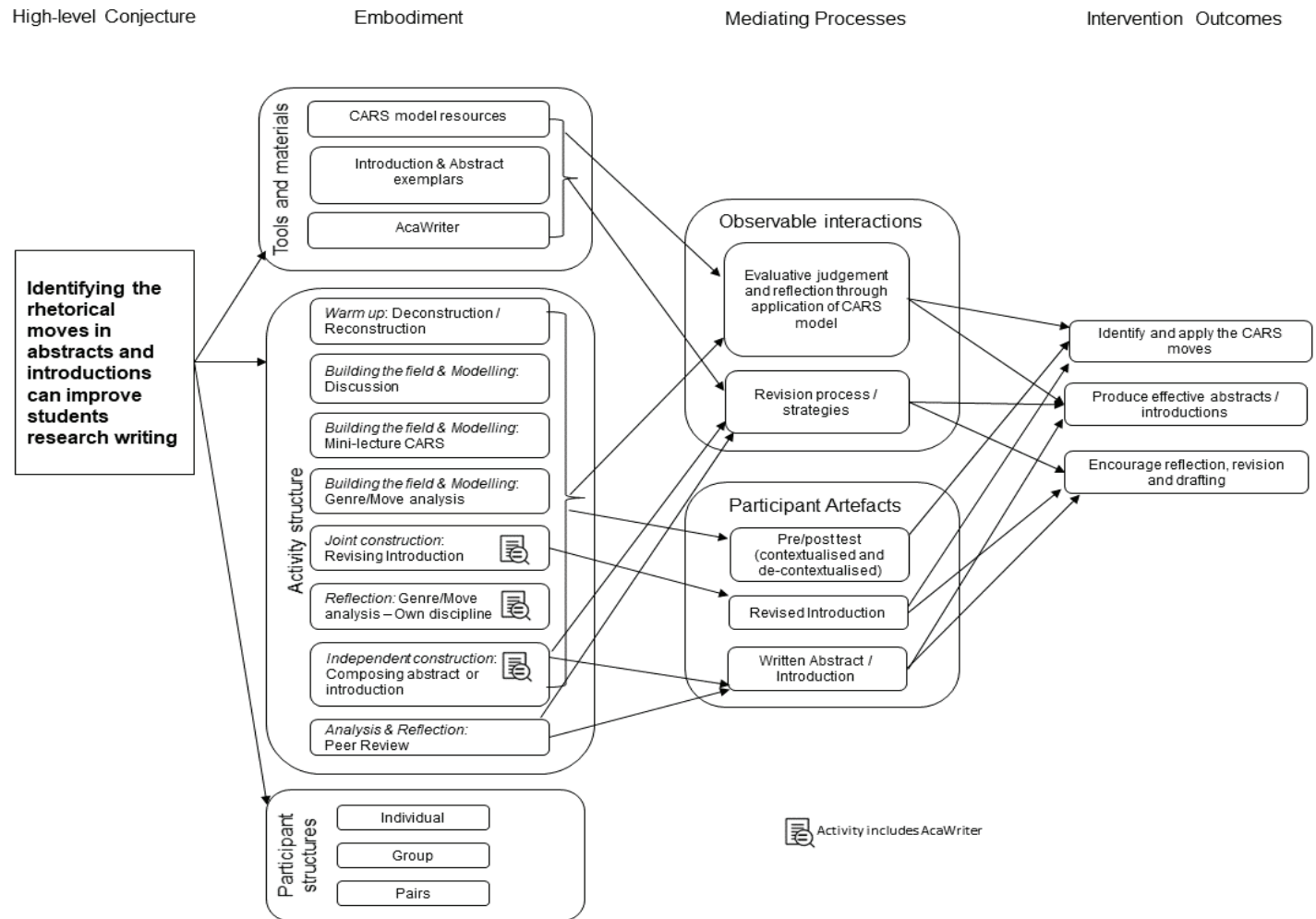
**Figure 9.1 – Overview of iterations**

## 9.2 Design Iteration 1 & Implementation (Pilot)

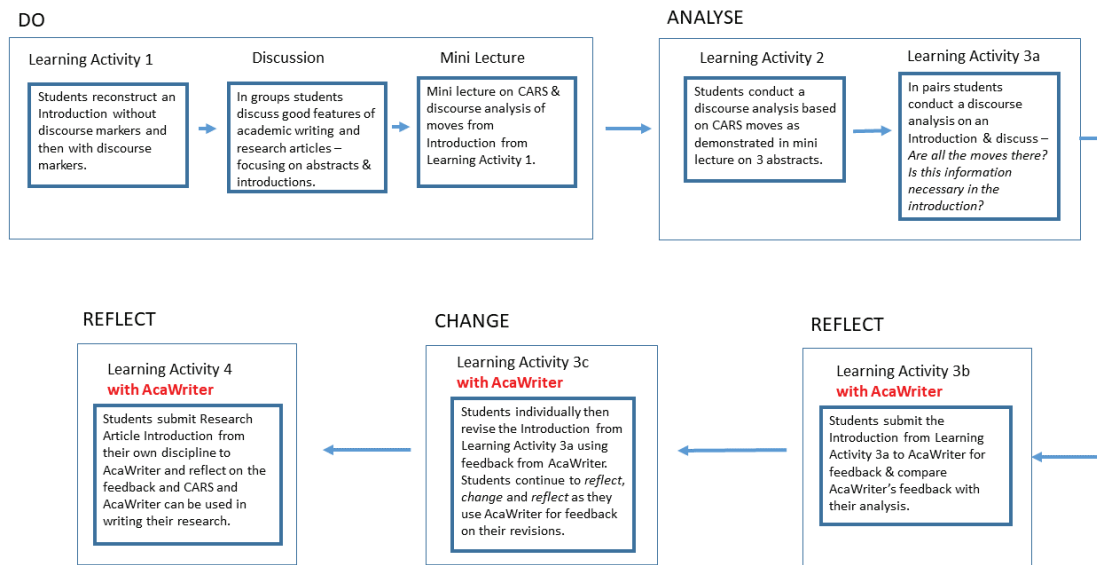
### 9.2.1 Learning Context & Learning Design

Iteration 1 consisted of a pilot study. The pilot study was conducted to determine if the learning design was appropriate, if the activities were suitable particularly when they were integrated with AcaWriter, and to determine if AcaWriter was useful and helpful for students. The intervention consisted of two face-to-face workshops for HDR students on how to write an introduction and abstract using the CARS model and AcaWriter. The workshop followed the three stages of teaching and learning cycle (TLC): *deconstruction (building the field)*, *joint construction*, and *independent construction* (Rose & Martin, 2012), as discussed in section 8.1.3. The TLC was applied in the sessions as it raises student’s rhetorical awareness, which is needed in HDR research writing, through a sequence of structured connected stages and learning activities. The TLC approach allows students to become independent writers as they go through the workshop stages and scaffolded activities. Figure 9.2 is a conjecture map of the first iteration which shows an overview of how the TLC approach was incorporated. Section 3.3 introduced ‘conjecture maps’ as a representation to clarify how design features link to intended mechanisms and outcomes (Sandoval, 2014). The workshops are premised on the *conjecture* that “identifying the rhetorical moves in abstracts and introductions can improve students’ research writing”, this is *embodied* into the activity structure, tool and material design, and participant structures. The activities embodied generates the *mediating processes* that is the learning processes that students go through, which lead to the desired *intervention outcome*. The first session involved the TLC stages of *deconstruction* and *joint construction*. In the deconstruction stage the students reconstructed two versions of the same introduction; one version had its metadiscourse markers removed. *Building the field*

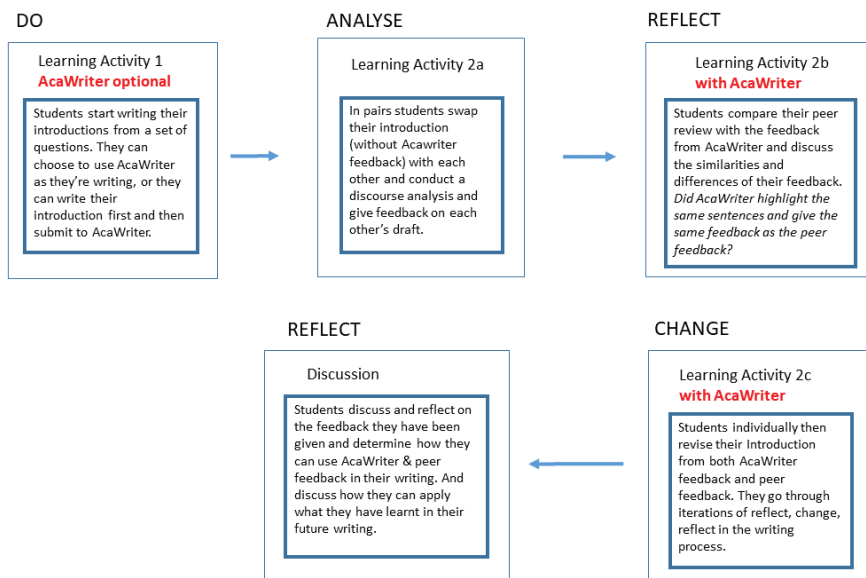
and *modelling* took place through discussions about writing in general, writing abstracts and introductions, a mini-lecture on the CARS model where an introduction was deconstructed according to the CARS model, and analysed abstracts and introductions according to CARS where more discussion took place about the moves the students found and if they followed the CARS model. Students were then asked to submit a sample introduction to AcaWriter for feedback and reflect on whether they agreed with AcaWriter's feedback. The second stage of this activity is where *joint construction* took place, as students revised the introduction according to their analysis and AcaWriter's feedback in pairs or individually. In the final activity in this session, students submitted an introduction or abstract from their discipline to AcaWriter, where again they reflected on whether AcaWriter identified the moves or not, or if they found moves that AcaWriter did not detect. In two of the sessions the final activity occurred in the second workshop due to time constraints. The second workshop focused on *independent construction* where students worked on their own abstract or introduction in AcaWriter, and requesting feedback when needed. Students were also asked to share their drafts with their peers so that they could also receive feedback from their peers. Figure 9.3 and Figure 9.4 present a detailed overview of the activities devised for the workshop and the sequence that they took place. It is important to note that while this was the intended design of the workshops, due to the messiness of the classroom environment some of the activities were changed slightly.



**Figure 9.2 – Conjecture map first iteration**



**Figure 9.3 – Overview of learning design for session 1**



**Figure 9.4 – Overview of learning design for session 2**

### 9.2.2 Recruitment & Participants

The intervention was promoted to HDR students via email, word of mouth and flyers were distributed around campus. The first round of workshops was conducted with three

students to trial the learning design of the workshops. The second and third round of workshops were capped at 15 to ensure that learning and engagement was facilitated throughout the session. Some of these students were recruited through my personal networks. The first round of workshops was advertised as two sessions taking place over two weeks and students were asked to register for both sessions. However, it seems that there may have been confusion as six students signed up to the first session and 15 to the second session. While there was interest in the workshops (additional requests asking to attend the workshops) which necessitated the creation of a third round of workshops, only four to five students attended the second and third round of workshops. Another attempt to recruit students, this time from a specific faculty with endorsement from the graduate research faculty head, was also unsuccessful. Only one student replied expressing interest in participating in the workshops.

This intervention (iteration 1) was piloted with groups of three to five students in three separate sessions. Overall, 12 students participated in the study, helping to gain a preliminary understanding of whether the writing analytic tool and learning design were useful for students. The students were at different stages of the doctoral journey. Eleven were international students and one was a domestic student. Three students were unable to attend session 2. Therefore, their workshop data was excluded from the analysis, however one of the students who did not attend the second workshop participated in an interview.

### 9.2.3 Data collection methods & analysis

#### *Pre and post-tests*

Pre and post-tests were conducted at the start and end of the workshops to measure student understanding of the CARS rhetorical moves (a strategy also adopted by Cotos, 2010). Both tests contained two tasks. In the first task, students received a list of 13 sentences and were asked to annotate each sentence for the CARS moves. Students were given a score of 1 if they annotated the sentence with the correct move and a score of 0 for an incorrect move. The second task asked students to read an introduction and annotate the introduction for the three CARS moves. Scores of 1 were given if they identified the move that each section belonged to correctly. If students annotated part of the section correctly and the other incorrectly, they were given 0.5 and if the move was completely incorrect, they were given 0. In both cases different, but equivalent, sample

materials (sentences, and introductions) were used pre and post-test. Students were not provided with feedback on their results in the pre-test.

As one student sent an incomplete pre-test and three others did not attend the second session<sup>19</sup>, only data from the remaining students ( $n = 8$ ) were included in the pre and post-test. In task 1 (annotating 13 sentences), the average number of sentences correctly annotated by students increased from 8.00 (SD = 3.25) pre-test to 9.50 (SD = 3.25) post-test. In task 2 (introduction annotation), students ( $n = 8$ ), improved their scores from 1.81 (SD = 0.59), to 2.00 (SD = 0.76). However, in both tasks not all students improved their performance individually. These results suggest that understanding rhetorical moves used in research writing is a challenging skill to learn for some students and that more time is needed to learn to apply the moves.

### *Focus group and Interviews*

A focus group and three interviews were conducted with students who participated in the workshops, regarding their experience of the intervention. The interviews were conducted approximately three to six weeks after the intervention. Both interviews and focus group lasted between approximately 10 minutes to 30 minutes. The focus group went for 29.23 minutes, the interviews went for 16.23 minutes, 23.10 minutes and 10.20 minutes. During the interviews some of the students did not elaborate on their answers. The semi-structured focus group ( $n = 4$ ) and interviews ( $n = 3$ ) were recorded, and verbatim transcribed. The interview data was analysed inductively, by first developing codes and then searching for themes. The following questions were asked:

- Before coming to the workshop did you know what rhetorical moves were? What is your understanding of rhetorical moves now?
- Did you find that you learned rhetorical moves through the learning activities and using AcaWriter? How?
- What features of the learning activities and AcaWriter do you think helped you learn rhetorical moves the most?

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<sup>19</sup> Three students were unable to attend the second workshop and one student withdrew from the study.



- Did AcaWriter help you focus on rhetorical moves? If so, how? What features made you focus on them?
- Do you think you can apply this knowledge (rhetorical moves) to your writing? Why?
- Do you think you improved your skill of research writing after attending the intervention and using AcaWriter? How? Why?
- What did you think about using AcaWriter to help you with your writing?
- Did you enjoy using AcaWriter?
- Did using AcaWriter and the learning activities help motivate you to write?

Three common themes were identified from the data: thinking about writing, structuring writing, and usefulness of automated feedback. The data revealed that the students found the intervention useful. Some of the students explained how knowing the CARS rhetorical moves helped them with structuring their abstracts and introduction:

*“I’m very impressed with the structure because after I attend the first workshop I also discussed about it with my supervisor and about the structure and basically it’s ... divided into 3 sections basically, and so yes, my supervisor say that’s right, that’s the right structure, and you should write in that way.”* (Participant 6)

*“Actually I am using the tool, oh no sorry, not the tool, but the moves. It was very useful to structure the intro you know, and because before, I had a mess, it’s like what I put first...just ideas. But, now knowing the moves, I can, it’s easy for me to follow them and structure in an easy way, my ideas.”* (Participant 2)

*“I would say that with the CARS model, I now trying to follow that structure.”* (Participant 3)

*“Now I look for those moves, those recommendations first, and then I write something.”* (Participant 4)

*“I think in that sense that what I was saying, I mean, this idea of finding [establishing] the niche, occupying the niche, it's very helpful when you're writing. I knew about the rhetorical moves but I didn't have the clear structure, I mean, meaning... for each one of those moves.” (Participant 1)*

The students also stated that the automated feedback messages and highlighting helped them reflect on their writing and its rhetorical structure:

*“It makes you think about if you have the moves even though the tool is not perfect it gives you some hints...a kind of an idea...like a message, ok you're missing this, and you take care about that...it is not perfect, but because it is not perfect, you can get an overall idea not like a very specific thing. (Participant 3)*

*“When I used that tool, AcaWriter tool, so, it's like that program will help me analyse my writing automatically... because I told you that I not familiar with that theory but when I use this tool it just show me I think on the right hand [what] these colours mean, and sometimes I didn't say, like the important thing or the gap in my topic...I just use only literature review...so it helps me a lot, I think it's very good for someone as a beginner, of using this.” (Participant 10)*

*“It highlights the sentence, although sometimes it's a little bit confusing. Why it's not [highlighted] sometimes. I know I have [the] actual writing to the three sections, but I think I did, but the machine doesn't [identify]. But still it makes me very clear what should I do step by step”. (Participant 6)*

*“The highlighting. I could see the structure in a visual way and I think I am more of a visual learner, so for me personally, that's more helpful*

*rather than hearing about it, um so I can relate to it better.” (Participant 7)*

*I think one of the main contributions of AcaWriter is to help you structure your thinking. (Participant 1)*

The same participant mentioned that AcaWriter helped them to critically analyse their writing:

*I think it was very useful to use a piece of writing of my own and then when the software gives the feedback, maybe you think you're having the moves, you have the right structure but then it, it happened in my case the software told me ok, you're missing move 1, but I thought that it was there...I think in that sense, it challenges you in the way that you're thinking. (Participant 1)*

While most students reported that AcaWriter helped them learn the CARS rhetorical moves, one student stated that they needed more time to become more familiar with AcaWriter and the CARS framework:

*“I didn't understand what that feedback means...because at that time, because you are the mentor you just came to me and explained to me how I can improve it in that feedback, so I think it will be helpful for students especially for ... beginner[s]... using this program, using AcaWriter with a mentor, who are experts using this tool. Otherwise it's not helpful for students because I know, because when I finished that workshop I just talk to one friend and we thought that that tool is very good for PhD students, for research students, but the problem is, we not, we are not familiar with that, we didn't use before, we don't understand, because it was a really short workshop, at the beginning you allow one hour and then we have to use by ourselves, I think that yeah, if we can use that tool with mentors, lecture or mentor that will be helpful.” (Participant 10)*

The comment above demonstrates that there is a need to provide multiple forms of support for students. While most students were able to learn the rhetorical moves and how to use AcaWriter in the workshops provided, this student needed additional support to learn the moves and use the tool. This comment emphasises the findings from Chapter 4, Chapter 5 and Chapter 6, that a one size fits all approach does not address students' needs.

The findings from this study also found that some students were not sure how they would use the tool outside the workshop.

***AcaWriter Engagement and Revision Analysis of Students' work***

To study how students engaged with the automated feedback and its impact on student writing, the final activity where students were asked to work on their own introduction or abstract was analysed. Only the remaining nine students' work was analysed. AcaWriter records each time a student requests feedback and a draft is created each time a student requests feedback.

Table 9.1 shows the number of times the participants requested feedback. The average number of feedback requests was 9.7. While all students ( $n = 9$ ) requested feedback from AcaWriter, 8 out of the 9 students continued to seek AcaWriter feedback and revise their text in AcaWriter.

**Table 9.1 – AcaWriter feedback requests**

<b>Participant</b>	<b>Feedback Requests</b>
1	1
2	9
3	14
4	19
5	2
6	23
7	11
8	6

<b>Participant</b>	<b>Feedback Requests</b>
12	3

The feedback requests indicate that the majority of students did request feedback from AcaWriter and revise their text. As the count of feedback requests can only give us a snapshot of students' use of AcaWriter, the manner in which students engaged with AcaWriter's feedback was also analysed.

A total of 72 student drafts were qualitatively analysed. The revisions between each draft were contrasted using a text comparison tool which highlighted the changes made in a text. The tool did not classify what kind of changes were made, so the drafts were manually coded. The first qualitative analysis of the students' revisions focused on the *type of revision* (what kind of revision the student performed). Each revision was categorised according to the revision taxonomy below in Table 9.2. The taxonomy was adapted from Faigley and Witte (1981) and Crawford et al. (2008) where they used their taxonomies to analyse the effects of revision changes. The revision analysis was completed by the researcher and another researcher (Researcher 2). Disagreement occurred when it came to deciding whether a 'deletion' indicated a response to the AcaWriter feedback. I explained that when a deletion occurred in the sentences that were trying to achieve a move, it is a direct response to the automated feedback. After explaining this rationale both researchers came to agreement.

**Table 9.2 – Revision taxonomy**

<b>Revision Type</b>	<b>Definition</b>
Deletion	Any unit (sentence or word) deleted without replacement – e.g. a whole sentence deleted vs a word that is deleted and replaced with a new word, or parts of a sentence that is deleted and not replaced.
Addition	Any unit added as well as replaced.
Rearrangement	Reorganises sentences or phrases from one section of the text to another occurring at the sentence level or paragraph level.

<b>Revision Type</b>	<b>Definition</b>
Expansion	Creates multiple sentences where there was only one.
Consolidation	Condenses multiple sentences into one.
Surface Revision	Any revision related to punctuation, addition/deletion of citations, spelling, grammar
<b>Feedback Impact</b>	
Directly addressed the FB message	Revision is directly related to FB message - making changes to sentences that are mentioned in the feedback message. May or may not be tagged by AcaWriter.
Does not address FB message	Revision does not relate back to feedback message.
No revisions made	No revisions were made.
N/A	Revisions made, but there was no feedback message.

Presented below are examples of revisions and the associated feedback messages. To see a complete example of a participant’s revision analysis see Appendix F: Revision Analysis Example. An example of a revision that was directly related to AcaWriter’s feedback can be seen for Participant 3. The student’s initial draft and the feedback messages that were generated on this draft are shown in “Draft 1”, and the student’s revision in response to AcaWriter’s feedback is demonstrated in “Draft 2” highlighted in green.

#### Participant 3 - Draft 1

The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data.

#### **Feedback messages:**

*It looks like you are missing Move 1 – Establishing a research territory (E or B sentences). Here you should show how your research topic is relevant and important by introducing & reviewing previous research on your topic. For example, recent research indicates that the effects of climate change have.... (for more examples head to the resources tab)*

*It looks like you are missing Move 3 – Occupying the niche (S or N sentences). Here you should state how your research fills the gap or solves the research problem mentioned in Move 2. You can do this by stating the aim and purpose of your research. For example, the goal of this study, this research shows that., the purpose of this investigation....(for more examples head to the resources tab)*

### Participant 3 - Draft 2

Collaboration is one of the 21st century competencies that higher education seeks to improve for the future workforce. The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data.

In this example, the student appears to have focused on the first feedback message that explains that the text is missing *Move 1* sentences. As can be seen in “Draft 2”, the student has added a sentence attempting to create *Move 1*.

Another example of a student’s revision directly related to AcaWriter’s feedback is shown in Participant 7. The feedback that was given on the student’s draft is presented in “Draft 1” and the sentences that the student revises are underlined. In “Draft 2” the student’s revision in response to the feedback is highlighted in green.

## Participant 7 - Draft 1

Since museums have always been a site full of ongoing interactive activities that involve exhibition displays, visitors and curators. Museums today are moving towards not only displaying objects but also communicating with the visitors in a variety of formats, including more tangible and bodily experiences. All of it brings new ways to engage with an audience. This research intends to investigate how people experience museum visit and how we can design for a museum experience with the help of technologies. We will explore the underlining principles of a casual individual museum visit, what elements of this experience may produce insights into an exhibit design with the help of technologies. For example, if we could design exhibits that will add quality to our experiences and make them more memorable. Today, we are facing with the more intense presence of technologies in our lives. We are surrounded by technologies, we are developing closer relationships with technologies and we are concerned on the topics such as user-friendliness of technologies. Museum sites are no exception to the technological integration. In fact, museums are often the places to be among the first to test technologies in order to: a) facilitate learning about the displayed knowledge; b) accentuate an innovative approach to the public demands of being entertained and engage visitors in a new way; c) support museum curators. A lot of studies talk about reaching out for that “positive experience” when setting up an exhibition space, including technologies that are embedded in displays. And still there is still a little understanding between a given museum and exhibit set up and what is actually happening during that process of experiencing a museum visit and using technologies during that experience. In this research we will explore the underlying principles of a casual individual museum visit from a design perspective.

### **Feedback messages:**

*It looks like you are missing Move 1 – Establishing a research territory (E or B sentences). Here you should show how your research topic is relevant and important by introducing & reviewing previous research on your topic. For example, recent research indicates that the effects of climate change have.... (for more examples head to the resources tab)*

*It looks like you are missing Move 2 – Establishing a niche (C or Q sentences). Here you should indicate the gap and state the research problem, by explaining how previous research is incomplete or that there are aspects of the research topic that still needs investigating. This can be done by using sentences like these: However, these studies have failed to recognise that...., Limited research exists on....., Despite earlier studies the effects of x remains unclear. (for more examples head to the resources tab)*



## Participant 7 -Draft 2

Since museums have always been a site full of ongoing interactive activities that involve exhibition displays, visitors and curators. Museums today are moving towards not only displaying objects but also communicating with the visitors in a variety of formats, including more tangible and bodily experiences. All of it brings new ways to engage with an audience. Today, we are facing with the more intense presence of technologies in our lives. We are surrounded by technologies and we are concerned on the topics such as user-friendliness of technologies. Museum sites are no exception to the technological integration. In fact, museums are often the places to be among the first to test technologies in order to: a) facilitate learning about the displayed knowledge; b) accentuate an innovative approach to the public demands of being entertained and engage visitors in a new way; c) support museum curators. A lot of studies talk about reaching out for that “positive experience” when setting up an exhibition space, including technologies that are embedded in displays. And still there is still a little understanding between a given museum and exhibit set up and what is actually happening during that process of experiencing a museum visit and using technologies during that experience. This research intends to investigate how people experience museum visit and how we can design for a museum experience with the help of technologies. We will explore the underlining principles of a casual individual museum visit, what elements of this experience may produce insights into an exhibit design with the help of technologies. For example, if we could design exhibits that will add quality to our experiences and make them more memorable.

Here the student has *Move 3* sentences towards the beginning of the text. The student has moved these sentences to the end of the text, and in doing so the remaining sentences attempt to explain why the research topic is relevant. The participant has also deleted information from the *Move 1* sentence.

The second qualitative analysis focused on the *feedback impact* (whether the revision related to the automated feedback messages improved the text). To determine if AcaWriter’s feedback led to revisions that improved the quality of students’ texts, the first and last draft of the participants’ drafts was analysed. This was important to establish whether AcaWriter’s feedback can improve the quality of students’ writing. To assess the impact of AcaWriter’s feedback on students’ revisions, categories for classifying improvement of the students’ text were developed. This framework was developed by analysing the two drafts and examining how the revisions impacted the final draft. Table 9.3 presents the three categories that emerged.

**Table 9.3 – Revision Impact Framework**

<b>Draft Quality</b>	<b>Description</b>
Improved	Participant has attempted to include all the three moves and revisions have improved the quality of the text
Degraded	Participant has attempted to include all three moves, but the revisions made have lowered the quality of the text
Neutral	Participant has attempted to include all three moves, but the revisions made do not improve the text

This analysis revealed that six out of the nine participants made revisions that improved the quality of their texts. An example of this can be seen in Participant 3 - Excerpt 1 and Excerpt 2:

Excerpt 1 - First Draft

The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data.

## Excerpt 2 - Last Draft

Collaboration is important for the future workforce, as this has been reported as one of the 21st century competencies. When people collaborate, communication, time management and decision making are some of the skills that are developed through people's interactions. Given that collaboration is a complex task, which prompts multiple interactions through multiple modes, it is difficult to analyse and understand the whole activity at a glance. Previous research have relied on observations to understand, analyse and establish patterns of collaboration. However, observers sometimes could miss important things that were impossible to capture only by observations. The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data. In this paper, we propose a theoretical approach to make sense of these complex data. through a model to analyse collaboration activities, built from concepts in activity-centered design and quantitative ethnography, aiming at representing and supporting the meaning-making of collaboration. Furthermore, we illustrate our proposed approach through a simulation-based case study. Further directions on this research will explore the transferability of the approach to other contexts, settings and data.

As can be seen in the final draft, participant 3 has added *Move 1* (highlighted in pink) and *Move 3* (highlighted in green) sentences, and an additional *Move 2* sentence (highlighted in blue).

While the majority of the participants' revisions improved their draft, one participant's draft was degraded and another participant's draft was found to be neutral. The degraded text can be seen in Participant 4 - Excerpt 3 and Excerpt 4:

### Excerpt 3 - First Draft

The field of Participatory Design (PD) is a popular area where collaboration for interdisciplinary groups is a common subject used to improve the design journey. There has been a growing interest in using PD research to provide teams with design objects including tools, techniques and methods to follow and improve the current design process. Despite this interest in producing design objects for team collaboration, there are shortcomings with this approach on delivering objects for standardized design practices. While major work has been undertaken in generating toolkits, measuring the impact has not been fully understood, leaving behind possible constraint over time, project resources and stakeholders availability. The purpose of this paper is to provide a framework to guide researchers into using the most efficient tools based on standard project variables including time, materials and human resources.

### Excerpt 4 - Last Draft

The field of Participatory Design (PD) is a popular area where collaboration for interdisciplinary groups is a common subject used to improve the design journey. There has been a growing interest in using PD research to provide teams with design objects. Previous research in participatory design have shown interesting tools and techniques. While major work has been undertaken in generating toolkits, measuring the impact has not been fully understood, leaving behind possible constraint over time, project resources and stakeholders availability. However, there is a lack of evidence that supports their efficiency. Despite this interest in producing design objects for team collaboration, there are shortcomings with this approach on delivering objects for standardized design practices. The purpose of this paper is to provide a framework to guide researchers into using the most efficient tools based on standard project variables including time, materials and human resources.

Here, in the final draft the participant has deleted information from *Move 1* (see underlined and highlighted in pink in draft 1). This information provides an explanation of what constitutes as design objects. The final draft does not contain this information which may leave readers wondering what exactly are design objects (see highlighted in pink in excerpt 4). The final draft also has an additional *Move 2* sentence (see highlighted in draft 2) which interrupts the logical order of the text. It is inferred that this particular student was aiming to have their text highlighted in the order of Move 1, Move 2, Move 3 and was following AcaWriter's feedback too diligently.

The revision analysis also included examining the revision types to gain an understanding of what revision types were employed by the students. Table 9.4 presents the types of the revisions that the participants employed. Addition was the most frequent revision type, followed by deletions. Surface revisions were also commonly employed. Expansion and consolidation were the least frequently used revision types. While half of the feedback messages provided advice on rearranging the moves in their text, rearrangement was rarely seen in the students' revision. As addition and surface revisions were the most common revisions it may suggest that students view writing as a simple, linear process as discussed in section 2.1.3.

**Table 9.4 – Summary Data**

<b>Participant</b>	<b>Feedback Requests</b>	<b>Revision types</b>	<b>Revision Impact</b>
1	1	0	N/A
2	9	Addition, Surface Revisions	Improved
3	14	Addition, Deletions, Surface Revisions	Improved
4	19	Rearrangement, Deletion, Additions, Expansion, Consolidation, Surface Revisions	Degraded
5	2	Deletion, Additions, Consolidation	Improved
6	23	Rearrangement, Additions, Deletions, Surface Revisions	Improved
7	11	Rearrangement, Deletions, Additions, Consolidation, Surface revisions	Improved
8	6	Deletions, Additions, Consolidation	Neutral

<b>Participant</b>	<b>Feedback Requests</b>	<b>Revision types</b>	<b>Revision Impact</b>
12	3	Rearrangement, Deletion, Additions	Improved

#### 9.2.4 Discussion

While the sample size for this iteration was small, overall the findings of the data analysis from this pilot iteration found that the intervention was useful for the students. The pre and post-test results showed overall that the students improved their scores (9.2.3). Although individually, not all students' scores improved. This implies that for some students more time is needed to learn and understand the CARS moves. The CARS model helped students understand the structure of abstracts and introductions. The majority of the student's perceptions of the tool were positive, and the students reported that AcaWriter's feedback help them reflect on their writing, in particular the rhetorical structure. However, one of the students reported that they needed more time to understand the CARS model and additional guidance using AcaWriter. This student's experience demonstrates that students' needs are unique and that additional forms of support are needed to address students' needs.

The feedback request logs show that all the students sought feedback from AcaWriter. Eight of the nine students continued to revise their draft using AcaWriter. The revision analysis showed that the majority of the students' drafts had improved. This finding suggests that AcaWriter can impact and improve the quality of student writing. However, not all of the students' drafts improved. One student's draft was degraded and did not improve. The reason that the draft was degraded was due to following AcaWriter's feedback too diligently. This finding shows that some students' may take AcaWriter's feedback indiscriminately and may not use their own evaluative judgement (see 8.3 for an explanation of evaluative judgement). A higher risk is that students may even neglect their own evaluative judgement, trusting a machine instead, which could undermine student's confidence. This means that students need to understand the genre and the moves well enough so that when they can reflect critically on their writing and AcaWriter's feedback. These individual differences could also be due to students' feedback literacy skills that is how they interpret and make sense of the feedback they

have received. Additional investigation studying students' automated feedback literacy would be useful to further examine their revision choices (this tension is discussed further in section 9.2.5). Further work has scaffolded students' critical engagement with AcaWriter (Shibani et al., 2022).

### 9.2.5 Design reflections

After the completion of iteration 1, feedback from the participants indicated that the intervention was useful. It helped them think more about the structure of their introductions and abstracts via the CARS framework. AcaWriter was also seen as helpful by most of the participants as they were able to check their writing for the CARS moves and reflect whether or not they had achieved them. The pre and post-test also showed that the majority of the participants improved their score, the scores imply that they improved their ability in identifying the CARS moves after attending the intervention. The feedback from the participants, the pre/post-test findings and the revision analysis were seen as a positive start in embedding a writing analytic tool in HDR writing workshops.

#### *Reflections on learning design*

Iteration 1 was designed to be facilitated over two sessions. But, as some students were unable to attend the following session, I decided that the next iteration would only involve one workshop. As I am a HDR student, myself, I realised that research students are extremely busy and that commitment to two workshops would be difficult, especially when the CARS framework and genre/move analysis were taught in the first session. Only having one workshop takes into consideration students' schedules and would also make data collection easier in the subsequent iterations.

The more I reflected on the sessions and the learning design, I realised that teaching the CARS framework for both abstracts and introductions was problematic. While generally abstracts start with describing background information or context of the research, many abstracts also start with Move 3: Occupying the Niche – where the author states the purpose of their research. While the move analysis of abstracts learning activity dealt with the different order of the CARS moves and it was frequently discussed that not all disciplines followed the CARS structure, I felt that this was confusing for students. I decided to separate the two part-genres, so that the next iteration would focus solely on introductions. Additionally, as one participant mentioned that they needed more time to

become familiar with the CARS framework and AcaWriter, the number of learning activities would be reduced in the next iterations.

### ***Reflections on the tool***

The revision analysis revealed several limitations of AcaWriter. First, AcaWriter did not always recognise when a student made a successful attempt at a revision. This is a limitation of the tool and while students are notified via a warning message that AcaWriter is an imperfect machine and may not detect their moves, this information should be reinforced and emphasised during the subsequent interventions. Second, some students may solely rely on AcaWriter feedback without using their evaluative judgement. This was seen in Participant 4 – Excerpt 3 and Excerpt 4. This situation points to a tension between creating a tool capable of helping students to learn the research writing genre while also giving them enough confidence to disagree with the tool's sometimes imperfect results. As students are novices learning the genre, they may not be confident enough to disagree with AcaWriter's feedback. As the tool is imperfect, the students must also be further informed of the limitations of AcaWriter and that it does not always identify all the relevant rhetorical moves (or their absence). This means scaffolding is very important when it comes to using the tool and this will in turn support students in coming to understand their research writing genre. This tension is discussed further in Chapter 10, section 10.4.4. Therefore, it was decided that greater emphasis would be placed on AcaWriter being an imperfect machine, and that it was acceptable to disagree with the feedback.

### ***Reflections on recruitment, data collection and data analysis***

Many students ( $n = 6$ ,  $n = 15$  for the first round of workshops) who had signed up for the sessions did not attend and others withdrew in advance due to other commitments. This participation rate provides a smaller sample for analysis, but nevertheless, as a pilot it offered insight regarding the design of these workshops given the competing time pressures HDR students experience. As a result, the next iteration adopted a learning design that reduced the time commitment for students, to attempt to connect to their context more explicitly. The low attendance rates identified the need for more personalised, just in time support. One mitigation was to have flexible workshop dates. Therefore, in the following iteration, workshops were conducted according to the availability of students. Students would be able to nominate a date and time convenient to them and workshops would be held accordingly. The low and unpredictable attendance



also suggests that additional opportunities of support beyond workshops may be needed to support and develop students' research writing.

While the pre and post-tests implied that the majority of students improved their ability in identifying the CARS rhetorical moves, the pilot exposed weaknesses in the data collection method. In the first round of workshops, two methods of completing the pre/post-tests were trialled. The pre-test was completed via Word and emailed to the researcher. The post-test was completed on paper. It was decided that the best method was to complete both pre and post-tests via Word, as it was easier to analyse and collect the test. However, in the second round of workshops, one participant emailed empty pre-tests and did not save them. Because this happened, in the following workshops, pre and post tests were completed on paper. But, completing the tests on paper was problematic, as two participants did not turn over the page in the pre-test when they were asked to annotate the 13 sentences. As pre/post tests are best used over an extended length of time, and the following iteration would be one workshop, it was decided that pre/post tests would not be included as an evaluation method. Instead, participants would be asked to prepare an introduction to revise in the workshop.

### 9.3 Design Iteration 2 & Implementation

#### 9.3.1 Learning Context & Learning Design

In iteration 2 the focus of the workshop was to determine the effectiveness of the learning design, investigate students' perceptions of AcaWriter's automated feedback and its use as revision a tool, and assessing whether aligning workshops to students schedules would increase student participation. The intervention was redesigned based on the design reflections from iteration 1. A conjecture map of iteration 2, with the changes shaded in grey can be seen in Figure 9.5. This iteration was a single 2 hour workshop that focused only on writing Introductions. As iteration 1, intervention 2 followed the TLC (see section 8.1.3 for a detailed explanation of the TLC). *Building the field* was established by discussions about writing and a mini-lecture of the CARS model where an introduction was deconstructed according to the CARS model. After, this was followed by a genre analysis of two introductions. The students were then asked to submit the same introductions into AcaWriter for feedback where they discussed whether or not AcaWriter's feedback matched their analysis. While the learning design included *joint construction* revising one of the introductions with AcaWriter, when the workshop took

place this learning task did not take place. The students then went on to guided *independent construction* where they were asked to submit their Introduction that they had prepared prior to the workshop for feedback. They individually worked on their drafts and were then asked to share their draft with another student. Students were given the opportunity to ask questions anytime throughout the workshop.

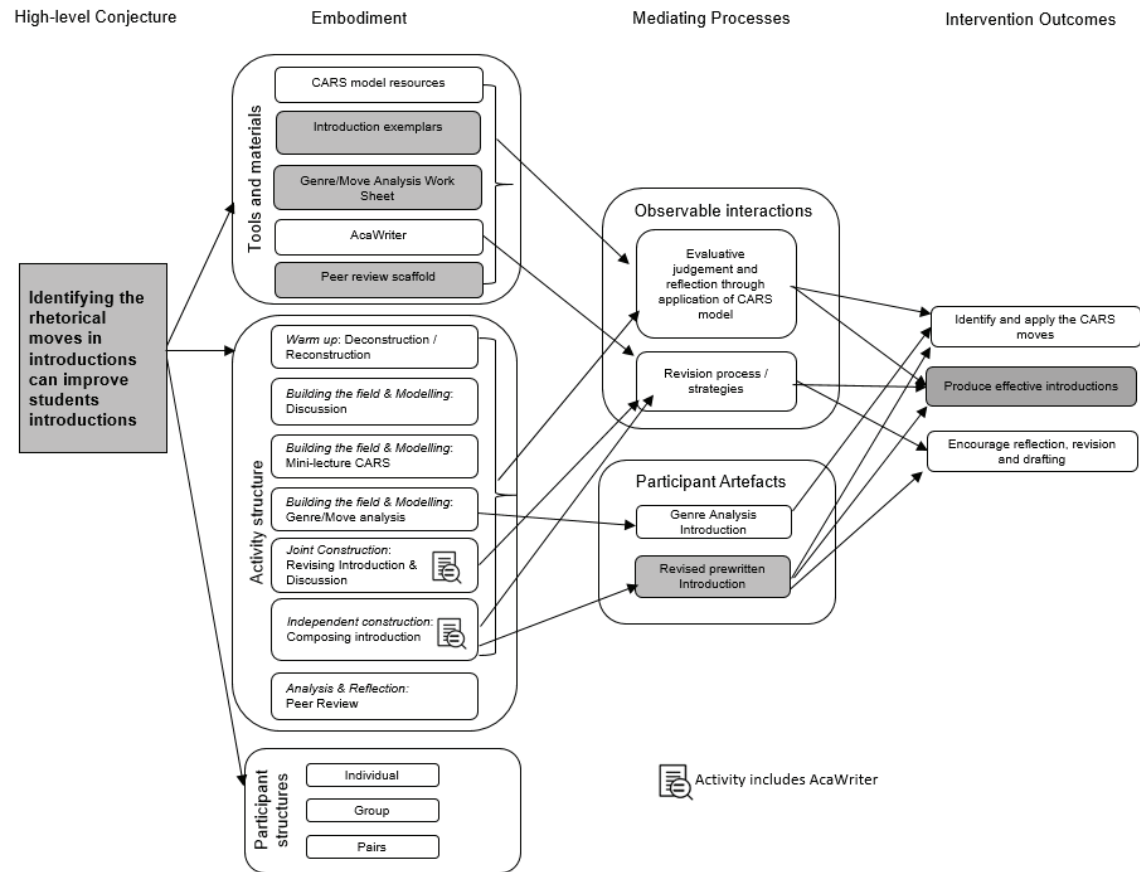


Figure 9.5 – Conjecture map second iteration, changes from iteration 1 shaded in grey

### 9.3.2 Recruitment and Participants

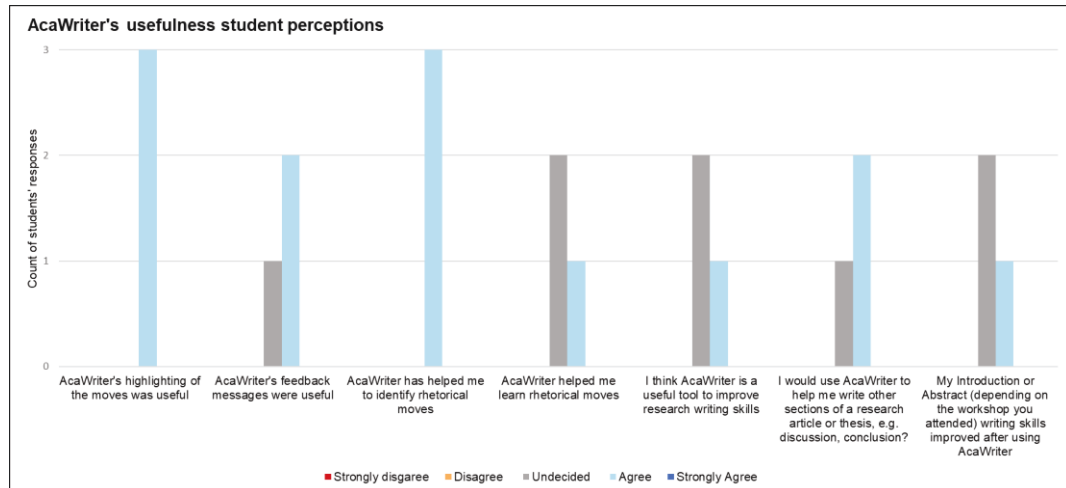
For this iteration a call for participants was placed in the HDR student newsletter and through word of mouth. Unlike iteration 1 where there were pre-set workshop dates, in this iteration it was decided to conduct the workshop according to the students' schedules. This approach was taken due to low student uptake in the previous iteration. Four students were interested in attending the workshop and a date was selected based on their schedule, with three attending. These three students were recruited through my personal networks.

### 9.3.3 Data collection methods & analysis

#### *Survey response*

Following the session students completed an online survey about their perceptions and experiences of using AcaWriter, indicating their level of agreement with statements using a six-point Likert scale from '1. Strongly Disagree' to '6. Strongly Agree' (the complete survey is provided in Appendix G: Post Survey Questions Iteration 2). Based on the small sample ( $n = 3$ ) frequencies are reported.

In regards to AcaWriter's usefulness the students' perceptions were mostly positive. Figure 9.6 shows that all the students agreed that the highlighting of the moves was useful, and two of the students found the feedback messages useful, while one student was undecided. AcaWriter helped the students identify the rhetorical moves in their writing, and despite the sample size, these results are encouraging, because it suggests that AcaWriter's feedback may be a useful tool to assist students to conduct a genre analysis. Only one student agreed that AcaWriter helped them learn rhetorical moves, and the remaining two students were undecided. The capacity and potential of AcaWriter was further identified as a useful tool to write other sections of a research article or thesis, such as the discussion, or conclusion sections. Only one student agreed that AcaWriter is a useful tool to improve research writing skills and that their introduction skills had improved after using AcaWriter, while the other two students were undecided.

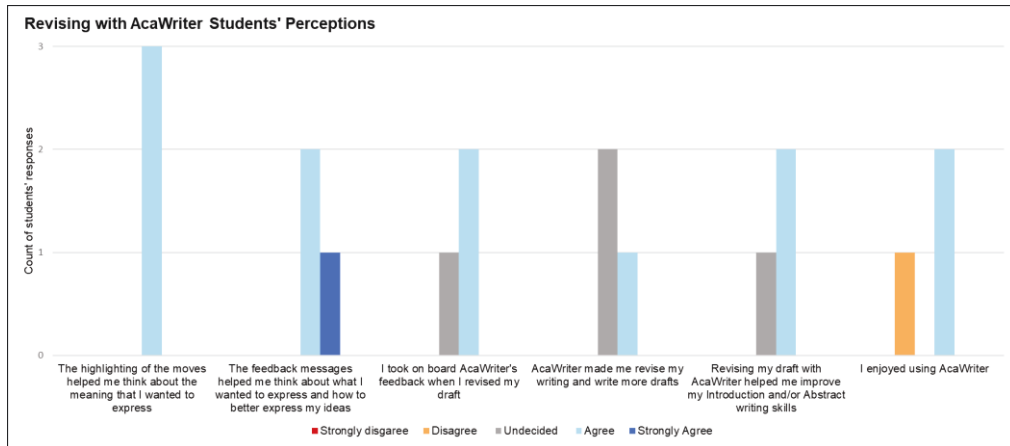


**Figure 9.6 – AcaWriter’s usefulness students’ perceptions<sup>20</sup>**

AcaWriter was identified as assisting students in the revision process as presented in Figure 9.7. While the sample size is small, all three reported that the highlighting and feedback messages helped them think about the meaning they wanted to express. When it came to revising and using AcaWriter the students’ perceptions were mixed; only one student indicated that AcaWriter made them revise and write more drafts and one student reported that they did not enjoy using AcaWriter.

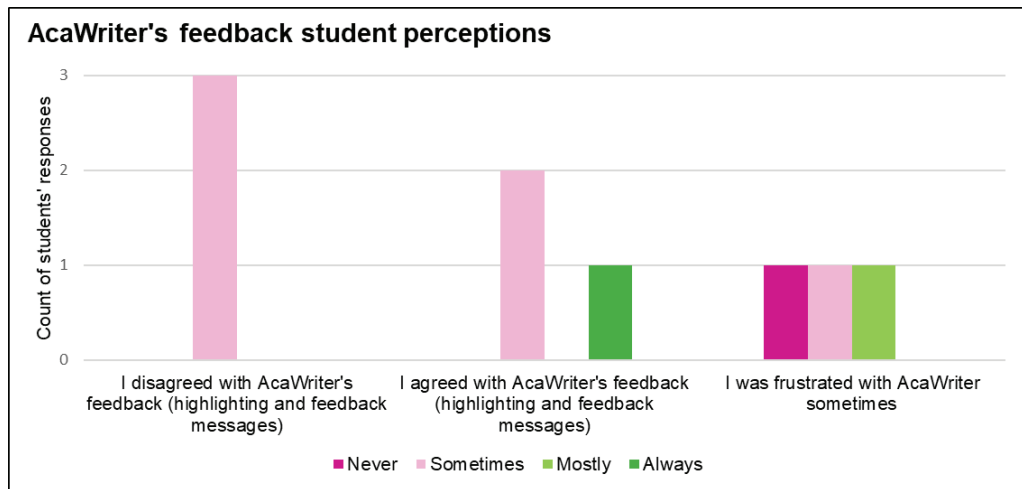
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<sup>20</sup> One respondent reported that they ‘strongly disagreed’ that the highlighting of the moves were useful, however, in the interview the participant spoke highly about the highlighting feedback. Based on this positive feedback the interviewer asked for clarification because they had marked ‘strongly disagree’ on the survey. The respondent indicated that it was likely an error and that it could be changed. This clarification was requested based on the participant’s spontaneous positive feedback during the interview, and I do not believe is likely due to coercion or experimenter effects. Therefore, based on the participant feedback the result was modified in the data, as reflected here.



**Figure 9.7 - Revising with AcaWriter students' perceptions**

Student perceptions towards AcaWriter's feedback was fairly positive, presented in Figure 9.8. The students only 'sometimes' disagreed and agreed with AcaWriter's feedback, showing that most of the students are using their evaluative judgement when responding to AcaWriter's feedback. There were negative perceptions towards using AcaWriter, with two students reporting that they were frustrated with AcaWriter.



**Figure 9.8 – AcaWriter's feedback students' perceptions**

***Open-ended survey questions***

To explore how the students interacted with AcaWriter, the survey asked the students what strategies they used when they interacted with AcaWriter. While AcaWriter does not provide grammatical feedback, Participant 1, an international student, stated how AcaWriter prompted her to reflect on and correct the tenses used in her text, "*Is the first*

*time I use AcaWriter but as English is not my mother tongue I realise that most of the mistakes happened because I do not use the right tenses, so my strategy is [was] to verify tenses to validate if the tool change the move and it works sometimes*". Participant 3 explained that he used the CARS model to write his introduction along with AcaWriter's feedback, *"In order to write the introduction I used the CARS model to establish my rhetoric moves. I was expecting AcaWriter to give feedback based on these moves"*. While, Participant 1 and 3 explained how they went about writing their introduction, Participant 2, stated that he did not use any strategies.

The students were asked what features of AcaWriter they found beneficial. All three students found the identification of the moves useful. Participant 1 was the only participant to report that the feedback messages were helpful, *"More than identify the rhetorical moves, Feedback is very interesting, because it makes some suggestions about how to organise better the ideas"*. It appears that the feedback messages may not have been useful for the other participants as they explained in the following question that AcaWriter's feedback was sometimes confusing and general. Participant 1 also reported that the learning design of the workshop was helpful when it came to using AcaWriter, *"I found very useful that Sophie explain the rhetorical moves and bring some exercises to the class before using the tool. AcaWriter is a nice tool for supporting the writing exercise"*.

The students were also asked what how AcaWriter could be improved to support HDR writing. Improvement of feedback was suggested with Participant 2 stating, *"Improve the way AcaWriter give the feedback, sometimes is unclear"* and Participant 3 stating *"The feedback can be more personalised than general"*. Increasing the accuracy of the tool was also reported by Participant 2 *"AcaWriter need to improve the rules to take more sentences in the rhetorical moves"*, with Participant 3 agreeing stating *"AcaWriter can be trained to identify rhetoric moves even as the coherency of the writing decreases"*.

### ***Interviews***

Interviews with the three students were conducted within one to two weeks after the intervention took place, which set out to explore students' perceptions and experiences of the workshop. The interviews went for approximately 20 to 30 minutes, and were transcribed verbatim and analysed thematically (the interview schedule is provided in Appendix H: Interview Schedule Iterations 2 and 3). The themes and findings are presented below.

*The workshop was helpful*

Students found the workshop and the learning activities helpful as some of them were not confident in writing an introduction, Participant 1 explains:

*Okay. Actually, first of all, I do think it's quite important to include workshops like this, especially in the first stage, in PhD stages because... For example, this, for me, was very useful but maybe not because AcaWriter. I told you during the session, it's more because of you. Because you teach us how to write the introduction. Actually, I didn't know how to do it before. So now, after knowing all the things that you gave us, now I know what kind of things to write. So, I think it's very useful.*

Some students also found the concept of rhetorical moves useful in structuring their introductions:

*The first thing, I was introduced to the CARS model, which I was not aware of, and also the rhetoric move in detail. Like when they actually change a move, from one move to the other. So, after establishing a research territory, when do you actually start moving to move two? So that is like after reviewing some items and giving literature review, then quickly go about the move two. These things I think the session helped me identify.*  
(Participant 3)

Understanding the concept of rhetorical moves helped the students read and analyse articles. This is explained here, by Participant 3:

*...I think the rhetorical move exercise was really good for me, because now I have the lens of looking at an article, in trying to find what it can raise. The context, and also, what specifically the article is aiming to address at. So, these viewpoints of looking at an article has definitely been influenced by the rhetorical moves that I learnt through the session.*

Participant 1 echoed this and found that looking for rhetorical moves enabled her to understand what the article was about, as explained here:

*Actually, it helps me a lot. After going to the workshop, I have to read, because I'm in the first stage of my PhD. So, now I'm reading and the very first article that I read after your workshop, I was very critically about it because I read the introduction by looking for the gap, for the questions,*



*for the context. And it was very helpful. For example, I have read some article before, but before I had a look for those movements. But now, I try to find all of those rhetorical moves to understand what the paper is about and what's the gap. Because now, I'm looking for the gap so I want some references about what the gap in each of those papers. So, I think now, I'm really better than before.*

These responses confirms that understanding rhetorical moves not only helps in the writing process, but is valuable for improving the reading skills of the participants in this iteration.

*AcaWriter prompts reflection and revision*

Two of the students reported that AcaWriter's highlighting provoked them to think more about their writing. They found AcaWriter's highlighting of the moves helpful as it helped them identify missing moves in their introduction:

**Researcher:** *Did you use the feedback tab?*

**Participant 3:** *Yes, I did it once, because the first time when I used, because I was missing the last move, the feedback tab did indicate that I was missing the move three. But then, I think afterwards, I was mostly focusing on the way it was highlighting the moves with the colour tags. Which was interesting, because I could quickly... So, each time I edit, I get the result and I know well where I'm missing it. So, rather than going to the feedback I was mostly on the main tab, which was the highlighted rhetorical moves.*

The comment above suggests that for some students immediate visible feedback is useful, particularly when thinking about structure, and that students have a preference for the type of automated feedback they receive. For this student, they preferred the highlighting rather than the feedback messages.

AcaWriter's feedback on the order of the rhetorical moves encouraged Participant 1 to go back and reflect on her writing which then prompted her to revise:

**Researcher:** *Did you use the feedback tab?*

**Participant 1:** *Yes. And actually, that was the thing that gave me the clue about the tense because he was telling me like, you are telling, you are talking about the gap first without saying if it was previous work. So, I read and I said, no, because I was trying to explain that it was previous*

*work and then I present the gap. But then I realised, maybe it's because he, I mean AcaWriter, understands something different. So, then when I was changing the tense, and then he [AcaWriter] realise that I was first talking about the context and then I was presenting the gap.*

Although AcaWriter's feedback encouraged Participants 1 and 3 to revise their work, Participant 2 explained that the feedback only prompted him to reflect on his writing, in particular if there were moves missing and why they were missing. He explained that if he agreed with AcaWriter he would edit his work, but if he disagreed he would ask a person to check his writing.

#### *Issues with AcaWriter*

While the students found AcaWriter's feedback helpful, two of the students expected more feedback from AcaWriter. Participant 3 found the feedback messages generic and repetitive:

*So first thing, the message[s] were repetitive. It was not personalised with respect to the article [introduction] that I submit[ed]. Probably it could highlight a few... Let's say it could grab a few sentence from my introduction and say, this probably do[es] not fit in a right move. But it was always saying, move three is missed. And then more generic message. So yes, it does help to identify whether a move is missed or not, but in terms of getting personalised, I think that feature is what the tool is missing. In the feedback feature of the tool.*

Participant 2 felt frustrated as, they seemed to expect more human like feedback from AcaWriter:

*Because I expect more. That was my fault. I expect more, because I was use Grammarly and other tools. I expect more feedback, in detail. But I told you that in my house I think, okay, is a machine. Is not a human. A human can say this, this, this, but [it] is not a human...I expect[ed] more.*

Participant 1 also wanted more detailed feedback:

*When you do not included any specific rhetorical move, he [AcaWriter] just said, you are missing the move. But he didn't give you more extra information or something like that. He just said, you are missing the move, and that's it.*

However, when Participant 1 is informed by the researcher that there is an example she goes on to explain that:

*Yes, maybe I didn't see it because [unclear] are like, you are missing. So, maybe because I was angry, I said, really, there it is, and I come back to the writing and I just read. But maybe it said something else.*

This response demonstrates that when students are frustrated with AcaWriter's feedback they may then disregard the feedback and not read the feedback properly. Just as with supervisor feedback that is difficult to understand (see section 6.3.3) when students are frustrated with AcaWriter's feedback it may also evoke negative emotions. While the feedback message only contained one example of a move 1, it does tell the user that additional examples are located in the resource tab. Providing examples in the feedback messages was a key design principle in developing AcaWriter for research writing (see sections 7.4 and 8.5.7). This comment by Participant 1 implies that examples are important when learning research writing.

Some students found AcaWriter's feedback confusing when they felt that the move was in their writing, as Participant 3 explains:

*Right. The first time, like for instance the first move, which is establishing a research territory, it was not highlighted, which I was [not] expecting, because I felt I had put in the move. It was the first time, so I was a bit confused whether the move is missed, or whether it's not being indicated.*

The comment above points to the tension between the student's critical engagement with AcaWriter and their texts. Participant 3 may have included a move one in his text, but AcaWriter did not identify it. Or, it could also be that Participant 3 did not include a move 1 in his text and that AcaWriter was right. This tension is further discussed in the Design Reflections (9.3.5).

Another issue with AcaWriter's feedback was the perceived need for validation from a human. Participant 2 explained that he if disagreed with AcaWriter's feedback, he would ask for human opinion and their help. Participant 1 shared similar thoughts, as she felt that even when AcaWriter is used in a classroom, it was important for a teacher to also evaluate the text. Participant 2 also explained that students would find using AcaWriter at home difficult as there would be no one to help the student understand the feedback and how to use AcaWriter. This perceived need for human validation points again to the

tension between AcaWriter and student's critical engagement with their tool and their texts. While the students have agency to agree or disagree with the tool, the students appear to not have the confidence to do so (this is discussed further in section 9.3.5).

AcaWriter's accuracy was also expressed as an issue by some of the students. In particular, Participant 2 stated several times during the interview that the accuracy of the tool needed to be improved.

#### *Students perceptions of additional feedback for AcaWriter improvement*

The students were also asked what other kinds of feedback would be useful. Participant 3 suggested that AcaWriter could "...actually help the students in highlighting why a paragraph, or a group of sentence, is actually not contributing to a move. If some sentence[s] are not highlighted, there could be, probably, a message which says, these sentence are not part of a move, because so and so". However, providing feedback on every sentence or paragraph may be problematic, as having feedback on every paragraph or sentence could be overwhelming. This comment may also indicate that students have different expectations when it comes to automated feedback, as supervisors and teacher are very unlikely to provide feedback on every paragraph in a students work.

Participant 1 recommended more explicit information, in particular how to achieve the missing move along with more examples. Participant 2 requested more examples and templates that students could fill in to help when starting to write. It appears that students value examples, explanations and templates to help them with their research writing. Another suggestion from Participant 3 was for AcaWriter to identify incoherent sentences so that they could be revised. This suggestion may not be possible to implement in AcaWriter, as AcaWriter is a tool that focuses on rhetorical moves. However, AcaWriter could provide students opportunities for this type of feedback by providing links to other automated feedback tools that do provide this kind of feedback, for example Grammarly.

#### *AcaWriter Engagement and Revision Analysis of Students' work*

One of the final activities in this workshop was for students to work on the introductions they had prepared earlier using AcaWriter. As AcaWriter captures students' revisions and feedback requests, the students' engagement with AcaWriter and their revisions were analysed, following the same procedure as iteration 1. Table 9.5 shows the number of feedback requests per student. Compared to the previous iteration, engagement with

AcaWriter was lower. The low engagement with AcaWriter is most likely due to the students working on an already prepared Introduction.

**Table 9.5 – AcaWriter feedback requests**

<b>Participant</b>	<b>Feedback Requests/Drafts</b>
1	4
2	3
3	1

A total of eight drafts were qualitatively analysed for this iteration. As mentioned in iteration 1, the revisions were contrasted using a text comparison tool. To examine the types of changes made the revisions were manually coded according to the revision taxonomy presented earlier in Table 9.2. To determine whether the revisions impacted the overall quality of the text, the first and last draft was analysed as presented earlier in Table 9.3. Table 9.6 presents a summary of the students’ revision types, and the revision impact. Similar to iteration 1 students mainly made additions and deletions. However, in iteration one additional revision types were also observed such as expansions and consolidations (see AcaWriter Engagement and Revision Analysis of Students’ work). While in iteration one most students’ drafts improved, in this iteration no impact found. While it is unclear as to why the students did not use other revision types and no revision impact was found, it could be due to students working on a prepared introduction. In the previous iteration students were asked to write an abstract or introduction.

**Table 9.6 – Iteration 2 Revision analysis summary table**

<b>Participant</b>	<b>Revision Types</b>	<b>Revision Impact</b>
1	Additions, Deletions, Surface Revisions	Neutral
2	Addition, Deletion	Neutral
3	N/A	N/A

#### 9.3.4 Discussion

Overall, the data analysis from this iteration showed that the students found the workshop valuable. Learning the CARS moves and examples helped the students understand how to write an introduction. Understanding the rhetorical moves also helped them when they read articles as they were then able to identify the moves in research articles. The interviews suggest that AcaWriter was useful in reflecting on the rhetorical moves in their writing. This reflection process encouraged two of the students to revise their writing.

However, the students were not completely satisfied with AcaWriter. Two students were expecting more sophisticated and personalised feedback, and one student wanted more information on how to achieve the moves in their writing. These expectations led to feelings of frustration. These findings were confirmed in the survey responses when the students were asked how AcaWriter could be improved. This indicates that before using the tool students should be given information about the limitations of the tool and even perhaps how the tool works so they understand how the system works so that it is not a black box. These findings also suggest that AcaWriter may not yet be suitable for research writing, in particular writing introductions.

As presented in Figure 9.6 and Figure 9.7 students indicated that AcaWriter helped them identify rhetorical moves, and that AcaWriter's feedback helped them think about the meaning that they wanted to express. The survey results appear to suggest that AcaWriter has the potential to help students revise their drafts and learn rhetorical moves. These results suggest that AcaWriter may have the capability to support the teaching and learning of research writing when embedded in a workshop. As the students sometimes disagreed with AcaWriter (9.3.3), it seems that AcaWriter may possibly be helping them to think critically about their writing, and starting to make evaluative judgements. This is a critical step for students to become independent, scholarly writers.

However, some students may need reassurance. This was evidenced by some of the students expressing that they needed final validation from a human that the text was ok, and even more so if they were unsure about AcaWriter's feedback and their writing. While human evaluation is possible in a workshop, students using the tool independently may not have someone to assess their work. This perceived need for reassurance also indicates that some students may not be confident in understanding and applying the rhetorical moves. This points to the tension between AcaWriter's feedback and students'

agency towards their own writing and the tool (discussed further in 9.3.5). This finding also alludes to the challenges involved in providing students with research writing support when they need it. There are a number of solutions to this problem: (1) more scaffolding on the rhetorical moves through the learning design, (2) better personalisation of the automated feedback, in particular the feedback messages (see students Open-ended survey questions responses and interviews in section 9.3.3), and (3) improved accuracy of the tool (see students Open-ended survey questions responses and interviews in section 9.3.3).

While in previous iterations AcaWriter's accuracy was not considered problematic, in this iteration two of the participants commented on the need to improve AcaWriter's accuracy in identifying rhetorical moves. This request for accuracy reinforces the existence of a tension between agency in novice students and their critical engagement with the tool. It seems students want definitive answers when it comes to automated feedback and find it uncomfortable or even frustrating when they have to critically engage with the feedback, although it is important to note that this problem also seemed to occur in student responses to supervisor feedback that they considered ambiguous (see section 6.3.3).

Similar to iteration one, the revision analysis found that additions and deletions were the most frequently used revision type. Although the revision analysis in the first iteration found that the majority of student's drafts improved as they used AcaWriter, in this iteration no improvement was found. This could be due to the workshop format and the small sample size. In the previous iteration the students had more time using AcaWriter and composing their draft which was written on the day, whereas in this iteration students worked on an already prepared introduction.

The analysis of various data points in this iteration revealed inconsistencies in some student claims. For example, Participant 1 stated that feedback messages only indicated that a move was missing and no additional information, however the feedback message does provide an example and asks the student to click on the resource tab for additional suggestions. This finding suggests that the student found the user interface confusing and that more examples should be more noticeable in the feedback messages. Participant 2 stated in the interview that he did not revise his draft, however, the revision analysis showed that he did make changes to his draft. Although the revisions were minor, this raises the question as to what students perceive as revision. Revision is any change to the

text, however, some students may regard global, substantial changes as revisions, rather than smaller changes like deletions. Finally, during the interview Participant 3 reported that he used AcaWriter to revise his draft, however, the AcaWriter logs do not reflect this (it is possible either he or the log is wrong). These examples demonstrate that interviews conducted several days after an intervention may not always be accurate, or useful in determining its effectiveness. Consequently, these findings show that a variety of evaluation methods are needed in order to determine the effectiveness of an intervention. For example, screen recording the students' use of AcaWriter during the session which would show how students use the tool and whether they looked at the feedback messages and the resource tab. This methodology would allow more detailed information on how students used the tool. The inconsistencies also point to the importance of interviewing students as soon as possible after an intervention.

While this is a small sample size, the findings presented here are valuable. The small sample size allowed the students to share their thoughts and experiences of the workshop and using AcaWriter. Small sample sizes like this allow for rich insights which is particularly useful when designing tools and understanding user experience. The findings suggest that the learning design and the content of the workshop was appropriate and useful, as students provided positive feedback about learning the concept of rhetorical moves.

#### 9.3.5 Design reflections

After the completion of iteration 2, feedback from the participants suggests that the intervention was useful. Learning the CARS moves helped them read and analyse articles, as well as structuring their introduction. The survey results show that AcaWriter helped students think about their expression and better express their ideas. However, results were mixed when it came to using AcaWriter in their drafting process.

##### *Reflections on learning design*

The one-on-one interviews revealed that the learning activities were helpful and beneficial. However, when the participants were asked to revise their draft using AcaWriter, for one participant no changes were seen via the tool. This may indicate that the student did not participate in this activity or that there was an error with the tool. While joint construction with AcaWriter was an intended learning activity, when it came to facilitating the workshop this activity did not take place. This situation points to the



gap between planned learning design and what happens in the classroom. This is the complexity and challenge when conducting research in classroom settings.

### *Reflections on the tool*

Perceptions of the tool were mixed. One student expressed frustration with AcaWriter and that the feedback messages were sometimes not clear. Another participant thought the feedback messages were generic and not personalised enough, while Participant 1 did not see the sentence stem example in the feedback. Therefore in the next iteration shorter and clearer feedback messages with more examples were created so that students have feedback messages along with more examples.

One participant reported that the accuracy of the detection of the moves needed improvement. Language is complex and can be difficult for AcaWriter to process, especially when larger texts are involved. For example, Move 1 is often the most difficult move to detect, as providing context and background information on a topic does not have set linguistic rules. The revision analysis also demonstrated that repeating moves within an introduction affects the feedback received (i.e., if an introduction had a Move 1, Move 2, Move 1, then Move 3 the feedback would suggest the order be amended). Adjusting this feedback required programming skills to modify the concept-matching rules (see section 8.4), which is a specialist labour intensive task. It was deemed that this cost would only produce minimal benefit in this early stage of the research. Therefore, this research relied upon its evaluation approach of the moves conducted at the beginning of this study (see section 8.5.1). In order to focus this evaluation on writing that most closely aligned with these moves, the next iteration focused solely on abstracts. As abstracts are smaller pieces of text there is less chance of recycling of moves and so less risk that the tool misidentifies sequences of moves as inappropriate, increasing potential for appropriate feedback.

The tension between AcaWriter's feedback and student's critical engagement with its feedback was also seen in this iteration. In this case one of the students was confused whether or not he had included a move one in his text. He explained that the feedback he received from AcaWriter showed that he was missing move one, however he thought that he had included a move one. It seems that the student may have been confused and may have not been confident enough to use his own judgement. This tension was observed further when two of the students needed human validation of their texts and in particularly when they were unsure of AcaWriter's feedback and their writing. These two instances

demonstrate students' lack of confidence and points back to the tension between the tool helping students learn the genre while also giving students enough agency to critique the tool. This tension could be mitigated with more scaffolded learning activities on learning the moves and using AcaWriter so that students use their evaluative judgement and are confident enough to disagree with the tool. This tension is discussed further in Chapter 10, section 10.4.4.

### ***Reflections on recruitment, data collection and data analysis***

Although the recruitment process was changed from the previous iteration (this iteration workshops were scheduled around students' availability), it was still difficult to recruit students. While four students registered for the workshop, only three students attended. It is possible that students do not read the HDR newsletter closely, or that students are time poor, or already engaged in learning writing within their faculty. While students claim that they want research writing support (see section 4.5), when it is offered students do not attend (see low attendance numbers in iteration 1 – section 9.2.2 and this iteration). The low attendance in this iteration and iteration 1 suggests that there may be an issue in the HDR education space at this university. Conversations with the Graduate Research School indicate that there is an ongoing issue engaging HDR students. Engagement and attendance seems to be an issue in the HDR context (Saetnan, 2020). Although universities collect registration and attendance details, this data is rarely published and so it is unknown whether other universities face similar problems. This attendance and engagement issue means that writing support should not just be limited to workshops and that a comprehensive and systematic approach to research writing development is needed, such as the Multi-level Model of Research Writing Development (MMRWD) (see section 10.2.2). To mitigate the recruitment issue for this research, additional strategies were considered for future interventions, such as embedding AcaWriter in existing workshops and creating an online course.

In regards to data collection, there was a small issue. One of the survey questions was a double-barrelled question, *AcaWriter made me revise my writing and write more drafts*. This question was looking at two different variables. As, AcaWriter could make students revise their writing, but perhaps not write many drafts. Therefore, in the next iteration this question was separated out.

## 9.4 Design Iteration 3 & Implementation

### 9.4.1 Learning Context & Learning Design

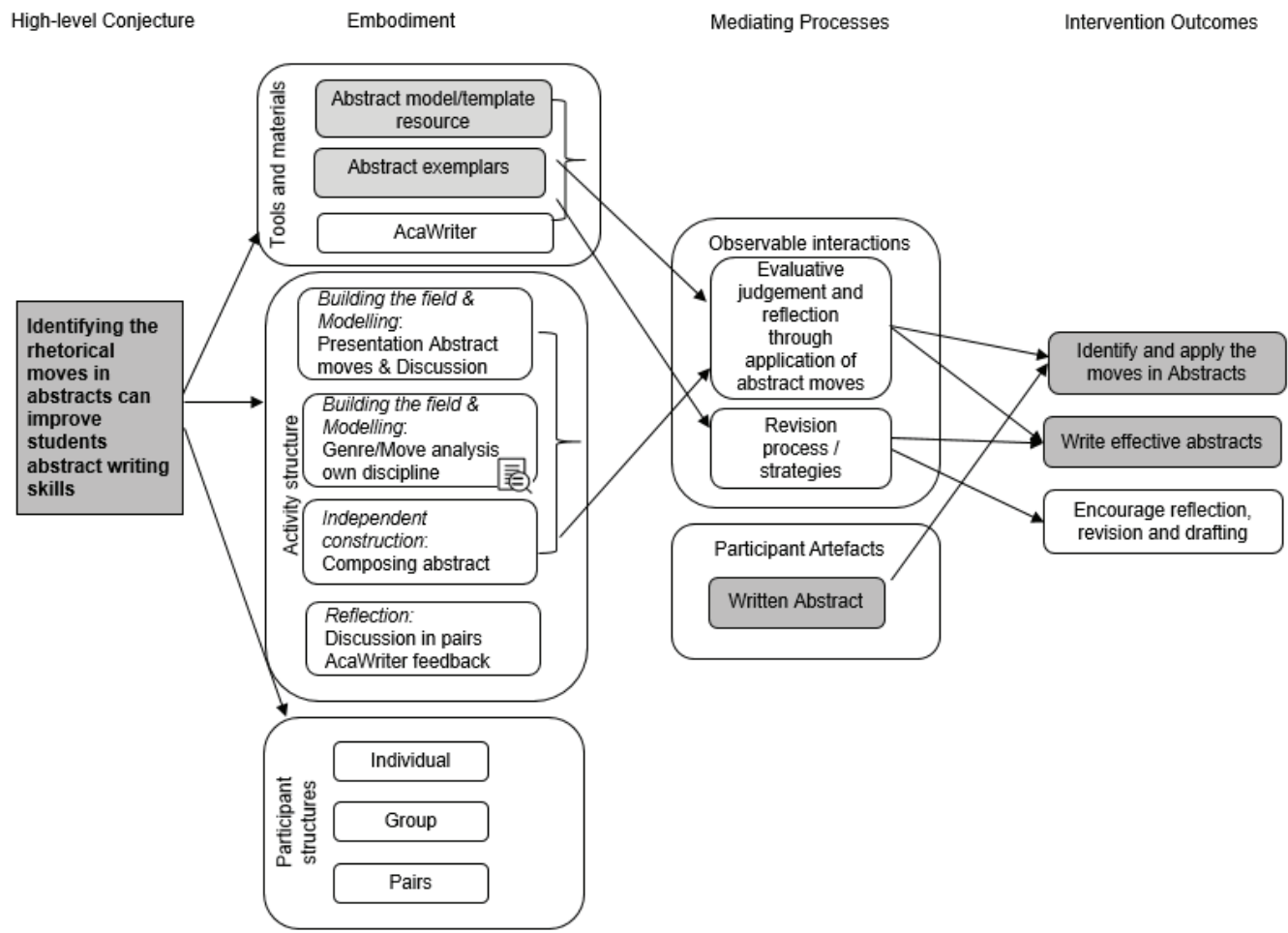
This intervention was embedded in existing HDR workshops to determine whether embedding AcaWriter in existing workshops would lead to better participation and recruitment. The iteration also focused on embedding AcaWriter in existing structures that were not led by the researcher to explore how aspects of the design principles can be adopted and adapted into existing practice, while respecting that existing practice. Meetings with the facilitator of the workshop were conducted to explore how AcaWriter could be embedded in the HDR writing workshops. As there were existing abstract and introduction workshops where students were introduced to the concepts of *moves* it was determined that AcaWriter would be best suited in the Abstract workshop. Therefore, this iteration focused only on writing abstracts. In this iteration AcaWriter was embedded in three workshops. One was a one-off workshop and the other two were implemented in winter and summer school which includes all of the workshops offered by the graduate research school over two days.

The facilitator's learning design for this iteration also followed the TLC (see section 8.1.3 for more information the TLC), but did not include joint construction. Building the field and deconstruction were implemented by first presenting a mini-lecture on the concept of moves, outlining the moves in abstracts and identifying the moves in abstracts examples from various disciplines. Figure 9.9 presents the conjecture map for this iteration. In the mini-lecture the CARS moves were not used, instead specific moves of abstracts were used that were determined by the facilitator. The moves included, reason for the work, background/context, problem addressed, methodology used, results obtained and implications of those results. This was done to align with the facilitator's existing practice. Next, the students were asked to analyse abstracts from their own disciplines using the moves presented in the mini-lecture. Then the researcher gave a presentation on AcaWriter, how it worked and explained the rhetorical moves AcaWriter detected. The

final activity involved *independent construction* where the students wrote their own abstract with AcaWriter<sup>21</sup>.

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<sup>21</sup> In one of the workshops, activity 2 was accidentally missed and students went straight on to writing their own abstract. In the one-off workshop an additional worksheet was piloted, but did not seem to add any additional benefit, so it was not used in the remaining workshop.



**Figure 9.9 – Conjecture Map Iteration 3**

#### 9.4.2 Design Refinements

For this iteration, building on the innovative work described in Chapter 8 (section 8.5), a specific Abstract parser was created. The moves in this parser took into consideration the moves the facilitator presented in the workshop and were adapted from Swales and Feak's (2009) abstract moves for novel integration in AcaWriter. The abstract move framework presented in Table 9.7 is different to the CARS parser discussed in Chapter 8 (section 8.5.1). In Swales and Feak's (2009) abstract framework the research problem / gap move is included in Move 1 and represented as 'situation'.

**Table 9.7 – Swales & Feak's (2009) abstract moves framework**

<b>Move</b>	<b>Labels</b>
Move 1	Background, Introduction, Situation
Move 2	Present research, Purpose
Move 3 (not modelled)	Methods, Materials, Subjects, Procedures
Move 4	Results, Findings
Move 5 (not modelled)	Discussion, Conclusion, Implications, Recommendations

However, in this study Move 1 was separated, so that the abstract framework included a research problem / gap move, presented in Table 9.8. The research problem / gap move was separated out because it could be confusing for students to have 'background, introduction and situation' as one move. It was also separated as its own move, as 'situation' was interpreted as the 'problem situation' by the researcher, and so that there was alignment with the CARS model. In the CARS model, 'problem situation' is represented by Move 2 – Establishing a niche (see section 8.5.1 for the CARS framework).

The Abstract parser focused on four specific moves: *background/context*, *purpose of the research*, *research problem/gap in the literature*, and *results*. At the time, AcaWriter was

not able to identify Move 3 (Methods, Materials, Subjects, and Procedures) and rules were not created for AcaWriter to identify Move 5 (Discussion, Conclusion, Implications, and Recommendations). The abstract moves were mapped to the AcaWriter tags as shown in Table 9.8. The mapping was completed in a similar manner to the mapping of the CARS parser (see section 8.5.1 for more details).

**Table 9.8 – Defining the Abstract parser’s rhetorical moves in terms of sentence tags**

Swales & Feak’s Move	Abstract Rhetorical Moves	AcaWriter Tags
Move 1	Background/context	E - Emphasis B - Background
Move 2	Purpose of the research	S – Summary
Move 1	Research problem/Gap in the literature	C – Contrast & Q – Question
Move 4	Results	S – Summary N - Novelty

New feedback rules were created for the Abstract parser. Unlike the CARS parser which had very specific rules, for example, if Move 1 appeared before Move 2, then cautionary feedback was generated, the Abstract parser was more flexible and included feedback that was based on the location of the move. Unlike the CARS parser both positive feedback, as well as cautionary feedback, was developed. Positive feedback was generated when AcaWriter identified a move in a specific location and cautionary feedback was given when a move was not detected in the particular location. These rules were developed based on the position of the moves in the genre writing conventions of abstracts. For example, *Background* and *Purpose of the research* moves are generally found at the beginning of abstracts, hence the first 10% rule for these moves, and the *Results* move is commonly located towards the end of abstracts, hence the last 10% for this move.

These new rules required collaboration between the academic language expert (the researcher) and the programmer. These rules were implemented computationally using positions based on percentage rules by using full stops — indicative of sentence boundaries — to segment the documents (a recognised limitation of this approach is the use of full stops as the only sentence boundary, other punctuation marks could be added in the future). The number of sentences in a document were counted, and rules created such that the "first 10%" of a 20 sentence document would indicate the first 2 sentences. This approach ensures that sentence length is not a key factor in splitting the document.

The percentage rules were defined as follows:

- Background / Context and Purpose of the research moves – only searched within the first 10% of the text.
- Problem / Gap in the literature – only searched in the middle between the first 10% and last 5%.
- Results move – only searched within the last 5% of text.

For example, if a text consisted of 100 sentences, then the first 10 sentences were checked for the *Background/Context* move and *Purpose of the research* move, sentences 11-95 were checked for the *Research problem/Gap in the literature* move, and the last five sentences were checked for the *Results/Findings* move.

The rules are explained in more detail in Table 9.9. The feedback messages were simplified, compared to the CARS parser. AcaWriter tag icons were also included in the feedback messages for ease of use. Figure 9.10 provides an example of how the feedback appears in AcaWriter. The language of the moves and tags was changed in the analytical report to align with the abstract moves, see Figure 9.11.



**Table 9.9 – Abstract parser feedback rules & messages (iteration 3)**

<b>Feedback rule</b>	<b>Feedback message</b>
<b>Positive Feedback</b>	
Emphasis in the first 10% of sentences in the text	✓ Great work, it looks like you have significance sentences in the beginning of your abstract. You have explained why your research topic is important <E>. This will help readers understand why your research is significant.
Background in the first 10% of sentences in the text	✓ Great work, it looks like you have Background sentences in the beginning of your abstract. You have provided background information on your research topic <B>. This will help readers understand the context of your research.
Summary in the first 10% of sentences in the text	✓ Great work, it looks like you have Purpose / Summary sentences in the beginning of your abstract. You have stated the purpose of your research, and/or what the paper will contribute < S >. This will make it easier for your reader to understand the goal of your research.
If all three tags Emphasis, Background, & Summary appear in the first 10% of sentences in the text	✓Great work, it looks like you have Context, Background and Purpose / Summary, sentences in your abstract. You have explained why your research topic is important <E>, provided background information <B>, and stated the purpose of your research <S>. These sentences will make it easier for your reader to understand why your research is significant and the goal of your research.
If Question or Contrast appear in the middle of the text	✓ Great work, it looks like you have Problem / Gap sentences in your abstract. You have indicated a gap in knowledge <Q> or identified issues in the literature <C>. By including these sentences your readers will know what problem you are trying to solve.

<b>Feedback rule</b>	<b>Feedback message</b>
Last 5% of the text check for Novelty.	✓ Great work, it looks like you have Novelty sentences towards the end of your abstract. You have explained a new finding, approach, and/or insight in your research <N>.
Last 5% of sentences in the text check for Summary	✓ Great work, it looks like you have Summary sentences towards the end of your abstract. You have stated what the purpose of your research and/or paper is <S>. This will make it easier for your reader to understand the goal of your research.
If both tags Summary & Novelty appear in the last 5% of sentences in the text	✓ Great work, it looks like you have Summary / Novelty sentences towards the end of your abstract. You have stated what the purpose of your research and/or paper is <S> and explained a new finding, approach, and/or insight in your research <N>.

### **Cautionary Feedback**

If no Summary, Emphasis, or Background sentences appear in the first 10% of sentences in the text.	! It looks like you're missing Background / Purpose sentences in the beginning of your abstract. Here you explain why your research is important <E > or provide background information on your research <B> or state the purpose of your research <S>. To achieve this move try including <E> sentences, for example: <i>x is an important feature in y., Substantial evidence in x suggests that..., The study of x is important because x impacts y.</i> Or <B> sentences: <i>X has been previously proposed..., Recent, literature concerning x has reported that..., Recent studies indicate that..., It is widely agreed that...</i> Or <S> sentences: <i>The purpose of this paper is to..., In this study we focus on..., The aim of this research is to...</i> Check if you have included these sentences near the start of your abstract
If no C or Q sentences appear in the	! It looks like you're missing Problem / Gap sentences in the middle of your abstract. Here you indicate a gap in knowledge, or identify issues in the literature: < C> and <Q> sentences. To achieve this

Feedback rule	Feedback message
middle of the text.	move try including sentences like these: <i>The problem of x has not been widely studied., This approach fails to address the issue of x., However, limited research has been conducted in x., Despite earlier studies x remains unknown.</i> Check if you have included these sentences in your abstract.
If no S or N sentences appear in the last 5% of sentences in the text.	! It looks like you're missing Summary / Novelty sentences towards the end. Here you summarise your research <S>, and/or explain a new finding, approach, or insight in your research <N>. To achieve this move try including <S > sentences, for example: <i>In this paper, we have..., In this study we..., The aim of this research was to... Or &lt;N&gt; sentences: Significant improvements in x have been developed, This paper builds on previously published work in this area by adding new insight/data..., We present a new method/approach/model/framework..., X reveals major improvements in y. The major innovation of x is its ability to identify/detect y.</i> Check if you have included these sentences at the end of your abstract.

NOTE: Computers don't understand writing like humans. So, AcaWriter may highlight rhetorically good sentences that actually make no sense, or leave un-highlighted a sentence that you feel is really good. It's fine to disagree with the feedback — but it's also your job to check your facts!

Analytical Report      Feedback      Resources

**i** Thank you for submitting your draft to AcaWriter. Quality writing comes from revision. Research shows that writing drafts and revising your text helps improve the quality of your writing.  
Remember AcaWriter is a machine – so it may not highlight all your moves correctly and could give you incorrect feedback. So, don't be afraid to disagree with the feedback, if you believe you have included all three moves in the correct order.

**!** It looks like you're missing Background / Purpose sentences in the beginning of your abstract. Here you explain why your research is important **E** or provide background information on your research **B** or state the purpose of your research **S**. To achieve this move try including **E** sentences, for example: *x is an important feature in y., Substantial evidence in x suggests that..., The study of x is important because x impacts y. Or **B** sentences: X has been previously proposed..., Recent, literature concerning x has reported that..., Recent studies indicate that..., It is widely agreed that... Or **S** sentences: The purpose of this paper is to..., In this study we focus on..., The aim of this research is to...* Check if you have included these sentences near the start of your abstract.

**✓** Great work, it looks like you have Problem / Gap sentences in your abstract. You have indicated a gap in knowledge or identified issues in the literature: **C** or **A**. By including these sentences your readers will know what problem you are trying to solve.

**✓** Great work, it looks like you have Summary sentences towards the end of your abstract. You have stated what the purpose of your research and/or paper is **S**. This will make it easier for your reader to understand the goal of your research.

**Figure 9.10 – Abstract parser feedback messages (iteration 3)**

[Get Feedback & Save](#)
[Download PDF](#)

NOTE: Computers don't understand writing like humans. So, AcaWriter may highlight rhetorically good sentences that actually make no sense, or leave un-highlighted a sentence that you feel is really good. It's fine to disagree with the feedback — but it's also your job to check your facts!

Analytical Report	Feedback	Resources
Background/Context/Purpose of research move.		
<span>E</span> Emphasis of a significant or an important idea <span>B</span> Background information and reviewing previous work		
Problem/ Gap in the literature move		
<span>C</span> Contrasting idea, tension, disagreement or critical insight <span>D</span> Question or gap in previous knowledge		
Purpose of research/ Results move		
<span>N</span> Novelty and value of your research <span>S</span> Summary of the author's goal or nature of the research, or structure of the paper		

**E B**

It is now widely accepted that timely, actionable feedback is essential for effective learning. In response to this, data science is now impacting the education sector, with a growing number of commercial products and research prototypes providing "learning dashboards", aiming to provide real time progress indicators. **E C** From a human-centred computing perspective, the end-user's interpretation of these visualisations is a critical challenge to design for, with empirical evidence already showing that 'usable' visualisations are not necessarily effective from a learning perspective. Since an educator's interpretation of visualised data is essentially the construction of a narrative about student progress, we draw on the growing body of work on Data Storytelling (DS) as the inspiration for a set of enhancements that could be applied to data visualisations to improve their communicative power. **S** We present a pilot study that explores the effectiveness of these DS elements based on educators' responses to paper prototypes. **S** The dual purpose is understanding

**Figure 9.11 – Abstract parser analytical report (iteration 3)**

### 9.4.3 Recruitment & Participants

For this iteration AcaWriter was embedded in abstract writing workshops during winter and summer school. Winter school was held on the 15<sup>th</sup> to 17<sup>th</sup> May and summer school on 30<sup>th</sup> of October to the 1<sup>st</sup> of November in 2019. The study was conducted on day two of the programs (16<sup>th</sup> May for winter school and 31<sup>st</sup> October for summer school). Therefore, recruitment of students took place in the workshop, where students opted in or out of the study. Twenty-five students attended the winter school workshop and 14 students participated in the study. For summer school workshop 31 students attended the workshop and 12 students participated in the study. A one-off workshop on how to write

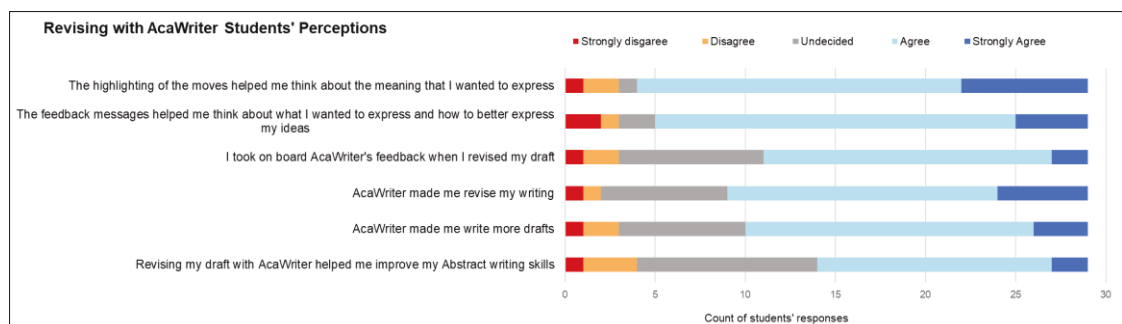
abstracts with AcaWriter was also included in this iteration Seventeen students attended this workshop, however only three students participated in the study. This one-off workshop was promoted via email by the Graduate Research School. Overall, approximately 73 students attended the workshops, however only 29 participated in the study.

#### 9.4.4 Data collection methods & analysis

##### *Likert scale survey response*

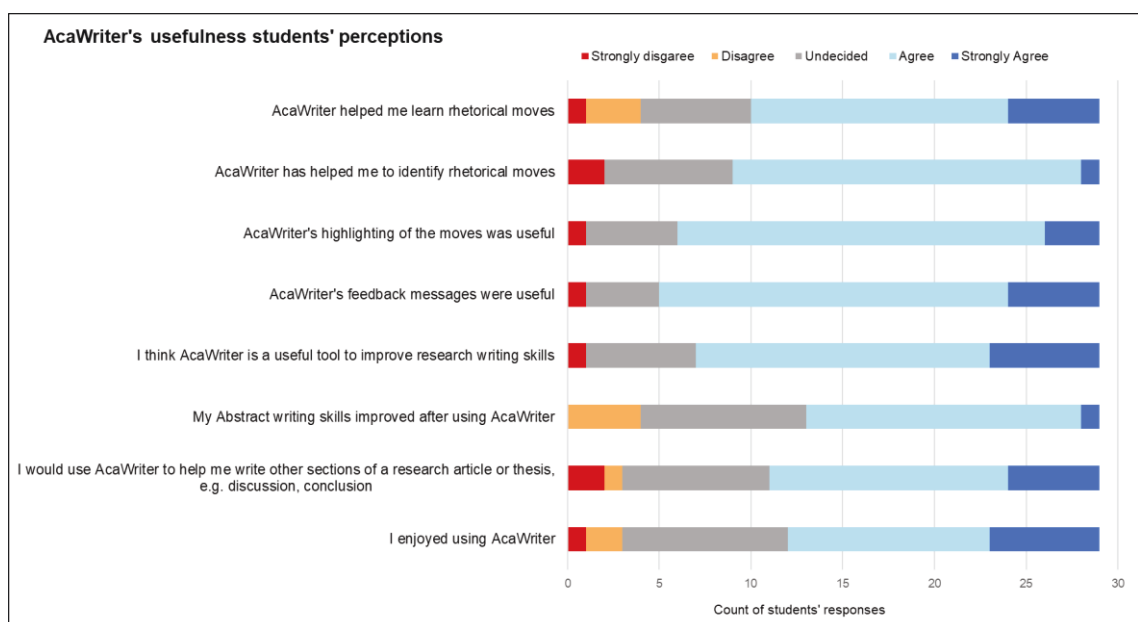
After the students participated in the AcaWriter activity they were asked to complete an online survey which posed questions about their perceptions and experiences using AcaWriter. Students were asked to indicate their level of agreement with statements using a six-point Likert scale from ‘1. Strongly Disagree’ to ‘6. Strongly Agree’ (the complete survey is provided in Appendix I: Post Survey Questions Iteration 3).

AcaWriter was found to assist students in the revision process. Figure 9.12 illustrates that 86% of the students reported that AcaWriter’s highlighting helped them think about the meaning that they wanted to express ( $n = 25$  when ‘Agree’ and ‘Strongly Agree’ are combined) and 83% of the students reported that the messages also helped them think about what they wanted to express and how to better express their ideas ( $n = 24$  when ‘Agree’ and ‘Strongly Agree’ are combined). Sixty-two percent of students took on board AcaWriter’s feedback ( $n = 18$  when ‘Agree’ and ‘Strongly Agree’ are combined). While the findings above are positive, when the students were asked if their abstract writing skills improved, 34% of the students were undecided and 14% disagreed ( $n = 10$  ‘Undecided’,  $n = 4$  when ‘Disagree’ and ‘Strongly Disagree’ are combined).



**Figure 9.12 - Students’ perceptions revising with AcaWriter**

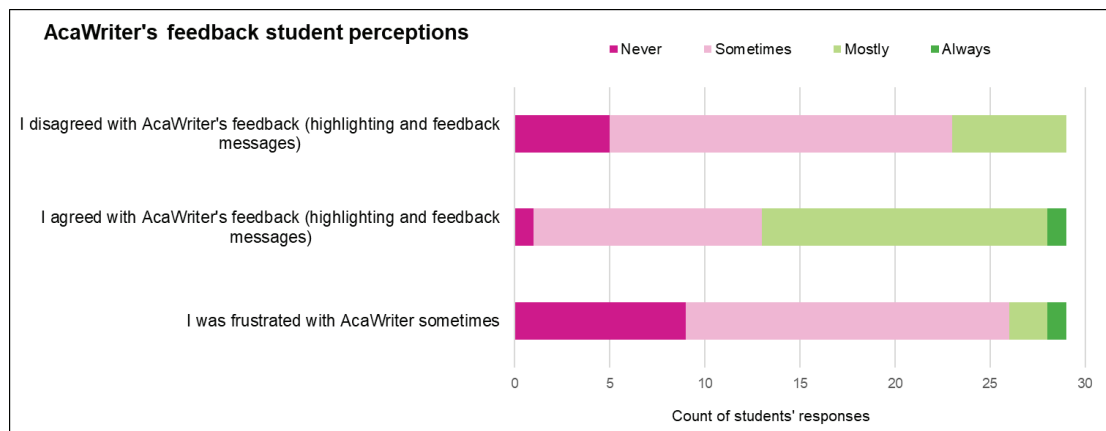
AcaWriter was identified as helpful in learning the abstract genre. Figure 9.13 illustrates that 65% of the students reported that AcaWriter helped them learn the moves and 70% reported that AcaWriter helped them identify the moves in an abstract ( $n = 19$ ,  $n = 20$ , respectively, when ‘Agreed’ and ‘Strongly Agreed’ are combined). The students indicated that AcaWriter’s automated feedback was beneficial with 79% of the students reporting that the highlighting was useful and 83% reporting that the feedback messages were useful ( $n = 23$ ,  $n = 24$  respectively, when ‘Agreed’ and ‘Strongly Agreed’ are combined). While these are positive results, some students were unsure about the usefulness of AcaWriter.



**Figure 9.13 - Student perceptions of AcaWriter’s usefulness**

The students were also asked to indicate whether they (a) disagreed and (b) agreed with statements regarding AcaWriter’s feedback by rating their level of agreement from ‘Never’, ‘Sometimes’, ‘Always’, ‘Mostly’ in order to triangulate students’ responses across these two dimensions (see Figure 9.14). The responses show that 62% ( $n = 18$ ) of the students’ sometimes disagreed with AcaWriter’s feedback highlighting and feedback messages and 51% ( $n = 15$ ) of the students mostly agreed with AcaWriter’s feedback. Although students did disagree with the feedback sometimes, most also agreed with it, while a very small proportion (10%,  $n = 3$ ) either mostly or were always frustrated. These responses indicate that even where students disagreed with the feedback sometimes, most

still found agreement with it and the low level of frustration suggests they were not put off by any perceived disagreement, consistent with the intended design of the tool.



**Figure 9.14 - Students perceptions towards AcaWriter's feedback**

### *Open-ended questions survey response*

Participants were asked open-ended questions to explore: how they used AcaWriter, what features they found beneficial, and how AcaWriter could be improved to help research writing. A thematic analysis was conducted to analyse the responses. For this iteration the responses were first coded per question and then categorised into themes for each question. The questions, themes identified and their representations are presented below.

#### *Strategies students used when interacting with AcaWriter*

To investigate how the students used AcaWriter, they were asked what strategies they used when interacting with the tool. Of the 29 responses, 23 were coded, and the remaining six were not useable. The findings from the students' reactions using the tool are summarised below.

#### *Reviewing, revising and/or editing*

Twelve students reported that they reviewed and revised their abstract with AcaWriter. While some students merely mentioned it in passing, here are three extended responses on how they revised their writing according to AcaWriter's feedback. This reviewing and revising process is expressed by Participant 1, "I loaded in an abstract into the window. Once I got the feedback I went back and tried to include the missing 'moves' and re assessed. I repeated this until I had changed the result presented in AcaWriter." Participant 2 explained that they revised with their abstract by "seeing if restructuring sentences changed the outcome". Similarly, Participant 17 explained that "shifting

*language to gauge responses from the program*” was how they used AcaWriter in their revision process.

#### *Comparing with published works*

While almost half of the students reviewed their own abstract using AcaWriter, Participants 2, 17, and 18 also used AcaWriter to reviewed published articles. Participant 2 submitted published abstracts *“to compare to my own work”*, whereas Participant 17 wanted to explore how published abstracts faired with AcaWriter: *“Comparing different kinds of abstracts to see how the program reacted, and compare these reactions”*. Similarly, Participant 18 *“tested”* AcaWriter with published physics abstracts.

#### *Low engagement with AcaWriter*

Eight students reported that they did not find the feedback useful or that it did not prompt them to revise or reflect on their writing which is the intended purpose of the tool. Participant 8 explains: *“I found it missed most of my moves so I found it not very beneficial to interact with much”*. Participant 27 *“just read feedback”* and Participant 24 stated *“no I did not revise my writing”*.

#### *Beneficial features of AcaWriter*

To investigate what features of AcaWriter were useful for students, participants were asked to explain what features of AcaWriter they found beneficial and why after using AcaWriter to write their own abstract. Of the 29 responses, 26 were coded.

#### *AcaWriter’s highlighting and feedback messages were useful*

Of the 26 responses, 20 of the students found AcaWriter’s feedback helpful with some providing more or less elaboration. Some students found AcaWriter’s highlighting feature useful to identify *“the move it belongs to”* (Participant 4) in their abstract. This is emphasised by Participant 1 who stated: *“I liked how it highlighted what each of my sentences were trying to achieve”*. Participant 18 explained how identifying the moves was useful so that they could determine if they had missed moves or could express the moves more effectively: *“Looking for the moves that are part of an effective abstract is beneficial, since it's really easy to miss or write in an ineffective way”*. Alongside the highlighting feature, other students expressed that they found the feedback messages beneficial. Participant 3 stated that *“the highlighting and the commentary about how to improve”* was useful. Two students explained that the information about the moves and the sentence examples were beneficial: *“I like the highlighting and the colouring, and the giving examples in the feedback...the words / phrases that can be used”* (Participant 14)



and *“The additional information provided on the moves and examples of words to use to write the sentences in a clearer way”*.

AcaWriter was also seen as a valuable starting point to writing an abstract. This was expressed by two participants: *“Creating a base structure for an generic abstract can give direction for writing when the approach is not yet fully formed”* (Participant 17) and *“Introduction or implication to how to write a good and complete abstract”* (Participant 20).

#### *AcaWriter’s feedback was not useful*

Two students expressed that AcaWriter was not useful. One participant explained that *“In theory it would be useful as a reminder to ensure that all the moves are clearly communicated”* (Participant 8) and Participant 29 explained that AcaWriter was not useful *“Because AcaWriter could only identify 1 move when clearly there were several”*.

#### *Improvements needed to AcaWriter to support HDR writing*

To explore how AcaWriter could better support HDR students’ research writing, the students were asked how AcaWriter could be improved. Two students expressed no changes and one student was unsure how AcaWriter could be improved. Two responses were unusable and therefore not coded. The remaining 24 responses were coded. The themes identified are presented below.

#### *Additional feedback*

Many of the students expressed that they would like additional feedback from AcaWriter. Additional feedback desired included feedback on *“grammar”* (Participant 12 & 24), feedback on synonyms *“suggestions on the words used, proposing alternative words to use”* and *“suggestions on the length of the abstract (to increase or decrease)”* (Participant 25). One student mentioned the detection of other moves: *“The tool also mentions a problem/gap move - sometimes the research is based on an opportunity rather than a problem/gap and not sure if this has been considered in the tool as it didn't seem to pick up these moves”* (Participant 6). Other students explained that more functionality from AcaWriter would help HDR students. For example, AcaWriter could provide feedback on thesis writing and the whole article, rather than just the abstract. One participant expressed that more personalised feedback would be valuable for students: *“It will be great if it will able to provided more specific comments rather than general feedback for every abstract”* (Participant 22).

### *Discipline specific feedback*

Some of the students were very much aware of the writing conventions of their discipline. Six students expressed that providing discipline specific feedback would improve AcaWriter. Participant 10 explained that AcaWriter should “...*consider abstracts from different fields and areas*”. The suggestion for discipline specific feedback is further highlighted by Participant 18 as they explain how different fields adhere to different writing conventions: “*Abstract for theory papers in some fields, like physics and math, is mostly the collection of results, and does not include most of the moves. There might be an option to choose the field before getting a feedback*”.

### *Improving Accuracy*

Students also expressed that AcaWriter could be improved by improving its accuracy in detecting the moves. This could be because AcaWriter did not identify all of the moves in their writing. This is explained by Participant 2: “Based on today's experience, I don't highly rate AcaWriter's accuracy. Improving its accuracy would make it a more attractive and useful tool. I mainly learned and evaluated my work when disagreeing with AcaWriter: it said I failed to make many moves and, when rereading my work and comparing it to the work of others, I believed that I had made said move”. Participant 29 explained that accuracy needed to be improved so that it could better support HDR writing: “*AcaWriter needs refinement for accuracy to reduce frustration and support HDR writing*”. In order to improve AcaWriter's accuracy some students suggested that AcaWriter needed “*an increased nuancing of phrase recognition*” (Participant 17) and “*advanced algorithm to recognize or identify elements of abstract more accurately*” (Participant 20).

### *Other improvements*

Additional improvements to AcaWriter were also mentioned, in particular improvements to the user interface. For example, Participant 12 suggested “*better highlighting*” and Participant 20 recommended a hover feature so that when the mouse moves over the icons “*some related information will float up automatically*”. Other improvements included “*continuous support*” (Participant 28) and “*more trials*” (Participant 21).

### *Concerns with AcaWriter*

Throughout the coding process issues regarding the use of AcaWriter were also identified and coded across the three questions. One concern is that students may regard AcaWriter as grading their work, as one student commented that, “*I was unable to edit my work in*

*a way that AcaWriter gave me a "pass" mark*" (Participant 3). Another concern is that students may view AcaWriter's feedback as identifying "*mistakes*" (Participant 24) in their writing, rather than a tool to support and improve their writing. Lastly, students might not be aware of the resources tab which links to additional sentence examples. Students might only be looking at the feedback messages for examples. The Abstract parser contains feedback messages that provide sentence examples, however, Participant 25 commented that "*examples on the gaps to fix (like sentences and words)*" would improve AcaWriter. This comment suggests that the student may not have seen the feedback messages due to user experience, or that they possibly did not follow the guide and did not use the intended Abstract parser and may have used AcaWriter's analytical parser instead which does not provide feedback messages.

### ***Interviews***

Semi-structured interviews were conducted with two students who attended the winter school workshops. The interviews were conducted within three weeks after the workshops, contingent to the students' schedules. The interviews lasted approximately 15 to 20 minutes, and were audio-recorded and transcribed for analysis (the interview schedule is provided in Appendix H: Interview Schedule Iterations 2 and 3). The interview data was coded inductively and categorised into four over-arching themes: revising with AcaWriter, AcaWriter's shortcomings, appropriate learning design, and learning research writing during candidature is complicated. The themes and interview findings are presented below.

#### ***Revising with AcaWriter***

The theme revising with AcaWriter was identified by the students' experiences using AcaWriter in their writing process. They saw AcaWriter as a useful checking device. As they were novices to research writing having this extra step was helpful in their writing process as they could seek feedback from AcaWriter first before submitting their work. In this checking process AcaWriter helped to identify if all the moves were present or if some were missing in their abstracts. This notion of checking was expressed by Participant 2:

*So, I would definitely go back to AcaWriter in actually assessing my abstract, definitely yes, because it gives me an understanding whether all*

*the elements, all the moves are there in my abstract, and then [if] it is cohesive, actually. [If] it contains everything, and then I can pretty much move forward and submit my abstract or paper.*

This checking process with AcaWriter was also seen as a helpful additional layer to the revision process. As established in section 4.3.6 students rely mostly on their supervisors for feedback during their writing process. AcaWriter was seen as an additional tool and step in the writing process, as highlighted by Participant 1:

*It's helpful because if you have nothing and then you write an abstract, usually what you do is that maybe you send to an advisor or something like that. So, I think it's another step on that revision process so that you can have another chance of revising yourself before you send it off to somebody else.*

The comment above demonstrates that AcaWriter can be seen as a tool to improve the quality of text before students send it to their supervisors.

AcaWriter seemed to reinforce the moves in abstracts while they used the tool. As presented in Figure 9.11 AcaWriter's interface presents the majority of the moves in an abstract and the type of sentences needed to achieve each move. It seems that having the moves present in AcaWriter's interface served as a reminder of the moves required in an abstract. Participant 2 explains how AcaWriter was helpful to determine what information was needed in an abstract:

*I didn't think that, okay, so background, purpose and these information should be there, so I thought it is... Just put on what are you doing, and then finish it with a bit of your findings. So, that's what my understanding was of [an] abstract, but then with the moves that AcaWriter showed, it became easier. And then I had to put a bit of information more because that's how I could relate with the purpose, the background, so those things.*

As Participant 2 had all the moves in her abstract, she did not use AcaWriter again to revise her draft. It seems that this is more of a realisation, and that her revising may have taken place within her document rather than in AcaWriter.

Similarly, Participant 1 explained how AcaWriter is useful for novice writers, or as a refresher for someone coming back to research writing:

*Well, the thing is that I hadn't been writing scientifically for a long time, because I did a scientific paper like 10 years ago, and then I was writing different kinds of stuff, and then not writing. So, I think that it's very useful to get somebody acquainted if they're starting to do scientific writing or some kind of academic writing, or if they need to be reminded. I think it's very useful as a roadmap to use.*

The students' found AcaWriter's feedback useful. They both expressed that the suggestions in the feedback messages were helpful. However they each preferred different aspects of AcaWriter's feedback. Participant 1 explained that the feedback messages were most useful:

*I guess when you put it in, then it's an analytical report. And then you had all the little dot things. But then when you go to the feedback, then that's when it explains what you're missing and stuff like that. So that I found useful.*

*Yeah I thought it picked out the sentences and it gave you a suggestion, and I liked that the way that it was worded, it wasn't... it was pleasant. I appreciated that.*

While Participant 1 preferred the feedback messages, Participant 2 favoured the analytical report as it was a visual representation of what moves were present in the abstract:

*Highlighting made it more visual, and then bang on, this is what we are looking for. So that is why highlighting was one good thing. And the second was the messages...So, definitely, I think the visual first, and then the messages. But both were helping each other, I would say.*

The three excerpts above demonstrate how feedback is also a complicated process in the research writing. Participant 1 valued how the feedback was written "...because sometimes it can be a bit harsh." Whereas, Participant 2 really valued the highlighting. This suggests that providing multiple forms of feedback is advantageous in research writing.

#### *Appropriate learning design*

'Appropriate learning design' captures students' perceptions of the learning design of the lesson. It appears that the learning design was effective and that understanding rhetorical

moves are helpful in the writing process. The interviews indicated that the students found the learning activities useful, especially the use of examples, as highlighted by both participants:

*Because I think that sometimes when you have the information, and it can be a bit abstract when you actually have an example that you can identify yourself, then I think that it becomes more...um.. What's the word I'm trying to find? Yeah. I guess it's just more fixed on you once you're able to identify something, because when you're writing yourself, then um, you can remember okay, well, I remember when I was reading..., I think this is this is the part where this move was there. (Participant 1)*

*So, I think I can better understand with examples. So, when we were actually told to go back to the paper that we have got and then relate the moves with the paper that helped me understand it more. The clarity was much more in that aspect, rather than him just telling about the moves, because I feel if you have much more example it becomes easier. And then I think for his abstract part also, he gave plenty of examples [of] how it could be written. So, that gave much more clarity, rather than...just speaking... For me, that doesn't work, frankly speaking, and especially in research papers. Yes, we have gone to a lot of workshops and everything happens, but unless and until there are few examples to actually help us understand that... I think that was the best part, learning with examples. (Participant 2)*

The learning design was found to be effective in teaching abstract writing, as Participant 1 explains:

*Yes, I think that especially during the workshop, it was really useful to have the introduction and then going through different texts and identifying. And then using that knowledge to then think, okay, well, when I write then you have to do that as well and make that smooth transition.*

Participant 1 also explained how she knew what to include in her abstract when it came to writing her own abstract using AcaWriter:

*I think it's good to point out that the piece that I wrote was after having done the workshop part where you actually get introduced to the moves. So, I knew to put those in.*

These comments indicate this adapted version of TLC is effective in research writing. It confirms that students do draw on the features of the genre introduced during the *deconstruction* and *building the field* stage to *independently construct* their own abstract.

#### *AcaWriter's shortcomings and additional beneficial features*

AcaWriter's shortcomings highlights the issues that the students encountered when using AcaWriter and the additional features that could be beneficial for students when using AcaWriter. While the students reported mostly positive aspects about using AcaWriter, both needed some assistance. For example, Participant 2 explained that:

*So, I think that is the part which I needed help from you to understand that because it wasn't clear at the first go...much clarity is required for the first time user because there are certain things...I did not understand at the first go that, okay, am I missing this, am I not missing this?*

While Participant 2 needed clarification from the researcher on interpreting the feedback, Participant 1 needed reassurance from the researcher that she had indeed achieved a move, even though AcaWriter was unable to recognise it:

*Well, I was pleasantly surprised that you know it (AcaWriter's feedback) was mostly positive, you know. And when it didn't appear on the sentence that I thought it was a move, I guess I questioned myself, and then because you were there, I could ask you.*

These comments above again point to the tension between the imperfect tool and students' confidence with their writing and learning the genre, previously established in iterations 1 (sections 9.2.4 and 9.2.5) and iteration 2 (sections 9.3.4 and 9.3.5). It seems the students were confused by the feedback and needed agency to dispute the feedback given by AcaWriter and trust their judgment.

The students' were also asked what additional feedback they thought would be valuable for students. Participant 2 explained that abstract exemplars were needed in AcaWriter and that a plagiarism check would also be helpful:

*The one thing which I already told is about the plagiarism check. If we can do that, that would be really good. And I think we can have... In AcaWriter itself we can have few best abstract examples. Like the best ones, I'm saying. So, though ours won't be the best, but then it could actually help us to achieve to that level. So, if we have that information itself in the AcaWriter, instead of finding elsewhere, that could be also one beneficial stuff, I would say.*

This comment from Participant 2 suggests that having resources at students' fingertips is useful and practical rather than searching for resources. The comment also suggests that students want one tool that can accommodate their needs, rather than using additional platforms. However, it is difficult for one tool to do everything (for example, feedback on plagiarism, and feedback of grammar) and providing feedback on multiple aspects of writing would be overwhelming. As previously mentioned in iteration 2 (section 9.4.4) AcaWriter could instead provide students opportunities for additional types of feedback by providing links to other automated feedback tools.

*Learning research writing during candidature is complicated*

The final theme 'Learning research writing during candidature is complicated' presents some of the difficulties that the students expressed in their research writing. Participant 1 explains how research students are extremely busy where they do not have time to focus on one task, and often feel guilty about allocating a large amount of time to writing. Here she also describes how after attending the winter school she has now allocated writing time within her research group:

*...I think that it was also the time to devote to just do that. Because usually you get kind of pulled in a lot of directions and at least I don't give myself permission to just do one, to give you a big chunk of time to do something. And it's a feedback that I gave back to my group and my advisor, and we're actually implementing a day of the week that we do writing...So, we can have time to concentrate, because it's very hard to do that. And I said, I think that was very useful to me.*

Participant 2 expressed the frustrations of being a novice research writer. She describes how the burgeoning amount of literature is overwhelming and she feels unaware of scholarly writing conventions:



*So, because research itself, when we talk about literature, it is all around the place. You don't know what to focus on. And for beginners, we are clueless. Literally, we are clueless what should be in the paper, what not, how the flow should be coming. So, because since we are new, we want to know each and every aspect of the topic that we are studying, but then eventually what happens is we end up having a lot of information and we don't know how to actually put that information in a correct way...*

Another issue faced by novice researchers and described by Participant 1 concerns the insecurities of being a good writer and how asking for help can sometimes be awkward. She goes to also explain that AcaWriter can help with writing insecurity:

*Well, the thing is that I used to think I was good writer, and I think I was. But I think I've been so out of practice for such a long time, that it's helpful to have those tools and something like that. And I think that you can be a bit self-conscious sometimes to approach other people to help you. And so, it's nice to have something that you can just check yourself and try to fix it yourself before you take it to somebody else.*

#### 9.4.5 Discussion

The findings from the survey suggest that students' perceptions towards AcaWriter were mostly positive. Overall, the majority of students agreed that AcaWriter made them think about think about the meaning that they wanted to express and how to better express their ideas. It seems that AcaWriter was most helpful in prompting to students to think more critically about the meaning they wanted to express. This could be due to AcaWriter making their thinking visible (see section 8.4) through the highlighting of the moves and the automated feedback messages.

The results also suggest that AcaWriter is useful tool to facilitate the revision process as the majority of students reported that they revised and wrote more drafts and took on board AcaWriter's feedback. The open-ended responses revealed that students used AcaWriter to check if the moves were present. The interviews lent further detailed support to the survey results as one of the students revealed that they used AcaWriter as an additional step in the revision process. The same student expressed that students may feel insecure about their writing and so AcaWriter is a useful tool to check the quality of their writing before handing it over to someone else, like their supervisors. However, the

survey also showed that not all students used AcaWriter to revise their writing. Further research is needed to investigate why the students did not use the tool in their revision process.

A majority of the students found AcaWriter's highlighting and feedback messages useful. The highlighting identified the moves in their writing and the feedback messages provided suggestions and examples. It appears that both forms of automated feedback were valuable. This finding highlights the importance of having multiple forms of feedback.

Research writing is challenging for most HDR students as previously stated throughout this thesis. Genre analysis and move analysis allow students to see how meaning works in texts and raises students' rhetorical awareness. The survey results demonstrate that students found AcaWriter helpful in learning and identifying rhetorical moves which is an important skill to have in research writing. The interviews echoed these findings as the one of the students explained that having the moves helped her identify what information was needed in the abstract and the other student described AcaWriter as a road map for scientific writing. The interview and survey results suggest that embedding AcaWriter in the classroom can be useful for the teaching and learning of research writing.

The findings show that the majority of students' sometimes disagreed with AcaWriter's feedback highlighting and feedback messages, and just over half mostly agreed with AcaWriter's feedback. Although students did disagree with the feedback, many of the students also agreed with the feedback and only a small number of students reported frustration with the tool. These responses are positive as it suggests that most students were not put off by the perceived disagreement and that the tool is being used as intended.

When it came to additional improvements for AcaWriter, additional feedback from AcaWriter was suggested. Additional feedback included grammar feedback, a thesaurus tool, text length, additional moves, additional article/thesis sections, a plagiarism check, abstract exemplars, discipline specific feedback and more specific, personalised comments. These responses imply that students want writing resources all in one location. While it may not be practical having all these resources and features built into AcaWriter, providing links from AcaWriter to these resources would help students when they are writing, as they would not have to search far to access additional resources and tools. Having a one stop shop with all research writing resources would help save students time in learning research writing and in their research writing process. However this one stop

shop does not mean providing all research writing resources within AcaWriter. Instead a platform or webpage where appropriate tools and resources sit would help students navigate what tools and resources are available for their needs.

The interviews and survey responses revealed that students may need additional information about using AcaWriter. One student explained that they were not able to obtain a pass mark in AcaWriter and another student explained that AcaWriter identified mistakes in their writing. It is important for students to understand that AcaWriter does not recognise mistakes in texts and that it does not grade texts. Additional guidance on using AcaWriter was also sought during the workshop. Both of the interviewees explained that they needed additional guidance when first using AcaWriter and that they were unsure of whether they had achieved the move in their writing based on AcaWriter's feedback. This tension between the tool's imperfect feedback and student's agency means that students may need additional scaffolding on learning the moves, so that they gain confidence in their knowledge of the genre and are then able to critique the feedback. It seems that additional information, other than a warning sign is needed (see Figure 9.11) so that students understand the tool is imperfect. It appears that additional scaffolding is also needed so that students understand how to use the tool and how to interpret the feedback. This tension is discussed further in Chapter 10, section 10.4.4.

Regarding the learning design of the workshop, the interviews revealed that the learning design was appropriate and effective in teaching abstract writing. This finding confirms that this adapted version of TLC and genre/move analysis is an effective approach in teaching research writing. During the *deconstruction* and *building the field* stage students are able to establish how the moves are instantiated in research abstracts. Having this understanding allowed the students to then transfer this knowledge to their own abstract.

The interviews established that learning research writing during candidature is difficult. Being time poor was expressed as one of the barriers to research writing. Being exposed to the writing workshop inspired one of the students to dedicate writing time in her research group. This shows that workshops are valuable in showing students that research writing is more than just 'writing' and that it is an iterative process that requires time. Being unaware of scholarly writing conventions and expectations was another difficulty mentioned. In this instance AcaWriter may be a useful tool to assist students with scholarly writing conventions and expectations, as has been shown in this research.

AcaWriter has the potential to include additional features, for instance all rhetorical moves for all sections of a research article can be included.

While AcaWriter allows students to revise their texts in the tool, some students may decide not to use the text editor, and instead apply changes directly to their document outside of AcaWriter. For example, Participant 2 explained during the interview that *“And then I had to put a bit of information more because that’s how I could relate with the purpose, the background, so those things”*, however the AcaWriter logs show that she did not add information to her draft. Participant 2 explained that because AcaWriter identified all the moves in her abstract, she did not continue to revise and use AcaWriter. This response shows that when AcaWriter confirms all the moves are there, students may not continue to revise their work. This may be an issue because often student’s texts can be improved even if all the moves are included in their text.

Overall, the findings from this iteration suggest that AcaWriter has the potential to support students with their research writing. The findings suggest that students found AcaWriter helpful when it came to revising their work.

#### 9.4.6 Design reflections

##### ***Reflections on learning design***

In this iteration many students needed assistance using AcaWriter when they were writing their abstract. This could be due to the students only having that one activity to use AcaWriter. Whereas, in previous iterations there were additional activities using AcaWriter before moving on to writing with AcaWriter. The students in this iteration had less time to interact with AcaWriter and therefore needed more assistance in understanding how to use AcaWriter and interpreting the feedback. This issue suggests that it is necessary to have multiple forms of support for students to engage with the tool in a meaningful way. For example, an interactive guide on using AcaWriter, online resources on how to interpret and action the feedback, additional scaffolding or resources on learning the moves, as well as one-on-one assistance with educators to show students how to use the tool effectively.

##### ***Reflections on the tool***

This iteration involved integrating AcaWriter into existing practice where restraints were encountered. While the AcaWriter moves did not completely align with the facilitator’s language of the moves, there was overlap between the two descriptions. For example,

*reason for the work, background/context, and problem addressed* were similar to AcaWriter's moves: *Background/context, Purpose of the research, Research problem/gap* in the literature move. This limitation is a constraint when embedding tools in existing practice.

Compared to the introduction parser from the two previous iterations, the abstract parser did not contain sequencing rules, such as, *generate feedback if the results move is before the background/context move* (see section 8.5.2 for details). For this iteration only location rules and percentages were applied so that AcaWriter's feedback would be simpler. The location rules combined with percentage rules were intended to make the parser less prescriptive, however the findings from the survey indicated that the parser turned out to be prescriptive, suggesting that the rules may need further refining.

The development of this parser incurred some challenges in operationalisation, through implementing linguistic norms in computational rules. The intent of this parser was to provide location (beginning, middle, and end) feedback on the rhetorical moves in students' writing. However, formalising the rules of the moves into computational identification was challenging. While generally most abstracts have a background/context or purpose of the research move in approximately the first 10%, implementing approximate or fuzzy rules is more challenging than strict rules, for a range of reasons. Therefore, set rules had to be in place so that the software could analyse the text and provide feedback. However, implementing set rules has its limitations, as there are always exceptions to the rule, for example, a student may have a background/context move in the beginning of their abstract, but not within the first 10% of the abstract, generating cautionary feedback stating that the move was not detected. This could lead to students being frustrated with AcaWriter, as was revealed in the survey findings.

During the workshop some students found AcaWriter difficult to use. While, there was a demonstration given during the workshops, supplemented with a 'how to' guide, it seems that a different approach is needed so that students understand what AcaWriter can do, how to interpret the feedback and how to use the tool. An interactive guide could be developed within AcaWriter to further assist students in using the tool. The next iteration was an online course, replacing face-to-face facilitation, demonstrating how an interactive guide could be developed (see Figure 9.18 in section 9.5.1 for the implementation of the interactive guide in Iteration 4). Furthermore, this resource could be used in face-to-face workshops.

### *Reflections on recruitment, data collection and data analysis*

For iteration 3 recruitment of students occurred within the established winter and summer school academic literacies program. An additional one-off abstract writing workshop was also held to recruit additional students. Students were told previously that they would be using AcaWriter as part of the workshop and that participation in the study was voluntary. As participation in the study was opt in rather than opt out, students who attended the workshops were not automatically a part of the study. While the learning design intended that all students used AcaWriter during the workshop, students' data could only be used in this study if they had actively consented to participate. This had implications on the participation numbers, as the number of participants was sometimes less than the attendance number (winter school had a 56% participation rate; summer school 39%; and the one-off workshop in June the participation rate was 18%). The opt-in method also had implications with the AcaWriter engagement data analysis. As it seemed that almost all students used the tool during the workshops it was time consuming and difficult to sort through the participants and non-participants. Future iterations should perhaps consider the opt-out method rather than the opt-in. Additionally, the AcaWriter interface could also include the option of students' opting out of their data being collected.

While the participation rate ( $n = 29$ ) for this iteration was better than the previous iterations, when the total amount of students enrolled in a HDR course ( $n = 2198$ ) are taken into account it is still a low participation rate (1.3%). The next iteration worked towards a different approach where students would be able to access an online course and AcaWriter anywhere and anytime.

Manual analyses of this larger sample of 29 students for revision features is resource intensive (see revision analysis conducted in iteration one in section 9.2.3). Future work could move this manual analysis to an online system where there is potential to automate the revision analysis. One approach is through automated revision graphs (see Shibani, 2020) where students revisions are presented through visualisations.

## 9.5 Design Iteration 4 & Implementation

### 9.5.1 Learning Context & Learning Design

For this iteration the learning context was a self-paced online course on how to write abstracts<sup>22</sup>. While the target cohort for the online course was HDR students, anyone globally could participate in the course. There were four key reasons for creating an online for this iteration. First, creating an online course about the rhetorical moves in abstracts and embedding AcaWriter within the course would provide students an additional mode of research writing support and multiple ways to engage with AcaWriter. Second, as the participation rate in the previous iterations was small, an online course may result in a higher participation rate as it would have further reach than a physical workshop. Third, as some students may need additional time to learn about the concept of rhetorical moves, providing self-access resources such as an online course allows students to learn about the moves in their own time, at their own pace, and they are able to access the information repeatedly wherever and whenever they want.

The online course was created with the learning management system Canvas<sup>23</sup>. Different online tools were also used to create the activities, such as H5P and Genially<sup>24</sup>. The course was created in collaboration with a learning designer. A conjecture map was not created for this iteration as the online course was built from the previous iterations. Instead, Figure 9.15 presents the structure of the course and a summary of the course is presented. As with previous iterations, the TLC principles were followed in structuring the online course (see section 8.1.3 for more information on the TLC). For each module presented in Figure 9.15 interactive learning tasks were purposefully included to engage the students. Some of the activities were designed to mimic the activities in the face-to-face workshops. The inclusion of interactive learning tasks meant that the course was not text heavy and just reading information.

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<sup>22</sup> The online course abstract course is open access and available here: <https://open.uts.edu.au/uts-open/study-area/communication--media/writing-an-abstract>

<sup>23</sup> Canvas is a Learning Management System (LMS) that provides engaging, online, learning experiences through the use of interactive learning tasks.

<sup>24</sup> H5P and Genially are online tools that create interactive content and learning activities can be embedded in an LMS.

☰ ▼ 1. Writing an abstract
☰ 📄 Overview: Writing an abstract
☰ 📄 1.1 What's the purpose of an abstract?
☰ 📄 1.2 What are abstracts made of?
☰ 📄 1.3 Background or context
☰ 📄 1.4 Purpose of the paper
☰ 📄 1.5 Explaining the problem
☰ 📄 1.6 Describing methods
☰ 📄 1.7 Presenting your results
☰ 📄 1.8 Stating the conclusion, implications and significance
☰ 📄 1.9 The moves in context
☰ 📄 1.10 Making the first move
☰ 📄 1.11 Finding the right move
☰ 📄 1.12 Moves in your discipline
☰ 📄 1.13 Connecting the moves
☰ 📄 1.14 Sentence starters
☰ 📄 <u>1.15 Bringing it all together</u>
☰ 📄 Introduction to AcaWriter
☰ 📄 Let's try AcaWriter
☰ 📄 Share your feedback from AcaWriter
☰ 📄 Summary: Writing an abstract

**Figure 9.15 – Writing an abstract course structure**



*Deconstruction, building the field* and *modelling* were established through a series of explanations about abstracts, their rhetorical moves and examples, along with interactive activities, such as polls, drag and drops, rewriting moves, sharing their moves and opinions. Figure 9.16 presents one of the first activities in building the field.

## 1.2 What are abstracts made of?

We've just learnt what the purpose of an abstract is and that your abstract is an outline of the argument you are putting forward so this means writing with authority, stating a point of view and persuading the reader to accept your argument. One way we can do this is by writing 'moves'.


### So what's a 'move'?

A move is a string of text that conveys a communicative goal (Swales, 1990) et. For example, when we state our research aim, that's a move, as we are communicating to our reader the aim of our research. When writing an abstract we use these moves to help readers navigate our writing.

Researchers in linguistics and discourse analysis have investigated the types of moves that exist in abstracts in a variety of disciplines (Swales & Feak, 2009) et. They have identified these common moves in research article abstracts, they include:

- 01 Background / Context
- 04 Methods / Approach / Procedure
- 02 Purpose of the paper / Present research
- 05 Results / Findings
- 03 Research problem / Issues / Gap in the literature
- 06 Conclusion / Implications / Significance

These moves have a purpose as they are answering the *why, what, how, and so what* of the research. It's important to note that not all abstracts will follow this order or use all six moves. It's up to you to choose which moves to include and which order they will follow to best communicate your research.

 Drag and drop the implied questions below to match the corresponding move.

Edit
Reports

MOVES		IMPLIED QUESTIONS	
Background / Context	Purpose of the paper / Present research	What's the answer to the problem? What was discovered?	What do the findings mean? What's the significance of the findings? What are the implications of the study?
Research problem / Issues / Gap in the literature	Methods / Approach / Procedure	What is this study about? What is the aim of this research?	What problem or issue are you trying to solve? What gap are you trying to fill? What is unknown?
Results / Findings	Conclusion / Implications / Significance	What do we know about the topic? Why is this topic / research important?	How was the study carried out? What methods, models, approaches, or data are used in the study?

**Figure 9.16 – What are abstracts made of?**

In the *deconstruction stage*, each activity builds up to the next. After the students have learned all the moves in an abstract, they are then asked to perform a move analysis on

abstracts in different disciplines, see Figure 9.17. This activity is placed here not only as concluding activity after learning all the moves, but to show students that for different disciplines, different moves are used and in a different order.

## 1.9 The moves in context



So we've now learnt about the moves in abstracts, but how are they used in different disciplines?

Here's a selection of abstracts from multiple fields so we can explore how moves are used across disciplines. This is also a chance to practice identifying the different moves and seeing them in context. **Please note:** We've shortened each of the moves' titles for this activity.



Identify the moves in each of the following abstracts by dragging the correct move to the beginning of each sentence. There are four abstracts, one from Science, Social sciences, IT and Business. Click on each discipline to reveal an abstract.



Drag the moves to the correct sentence.

Compared to traditional persuasive technology and health games, gamification is posited to offer several advantages for motivating behaviour change for health and well-being, and increasingly used. Yet little is known about its effectiveness. We aimed to assess the amount and quality of empirical support for the advantages and effectiveness of gamification applied to health and well-being. We identified seven potential advantages of gamification from existing research and conducted a systematic literature review of empirical studies on gamification for health and well-being, assessing quality of evidence, effect type, and application domain. We identified 19 papers that report empirical evidence on the effect of gamification on health and well-being. 59% reported positive, 41% mixed effects, with mostly moderate or lower quality of evidence provided. Results were clear for health-related behaviours, but mixed for cognitive outcomes. The current state of evidence supports that gamification can have a positive impact in health and wellbeing, particularly for health behaviours. However several studies report mixed or neutral effect. Findings need to be interpreted with caution due to the relatively small number of studies and methodological limitations of many studies (e.g., a lack of comparison of gamified interventions to non-gamified versions of the intervention).

- Gap
- Findings
- Purpose
- Implications
- Background
- Methodology
- Findings
- Implications
- Implications
- Findings

[Check](#)

**Figure 9.17 – The moves in context**

Following the move analysis activity is a discussion on the different moves that can be used to begin an abstract, depending on style and purpose. Next, students annotate an abstract by matching sentences with its correct move. To finish up this section of the course, students then perform a move analysis on an abstract from their own field and share their analysis. While in an asynchronous online format *joint construction* (creating a text together) is challenging, this stage of the TLC was modelled through a drag and drop activity where students arrange an abstract in its correct order. Before *independent*

*construction*, students are shown sentence starters for each of the moves to help them get started writing their own abstract. *Independent construction* follows with a downloadable template. Here students are also encouraged to share their draft abstract. Students are also then given the opportunity to continue their *independent construction* using AcaWriter. How to use AcaWriter is explained step by step through an interactive guide so that it is easy for students to follow, see Figure 9.18.

## Let's try AcaWriter



We're now going to give AcaWriter a go by submitting your first draft abstract. Follow the steps in the interactive below to learn how to access and receive feedback from AcaWriter.

**Note:** You will need to enter this assignment code **p5OixZs** into the assignment code box when prompted.

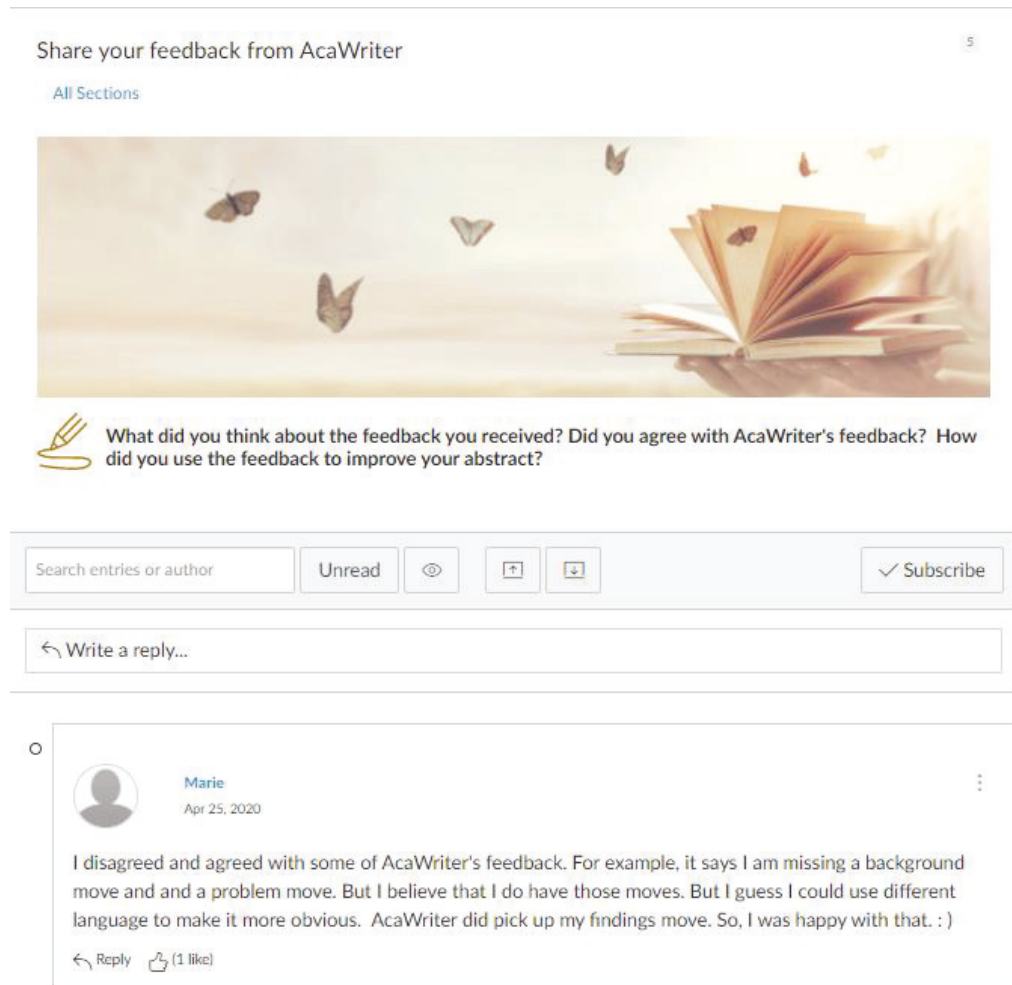
The screenshot shows the AcaWriter web interface. At the top, there's a navigation bar with 'UTS AcaWriter' and user information. The main content area is titled 'Open UTS Writing an Abstract' and contains a text editor with a draft abstract. A 'Get Feedback' button is visible next to the text. A large blue overlay box titled 'Step 4' provides instructions: 'Once you're ready for feedback, press the Get Feedback button and you'll see all the moves you've made highlighted.' Below this is a red 'NEXT' button. The interface also includes a 'Feedback' section on the right with a placeholder for feedback.

**Remember:** Computers don't read writing like humans. So, if you're sure your writing's good, it's fine to disagree with AcaWriter's feedback, just like you'd ignore a poor grammar suggestion.

On the next page we'd love for you to share the feedback you received from AcaWriter along with any thoughts you have. Good luck!

**Figure 9.18 – Let's try AcaWriter (Interactive guide)**

Once students have used AcaWriter they are encouraged to come back to the online course and share their feedback and thoughts about AcaWriter’s feedback on their draft. Figure 9.19 presents a prepopulated example of student feedback.



**Figure 9.19 – Share your AcaWriter Feedback**

### 9.5.2 Design Refinements

As this iteration was an online self-paced course, AcaWriter required further refinement to make the tool easier to use. The AcaWriter tags were removed so that the tool design aligned with the learning design. This was considered particularly important as students would not be able to ask questions because they were not in a classroom setting. In a workshop scenario, I would explain that the AcaWriter tags correspond to an abstract move. However, in an online course to reduce potential information overload, the AcaWriter feedback focused on the move level analytic feedback (see Figure 9.20) which aligned with the moves taught in the online course (see Figure 9.16). But, if students were



interested in how the moves were identified then they could find more information about the moves and their tags by clicking on ‘show move details’, see Figure 9.21. This feature demonstrates the how the tool is identifying the moves by looking for these types of sentences and allows students to understand why it identified the sentence as a particular move, as provided in previous iterations.

The screenshot displays a web interface for an analytical report. At the top, there are three tabs: 'Analytical Report' (selected), 'Feedback', and 'Resources'. Below the tabs is a 'Show move details' button. The main content area features a list of four moves, each with a colored header bar: 'Background / Context move' (orange), 'Purpose of the Paper / Present Research move' (green), 'Research Problem / Issues / Gap in the literature move' (blue), and 'Results / Findings move' (yellow). Below the list is a paragraph of text with several segments highlighted in colors corresponding to the moves: 'It is now widely accepted that timely, actionable feedback is essential for effective learning.' (orange), 'In response to this, data science is now impacting the education sector, with a growing number of commercial products and research prototypes providing "learning dashboards", aiming to provide real time progress indicators.' (blue), 'From a human-centred computing perspective, the end-user's interpretation of these visualisations is a critical challenge to design for, with empirical evidence already showing that 'usable' visualisations are not necessarily effective from a learning perspective.' (green), 'Since an educator's interpretation of visualised data is essentially the construction of a narrative about student progress, we draw on the growing body of work on Data Storytelling (DS) as the inspiration for a set of enhancements that could be applied to data visualisations to improve their communicative power.' (blue), and 'We present a pilot study that explores the effectiveness of these DS elements based on educators' responses to paper prototypes.' (yellow).

**Figure 9.20 – Abstract parser analytical report (iteration 4)**

Analytical Report
Feedback
Resources

[Hide move details](#)

**Background / Context move**

- B Background information
- E Emphasis of a significant or an important idea
- T Trend

**Purpose of the Paper / Present Research move**

- S Summary of the author's goal or stating the nature of the research

**Research Problem / Issues / Gap in the literature move**

- C Contrasting idea, issues, disagreement or critical insight
- Q Question or gap in previous knowledge

**Results / Findings move**

- N Novelty and value of the research
- S Summary of the author's goal or stating the nature of the research

B E It is now widely accepted that timely, actionable feedback is essential for effective learning. In response to this, data science is now impacting the education sector, with a growing number of commercial products and research prototypes providing "learning dashboards", aiming to provide real time progress indicators. E C From a human-centred computing perspective, the end-user's interpretation of these visualisations is a critical challenge to design for, with empirical evidence already showing that 'usable' visualisations are not necessarily effective from a learning perspective. Since an educator's interpretation of visualised data is essentially the construction of a narrative about student progress, we draw on the growing body of work on Data Storytelling (DS) as the inspiration for a set of enhancements that could be applied to data visualisations to improve their communicative power. S We present a pilot study that explores the effectiveness of these DS elements based on educators' responses to paper prototypes.

**Figure 9.21 – Abstract parser analytical report - show move details (iteration 4)**

The rules were also changed to allow for more flexibility, compared to the previous iteration. In this iteration AcaWriter checks the whole text except for the last 5% for the Background / Context, Purpose of the paper / Present research, Research Problem / Issues / Gap in the literature moves. Then AcaWriter checks the last 5% of the text to determine if the Results / Findings appears in the text. The feedback messages were also slightly changed as well, with the removal of the AcaWriter tags. See Table 9.10 for an explanation of the rules and corresponding feedback messages. In addition, an extra AcaWriter tag, Trend, was also mapped to the Background / Context move.

**Table 9.10 – Abstract parser feedback rules & messages (iteration 4)**

Feedback rule	Feedback Message
<b>Positive Feedback</b>	
<p>If Emphasis, Trend <b>or</b> Background appear <b>AND</b> not Summary in the text excluding the last three sentences</p>	<p>✓ Well done, it looks like you have <b>Background / Context</b> moves in your abstract. You have provided background information on your research topic and/or explained why your research topic is important which will help readers understand why your research is significant.</p>
<p>If Summary appears <b>AND</b> not if Emphasis, Trend <b>or</b> Background appear in the text excluding the last three sentences</p>	<p>✓ Well done, it looks like you have <b>Purpose of the Paper / Present Research</b> moves in your abstract. You have stated the purpose of your research, and/or presented what your research is about which will make it easier for your reader to understand the goal of your research.</p>
<p>If Summary <b>or</b> Novelty appears in the last 3 sentences of the abstract</p>	<p>✓ Well done, it looks like you have <b>Results/Findings</b> moves in your abstract. You have explained your findings and/or answered your research problem. This move will help readers understand what you have discovered.</p>
<p>If Contrast <b>or</b> Question appear</p>	<p>✓ Well done, it looks like you have <b>Research Problem / Issues / Gap in the literature</b> moves in your abstract. You have highlighted the research problem, identified issues or indicated a gap in the literature. By including this move your readers will know what problem you're trying to solve.</p>

Feedback rule	Feedback Message
<b>Cautionary Feedback</b>	
<p>If no Summary sentences appear</p>	<p>! AcaWriter didn't identify any <b>Purpose of the Paper / Present Research</b> moves in your abstract. Here you explain the purpose of your research, and/or explain what your research is about. To achieve this move try including these sentences: <i>The purpose of this paper is to..., In this study we focus on..., The aim of this research is to..., We explore x, Our study investigates..., We analyse x...</i></p> <p>Check if you have included these sentences in your abstract.</p>
<p>If no Emphasis, Trend <b>or</b> Background sentences appear</p>	<p>! AcaWriter didn't identify any <b>Background / Context</b> moves in your abstract. Here you explain why your research is important, or provide background information on your research. To achieve this move try including these sentences: <i>x is an important feature in y., Substantial evidence in x suggests that..., The study of x is important because x impacts y., x has been previously proposed..., Recent, literature concerning x has reported that..., Recent studies indicate that..., It is widely agreed that...</i></p> <p>Check if you have included these sentences in your abstract.</p>
<p>If no Contrast <b>or</b> Question sentences appear</p>	<p>! AcaWriter didn't identify any <b>Research Problem / Issues / Gap in the literature</b> moves in your abstract. Here you state your research problem, indicate a gap in knowledge, or identify issues in the literature. To achieve this move try including sentences like these: <i>The problem of x has not been widely studied., This approach fails to address the issue of x., However, limited research has been conducted in x., Despite earlier studies x remains unknown, Previous studies have only looked at x.</i></p>



Feedback rule	Feedback Message
If no Novelty or Summary sentences appear in the last three sentences of the text	<p>Check if you have included these sentences in your abstract.</p> <hr/> <p>! AcaWriter didn't identify any Results/Findings moves in your abstract. Here you state what you found and/or your answer to the research problem.</p> <p><i>Our evidence confirms that..., The analysis shows... Our review found... Significant improvements in x have been developed., We present a new method/approach/model/framework..., The major innovation of x is its ability to identify/detect y.</i></p> <p>Check if you have included these sentences in your abstract.</p>

### 9.5.3 Recruitment & Participants

To launch the online course and recruit participants, the online course was promoted through newsletters (e.g. the HDR monthly newsletter and the Connected Intelligence Centre's newsletter), social media platforms (such as twitter, Facebook and LinkedIn), listservs, word of mouth and email. As of 30<sup>th</sup> December 2020 there were 477 learners enrolled in the online course. Of those 477, 153 learners gave consent to participate in this research<sup>25</sup>. This consent is provided before the course begins, where the learners are asked if they would like to participate in the research and are given the option of downloading the participant information sheet. The learners were also given the option of returning to the consent form and changing their response if they decided they no longer wanted to participate. The consent question has since been removed as I am no longer collecting data.

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<sup>25</sup> It is unknown how many of the learners were UTS HDR students, as anyone can register for the course using any email. In addition, it is not possible to determine coursework students from HDR students as all students have the same domain name: e.g. studentx@student.uts.edu.

#### 9.5.4 Data collection methods & analysis

##### *Engagement with online course*

To investigate how the learners interacted with the online course, participation data was collected from each of the activities. This data only reports the learners' attempt at the activity. This is likely an underestimate of the number of learners who engaged with the course, as the data does not include page views. It is important to note that the data presented is computer log data, and it does not indicate what students were actually doing when they apparently did or did not engage with a resource. Table 9.11 presents a breakdown of each module, a description of the learning activity, and learner participation rate.

**Table 9.11 – Participation rate of students ( $n = 153$ )**

<b>Module</b>	<b>Learning Activity</b>	<b>Learning Activity Type</b>	<b>Learner Participation (count)</b>	<b>Learner Participation (%) (n153)</b>
1.1 What's the purpose of an abstract?	Click on the statement below that most closely matches your idea of what an abstract is. You'll be able to see how your thinking compares with your peers.	Poll	108	71%
1.2 What are abstracts made of?	Drag and drop the implied questions below to match the corresponding move.	Drag & Drop	83	54%
1.3 Background or context	What's the context of your research? Share your context/background	Discussion	42	27%

<b>Module</b>	<b>Learning Activity</b>	<b>Learning Activity Type</b>	<b>Learner Participation (count)</b>	<b>Learner Participation (%) (n153)</b>
	move and comment on others.			
1.4 Purpose of the paper	What did you notice about the different approaches? Which one do you like best and why?	Discussion	23	15%
1.5 Explaining the problem	What did you notice about the way each of these sentences start? Can you see a pattern?	Discussion	21	14%
1.6 Describing methods (Activity A)	Did you notice that some of the examples used either passive or active voice? Which do you think is better for academic writing? An active or passive voice?  What is the reasoning behind your choice?	Poll, Discussion	39	25%
1.6 Describing methods (Activity B)	Here are three different versions of the same method. Select the version you think is better and give your reasoning in the comments box.	Poll, Discussion	38	25%

<b>Module</b>	<b>Learning Activity</b>	<b>Learning Activity Type</b>	<b>Learner Participation (count)</b>	<b>Learner Participation (%) (n153)</b>
	Which did you choose: 1, 2 or 3? Why did you choose that one? What were its features?			
1.7 Presenting your results	Which style do you prefer? Stating what you found straight away, or presenting a general overview of what you found and then specific details? Share your preference in the comments below.	Discussion	19	12%
1.8 Stating the conclusion, implications and significance	Below is the conclusion move taken from an abstract accepted for publication. It's a little lengthy and it also doesn't really explain the 'so what' of the research. Have a go at rewriting this conclusion move in one or two sentences and share your sentence in the	Discussion	18	12%

<b>Module</b>	<b>Learning Activity</b>	<b>Learning Activity Type</b>	<b>Learner Participation (count)</b>	<b>Learner Participation (%) (n153)</b>
	comments below. Feel free to comment on others.			
1.9 The moves in context	Identify the moves in each of the following abstracts by dragging the correct move to the beginning of each sentence. There are four abstracts, one from Science, Social sciences, IT and Business.	Drag the text	1	1%
1.10 Making the first move	We now know three ways of starting an abstract. Select which move you prefer and share your reasoning in the comments below.	Poll, Discussion	31	20%
1.11 Finding the right move	You've got the moves, so let's try finding the moves in abstracts in your discipline. But, before you make your move, have a go at matching the moves to	Drag & Drop	45	29%

<b>Module</b>	<b>Learning Activity</b>	<b>Learning Activity Type</b>	<b>Learner Participation (count)</b>	<b>Learner Participation (%) (n153)</b>
	the sentences in the below abstract.			
1.12 Moves in your discipline	Paste your annotated abstract into the discussion below. What did you find? Did the abstract from your field use all of the above moves? And did it follow a particular order of moves?	Discussion	12	8%
1.13 Connecting the moves	The activity below may prove a little more difficult to complete. Try putting this abstract back together. Drag and drop the following sentences into the correct order to create a complete abstract.	Drag & Drop	42	27%
1.15 Bringing it all together (Activity A)	Start planning your abstract by filling out the form below. It doesn't have to be perfect because you	Form	4	3%

<b>Module</b>	<b>Learning Activity</b>	<b>Learning Activity Type</b>	<b>Learner Participation (count)</b>	<b>Learner Participation (%) (n153)</b>
	can use this as a first draft of your abstract.			
1.15 Bringing it all together (Activity B)	Feel free to share your abstract and comment on others' abstracts in the field below.	Discussion	2	1%
Let's try AcaWriter	We're now going to give AcaWriter a go by submitting your first draft abstract.	AcaWriter	11	7%
Share your feedback from AcaWriter	What did you think about the feedback you received? Did you agree with AcaWriter's feedback? How did you use the feedback to improve your abstract?	Discussion	4	3%

The participation data shows that engagement in the online course is high at the start of the course with 71% of the students participating in the first the learning activity, however, as the course progresses engagement in the course decreases. Twenty seven percent of learners participated in module 1.13 and less than 3% of learners contributed to module 1.15. This low participation rate could be because the activity asks learners to complete a draft of their abstract and share it via the online course. The learners may not have a complete draft of their abstract and therefore unable to share. Or learners may not have been at the point of writing their abstract. Additionally, it could be that participation tends to decline towards the end of self-paced online courses. It is important to note that

the data presented here refers to engagement with the interactive activities, and it is possible that people viewed pages but did not participate in the interactive activities.

Interactive activities, such as drag and drop, polls, and polls with discussions had the highest participation rate from 71% to 20% (modules 1.1, 1.2, 1.6, 1.10, 1.11, and 1.13). However, module 1.9 had the lowest participation rate which also includes an interactive activity. In this activity learners annotate abstracts from a variety of disciplines using the drag the text function. Only one learner participated in this activity. The data presented above illustrates that there is variation across the activities, but it is difficult to determine why learners did or did not attempt an activity. The participation data also indicates that learners are willing to share parts of their writing and their opinions on writing to an unknown audience. This is shown in modules 1.3 ( $n = 42$ ), 1.4 ( $n = 23$ ), 1.6 ( $n = 39$ ), and 1.7 ( $n = 19$ ).

The AcaWriter component of the online course also had a low engagement rate. Eleven learners went on to submit their abstract to AcaWriter and only four students shared their AcaWriter feedback. It is unclear as to why most of the learners did not engage with the AcaWriter task. For example, it could be that the learners did not have a complete draft of their abstract, they did not have time to complete the activity, they may not have found it useful, or they may have not known what to do.

### *Survey response*

The learners were given the opportunity to evaluate the online course upon completing it. The intent of the survey was to evaluate the whole course. Only 14 learners participated, a response rate of 9% (the complete survey is provided in Appendix J: Post Intervention Questions Iteration 4 (feedback about the online course)). This is a low response rate given 153 learners were enrolled in the course and points to the continuing problems with participation as seen throughout the iterations. Of the 14 learners, ten were HDR students and one was a prospective PhD student. One participant was a researcher and the remaining two participants were university staff members.

To determine whether the online course was an appropriate and effective resource to teach abstract writing, the survey participants were asked to rank five evaluative statements presented with the following introduction: ‘Compared to attending a traditional face to face (f2f) workshop (e.g. a 2 hour mix of lecture and exercises), this online course...’. Figure 9.22 presents the statements and count of the responses.

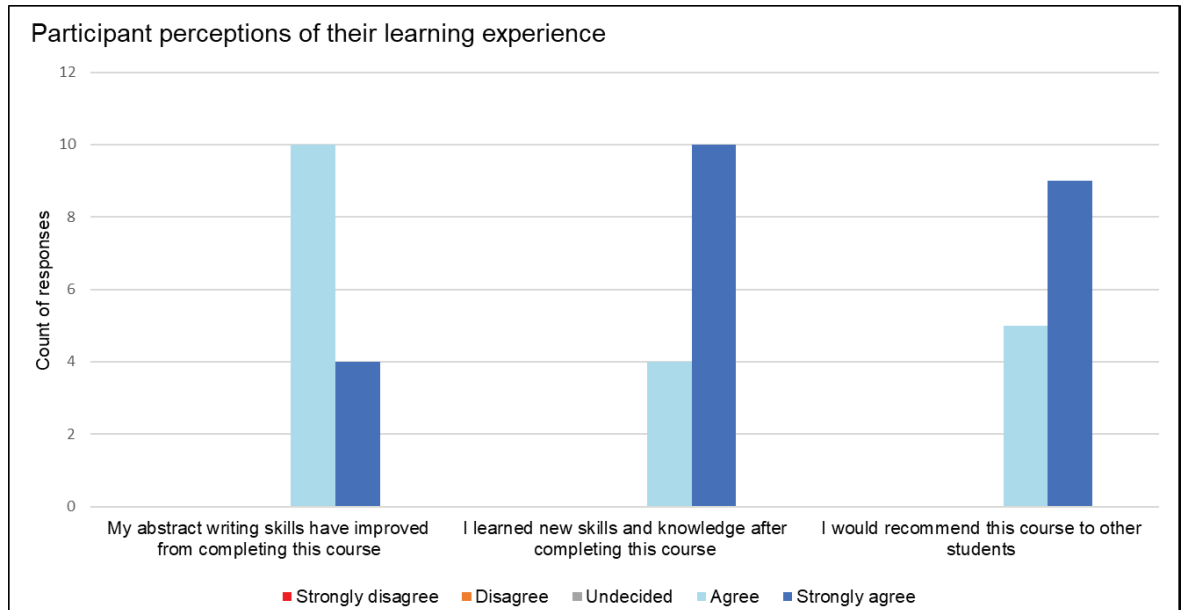


Responses towards the online course were positive. The respondents felt that the online course was more convenient to take ( $n = 13$ ), provided them with high quality support ( $n = 10$  when rating 1 and 2 are combined) and was an effective resource to teach abstract writing ( $n = 9$  when ratings ‘1’ and ‘2’ are combined). Even though it was an online course the respondents felt that it was a more engaging experience compared to a face-to-face workshop ( $n = 10$  when ratings ‘1’ and ‘2’ are combined) and that they would participate in online learning again ( $n = 10$  when ratings ‘1’ and ‘2’ are combined). While the survey response rate is low, these results indicate that for the respondents the online course was a valuable resource in learning abstract writing. Participants were also asked to explain their responses to the statements and six participants completed this activity. They reported that they liked the interactive activities, materials and examples. They found the course easy to navigate and appreciated the self-paced nature of the course.

Statements	1	2	3	4	5
	This describes the online course best		This describes the online and f2f equally		This describes f2f best
is more convenient to take	13	0	1	0	0
provides me with high quality support when I need it	7	3	1	1	2
teaches me more effectively about writing abstracts	6	3	5	0	0
is a more engaging experience	5	5	3	0	1
is a way of learning I'd be likely to participate in again	9	4	1	0	0

**Figure 9.22 - Learners’ perceptions of the online course**

To explore the respondents’ learning experience they were asked to select a response to three evaluative statements presented in Figure 9.23. All the respondents reported that their abstract writing skills had improved, that they learned new skills and knowledge, and that they would recommend the course to other students.

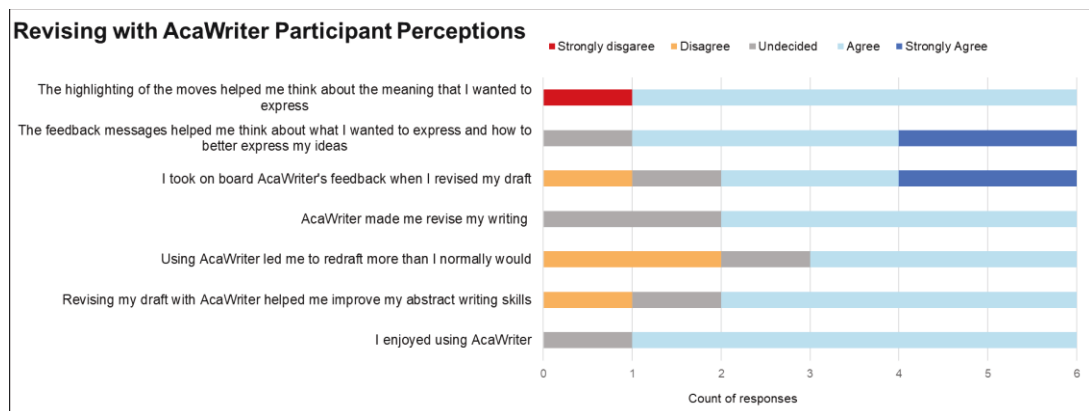


**Figure 9.23 – Participant perceptions of their learning experience**

Three open-ended questions were posed to the participants. The first question asked the participants to explain if and how the online course helped them improve their knowledge and skills of abstract writing. All respondents except for one staff member commented that the course did help them improve their abstract writing skills. The staff member explained that they wanted to make sure that their knowledge was current. Other respondents explained that breaking the abstract down into moves helped them understand its different parts and that they learned new strategies. The second question asked what learning activities they found useful. The respondents reported that they found the interactive activities and learning about the moves most useful. The final question asked if the participants would welcome additional online courses about other aspects of writing. Thirteen respondents stated that they would like additional online courses. Particularly on the different sections of research articles, such as the introduction, methodology, discussion and literature review.

The learners were also given the opportunity to complete an additional survey regarding their experience and perception of AcaWriter. The learners were asked to indicate their level of agreement with 16 statements using a six-point Likert scale from ‘1 Strongly Disagree’ to ‘6. Strongly Agree’ (the complete survey is provided in Appendix K: Post Intervention Survey Questions Iteration 4 (feedback about AcaWriter)). Only six learners completed the survey, out of the 11 learners who participated in the AcaWriter activity.

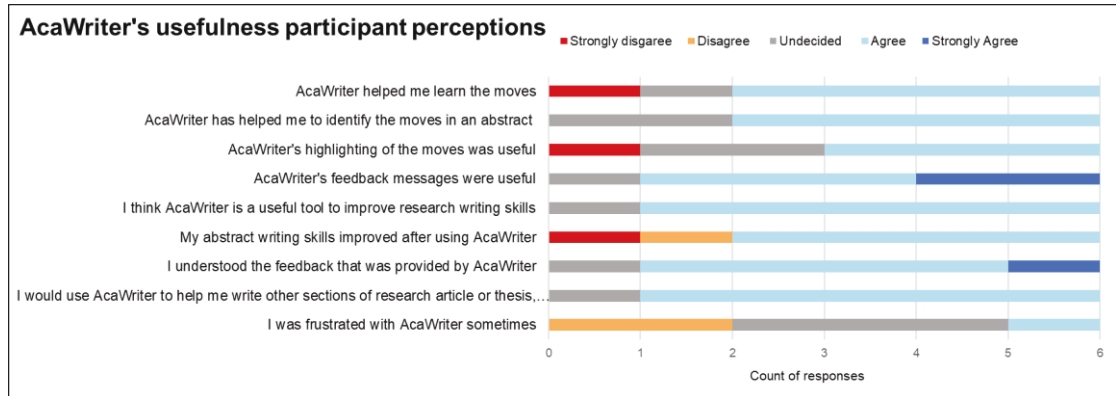
The majority of the respondents enjoyed using AcaWriter in the revision process ( $n = 5$ ) as illustrated in Figure 9.24. Most of the respondents reported that AcaWriter’s highlighting helped them think about the meaning they wanted to express and that the feedback messages helped them think about what they wanted to express and how to better express their ideas ( $n = 5$  when ‘Agree’ and ‘Strongly Agree’ are combined). The majority of the respondents took on board AcaWriter’s feedback and that it made them revise their writing ( $n = 4$  when ‘Agree’ and ‘Strongly Agree’ are combined,  $n = 4$  ‘Agreed’, respectively). When it came to AcaWriter encouraging redrafting, half of the respondents reported that AcaWriter led them to redraft more than they usually would, with the other half being undecided or disagreeing.



**Figure 9.24 – Revising with AcaWriter students’ perceptions ( $n = 6$ )**

The respondents identified that AcaWriter was a useful tool in the research writing process, as presented in Figure 9.25. A majority of the respondents reported that their abstract writing skills improved after using AcaWriter ( $n = 4$  ‘Agreed’), that it was a useful tool to improve research writing ( $n = 5$ , ‘Agreed’), and that they would use AcaWriter to help write other sections of research articles or thesis ( $n = 5$  ‘Agreed’). AcaWriter’s feedback messages were found to be useful and easily understood ( $n = 5$  when ‘Agree’ and ‘Strongly Agree’ is combined for both statements). However, only half of the respondents thought that AcaWriter’s highlighting of the moves was useful ( $n = 3$  ‘Agreed’). More than half the respondents reported that AcaWriter helped them identify and learn the moves in an abstract ( $n = 5$  ‘Agreed’). Although it is worth noting that some respondents were undecided and one respondent strongly disagreed that AcaWriter helped them learn the moves in an abstract. There were also mixed responses when the participants were asked if they felt frustrated with AcaWriter ( $n = 2$  ‘Disagree’,  $n = 3$

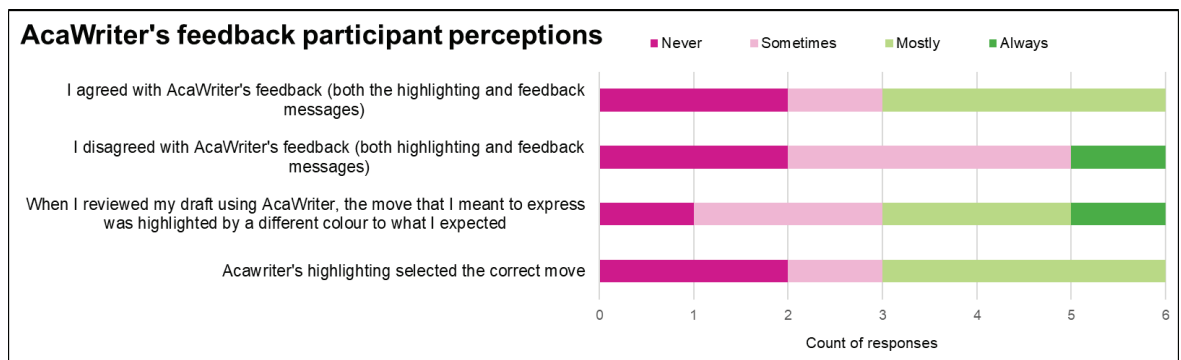
‘Undecided’,  $n = 1$  ‘Agreed’). While this is a small sample size, the results are encouraging as most of the responses were positive towards using AcaWriter in their research writing process.



**Figure 9.25 – AcaWriter’s usefulness participant perceptions**

The respondents were also asked to indicate whether they disagreed or agreed with statements regarding AcaWriter’s feedback by rating their level of agreement from ‘Never’, ‘Sometimes’, ‘Always’, ‘Mostly’, presented in Figure 9.26.

Half of the respondents reported that they sometimes ‘disagreed’ with AcaWriter’s feedback, but they also ‘mostly’ agreed with the tool’s feedback. The respondents reported a range of responses when they were asked ‘When I reviewed my draft using AcaWriter, the move that I meant to express was highlighted by a different colour to what I expected’ ( $n = 1$  ‘Never’,  $n = 2$  ‘Sometimes’, ‘Mostly’  $n = 2$ ,  $n = 1$  ‘Always’). This result indicates that the participants’ experiences with AcaWriter are varied and could possibly be due to style, discipline and quality of the writing.



**Figure 9.26 – AcaWriter’s feedback participant perceptions**

The respondents were also asked three open-ended questions. Only two respondents answered the questions. The respondents were asked what strategies they used when they were interacting with AcaWriter; they reported that they used reviewing and critical thinking. For the two remaining questions, only the responses from one respondent were taken into account, as the responses from the remaining respondent were difficult to understand. When asked what features of AcaWriter they found beneficial, the respondent stated that it was the highlighting and feedback messages. The respondents were also asked how AcaWriter could be improved for HDR writing. The respondent reported that they wanted additional feedback regarding vocabulary changes that could be made to improve their abstract.

#### 9.5.5 Discussion

The survey findings showed that the abstract online course was a convenient, effective and engaging approach in learning how to write the genre of abstracts. The respondents reported in the survey that the abstract writing course improved their knowledge and skills of abstract writing. It appears that breaking down abstracts into moves is a useful approach to explaining how abstracts work. The addition of examples and activities, further improved their understanding of the abstract and its function. The *Writing an Abstract* course was designed according to TLC and the success of this approach suggests that the TLC can be transferred online and be an effective mode of teaching abstract writing in this format (see 8.1.3 for information on TLC). What is significant about this finding is that the TLC is an effective approach to design self-paced online research writing courses, and could be extended for example to teaching the writing of additional genres and part-genres. In short, the findings from this section suggest that the online writing course is a valuable resource for students learning research writing.

While not many learners participated in the AcaWriter activity, the findings suggest that for the respondents AcaWriter is a valuable tool in the research writing process. AcaWriter was found to encourage respondents to think more critically about their writing as the feedback prompted them to think both about the meaning they wanted to express and how to better express ideas. The feedback messages of AcaWriter were identified as being useful and were easily understood, which means the design of the feedback messages is important and should be based on good feedback practices as discussed in section 8.3. Well-constructed automated feedback is particularly important when the tool

is embedded in an online course as the learners receiving it do not have access to a teacher to assist them in their sense making.

The respondents indicated in the survey that AcaWriter has the capacity to facilitate the revision process, acknowledging that the feedback provided lead to them revising their writing and undertaking additional drafts. This finding is key as it suggests the value of automated feedback tools, in this case providing timely feedback on their drafts and supporting learners in the development of their research writing skills.

The findings from the survey suggest that AcaWriter was also valuable in helping the respondents learn and identify the rhetorical moves in an abstract. This is likely due to the highlighting of moves and feedback messages, all of which reinforce the information presented in the online course. Such a design can be successful when the language used in the tool mirrors that in the online course. This survey data suggests that writing analytics tools, like AcaWriter, can possibly have a place in the teaching and learning of research writing. AcaWriter could be particularly valuable for the numerous students undertaking a research degree who are doing so externally and online, as they have limited access to university writing support such as workshops and face-to-face consultations.

The mixed responses towards AcaWriter's accuracy in identifying the moves accurately is most likely due to the tool's limitation in identifying moves. Although AcaWriter detects a range of moves (Knight, Abel, et al., 2020), it may not have been able to detect all of the moves presented in the student's text which can be impacted by the discipline and the quality of writing. This means that additional rules and/or analytical additional methods should be considered in the design of AcaWriter if it were to be applicable across the spectrum of research writing.

#### 9.5.6 Design reflections

##### *Reflections on learning design*

The findings from the survey indicate that the online course was valuable for the respondents. The survey findings also suggest that design of the online course; a breakdown of each move followed with examples and an activity, is an effective approach to teaching writing online. Additionally, online interactive activities can be a meaningful way to help students understand the different moves within an abstract. While the individual discussion activities did not have the same uptake as the interactive activities, some learners did share their writing. The data analysis revealed that as the course goes

on the participation rate decreases. It is not clear as to why the learners did not engage completely with the course. It may be that learners did not have a good user experience when using the learning management system and engaging with the learning tools, for example the H5P interactives. It may be that shorter courses are more appropriate when conducted online. Further work is needed to understand how to create manageable short courses that contain enough informative and interactive content. The addition of annotated abstracts from a variety of disciplines might be valuable for the students. While the students have access to the existing abstracts via the interactive activities, there are no downloadable annotated exemplar abstracts. As students learn in their own unique ways, downloadable annotated abstracts may be helpful for students as they can access the exemplars without having to go back into the course.

Only a limited number of students used AcaWriter. This could be due to students not getting far enough in the course to use AcaWriter, or perhaps the students were not at the point of needing to write an abstract and so found the activity irrelevant. To increase the use of AcaWriter, future online writing courses could embed AcaWriter into the course and have writing activities throughout the course that involve the use of AcaWriter.

### ***Reflections on the tool***

In this iteration AcaWriter's parser was simplified so that there were fewer rules. It was anticipated that this would make AcaWriter more readily interpretable when providing student feedback. However, the survey results revealed that AcaWriter did not identify all learners' moves in their abstracts, and that sometimes their sentences were highlighted by a different move. This finding means that AcaWriter's parser needs additional refinement in its concept-matching rules (see section 8.4), or a new approach such as machine learning could be applied to provide more accurate feedback. Using such an approach would also mean that additional moves, such as the methods move, could be added to AcaWriter.

While resources on abstract writing are embedded in the online course, there are no additional resources added to AcaWriter. To reflect the content of the online course the same resources as well as additional resources, for example annotated abstracts could also be included in the tool.

### *Reflections on recruitment, data collection and data analysis*

While participation in this was greater than the previous iteration ( $n = 29$ ), only 153 learners participated in the study, even though 477 learners enrolled in the course. As the data in this study only used data logs from the activities to determine engagement with the course, it is likely an underestimate as learners may have viewed the course but not participated in the activities. It is also possible that the remaining learners did go on to complete the course after the data collection period.

For this iteration only a survey was used to determine students' perspective on the online course and AcaWriter. The response rate for the survey was low. For a higher response rate in the future an incentive could be provided to the students. However, this is difficult as the course is available to students from around the world. Additionally, no interviews were conducted for this iteration due the challenges of Covid-19. It may be beneficial to gain a richer understanding of students' experiences using the online course and AcaWriter.

Additional analysis is also needed on student engagement during the course. While, data was collected in terms of engagement with the activities, not all students are interested in completing all activities. Canvas offers limited analytics, so it was difficult to determine how many learners viewed the pages. Data on the page views may give us more information, for instance it may help determine different learning patterns. For example, some students may only want to read the information about each move, rather than completing the activities. This data would also help determine how many students completed the course. A deeper analysis looking at which modules were viewed the most, the duration spent on them and click stream data would help educators create better online learning experiences for students.

## 9.6 Limitations of this study

This chapter has presented how a writing analytics tool, AcaWriter was incorporated in HDR writing workshops. It has explored learners' perceptions of the learning design, their perceptions and experiences of using AcaWriter, and how it impacted their writing. The empirical findings reported herein should be considered in the light of some limitations. First, the sample sizes of each iteration was considerably small, which means that the findings presented are not necessarily generalisable and are confined to the context in which the study was conducted. In particular, the revision analysis of student texts,



presented in 9.2.3, and the interviews conducted in iterations two and three. Recruiting students to participate in the study was an ongoing issue throughout the study.

A second limitation is the context in which the studies took place, authentic classrooms. While the learning design aimed to be consistent in each iteration, there were sometimes variations. For example, in iteration one the duration between the first and second workshop was not always the same due to students' schedules, and in iteration three, one activity was missed by the facilitator. Classrooms are complex environments and had the studies been undertaken in a lab type setting, it would not have revealed the important insight that students needed additional assistance and scaffolding using the tool. That is, some students needed more assistance accessing the tool and did not use the instructions presented to them. In a lab setting participants would be able to seek assistance from the researcher quite easily, compared to a classroom environment where I was attending to multiple students and could not always provide one-on-one assistance to all the students. An additional consequence of this is that students accessed AcaWriter's Abstract parser in different ways, and often differently to the instructions provided, which meant tracking their engagement would involve more time consuming efforts. Future studies embedding AcaWriter in classrooms should provide further scaffolding and resources so that students understand how to use the tool and access the intended parser.

Another limitation is the lack of triangulation of demographic information, particularly in iteration three. I attempted to obtain demographic information from the participants by asking them to participate in the survey presented in Chapter 4, but not all the students completed the survey. It was, therefore decided not to include the demographic data and only present students' perceptions of using the tool.

The fourth limitation is that the iterations relied on self-reported data about student engagement with AcaWriter, such as surveys and interviews, and their engagement was not always independently verified. Self-report data is impacted by individual differences in recall and metacognitive awareness, as well as the potential of researcher effects (i.e., researcher influence over provided responses). As I delivered most of the workshops and interviews, it is possible that I as an individual and as an HDR student may have had some impact on the students' responses. Examining student engagement with the tool was not possible in iteration 3 and 4 due to technical difficulties.

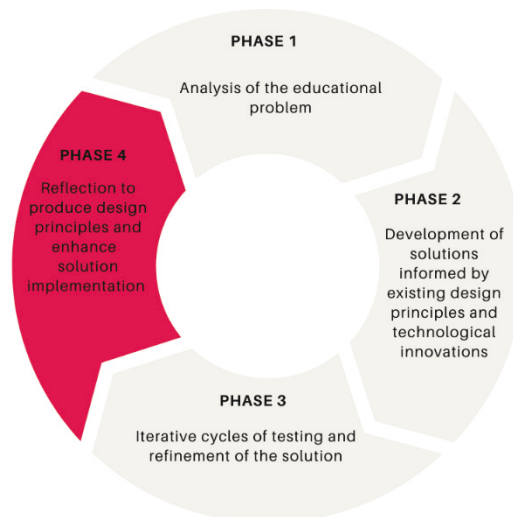
## 9.7 Summary and implications

This chapter presented the four iterations of a writing intervention for HDR students that involved the use of an automated feedback tool, AcaWriter. Four stages of data collection and analysis were used, when combined together these present a complex picture of how students use automated feedback and their perceptions of AcaWriter. This chapter explored students' learning experiences of the interventions and their perceptions of AcaWriter. Each iteration builds off the previous one as design changes are made to the learning design and AcaWriter. Changes to the learning design were presented as conjecture maps. The use of conjecture maps allowed the learning design of the iterations to be mapped and show where AcaWriter was integrated. Changes to AcaWriter's user interface and its parser, and the rationale, are explained in the respective iterations (iterations 3 and 4). The evolution of the parsers throughout the study can be seen in Chapter 10: section 10.4.2 - Figure 10.2. Reflections of each iteration are also presented and how they have impacted the following iteration. The findings demonstrate that the move analysis approach and TLC are effective ways to teach research writing. While AcaWriter has shown potential to support and develop HDR writing, additional automated feedback is needed for students to meaningfully interact with the tool.

# Chapter 10: Discussion & Conclusion

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This chapter presents the final phase of the DBR process and the findings of this research. This research conducted an investigation into the writing needs of Higher Degree Research (HDR) students, and the implications for automated writing feedback. The thesis has presented a program of research that designed, implemented and evaluated a writing analytics tool (AcaWriter) as an innovative solution to support and develop HDR students' research writing. This chapter presents the main findings of this research and its contributions to the scholarship of research writing pedagogy, writing analytics and HDR education. It presents the final design principles as well as provide recommendations and proposed future work for researchers, practitioners and institutions and concludes by outlining the challenges involved in this type of research.



## 10.1 Overview of the research

This research followed a Design Based Research (DBR) approach as it emphasises bridging the theory-practice divide (Barab & Squire, 2004) and provides both practical and theoretical research outputs. DBR enabled the development of a theoretically and empirically grounded technical solution, AcaWriter, to address the educational problem of a *current lack of resources and support to develop HDR students' research writing*. The DBR process also provided theoretical insights into HDR students' research writing experiences which has led to the creation of the two major contributions of my thesis: the

Multi-level Model of Research Writing Development (MMRWD) presented in section 10.2.2, and the design principles for AcaWriter for HDR contexts presented in 10.4.3.

Throughout this thesis, I have argued for new modes of research writing development and support in HDR programs, and that writing analytics tools are an innovative solution to develop and support HDR students' research writing. To ground the tool in existing theory and evidence, as well as in the new evidence gathered in this research, three research questions were established:

- Research Question 1: *How do HDR students learn research writing?*
- Research Question 2: *What are HDR students' research writing barriers and what are their experiences in terms of supervisor feedback?*
- Research Question 3: *How can writing analytics tools be designed, implemented and evaluated to help develop HDR students' research writing skills?*

To address the educational problem and answer the research questions, this research was conducted according to the four phases of DBR, detailed in Chapter 3. Table 10.1 presents an overview of the phases and the studies conducted.

**Table 10.1 - Overview of DBR phases**

<b>DBR Phase</b>	<b>Applied and explored in</b>
<b>Phase One</b>	Chapter 2 Literature Review: Sections 2.1 and 2.2
Analysis of practical problems by researchers and practitioners	Chapter 4 Learning How to Write About Research - Tools, Resources, Training & Feedback Chapter 5 Supervisor & Graduate Research Staff Perspectives Chapter 6 : Students' Research Writing Experiences
<b>Phase two</b>	Chapter 7 Developing Initial Design Principles
Development of solutions informed by existing design principles and technological innovations	Chapter 8 : Designing and Developing Writing Analytics for Research Students

DBR Phase	Applied and explored in
<b>Phase three</b> Iterative cycles of testing and refinement of solutions in practice	Chapter 9 : Implementing Writing Analytics in Research Writing Contexts
<b>Phase four</b> Reflection to produce design principles and enhance solution implementation	Chapter 10 : Discussion & Conclusion

In phase one the literature review established the educational problem of HDR students' challenges with research writing. In the next stage of phase one surveys and interviews explored HDR students' research writing experiences, how they learned research writing, their research writing barriers and their experiences with supervisor feedback, as well as supervisors and graduate research staff perspectives on HDR writing. This exploration facilitated a deeper understanding of the educational problem and HDR students' needs. These studies confirmed that additional modes of research writing development were needed in the HDR space.

In phase two, the findings from phase one were synthesised to create initial design principles for the writing analytics tool. This phase also included the analysis of scholarship on genre-based pedagogies, particularly, English for Specific Purposes (ESP), and Systemic Functional Linguistics (SFL). Cognitive writing theories and feedback best practices were also examined. This literature formed the theoretical framework which informed the design of AcaWriter's Abstract and Introduction parsers and the UX (user experience) as well as the design of the interventions.

Phase three involved the iterative testing and refinement of AcaWriter and the learning design of the intervention. Data were collected and analysed from each iteration to inform successive iterations of AcaWriter and the learning design. Reflections on each iteration were also noted to inform the following iterations. This process enabled the continued refinement of AcaWriter to see how it could best meet students' research writing needs.

Phase four, the focus of this chapter, distils the main findings, implications and recommendations for each research question. This phase also includes the final reflections on the entire research process and presents the final 12 design principles that I have developed from this program of research, which can be used to inform the future development and intervention of writing analytics tools in HDR contexts.

## 10.2 Implications of Research Question 1: Learning research writing

### *How do HDR students learn research writing?*

#### 10.2.1 Main findings & Discussion

Chapter 4 and Chapter 6 explored students' research writing experiences. This exploration was undertaken to better understand the HDR learning context and explore *how HDR students learn research writing*. The findings highlighted that supervisors, self-access resources, workshops and feedback were the main ways students learned research writing. These findings provided a preliminary understanding of "how doctoral students actually learn research writing" (Aitchison et al., 2012, p. 436), an issue raised more than ten years ago, but with very little evidence published since. Investigating this question also explored the types of support students perceived as beneficial. It was workshops and feedback that were key learning support modes. The implications of these results are discussed below, followed by recommendations on how to improve research writing development for HDR students.

#### *Supervisors*

HDR students learn their research writing skills and achieve their writing goals of publishing papers and completing their thesis by relying mostly on their supervisors for writing support. While this finding might not be new, it does confirm that supervisors are still expected by their students to teach writing. With the massification of doctoral degrees, the recent university funding cuts, and dealing with the issues that Covid-19 brought to the tertiary sector, there will be fewer supervisors, with less time, and the same number of students, if not more. The research presented here confirms that current support practices in place do not address both supervisor or student needs, and that more varied models providing greater support are needed to help both groups when it comes to research writing.

This research has particularly focussed upon a possible new model of support that could be provided using writing analytics tools to provide automated feedback to students on their drafts and help students identify the ‘moves’ in research writing (Chapter 9). As more varied forms of support models are needed, this research has also developed a multilayered model of research writing development (MMRWD) discussed later in the chapter. The MMRWD provides a framework of the different types of support that could be implemented to support HDR students’ diverse needs (Chapter 4). The MMRWD is a multi-level system of support in that it combines both self-access resources and facilitated interventions in collaboration with discipline specialists designed to meet the diverse needs of all HDR students.

### *Self-access resources*

The student survey and interviews established that some students do access a variety of electronic tools, books, websites and social media to help them with their research writing, while others did not. Electronic tools were primarily used by students to assist with lower-level language features such as grammar and spelling. Only a small number of students used web related resources and the concern here is that many of these students were unaware of such web resources such as the Thesis Whisperer and the Doctoral Writing SIG. As having established that Writing is critical in section 5.2.1 and that students are expected to know how to write (see section 2.1.3) the lack of awareness of the resources available to students is a concern. This is because while some supervisors provide effective writing support to their students, others may not (see section 2.2.4), and for those students who do not receive adequate writing support from their supervisors and limited institutional support exists, then it is important for students to be aware of the resources available to them and when to access them. In determining *how HDR students learn about research writing*, another issue to emerge concerned the time it takes to find effective resources (see Students’ research writing strategies in section 6.3.1). With this lack of awareness of such online resources evidenced in 4.3.2 and that searching for resources is time consuming it is critical that faculties or Academic Language and Learning (ALL) educators working in the HDR context ensure that expert trusted resources are easily available and accessible to students, for example that they are online so students can access them when they need it, and that the resources are clearly identified on when and how to use them.

Further insight into *how HDR students learn research writing* established that many students do use books to help them with their writing, in particular ‘how to write books’ however, the issue with this approach to learning about research writing, is that some advice given in such books oversimplifies the undertaking of a research project and writing the dissertation (Kamler & Thomson, 2008). ‘How to books’ often neglect the complexity of research writing particularly when research writing is “a discursive social practice embedded in a tangle of cultural, historical practices that are both institutional and disciplinary” (Kamler & Thomson, 2008, p. 508).

This means that since students are inclined to use ‘how to books’ as a resource for learning research writing, it is important that students are aware of which books are most beneficial for their needs. To do so means that educators, faculty staff or the centralised HDR department should provide a list of vetted books that are useful for students, so that they do not rely on publications that are unhelpful. In fact, ALL educators, who are mostly, well experienced in academic literacies are well placed to recommend books that talk about “the discursive practices of doctoral writing” and position students as “knowledgeable scholars-in-the-making” (Kamler & Thomson, 2008, p. 512).

Self-access resources are valuable in the research writing process, as they can meet some students’ immediate needs, for example, how to structure an introduction, or how to begin your literature review. Self-access resources also allow students to learn at their own pace and give students autonomy in their learning. One way universities can utilise these benefits of self-access resources is by developing a repository of quality resources on research writing. The repository would form the basis of HDR writing support and is a critical component for the MMRWD framework (section 10.2.2).

### ***Workshops***

While this study sought to determine *how HDR students learn research writing*, it also aimed to understand *what kind of research writing support students found useful*. Workshops are a popular method for students to learn strategies and tips on how to better write about their research. In this study many students reported they attended the workshops offered at the university (section 4.3.4). Other students reported they had not attended these types of workshops based on issues of time or not meeting their specific needs. It appears workshops on a variety of writing aspects and the writing process are beneficial and that students do want workshops that meet their needs. Some students wanted targeted workshops on English language for academic writing and others wanting



more advanced workshops on critical writing and reading (section 4.5.1). Workshops therefore need to be geared towards students' needs.

As most HDR degrees in Australia do not consist of a year/s of coursework like universities in the United States, it is important then to provide opportunities for students to engage in conversations about the features of writing and the writing process from those who are trained in academic literacies and genre theory, and therefore most likely to be someone other than their supervisors. Workshops are well situated for such conversations. Academic literacies workshops allow students to see how knowledge is produced through rhetorical and move analyses, identify sentence level lexicogrammatical features, and offers a safe place for students to discuss their writing processes and offer-self regulation strategies. Generic workshops offer opportunities for these conversations to take place, however, discipline specific targeted workshops would provide students with a richer understanding of how knowledge is produced in their discourse communities.

A developmental approach to teaching research writing through workshops would provide students tools and knowledge to analyse writing, and where students could bring their drafts and work on them with guided practice. Targeted workshops may not address all HDR student needs however, and students who do need the training may not attend. However, targeted workshops are clearly a need (section 4.5.1) and it is the need for a range of workshops at different levels that is important. This need for a range of workshops is a key element in the MMRWD (section 10.2.2) to address the varied needs of students.

### ***Feedback***

Receiving feedback on writing is critical in developing and learning research writing. It is therefore not surprising that feedback was also mentioned as beneficial in supporting students' research writing as reported in section 4.5.2. Reflecting on these findings, it is clear additional feedback from someone other than supervisors is valuable. While supervisors mostly provide specialised content focused feedback to their students, many do not have the linguistic knowledge to provide feedback on the rhetorical features of texts as discussed in section 1.1 and 2.2.4. Feedback focused on textual and rhetorical features of writing would help students analyse and evaluate their own writing, and in turn develop self-regulation strategies and high level problem solving skills that would enable students to revise their writing more effectively (see section 8.2 and 8.3), a process

necessary for research writing. Feedback from someone with an academic literacies background would be well suited to provide additional feedback as they understand the complexity involved in research writing and not only offer students timely, personalised, specific feedback, they also help students decipher supervisor feedback and how to action the feedback. One-on-one consultations also provide ongoing writing development for students who are able to see academic language and learner educators regularly. However, providing such support is costly, which makes writing analytics tools appealing to provide feedback at scale (see sections 9.3.4, 9.4.5, and 9.5.5) mitigating the cost of human interventions and support. Writing analytics tools, like AcaWriter also provide students with immediate feedback and provide students with just in time support.

Feedback is an important element in the research writing process. Providing alternative forms of feedback is also a key component in the MMRWD (section 9.2.2). Alternative forms of feedback include one-on-one consultations from both general and discipline specific ALL educators, as well as automated feedback from the writing analytics tool, AcaWriter.

Research writing is emotional work, as reported in previous research (Aitchison et al., 2012) and confirmed in this study. And, students' needs are varied and unique. A one size fits all approach does not meet students' diverse needs. Therefore, institutions should endeavour to provide a variety of support models so completing a research degree is a less stressful experience, meets the needs of students and so that students finish their research on time. One way to provide students a variety of writing support models is adopting the MMRWD framework as recommended and explained in section 10.2.2.

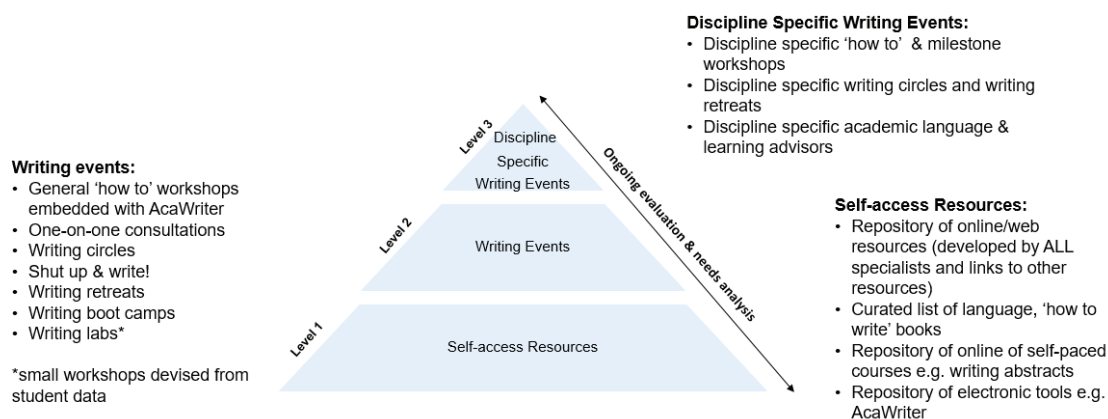
#### 10.2.2 Recommendations & future work for researchers, institutions and ALL practitioners

Having identified that supervision was the main method students learned research writing and establishing that a one size fits all approach does not cater to diverse student needs, the first recommendation argues for a more comprehensive, systematic approach to research writing pedagogy and learning design. The lack of explicit pedagogical frameworks for HDR writing support in the Australian context and lack of consistent, systematic curriculum in HDR programs (see sections 1.1 and 2.2) creates a challenging situation for centralised university research departments or any faculty trying to provide research writing support for their students. It is already established that the increasing

workload of supervisors, their lack of time and their unfamiliarity with linguistic and rhetorical knowledge, and lack of training in formal methods for teaching research writing impedes their ability to adequately support HDR students in the research writing process (see section 2.2.4). New models of support and infrastructure are needed to develop HDR students writing.

### ***Multi-level Model of Research Writing Development (MMRWD)***

To contribute to pedagogical theory and practice for HDR writing, and further support the ongoing development of research writing for students, a Multi-level Model of Research Writing Development (MMRWD) (Figure 10.1) is recommended. The MMRWD was developed through reflecting and synthesising the findings of students' research writing experiences (Chapter 4, Chapter 5, and Chapter 6). The MMRWD is a multi-level system of support that combines both self-access resources and facilitated interventions in collaboration with discipline specialists designed to meet the diverse needs of all HDR students. The MMRWD was inspired by Briguglio and Watson's (2014) Multi-layered Model of Language Development Provision (the MMLDP). Briguglio and Watson (2014, p. 67) argue that universities "should provide a variety of avenues for student language development, ranging from student self-access strategies to language support that is totally embedded in the curriculum" (see Figure 2.1 in section 2.2). Briguglio and Watson's (2014) MMLDP focuses on embedded language supported in the general university through units and courses where the writing is towards a common assessment task and are comparatively smaller texts than HDR theses. Written texts at the HDR level are not assessed via assessment rubrics and each are unique in terms of structure, features and characteristics. These differences along with the fact that most HDR students do not complete mandatory coursework means a different approach is needed. Therefore, the MMRWD focuses only on writing development for HDR students.



**Figure 10.1 – Multi-level Model of Research Writing Development**

The three levels of the MMRWD range from least support to most support and generic writing support to discipline specific support.

### *Level 1*

Level 1 includes writing support that is self-accessible to all HDR students. As the issue of awareness was one key finding from this study (see section 4.3.2 and 4.6), I propose that all relevant and valuable resources pertaining to HDR writing should be available for students in one place. These supports include a repository of websites that are beneficial for HDR students, for example, the Thesis Whisperer, the Patter blog, and the DoctoralWriting SIG. Resources created by ALL educators also sit here. Resources that explain how to write specific article sections and thesis sections along with annotated samples to show students *how* to write particular sections. Ideally these resources would also be grouped by discipline so that they are more meaningful for students. A carefully curated list of beneficial books that will assist students in their research writing process and their research journey is included here too, along with useful online writing courses and electronic tools. Having a repository of quality self-access resources will help students become aware of what is available to suit their needs and will be easily accessible. Students will not have to search far for quality resources, as was reported by one student (see section 6.3.1). Highlighting high quality self-access resources for students would provide students a first point of call to take action when they need assistance with their writing. While I expected this level of support to be available to the HDR students who took part in the study, very few online resources were available for students, instead students were offered services mainly at level 2. While this type of level

one support may be apparent to be included in terms of writing support services for students, it appeared that there were no systems in place to provide the students with self-access resources on research writing.

### *Level 2*

The next level of support includes opportunities for students to access generic support services facilitated by ALL educators. This support includes providing a range of generic workshops, seminars and one-on-one consultations that focus on language, structure and style. The survey respondents identified that they found workshops beneficial and requested that workshops be available on various aspects of research writing (see sections 4.3.4, 4.5.1). It is necessary that such support be available for students. Although this level of support exists at many universities, there is variation of this level of support. While there is criticism that generic workshops do not address specific needs, using genre theory and move analysis can show HDR students the ‘moves’ in research writing and how they then can apply such analysis to their own discipline. Carter (2011, p. 726) argues that genre theory provides “another useful lens onto the writing process”. Workshops at this level would include one-off ‘how to’ workshops or a 8 – 10 week writing course similar to the *Advanced Academic Writing for Graduate ESL Students* described by Starfield and Mort (2016). Generic workshops can also illustrate to students that theses are not bound by a formulaic structure such as the Introduction, Method, Results and Conclusion (IMRD). As interdisciplinary doctoral research continues, new types of doctorates and genres will emerge that may not follow the IMRD structure. Other workshops could be more targeted and focus specifically on English language in research writing, or for more advanced stages of candidature, workshops on publishing and converting chapters into journal articles. Automated feedback tools such as AcaWriter can also be embedded in generic workshops, as established in Chapter 9. At level 2, the additional writing support includes *Shut up and Write!* sessions (Mewburn et al., 2014), writing boot camps (Cayley, 2020; Rowtho et al., 2020), writing retreats (Kornhaber et al., 2016; Papen & Thériault, 2018; Tremblay-Wragg et al., 2021) and writing groups (Aitchison, 2009; Aitchison & Guerin, 2014). These additional forms of writing support would also help create a research community. To meet the specific needs of students, writing labs would also be provided at this level. Writing labs would take a data driven approach by conducting a needs analysis of students and creating small group workshops targeting a specific skill or need.

Ideally, it would be advantageous for institutions to provide all of these level 2 services, however it is noted that due to budgetary constraints institutions may not be able to provide all of the support models listed. Workshops and feedback were deemed beneficial types of support by the survey respondents (see section 4.5), therefore, universities should consider providing as a minimum generic workshops (see section 2.2.1) and individual consultations (see section 2.2.3) with a writing specialist as both forms of support can be beneficial for students writing development.

### *Level 3*

Level 3 focuses on providing writing development that focuses upon the academic discipline of students. As students must write for their discourse community there is no better way of understanding the writing conventions in their discipline than providing discipline specific support. I argue that level 3 represents the ideal level of support provided to students as it enables them to actively engage in texts that reflects their discourse community. By having targeted discipline specific support, workshops can be tailored to students' writing needs, for example, academic writing for the sciences. Successful academic writing requires a strong understanding of the intended audience and the appropriate ways to engage with that audience (K. Hyland, 2001), and being aware of the linguistic features and devices used in their discipline. For example, in Hyland's (2001) analysis of how authors engage their readers in research articles, he found that only philosophy articles asked genuine questions to their audience and used the pronoun *you*. Whereas, directives (phrases offering suggestions and actions, e.g. must, should) were mostly used in the hard sciences, for example, 'a distinction must be made...' and 'it is important to see...'. While level 2 workshops would equip students with the skills necessary to conduct a genre and move analysis, level 3 workshops would provide a far richer textual analysis of the devices used in specific disciplines and make visible the implicit cues used by authors. A discipline focus would also enable doctoral students to become discipline expert writers and signal membership to their discourse community.

### *Ongoing evaluation*

An ongoing evaluation of the resources and services offered at all levels would help determine if they are effective and useful for students. The evaluation would also seek to understand how research students learn research writing that is what services and resources they are using both internal and external to the institution. This part of the evaluation could be a snapshot in time like in Chapter 4, or conducted over time similar

to the study in Chapter 6. Including this approach in the evaluation would guide institutions on the resources and services needed to support the cohort. Ongoing evaluation allows for improvement of resources and services, and may provide new opportunities for future research writing development. Iterative cycles of evaluation allow for ongoing reflection which leads to providing services and resources that meet students' needs.

### 10.3 Implications of Research Question 2: Students research writing needs and their feedback experiences

*What are HDR students' research writing barriers and what are their experiences in terms of supervisor feedback?*

HDR students' face a multitude of challenges when it comes to research writing and student needs are diverse. The implications of these findings, synthesised from Chapter 4 and Chapter 6, are presented below, along with recommendations on ways to better support students with their research writing development.

#### 10.3.1 Main findings & Discussion

##### ***Students' research writing barriers***

Chapter 4 and Chapter 6 explored students' research writing barriers, finding that they are varied and vast. The studies found that students had difficulties across various elements of the writing process, from planning and generating ideas to building an argument (Chapter 4: section 4.4) and creating a research story (Chapter 6: section 6.3.1). These findings emphasise the diverse challenges HDR students experience in the research writing process, and that these challenges are unique to each student. Supervisor and Graduate Research Staff perspectives on student research writing challenges also highlighted similar issues, such as structure, audience, and storytelling (Chapter 5: section 5.2.7). The longitudinal study conducted in Chapter 6 established that students' research writing challenges are not unique to one point in time and that students' research writing challenges occur throughout candidature. The challenges identified were found during both stages of candidature that is at the beginning and during the final stages. This means that writing support should be continued throughout candidature focusing on the particular stage students are at, rather than just occurring at the beginning stages of candidature. As students' progress throughout their degree more complex forms of

writing are necessary. For example, at the early stages of their candidature and towards confirmation students are proposing their research project and identifying a gap in knowledge, whereas when nearing the end of candidature students are transforming their research into knowledge and presenting their contribution to the body of knowledge. These two phases are vastly different, with different rhetorical approaches, discourse features and structures.

While some students are able to navigate the research writing process, and the rhetorical and grammatical features of writing with the help of their supervisors, other students did feel not able to. Research confirms that not all supervisors are equipped or feel comfortable providing such feedback and support to their students (Aitchison et al., 2012; Paré, 2010, 2011) which means additional support and writing development is critical for HDR students. In particular support that is tailored to different student needs. The findings here reinforce the need for a comprehensive, systematic, data-driven approach to research writing support like the MMRWD proposed in section 10.2.2.

#### *Students' supervisory feedback experiences*

Chapter 6 explored the experiences of students with supervisor feedback. The findings from the study uncovered that supervisors provide feedback on a wide range of writing features, commenting on rhetorical features of writing such as argumentation, organisation of ideas, structure, narrative, discourse community expectations and surface level features of writings such as grammar. These findings confirm that supervisors are an integral part of the research writing process in research degrees.

However, the participants often found that the feedback they received was confusing, vague, difficult to understand, and sometimes evoked negative emotions (Chapter 6: 6.3.3). Similar findings have been reported elsewhere, such as Paré (2010, p. 108) who found that some supervisor feedback was “barely articulate”. General comments on how to fix their writing and rewriting sentences were also forms of feedback experienced by the students. Such comments without explanation were perceived unhelpful. Paré (2010) uncovered similar feedback in his study where supervisors provided practical feedback, but there was no explanation or justification as to why it was needed. The supervisors did not “trace their comments back to disciplinary conventions, rhetorical strategy, personal preference, or any other justification” (Paré, 2010, p. 108). Feedback such as this obstructs learning from happening and without a rationale as to why their writing has been changed could impact students' confidence and their scholarly identity, as



highlighted in Chapter 6 (section 6.3.3). And while some students feel comfortable discussing feedback with their supervisors, the longitudinal study uncovered that asking for guidance and disagreeing with feedback was difficult for most of the students (section 6.3.3), similar to previous findings (S. Chen et al., 2003; Winchester-Seeto et al., 2014). Although supervisors provide feedback with the best intentions and have rich discussions about feedback and writing, they may not be aware of how their feedback impacts their students. Negative emotions were felt by some of the students when they perceived they were being criticised about their writing (section 6.3.3). Feedback that leads to negative emotions is detrimental to students as negative emotions can obstruct students' learning (Carter & Kumar, 2017). Similarly, overly critical feedback can negatively impact learning (Boud & Molloy, 2013a; Hattie & Timperley, 2007).

The students had more positive experiences with feedback when it was explicit, constructive, provided solutions, suggestions and examples. This kind of feedback is most effective as it bridges the gap between what the student currently knows and what is required (Hattie & Timperley, 2007). Feedback that was positive and encouraging evoked positive emotions from the students. Positive feedback increased students' morale, confidence and made the students happy. Previous research has also shown that positive feedback increases confidence, produces feelings of acceptance and achievement (Kumar & Stracke, 2007), provides motivation (Stracke & Kumar, 2016), and membership to their discourse community (Stracke & Kumar, 2010). The findings from this study and that of previous studies together confirm how important it is to provide positive, encouraging feedback. However, all of the supervisors interviewed in this research (Chapter 5: section 5.2.4) stated that they had minimal to no training or advice on how to provide feedback or teach research writing. It is critical that supervisors know and understand how powerful positive feedback can be for students.

It appears that supervisors need a deeper understanding of feedback, its value and its nuances. The experiences described by the students in my study and previous studies on supervisor feedback (Paré, 2010, 2011), suggest that the quality of supervisor feedback has not changed in the past ten years. This means that supervisors' need additional training on best feedback practices (discussed in Chapter 8) as well as *how* to give feedback, and *how* feedback works in the writing process. For example, providing feedback without explanation is problematic, as it does not help the student understand *why* sentences were changed or *why* it needed to be fixed in a particular way. However,

it is noted that perhaps training on feedback is not possible due to institutional demands and supervisor workloads. If training on best feedback practices was provided to supervisors then supervisors would perhaps realise the benefits of providing explanations for their changes. Training on feedback would explain how feedback provides learning opportunities for students to improve. Such training could include a shared language on writing and feedback which would provide students more opportunities to learn more actively about rhetoric, disciplinary writing conventions, and style.

It is apparent that additional support models for students are necessary. Additional resources and training on setting expectations, managing and negotiating feedback is needed. It seems that this type of training is necessary and could help students become better negotiators, more assertive and in control of their research. This type of training may also reduce tension in student-supervisor relationships. Additional forms of receiving feedback is also needed. The MMRWD provides a framework as to what types of additional feedback could be provided, for example, one-on-one consultations with language specialists and automated feedback tools. These types of additional support are required, so that students are not always relying on their supervisors and have other avenues of feedback and support.

### 10.3.2 Recommendations & future work for researchers, institutions and ALL practitioners

Supporting students with writing development throughout their candidature demands institutions consider the following recommendations:

#### ***Conduct an ongoing needs analysis***

In order to keep abreast of student needs, it is important to understand the student cohort and their research writing challenges. Practitioners should work collaboratively with research staff to conduct regular needs analysis for every student at the point of enrolment. This could be a short questionnaire surveying students' needs and experiences which identifies which workshops would best benefit the students, for instance targeting a specific need or skill. The needs analysis could be similar to the survey conducted in Chapter 4 where students were asked to identify the challenges they faced with research writing. Since no such analysis is conducted at this university, both students, supervisors and the university would benefit from more information on student cohorts, therefore, conducting a needs analysis could obtain more information on student cohorts.

### ***A longitudinal study of research students writing experiences***

In addition to a regular needs analysis, investigating students' research journey over time would also be valuable in better understanding students' needs and the challenges they face. While this study explored students writing experiences at two specific times in their candidature, a longitudinal study over the entire doctoral journey, looking specifically how students navigate their learning and understanding of research writing practices, would further assist institutions to provide adequate research writing support. For example, the insights found in such a study could inform the types of support in level 2 and 3 in the MMRWD (10.2.2), having gathered rich data on research students' writing experiences.

### ***A longitudinal study of research students feedback experiences***

Conducting a longitudinal study of HDR students' feedback experiences, from the beginning of candidature to the end to capture the whole student journey, would provide institutions a better understanding of the types of feedback supervisors provide. A study such as this could also inform the types of services, training and resources that would help support supervisors.

### ***Develop resources and training on establishing feedback expectations and negotiating feedback***

Providing training and resources on how to establish and negotiate feedback is a critical need during candidature. As evidenced in Chapter 6 (section 6.3.3) many of the students had misaligned expectations of the feedback they received from their supervisors. Encouraging and providing resources to help students establish expectations of the kind of feedback they receive would provide both students and supervisors mutually aligned expectations of their roles. In addition to establishing feedback expectations, training on how to negotiate feedback, when students do not agree with the feedback given should also be provided. The findings from Chapter 6 (section 6.3.3) demonstrate that some of the students were not comfortable when came to negotiating the feedback they received. Providing training and strategies on how students can navigate this situation will provide students with more agency when it comes to their writing and negotiating feedback. This training could also be included in level 2 of the MMRWD (see section 10.2.2).

### ***Develop a shared language of writing for supervisors and students***

This research has demonstrated and confirmed previous studies that students find supervisor feedback confusing, vague and difficult to understand (Chapter 6: section

6.3.3). Establishing a shared language, such as the ‘moves’ concept (Chapter 8: section 8.1.2) would help supervisors discuss research writing conventions with their students and would assist students to understand how to decipher supervisor feedback. The findings in Chapter 9 – sections: 9.2.3, 9.3.3, and 9.4.4) demonstrated that students were able to use and understand the concepts of moves in their writing.

### ***Training on providing feedback***

Giving feedback is a critical skill. Yet, supervisors are expected to provide such feedback without the benefit of specific training regarding approaches to learning research writing, and providing feedback towards the desired goal. Additional training for supervisors focused on empirical findings of best feedback practices and teaching research writing would help supervisors understand the best ways to provide feedback and in turn may reduce tension between students and supervisors.

## **10.4 Implications of Research Question 3: Designing, implementing and evaluating writing analytics tools in HDR contexts**

*How can writing analytics tools be designed, implemented and evaluated to help develop HDR students’ research writing skills?*

### **10.4.1 Main findings & Discussion**

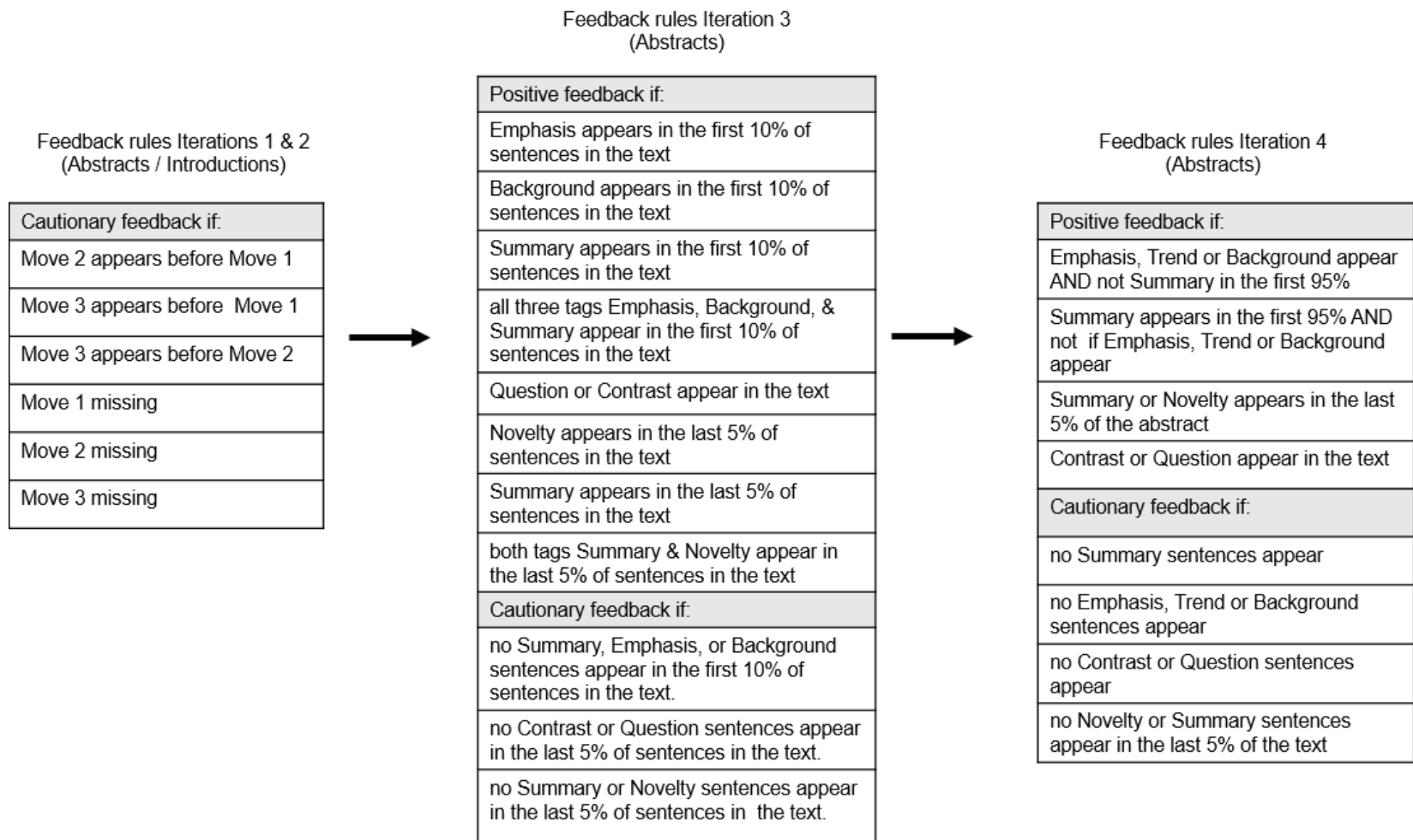
This section presents the process of designing, implementing and evaluating AcaWriter. It demonstrates how theory and practice are combined to provide a potential solution to the educational problem *that there is currently a lack of resources and support to develop HDR students’ research writing*. This section presents the final reflections of the iterations and the practical and theoretical outputs. AcaWriter for HDR contexts is the key practical output of this research. The three major outputs resulting from the iterative cycles of design, testing and refinement include AcaWriter’s feedback rules for the CARS and Abstract parser, the design principles for AcaWriter, and a design framework for creating writing analytics tools for HDR contexts. These evidence based heuristics are not prescriptive rules, but rather highlight how what has been learned in this research can help guide others and inform future research and practice. Next, this section presents the evaluation findings of AcaWriter through students’ perceptions and a revision analysis. The evaluation highlights that AcaWriter was well received by students and beneficial for their research writing process, in particular the revision process. I argue that writing

analytics tools like AcaWriter are a potential solution to develop and support HDR students' writing. The design, implementation and evaluation findings are presented according to the research outputs in terms of theoretical and practical contributions.

#### 10.4.2 AcaWriter's analytical parser development (feedback rules)

To tune AcaWriter for the specific features of HDR students' research writing, additional parsers were created by drawing on genre theory and English for Specific Purposes (ESP) principles, in particular the 'move' analysis approach (see section 8.1.2 or a detailed explanation). AcaWriter's existing sentence classifications were grouped into higher order classifications matching the language of CARS moves in which students were trained.

These additional parsers were trialled through four iterations where they were embedded in classrooms contexts and an online course. This research focused predominantly on the tool as a solution to the educational problem, and refinements were made to either the tool or learning design, or both during these four iterations. Figure 10.2 is a summary of the design refinements made to the parsers (see Design Refinements in Chapter 9 sections 9.4.2 and 9.5.2 for more details). The evolution of AcaWriter's HDR parsers is presented in and detailed below.



**Figure 10.2 – The evolution of AcaWriter’s HDR parsers**

### *Iteration 1 & 2 the CARS parser*

The CARS parser was the first parser created for AcaWriter and was developed by drawing on Swales and Feak (2012) Create A Research Space (CARS) model. AcaWriter's rhetorical moves were mapped to the CARS model and feedback rules were created following the CARS model. A detailed explanation of this mapping process is presented in Section 8.5.1. The feedback rules in this parser were quite prescriptive, see Figure 10.2 for an overview of the feedback rules. While the 'missing' rules worked quite well and prompted students to reflect on whether they had included the 'missing' moves, the sequence moves seemed problematic when used for larger pieces of text like an introduction. If students had followed the general CARS structure, and had additional moves within the moves, namely recycled moves, AcaWriter was unable to register this and would provide the sequencing feedback. Therefore, it was decided to create another parser focusing only on abstracts, a strategy presented in the next section.

### *Iteration 3 – Abstract parser*

The abstract parser for iteration three was designed to have fewer prescriptive rules than the CARS parser. For this iteration no sequencing moves were included and instead location rules applied. For instance, if no background move was identified in the first 10% of the abstract, cautionary feedback was generated (see 9.4.2). In addition to cautionary feedback, positive feedback was also included when a move was identified. While these rules appeared to be less prescriptive, with the expectation that the tool would identify moves more accurately, there were still issues with the parser. That is, it is difficult for machines to deal with ambiguity and set parameters must be created in order for the machine to provide feedback. Most abstracts have a background/context move in approximately the first 10% of their abstract, however if the abstract had this move just outside the 10% mark then cautionary feedback was generated. The implications of this for students was a feeling of frustration when they believed they had a move in their abstract but still received cautionary feedback. To combat this issue, the next iteration of the abstract parser contained even fewer prescriptive rules.

### *Iteration 4 – Abstract parser*

For this iteration the abstract parser was modified so that the rules were simpler. The Background/Context and the Research Problem / Issues / Gap in the literature moves for example, could be detected throughout the text, except in the last three sentences. Having rules like these meant the moves could appear anywhere in the majority of the abstract

and generate the correct feedback messages. This rule excluded the last three sentences as abstracts generally end with a Results/Findings move. So an additional rule was created to detect the Results/Findings move in the last 3 sentences of the abstract. Half the students reported that the AcaWriter mostly identified the correct move, however more testing needs to be done as the sample size for this iteration was quite small.

#### 10.4.3 Design principles for AcaWriter & writing analytics tools

The final design principles for AcaWriter have been developed through synthesising the findings of the four iterations (presented in Chapter 9), how students learn research writing, their research writing barriers and their research writing experiences presented in Chapter 4 and Chapter 6, and students' perceptions of AcaWriter. The final design principles that have been developed, and the synthesis of the findings, demonstrate how writing analytics tools can be designed for HDR contexts. The aim of this discussion is not to provide a set of prescriptive design principles, but rather to highlight what has been learned through this research and how it can be drawn upon to guide and inform future research and practice. Table 10.2 presents the initial design principles presented in Chapter 7 (7.4) and the final design principles. The table also illustrates the status of the design principles, that is, whether they were instantiated in the tool and learning intervention. The final design principles build off the initial design principles, with some of the initial design principles merged into new design principles. Additional design principles that are not instantiated in the tool are also presented. The final design principles aim to guide future development of AcaWriter and other writing analytical tools for HDR contexts.



**Table 10.2 – Design principles for Writing Analytic tools for HDR contexts**

<b>Initial Design Principles for HDR writing analytics tools</b>	<b>Design Principles for AcaWriter</b>	<b>Status: Completed ✓  Partially Completed ●  Future work →</b>
1. Automated writing feedback should ideally be constructive, specific, explicit and goal orientated	1. Automated writing feedback should be constructive, specific, explicit and contain examples	✓
2. Feedback language should be neutral	2. Feedback language should be neutral	✓
3. Positive feedback should be included	3. Automated feedback should contain both positive and cautionary feedback	✓
4. Feedback should contain examples	4. Parsers should be designed based on genres, part-genres	✓
5. Feedback should cover a range of writing elements	5. Feedback should be timely	✓
6. Feedback should be timely	6. Additional writing resources based on genre/part-genre should be embedded in AcaWriter	✓
7. Complementary embedded resources (discipline specific & general)	7. AcaWriter should be integrated in an appropriate learning design that supports people in learning how to use it (when embedded in classroom contexts and online courses)	✓
8. Repository of external resources	8. Parsers should be designed based on disciplines	→

Initial Design Principles for HDR writing analytics tools	Design Principles for AcaWriter	Status: Completed ✓  Partially Completed ●  Future work →
	9. Feedback should also target students' language needs	→
	10. AcaWriter's accuracy should be increased	→
	11. A variety of feedback types should be included: visual (tab 1) and written feedback (tab 2)	✓
	12. Detailed instructions on how to use AcaWriter should be included (both video and text)	●

The following section details the 12 design principles.

- Design principle 1: *Automated writing feedback should be constructive, specific, explicit and contain examples*

This design principle combines initial design principle 4 - *Feedback should contain examples*, as the feedback throughout the iterations contained constructive, specific feedback along with suggestions and examples. As established in Chapter 8 (section 8.3) providing clear, actionable feedback is important in students learning. The feedback provided by AcaWriter alerted students to missing moves in their text and explained how to achieve the move. This type of feedback was positively received by the students who used the tool (9.2.3, 9.3.3, and 9.4.4).

- Design principle 2: *Feedback language should be neutral*

Neutral language was implemented in the feedback messages throughout the iterations. The feedback messages were carefully constructed so that it did not infer criticism and evoke negative emotions. As established in Chapter 8 (section 8.3) feedback should be informative and non-judgemental.

- Design principle 3: *Automated feedback should contain both positive and cautionary feedback*

This design principle has changed slightly from initial design principle 3 - *Positive feedback should be included*. As established in Chapter 8 (section 8.3) feedback should comment on areas for improvement as well as positive features of students work. The design iterations of AcaWriter have shown students appreciated both cautionary and positive feedback (9.2.3, 9.3.3, and 9.4.4). Future applications of writing analytics tools should ensure that the design of the feedback is theoretically established, that is it follows feedback best practice and encourages self-regulation (see section 8.3). The automated feedback should clearly identify where improvement is needed and explanations on how to improve.

- Design principle 4: *Parsers should be designed based on genres, part-genres*

AcaWriter should be designed for authentic learning contexts and genres the students will have to engage in, such as writing research articles and a thesis. For instance, the design iterations showed that focusing AcaWriter on a part-genre was effective, particularly when embedding AcaWriter in a HDR workshop (see sections 9.2.3, 9.3.3, and 9.4.4) as most workshops on research writing are broken down into part-genres.

- Design principle 5: *Feedback should be timely*

Timely feedback is an essential component for HDR students when learning research writing and is an important factor in providing effective feedback (see section 8.3). This design principle has been instantiated in AcaWriter, as it is an automated feedback tool, providing instant feedback to students.

- Design principle 6: *Additional writing resources based on genre/part-genre and discipline should be embedded in AcaWriter*

This design principle was instantiated in the tool, as the resource tab in AcaWriter for both the CARS parser and Abstract parser (iteration 3) contained resources on writing abstracts and introductions. The fourth iteration of the Abstract parser did not contain additional resources, as AcaWriter was embedded in the online abstract writing course which contained resources on abstract writing. However perhaps additional resources should be embedded in the Abstract parser, as not all students will access the tool via the online course. Annotated exemplars of abstracts and introductions would be a useful

addition to the resource tab, as students explained that they used examples and exemplars to help them with their research writing (4.3.3 and 6.3.2).

- Design principle 7: *AcaWriter should be integrated in an appropriate learning design that supports people in learning how to use it (when embedded in classroom contexts and online courses)*

When AcaWriter and writing analytics tools are embedded in learning contexts both physical and online, the learning tasks should include activities where students use the tool. For instance, the first and second iterations included learning activities that incorporated the use of AcaWriter, whereas, the third iteration did not. Students in the third iteration experienced difficulties using the tool (see section 9.4.6). Aligning learning design with learning analytic tools is important as without this systematic process connection between the learning context and the tool is unclear (Law et al., 2017). Aligning learning design with the analytic tool provides more meaningful engagement with the tool as seen in undergraduate contexts (Knight, Shibani, et al., 2020).

- Design principle 8: *Parsers should be designed based on disciplines*

AcaWriter should also take into consideration the different disciplines that exist in research writing, as not all disciplines follow the same writing conventions. In fact it was student feedback that noted not all moves that were included in AcaWriter were needed in the abstract of their discipline and that they wanted more personalised feedback (9.4.4). Providing more contextualised automated feedback would increase engagement with the tool and would better develop students' research writing.

- Design principle 9: *Feedback should also target students' language needs*

Learner language needs should drive the types of automated feedback. This research discovered for instance that students wanted additional feedback with a language focus, such as grammar (9.4.4), and survey results from phase 1 of this research (see Chapter 4) showed students had different needs and challenges when it came to research writing. To develop a tool targeting students' needs, it is important to conduct a needs analysis (similar to the survey in Chapter 4), as this would indicate what features to include in the tool. While it may not be possible to also include feedback on language, an integrated suite of writing analytics tools that focus on language features could be included or linked to in the tool.

- Design principle 10: *AcaWriter's accuracy should be increased*

AcaWriter should increase its accuracy of identifying rhetorical moves. Accuracy was a common theme amongst the feedback given from the students throughout the iterations (9.3.3 and 9.4.4). Reduced accuracy may lead to reduced adoption as feedback is perceived to be of lower value. Having increased accuracy would increase engagement with tool and improve students' user experience of the tool.

- Design principle 11: *A variety of feedback types should be included: visual (tab 1) and written feedback (tab 2)*

The four iterations demonstrated how some students valued the highlighting and others found the feedback messages useful (9.2.3, 9.3.3 and 9.4.4). Some students preferred one feedback type over the other, which means that future writing analytics tools should provide a variety of feedback types. Students learn in a variety of ways and have their own preferences. By including a variety of feedback types helps support students learning.

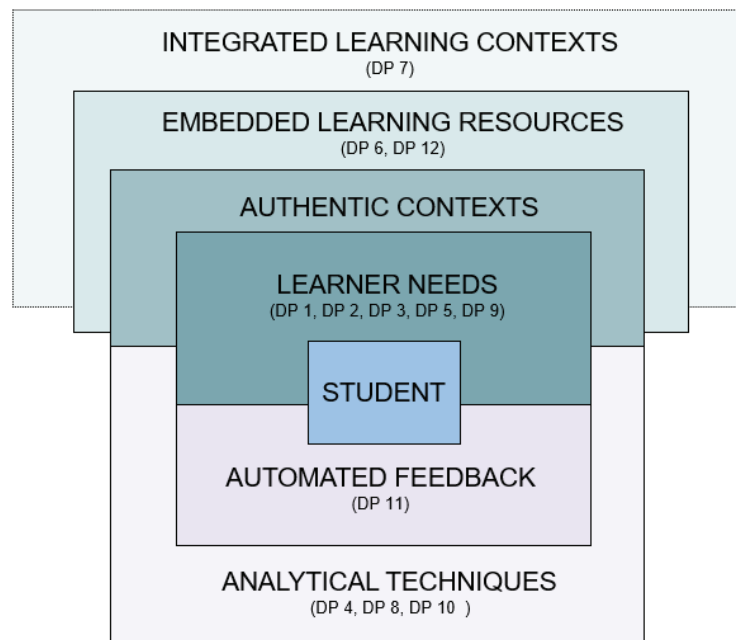
- Design principle 12: *Detailed instructions on how to use AcaWriter should be included (both video and text)*

Detailed scaffolding should be provided, as the iterations showed that not all the students were able to use the tool independently (9.2.3 and 9.4.6). The workshops only included written guides with screen shots to help students navigate and use the tool. The online abstract course included an interactive guide to show students how to use the tool. Although videos exist that explain how to use AcaWriter, it demonstrates the original analytical parser, not the parsers created for HDR writing. Therefore, videos explaining how to use the Abstract and CARS parsers, along with step by step instructions, would help students understand how to use the tool effectively.

### ***Framework to represent the design principles***

The design principles were synthesised to create a writing analytics design framework to represent the overall approach in creating a writing analytics tool for HDR students. Figure 10.3 demonstrates the layers involved when creating such a tool. At present, level 1 (self-access resources) and 2 (writing events) of the MMRWD (10.2.2) model are instantiated in the writing analytics designs developed through this thesis, drawing on analytic automated feedback at the text level. However, currently there is no automated feedback or analytics for disciplinary embedded learning resources (level 1 of MMRWD) or discipline level text event feedback (MMRWD level 3). Further automating feedback

could connect the embedded learning resources and automated feedback to the specific disciplinary context, thus addressing level 3 of the MMRWD (discipline specific writing events).



**Figure 10.3 –Writing analytics framework for HDR contexts indicating the interrelated and embedded nature of writing (top half) and the connection of writing analytics approaches (bottom half) to this. (Design Principles indicated as linked to their framework layer)**

At the centre of the framework is the **student**; the design principles of the analytic tool should be focused first and foremost on the student. The second layer represents the types of **automated feedback** (visual reports, messages, and diagrams) and the kinds of feedback correspond with **student’s needs**. The feedback generated should meet the students’ needs, facilitate self-regulation and be based on theoretical concepts. The next layer shows how the analytical techniques used to generate the feedback should correspond to the **authentic, student learning contexts**, for instance the research article genre, part-genres, their discourse community and distinguishing markers between disciplines. The authentic contexts must be established before applying and determining the **analytical techniques**, also ensuring the validity and accuracy of the tool. These three layers are interconnected, as each layer builds from each other, starting with student needs, which is why the boxes surround the student. The subsequent layer indicates that

in addition to providing feedback for authentic contexts, **embedded learning resources** are needed within the tool to develop student writing as well as guided scaffolding to use the writing analytic tool. The final layer presents **integrated learning contexts** to show that writing analytics tools should be integrated within the learning activities throughout the learning design in both online courses and face-to-face workshops. These two final layers are not interconnected like the first three layers of the frame, as student needs, analytical techniques, automated feedback and authentic learning contexts should be established before embedded learning resources and integrating the tool within learning contexts. This multilayered framework takes into account students' needs and experiences, their texts, and the discourse community to which they belong. Ivanič (2004) argues that viewing language through these three aspects provides a comprehensive writing pedagogy, as it considers “writing, written text, writing processes, the writing event, and the sociopolitical context of writing” as being “progressively embedded within one another, and intrinsically interrelated” (p.241).

Critics of writing analytic tools argue that they are typically disconnected from localised events of writing and the sociopolitical contexts that they take place in — that is the tools separate students from their discipline (Benzie & Harper, 2020). “Localised events” refer to the immediate social context of language — that is how language is used, its purpose, and its social activity. “Sociopolitical contexts” concern the “the multimodal practices, discourses and genres which are supported by the cultural context within which language use is taking place, and the patterns of privileging and relations of power among them” (Ivanič, 2004, p. 224). However, in the case of AcaWriter and this research, the writing analytic tool is integrated within learning contexts (level 1 and level 2 in the MMRWD) and its design has considered the student's authentic contexts. Engaging students with the move analysis approach (see 8.1.2) before they encounter AcaWriter makes them more aware of the moves that are in their disciplines' texts. The students are informed through the workshops and the online course that not all moves may appear in their discipline or that they may appear in a different order (for example with Swales' CARS model). Students are warned about the limitations of the tool and that it is acceptable to disagree with the feedback, since not all the moves might not be applicable in their field. Students are then better equipped to judge the appropriateness of their text for their discourse community. This research does not suggest that research writing development and support can be completely “outsourced” (to use Benzie and Harper's term) to writing analytic

tools like AcaWriter, but rather, that tools such as AcaWriter can assist students and supervisors if carefully designed, and thoughtfully integrated into the learning context, just as Benzie and Harper argue.

#### 10.4.4 AcaWriter implementation in HDR contexts

A consistent finding from this research is that, unlike other common writing tools like spell checkers, a novel tool like AcaWriter which is introducing new concepts, needs to be integrated in meaningful learning tasks. To facilitate this integration with AcaWriter, the learning design of the interventions was guided by the teaching and learning cycle (TLC), a pedagogic framework designed to engage students in the meaning-making process of texts, making them aware of the social purpose, structure and linguistic features of a text, which are essential elements to master for novice research writers. The TLC was combined with a move analysis to identify and deconstruct the structure, stages and linguistic features of abstracts and introductions (see Chapter 8 sections 8.1.2 and 8.1.3 for more information on the TLC and move analysis). This pedagogical approach was altered slightly to include the use of AcaWriter, in particular, the *joint construction* stage. For example, in iteration 1, instead of the students jointly creating a text with the guide of their peers and the teacher, joint construction took place using AcaWriter. In iteration 3 this stage was removed and in iteration 4 *joint construction* took place through a drag and drop activity. Then, in all iterations students went on to *independent construction* with the assistance of AcaWriter.

The overall findings from the four iterations indicate that the adapted TLC and adopting a move analysis approach is a suitable pedagogic framework to teach research writing as well as embed AcaWriter. In iteration one and two students found the CARS moves helpful to structure their abstracts and introductions. In iteration three, students found that dissecting texts made abstract writing concepts tangible. Learners in iteration four reported that the breakdown of abstracts into moves was a useful approach to understanding abstracts and the examples and activities reinforced their understanding. It is observed that having students go through learning and identifying the moves first is essential to their research writing development, an approach that provides students a critical lens to reflect on their writing as well as AcaWriter's feedback. The findings from the iterations confirm that the TLC and move analysis approach is an effective way to teach research writing both face-to-face and online. These approaches can be used for other sections of the research article and thesis genre.



Conjecture maps were used to document how the TLC was applied and incorporated AcaWriter in iterations one and three. Conjecture maps exemplify the underpinning logic of the design and how the characteristics of the design can cause particular effects, processes and outcomes (Bakker, 2018). The use of conjecture maps in this research enabled the design interventions to be mapped and therefore illustrated where AcaWriter was embedded. The conjecture maps also highlighted where writing analytics could be aligned with the learning design, providing a checkpoint to allow evaluation of the learning design with real time data and how students were engaging with the learning task, in this case AcaWriter (see Figure 9.2, Figure 9.5, and Figure 9.9). The checkpoints throughout iterations 1 and 2 were observed closely, however due to technical and time constraints engagement logs and revision analysis were not conducted for iterations 3 and 4. For iteration 1 and 2 all but two of the students submitted their writing to AcaWriter more than once. This research establishes that conjecture maps are a useful representation for checkpoint analytics and hence another form of evaluating a learning task and learning design.

The implementation of AcaWriter uncovered a tension between creating a tool capable of helping students to learn their research writing genre while also giving them enough confidence to disagree with the tool's sometimes imperfect results. Throughout the iterations some students appeared to lack confidence in disagreeing with the tool, or needed reassurance when making decisions regarding the tool's feedback and their writing. It seems the students wanted definitive answers when it came to receiving feedback from the tool. However, language and writing are complex, and while natural language processing is growing in sophistication, the analytics will never be perfect. It seems the best way to mitigate this tension is to place more emphasis on the learning design. This covers not only the design of activities to facilitate the learning of the genre and its moves, as seen throughout Chapter 9, but also designing activities that engage students in reflecting on the imperfections of the tool, as has been proposed by Kitto et al. (2018). Shibani et al. (2022) report such a learning design intervention with AcaWriter, proposing that scaffolding undergraduate students' critical engagement fostered their evaluative judgment, but future work is required to test this with HDR students.

This research confirms that DBR is an effective approach to develop, implement and evaluate educational innovations, having followed the DBR principles of integrating empirical research and theory to design a writing analytic tool for HDR students.

AcaWriter represents a practical answer to research question three demonstrating how writing analytic tools can be designed and implemented in HDR contexts. One major criticism of writing analytics and learning analytics tools is that they “are generally not developed from theoretically established instructional strategies, especially those related to provision of student feedback” (Gašević et al., 2015, p. 65). I argue that for learning analytics and writing analytics tools to be meaningful to learners and teachers, they must be both theory and data driven. The design principles presented in Table 10.2 and the accompanying framework in Figure 10.3 represent empirically-grounded design principles which together, provide future developers with flexible guidelines to design and create writing analytic tools for HDR contexts. This research’s design principles, learning design and resultant tool, AcaWriter, were informed by genre-based pedagogies, cognitive writing theories and best feedback practices, confirming that applying these theories is a suitable framework for designing the tool as well as its implementation.

#### 10.4.5 AcaWriter evaluation in HDR contexts

##### *Student perceptions*

AcaWriter was evaluated by investigating students’ perceptions of the tool. User perceptions are important when evaluating a tool, as it can establish the usability of the tool and its usefulness. In addition, exploring students’ perceptions helps to inform future design refinements and establish if the tool is meeting its intended goal. The students’ perception of AcaWriter was overall positive. The students’ perceived AcaWriter as a valuable tool to help them write introductions and abstracts. However some students wanted more personalised feedback, for example feedback on language and discipline specific feedback, others found AcaWriter’s feedback general and did not find it useful (see sections 9.2.3, 9.2.4, 9.3.3, 9.3.4, 9.4.4 and 9.4.5 for the findings and discussions where this is discussed in more detail). The evidence presented throughout the four iterations demonstrate the complexities involved in technology adoption and innovating in the HDR space; students would like more writing support, however, do not always take up the support that is offered to them. Despite AcaWriter’s imperfections and the complexities involved in implementing such a tool, the overall findings indicate that applying writing analytics tools in HDR contexts is a promising approach to support and develop students’ research writing.

### ***Revision analysis***

A revision analysis was conducted in iterations one and two to explore the impact of AcaWriter on students' revision process and their writing. The findings from the revision analysis from iteration 1 suggest that students actioned AcaWriter's feedback and that most of the student's drafts improved (see section 9.2.3). The students in iteration 2 engaged less with the tool and there were no significant changes in their drafts (see section 9.3.3). While the findings from the two iterations are varied, the findings are still encouraging as it indicates that automated feedback tools, like AcaWriter may have the potential to meaningfully impact students writing process and their texts.

#### **10.4.6 Recommendations & future work for researchers, institutions and ALL practitioners**

Other researchers, designers and practitioners can build on this research by considering the following:

##### ***Explore and understand the learning context***

Prior to creating a writing analytics tool it is important to explore the learning context with both students, supervisors, and academics so that designers, developers and researchers have a better understanding of the educational problem (see Chapter 4, Chapter 5 and Chapter 6). Students' learning needs should drive the design of the writing analytic tool (design principles) and the kinds of feedback the tool generates (see section 10.4.3). This process will create a more successful tool and will increase engagement and uptake of the tool when it meets students' needs.

##### ***Include theory in the design of writing analytics tools***

The design of the tool and its feedback should be informed by theory, in particular learning theories such as self-regulated learning, genre theory, cognitive writing theories, and feedback best practice (Chapter 8: section 8.1). A theoretical framework is important to distinguish *what* kinds of feedback will be generated and *how* the feedback will help develop students' writing. This research used the move analysis approach to design the analytical techniques, feedback rules and user interface (see section 8.5 for more details on the creation of the CARS parser and 9.4.2 for the creation of the Abstract Parser).

##### ***Conduct a revision analysis using automated tools***

To fully determine the impact of AcaWriter on HDR students' revision process and impact on the quality of their writing more evaluation is needed. A revision analysis was

conducted in iterations 1 and 2, however this analysis was not performed in iterations 3 and 4 due to technical issues and time limitations. Conducting a revision analysis such as this is quite labour intensive, therefore, alternative methods, such as automated revision analysis tools (Shibani, 2019, 2020), could be used to analyse student texts to identify revision patterns and how students engage with the automated feedback. Such an analysis, combined with a qualitative analysis would determine if the quality of the text improves.

#### ***Evaluate AcaWriter using additional approaches***

Additional evaluation strategies could investigate student sense making of AcaWriter's feedback along with think-aloud protocols and interviews, and even screen recordings. Finally, analysis of trace data for instance, click stream data, would also provide researchers an understanding of how AcaWriter is used, testing assumptions.

The following recommendations are derived from the findings of student perceptions of AcaWriter. While these recommendations are informed by the piloting of AcaWriter, they are applicable for researchers and designers of other writing analytics tools:

#### ***Include additional opportunities for feedback in AcaWriter***

Although the students found the feedback useful and beneficial, some students wanted individualised richer feedback on more features of their writing, such as grammar and vocabulary. While providing additional feedback on other features of writing may not be possible in AcaWriter, the tool should provide opportunities for students to seek this type of support and feedback. AcaWriter should consider including links to other writing analytics tool that focus on other features of writing, such as Grammarly.

#### ***Develop discipline specific feedback for AcaWriter***

Another means of providing personalised feedback is to provide discipline feedback. Unlike other learning analytics feedback tools that are embedded within a course and aligned with the course's assessment tasks, research degrees, in particular doctoral degrees do not contain rubrics or detailed assessment outlines. Therefore, providing contextualised feedback can be difficult. One way to solve this issue is by providing discipline specific feedback through machine learning techniques which would enable students to choose the discipline they belong to and receive the appropriate feedback according to their discipline (Cotos, 2016).

### ***Improve AcaWriter's accuracy through additional analytical techniques***

Improving the accuracy of AcaWriter by applying additional natural language processing techniques would result in a more robust tool. Machine learning techniques combined with a rules-based approach could provide more accurate feedback on the moves as well as provide feedback on additional moves that AcaWriter does not currently provide. These two approaches combined could provide discipline specific feedback on texts, and research advances with AcaWriter have demonstrated the potential of machine learning for its reflective writing parser (Liu et al., 2019, 2021).

### ***Develop additional parsers for other sections of research articles***

AcaWriter currently provides feedback on abstracts and introductions. Future research could build on AcaWriter by developing additional parsers to provide feedback on other sections of a research article, such as the discussion and methodology sections as additional move frameworks for other sections of research articles have been created (Cotos, 2016; Cotos et al., 2017). Creating additional parsers for other sections of the research article genre and for these would improve the functionality of the tool and increase its engagement and uptake.

## **10.5 Challenges and limitations**

The sections below present the challenges, characteristics of real-world research, and the technical, ethical and methodological challenges encountered in this research.

### **10.5.1 Technical challenges**

The analytical techniques used to develop the writing analytics tool featured in this research, AcaWriter, used a rules based approach, based on Sándor's (2007) concept matching framework to identify the rhetorical moves in texts (see section 8.4 for a detailed explanation). While new rules can be created, this involves creating complex rules based on linguistic structures and iterations of testing, creating a barrier to adaptation and extension by non-technical experts. Future research of this kind should continue to involve close collaboration between experts in academic language and learning, and natural language processing, so that future technical improvements are informed by strong pedagogical rationale to create a more robust tool.

### 10.5.2 Methodological challenges

Design Based Research was chosen as it is grounded in authentic learning contexts, rather than controlled laboratory environments that are separate from everyday real-world practice (see section 3.2 and 3.2.1). It attempts to bridge the divide between theory and practice to meaningfully impact learning and teaching. However, conducting research in real-world contexts presents challenges.

The first challenge is engaging HDR students as is evidenced in the small sample sizes across the iterations, especially in iterations one, two and four. It is not clear why it was difficult to engage this cohort of students, as many strategies were tried throughout the iterations. It could be that HDR students have competing schedules where they are conducting research, writing, and attending supervisory meetings. Their busy schedules make it difficult for them to participate in research projects. This is reflected beyond the research space in the reported relatively low participation of HDR students in writing support workshops, which may not reflect the breadth of students in the HDR cohort. Due to the methodology of this research, the students who participated in the studies self-selected. As a result, there may be some self-selection bias, for example, the students who self-selected to participate in the iterations using AcaWriter might be students who are most interested in using such a tool that provides automated feedback on writing. While it is important that future work understands the motivations to self-select in tool use, in this research these students may represent those who would most likely use such a tool and therefore provide key insights on how it could meet their needs. Across the work, this self-selection points to the need for multi-level provision of writing support, in which AcaWriter may be one resource for a cohort students.

Second, building relationships with staff to embed AcaWriter in established HDR writing workshops takes time. These factors should be taken into consideration in future research. Third, conducting research in real-world contexts is difficult as there are many variables out of the researcher's control. This was experienced in this research in the way students used and accessed AcaWriter. Some students did not follow the given instructions and others submitted published articles for feedback. These examples illustrate the messy, complex environment that are classrooms. This is the rationale for adopting a design based research approach, as its main objective is to study how new technologies are used in authentic educational environments. While, conducting research in everyday settings is challenging, it does provide findings that are closer to everyday practice. It enables us

to understand how people in fact use automated feedback tools and how they can be designed for real world contexts.

Finally, the studies presented in this thesis all took place at one institution, in Australia. The research writing experiences of HDR students, supervisors' perspectives towards research writing and support, and students' experiences of AcaWriter were therefore limited accordingly. It is important that the findings presented here in this thesis are considered in its local context, and tested in other contexts.

### 10.5.3 Research ethics challenges

The Human Research Ethics Committee (HREC) plays a pivotal role in ensuring studies are conducted to the highest standard. Adoption of the Design Based Research (DBR) approach added complexity to the engagement with the HREC, since the design iterations involved making informed, but ongoing changes to the learning design and evaluation methods. For example, a new ethics application had to be submitted from iteration one which only included face-to-face workshops, to iteration four which included the online course, necessitating changes to the data collection instruments to fit the online context. HREC needed to be kept informed of such changes, introducing some delays, and administrative and communication overheads. Since amendments and new applications were only reviewed once a month by UTS HREC, it was imperative that amendments or new applications were submitted in a timely manner, or incur a further month's review cycle. Consequently, the next iteration either had to be planned quickly or be delayed. This research involved two ethics applications plus multiple amendments, creating difficulty tracking what was permitted across the different amendments, and some uncertainty about merging data from different ethics applications. These processes created administrative overload for managing the changes.

This thesis suggests that there is a scope for greater agility when it comes to DBR research and the ethics process. Future research that applies DBR should make HRECs aware that its iterative nature will likely entail revisions. It would be advantageous for HRECs to establish flexible, rapid review cycles to facilitate the evolution of this kind of DBR in authentic contexts, when minor amendments are required. This would allow researchers more room to refine their interventions and possibly go through more iterations.

## 10.6 Conclusion

Contemporary changes to research continue to place pressure on higher degree research education. The commodification of knowledge has influenced changes in government funding and university policies which has placed increased pressure on institutions to publish their research. These changes have led to the massification of higher research degrees which in turn has led to increased participation in HDR programs and an increasingly diverse student cohort. While student enrolments in HDR programs continue to increase, the needs of this diverse cohort are rarely taken into consideration when designing *research writing* training, and little is known of how HDR students learn research writing. This research has provided insights into the challenges that students face in their research writing, and new insights on how students learn research writing (Chapter 4 and Chapter 6).

Research writing continues to be a contested space in HDR contexts for students, supervisors, and academic language and learning educators. Students continue to find research writing challenging, supervisors do not have the time or expertise to teach writing, and academic language and learning educators are continually asked to ‘fix’ student writing. This research has shown that students have unique needs when it comes to learning researching writing, however, the support systems currently in place do not meet the diverse needs of students. This research has proposed a solution to meeting the diverse needs of students through a multi-layered approach to research writing development (see section 10.2.2).

Limited resources and services exist to help support students and supervisors when it comes to research writing. This research investigated an alternative approach to provide research writing support and development to HDR students through the use of AcaWriter, a writing analytics tool. This research designed (Chapter 8), implemented and evaluated (Chapter 9) AcaWriter in HDR writing contexts. Designing AcaWriter for research writing and HDR contexts led to the creation of two parsers: the CARS parser (8.5) and the Abstract parser (9.4.2 and 9.5.2). The design of the tool drew from the students’ experiences with research writing and literature on students’ research writing challenges. The design of the tool was also theory driven as it drew on genre based-pedagogies, cognitive approaches to writing and best feedback practices (Chapter 8). New design features were added to AcaWriter to make it useful for HDR students and research writing. The user interface was changed (8.5.3); new feedback rules were created that did



not exist before (8.5.2); feedback messages were created, a feature that did not exist until this research (8.5.7). The design of AcaWriter led to the creation of design principles and a writing analytics design framework (10.4.3) which can aid future developments of AcaWriter and other writing analytics tool for HDR contexts.

The implementation of AcaWriter into the classroom and an online course included the Teaching-Learning Cycle (8.1.3) and the move analysis approach (8.1.2). This research has established that this adapted TLC and the move analysis approach is effective in the teaching and learning of research writing. How the TLC was implemented and the integration of AcaWriter into the cycle is represented through design conjectures (see Figure 9.2, Figure 9.5, and Figure 9.9 in Chapter 9).

The research highlights the importance of a multi-layered model to research writing support. Having established this model, the research demonstrates its significance in the design and implementation of AcaWriter; tools are not standalone supports, but must be embedded in wider practice through the multi-layer model. Integrated into this multi-layered approach, this thesis has argued that AcaWriter has the potential to assist students, supervisors and academic language and learning educators in the teaching and learning of research writing. For students, AcaWriter can assist in learning the rhetorical moves in introductions and abstracts, and facilitate the revision process. For supervisors, AcaWriter's assistance should release supervisors' time to focus on content aspects of students' writing. For academic language and learning educators, AcaWriter can be a useful tool in the classroom, or integrated into an online resource, by assisting in teaching introductions and abstracts.

To conclude, this research argues that a 'one size fits all' approach to research writing support does not meet students' unique needs, and additional modes of research writing support and development are needed. This thesis has proposed a multi-layered model to provide a comprehensive and systematic approach to supporting and developing HDR students' research writing. A writing analytics tool was designed and evaluated, motivated by existing theory and students' research writing experiences, to provide a new form of support to assist HDR students. The writing analytic tool is not a standalone solution, but when embedded within other forms of support such as workshops and an online course, the tool has the potential to assist students with their research writing. This research is the first step in pioneering a writing analytics tool in the Australian HDR context. Significantly, the systemic approach, underpinning design principles, and open

access software and resources from this research pave the path for future possibilities in creating automated feedback tools that will support and develop HDR students' research writing.

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# Appendices

## Appendix A: Thematic Analysis of Longitudinal Study

The images below are the coding tree developed during the thematic analysis.

Name	Files	References
Students research writing experiences	0	0
Students research writing strategies	2	2
Writing publications can help the writing process	0	0
Writing multiple sections as a strategy to improve writing	1	1
Writing more - keep writing	7	9
Writing synopsis to improve writing	1	1
Writing more papers as a strategy to improve writing	1	1
Write more and receive as much feedback as possible	2	2
Revising	2	3
Workshops not useful	4	4
Using electronic tools	3	3
Some resources not helpful	1	1
Resources and exemplars	0	0
Too busy to read books on writing	1	1
Guides on writing	1	4
Explicit resources sentence stems	5	8
Exemplars	7	8
Books	3	7
Reference managing system strategy to improve writing	1	1
Planning	5	6
Writing down ideas and planning on paper strategy for or	1	1
Printing articles	1	1
Pasting writing from other works strategy to start writing	1	1
Misc	1	1
Mindfulness	1	1
Focusing on one section	1	1
Explaining research to others	1	1
Did not use other forms of writing support	1	1
Concept map	1	1

<input type="checkbox"/> Students research writing challenges	0	0
<input type="checkbox"/> Writing Challenges	0	0
<input type="checkbox"/> Language and style features	0	0
<input type="checkbox"/> Writing for the educated lay person is challenging	2	2
<input type="checkbox"/> Writing concisely is a challenge	5	6
<input type="checkbox"/> Summarising is challenging	1	1
<input type="checkbox"/> Not having a large vocabulary is a challenge	4	6
<input type="checkbox"/> Grammar is challenging	1	3
<input type="checkbox"/> English language is challenging	3	3
<input type="checkbox"/> Creating effective captions is difficult	1	1
<input type="checkbox"/> Discourse features	0	0
<input type="checkbox"/> Writing the literature review is challenging	2	3
<input type="checkbox"/> Writing the introduction is challenging	1	3
<input type="checkbox"/> Writing the discussion and conclusion is challenging	1	1
<input type="checkbox"/> Writing the confirmation document is stressful	1	1
<input type="checkbox"/> Writing the confirmation document is a challenge	1	1
<input type="checkbox"/> Writing paragraphs is challenging	2	4
<input type="checkbox"/> Writing for their discipline is challenging	4	7
<input type="checkbox"/> Writing coherently is challenging	2	2
<input type="checkbox"/> Organising ideas is challenging	9	16
<input type="checkbox"/> Creating the narrative is challenging	3	3
<input type="checkbox"/> Connecting paragraphs-ideas is difficult	8	16
<input type="checkbox"/> Challenging to write in an interdisciplinary thesis	3	6
<input type="checkbox"/> Building an argument is challenging	5	11
<input type="checkbox"/> Additional challenges	0	0
<input type="checkbox"/> Starting is a challenge	4	5
<input type="checkbox"/> Planning	1	1
<input type="checkbox"/> Not having a clear idea is challenging	1	1
<input type="checkbox"/> Motivation can be a challenge	1	1
<input type="checkbox"/> Keeping on track is a challenging	2	2
<input type="checkbox"/> Getting stuck when writing	1	2
<input type="checkbox"/> Getting lost in their writing	2	3
<input type="checkbox"/> Everything in writing is difficult	2	2
<input type="checkbox"/> Adhering to length of paper is difficult	2	2

Concerns	0	0
Worried about organisation of ideas	1	1
Worried about examiners understanding thesis	3	4
Concerned about time	6	7
Students experiences with feedback	0	0
Supervisor Feedback	0	0
Unhelpful Supervisor feedback	0	0
Vague feedback is unhelpful	7	8
Unhelpful feedback is supervisors rewriting sentences	2	4
Unhelpful feedback is not reciving feedback timely	3	3
Unhelpful feedback is not focusing on the main adgenda	1	2
Unhelpful feedback is being criticised without solution or s	3	4
Supervisor expectations	1	1
Seeking help from others	1	1
Contradictory comments	2	3
Types of Supervisor feedback recieved	0	0
Supervisors too busy to teach writing	1	2
Supervisor only source of feedback	10	11
Supervisor feedback via discussion	1	1
Supervisor feedback on writing style	3	3
Supervisor feedback on writing strategy	3	3
Supervisor feedback on the moves in their abstract	1	1
Supervisor feedback on structure	1	1
Supervisor feedback on referencing, reporting literature	2	2
Supervisor feedback on paragraphs	4	4
Supervisor feedback on organising and connecting ideas	2	3
Supervisor feedback on narrative	1	1
Supervisor feedback on grammar	4	6
Supervisor feedback on content	5	6
Supervisor feedback on captions	1	1
Supervisor feedback on argument	2	2
Supervisor feedback on additional ideas	1	1
Supervisor feedback helpful conference expectations	1	1

<input type="checkbox"/>	<input type="radio"/> Helpful Supervisor feedback	0	0
	<input type="radio"/> Helpful feedback is receiving positive comments	5	5
	<input type="radio"/> Helpful feedback is providing suggestions and examples	8	11
	<input type="radio"/> Helpful feedback is having a discussion about written feed	2	4
	<input type="radio"/> Helpful feedback is focusing on one or smaller sections at	3	3
	<input checked="" type="radio"/> Helpful feedback is explicit	11	17
	<input type="radio"/> Helpful feedback is constructive not just criticism	2	2
<input type="checkbox"/>	<input type="radio"/> Emotions towards feedback	0	0
	<input type="radio"/> Supervisors didnt inform student of resources	1	2
	<input type="radio"/> Supervisor feedback can be overwhleming	2	2
	<input checked="" type="radio"/> Supervisor feedback can be frustrating	4	5
	<input checked="" type="radio"/> Supervisor feedback can be emotional	4	5
	<input checked="" type="radio"/> Supervisor feedback can be confusing	5	10
	<input checked="" type="radio"/> Negotiating feedback received	4	4
<input type="checkbox"/>	<input type="radio"/> Additional feedback	0	0
	<input type="radio"/> Feedback from friends after paper was submitted	1	1
	<input type="radio"/> Internal reviewer comments	1	2
	<input type="radio"/> Additional feedback from reviewers	1	1

# Appendix B: Online Survey Version 1

## PhD students writing experiences

Welcome to the PhD students writing experiences survey.

Thank you for taking the time to share your thoughts and writing experiences with us. The aim of this research is to gain a better understanding of PhD students' perceptions of writing, writing experiences and how they learn research writing so that educators can design better courses, support and tools to improve PhD students' writing skills during their candidature. There is limited research on doctoral students writing beliefs and how they learn research writing, so your participation will be very helpful. I know this is a long survey, but your input is extremely valuable.

This survey has 3 parts. The first section will ask you for some background information about yourself, questions about what tools you use to help you with your academic writing and your writing experiences. The remaining sections are two questionnaires that describe different perceptions of writing and the various ways students approach academic writing (e.g. thesis writing, research papers, reviews and critiques). There are no right or wrong answers; just think about your own beliefs and experiences.

**There's a prize!** We acknowledge that the survey is lengthy and as an incentive we are offering 2 participants the opportunity to win a \$50 prepaid Visa card.

If you would like to be in the running to win a \$50 visa gift voucher (there are two to give away) please answer this question in the survey: *What type of writing support do you think would be beneficial for PhD students?* And provide your email address in this question: *Would you like to participate in this research further?* Students who provide the most detailed answer will win a \$50 gift card.

**Who is doing the research?**

My name is Sophie Abel and I am a PhD student at UTS. My supervisors are Dr. Kirsty Kitto (Kirsty.Kitto@uts.edu.au), Professor Simon Buckingham Shum (Simon.BuckinghamShum@uts.edu.au), and Dr. Simon Knight (Simon.Knight@uts.edu.au) at the University of Technology Sydney.

**What is this research about?**

This research aims to discover how PhD students learn research writing and their beliefs about research writing. There is limited research on doctoral students writing beliefs and how they learn research writing. This information will help educators, instructors and learning designers create better writing support programmes, tools and interventions for PhD students.

**Why have I been asked?**

You have been invited to participate in this study because you are currently enrolled as a PhD or Masters Research student at UTS.

**If I say yes, what will it involve?**

If you decide to participate, you will participate in this online survey. The survey will take approximately 35 minutes of your time.

**Are there any risks/inconvenience?**

It is possible that you might feel embarrassed or uncomfortable being asked about your writing beliefs and how you learn research writing and giving your honest opinion. You will also be asked for your student number, you may feel uncomfortable providing this data. But, this research is confidential, that means I will not reveal that your answers to anybody and your data will be de-identified.

**Do I have to say yes?**

Participation in this study is voluntary. It is completely up to you whether or not you decide to take part.

**What will happen if I say no?**

**Are you a fulltime or part time student?**

\*

Choose one of the following answers

Please choose only one of the following:

- Full-time  
 Part-time

**Which faculty do you belong to?**

\*

Choose one of the following answers

Please choose only one of the following:

- Faculty of Arts and Social Sciences  
 UTS Business School  
 Faculty of Design, Architecture and Building  
 Faculty of Engineering and Information Technology  
 Faculty of Health  
 Faculty of Law  
 Faculty of Science  
 Graduate School of Health  
 Faculty of Transdisciplinary Innovation  
 Institute for Sustainable Futures  
 Connected Intelligence Centre

**Have you worked in academia or research before?**

\*

Choose one of the following answers

Please choose only one of the following:

- Yes  
 No

**What is your first language?**

\*

Choose one of the following answers

Please choose only one of the following:

If you decide not to participate, it will not affect your relationship with the researchers or the University of Technology Sydney. If you wish to withdraw from the study once it has started, you can do so at any time without having to give a reason, by contacting Sophie Abel [sophie.abel@student.uts.edu.au](mailto:sophie.abel@student.uts.edu.au).

**Confidentiality**

By clicking next you consent to the research team collecting and using personal information about you for the research project. All this information will be treated confidentially. Your data will be de-identified. It will be stored electronically and be password protected. Only the research group will have access to the data. Your information will only be used for the purpose of this research project.

We plan to publish the results at conferences and in journal articles. In any publication, information will be provided in such a way that you cannot be identified.

**What if I have concerns or a complaint?**

If you have any concerns about the research, please feel free to contact us at [Kirsty.Kitto@uts.edu.au](mailto:Kirsty.Kitto@uts.edu.au) or [sophie.abel@student.uts.edu.au](mailto:sophie.abel@student.uts.edu.au)

If you would like to talk to someone who is not connected with the research, you may contact the Research Ethics Officer on 02 9514 2478, or email [Research.Ethics@uts.edu.au](mailto:Research.Ethics@uts.edu.au) and quote this number: ETH17-1819 UTS HREC Approval Number

**By clicking next you agree to participate in this survey and understand:**

- that you will be asked to complete a survey and questionnaire about your perceptions of writing and learning research writing during your candidature. Results from aggregated data may be published in relevant, publicly accessible journals, conferences and media outlets.
- the purposes, procedures and risks of the research described in the Participant Information Sheet.
- results from the data will be de-identified and may be published in relevant, publicly accessible journals or conferences.

There are 101 questions in this survey

## Background information

This section will ask you for some background information about yourself.

**What is your student number? \***

Please write your answer here:

**What stage of your PhD are you at, approximately? \***

\*

Choose one of the following answers

Please choose only one of the following:

- Commencing – less than a year  
 Stage 1 - Confirmation of Candidature  
 Stage 2 - Confirmation of Advanced Progress  
 Stage 3 - Readiness to Submit Thesis for Examination

- English  
 Italian  
 Spanish  
 Portuguese  
 Dutch  
 German  
 Russian  
 Vietnamese  
 Japanese  
 Indonesian  
 Arabic  
 Awadhi  
 Hindi  
 Urdu  
 Bengali  
 Thai  
 Chinese (Mandarin)  
 Chinese (Cantonese)  
 Swahili  
 Tamil  
 Other

**What is the language in which you are most proficient for written tasks? \***

Please write your answer here:

**How would you rate your writing ability for writing research papers and your thesis? \***

\*

Choose one of the following answers

Please choose only one of the following:

- Poor
- Below average
- Average
- Proficient
- Highly proficient

**What is your age?**

\*  
Choose one of the following answers

Please choose only one of the following:

- 21-25
- 26-30
- 31-35
- 36-40
- 41-45
- 46+

**What gender do you most identify with?**

\*  
Choose one of the following answers

Please choose only one of the following:

- Female
- Male
- Other

**Do you have a google scholar profile, academia account, research gate profile or another online research specific account? \***

Please choose only one of the following:

- Yes
- No

### Learning Research Writing

The following questions will ask you about the tools and resources that you use to help you with your research writing.

**Do you use any of these electronic tools to help you with your thesis / article writing? \***

Check all that apply

Please choose all that apply:

- Grammarly
- Writefull
- Evernote
- Word spell/grammar check
- Google translate
- I don't use electronic tools
- Other:

**Why do you use these tools?**

\*  
Check all that apply

Please choose all that apply:

- For checking your grammar
- For checking your spelling
- To help with your expression
- To help you with note-taking
- To help you make your writing more clear and readable
- To help with English language
- I don't use electronic tools
- Other:

**Do you or have you used the following types of books to help you with your thesis / article writing? \***

Check all that apply

Please choose all that apply:

- "How to write..." a thesis/phd/article books
- Grammar books
- Academic writing books
- Dictionaries
- Thesaurus
- None
- Other:

**Explain the benefits the book/s provided for your writing?**

**If you answered None in the previous question please explain why.**

\*

Please write your answer here:

**Do you use the following websites/blogs to help you with your research writing?**

\*

Check all that apply

Please choose all that apply:

- Thesis Whisperer
- Doctoral writing SIG
- #PhD Chat
- I don't use websites/blogs
- Other:

**Explain why you use these websites?**

**If you answered I don't use websites/blogs please explain why.**

\*

Please write your answer here:

### Writing experience

Now I'd like to ask you questions about your writing experiences and your views on writing support in universities. Thanks for making it this far! 🍌

**Have you submitted a journal paper, conference paper or book chapter? Please also include papers that you have submitted that were not accepted.**

\*

Choose one of the following answers

Please choose only one of the following:

- Yes
- No

**Were the journal / conference paper/s or book chapter submitted in English, a language other than English, or both? \***

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '18 [WritingEx1]' (Have you submitted a journal paper, conference paper or book chapter? Please also include papers that you have submitted that were not accepted. )

Choose one of the following answers

Please choose only one of the following:

- English
- A language other than English
- Both

**How many journal/conference paper/s or book chapters have you submitted?**

\*

Only answer this question if the following conditions are met:

Answer was 'Yes' at question '18 [WritingEx1]' (Have you submitted a journal paper, conference paper or book chapter? Please also include papers that you have submitted that were not accepted. )

Please choose the appropriate response for each item:

	0	1	2	3	4	5+
In English	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In a language other than English	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>



	0	1	2	3	4	5+
How many were accepted in English?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How many were accepted in a language other than English?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How many were you sole author?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How many were you first author?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How many were you co-author?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

**What kind of revisions were needed to be made to the paper/s before being accepted for publication?**

\*

Only answer this question if the following conditions are met:  
Answer was 'Yes' at question '18 [WritingEx1]' (Have you submitted a journal paper, conference paper or book chapter? Please also include papers that you have submitted that were not accepted. )

Check all that apply

Please choose all that apply:

- Revising Literature Review
- Revising Data Analysis
- Revising Methodology
- Rewriting whole sections
- Grammar
- Language
- Other:

**Did you seek help from your supervisor/s, university staff member, friends, family with the revisions/writing?**

Only answer this question if the following conditions are met:  
Answer was 'Yes' at question '18 [WritingEx1]' (Have you submitted a journal paper, conference paper or book chapter? Please also include papers that you have submitted that were not accepted. )

Check all that apply

Please choose all that apply:

- Supervisor/s
- University staff member
- Academic literacies

- Academic literacies staff (eg. Writing/Language support staff)
- Friends
- Family
- Professional editor
- Other:

**What did they help you with?**

\*

Only answer this question if the following conditions are met:  
Answer was 'Yes' at question '18 [WritingEx1]' (Have you submitted a journal paper, conference paper or book chapter? Please also include papers that you have submitted that were not accepted. )

Check all that apply

Please choose all that apply:

- Structure
- Grammar
- Cohesion/Flow
- Expression
- Content (eg. missing information/more emphasis on other literature)
- Spelling
- Other:

**How did they help you? (e.g. did they give you written feedback?)**

\*

Only answer this question if the following conditions are met:  
Answer was 'Yes' at question '18 [WritingEx1]' (Have you submitted a journal paper, conference paper or book chapter? Please also include papers that you have submitted that were not accepted. )

Please write your answer here:

<sup>26</sup> Academic literacies appears twice in the question: Did you seek help from supervisors, university staff member, friends/family with the revisions/writing? If respondents chose both only one of the variables was counted.

**Have you ever gone to HELPS, Academic Literacies staff (GRS staff) for help with your writing?**

\*

Choose one of the following answers

Please choose only one of the following:

- Yes
- No
- I don't know

**What kind of help did the HELPS, Academic Literacies staff (GRS staff) give you? \***

Only answer this question if the following conditions are met:  
Answer was 'Yes' at question 25 [WritingEx7] (Have you ever gone to HELPS, Academic Literacies staff (GRS staff) for help with your writing? )

Please write your answer here:

**Was their help/advice useful?**

\*

Only answer this question if the following conditions are met:  
Answer was 'Yes' at question 25 [WritingEx7] (Have you ever gone to HELPS, Academic Literacies staff (GRS staff) for help with your writing? )

Choose one of the following answers

Please choose only one of the following:

- Yes
- No
- Other

**Do you attend the writing workshops (Introductions/abstracts, Kickstart, Literature Review) offered at UTS?**

\*

Choose one of the following answers

Please choose only one of the following:

- Yes
- No

**What type of writing support do you think would be beneficial for PhD students?**

\*

Please write your answer here:

**Who do you think should deliver/present this support? (faculty staff, language experts)**

\*

Please write your answer here:

**Would you like to participate further in this research?**

*Don't forget to provide your email address if you would like to win a \$50 prepaid Visa gift card.*

\*

Comment only when you choose an answer.

# Appendix C: Online Survey Version 2

## Pre-survey Abstract Writing Workshop

Thank you for taking part in the Abstract writing workshop piloting AcaWriter. This survey is to be completed before attending the workshop.

The aim of this research is to gain a better understanding of PhD students' perceptions of writing, writing experiences and how they learn research writing so that educators can design better courses, support and tools to improve PhD students' writing skills during their candidature. The survey will also ask you for some background information. There is limited research on doctoral students writing beliefs and how they learn research writing, so your participation will be very helpful. Your input is extremely valuable. This survey should only take you 15 - 30 minutes.

Below is the Participant Information Sheet.

### PARTICIPANT INFORMATION SHEET - PhD students (Intervention)

Embedding WA tools in Research Writing Pedagogy to develop and improve HDR students' research writing

#### WHO IS DOING THE RESEARCH?

My name is Sophie Abel and I am a PhD student at UTS. My supervisors are Dr. Kirsty Kitto (Kirsty.Kitto@uts.edu.au), Professor Simon Buckingham Shum (Simon.BuckinghamShum@uts.edu.au) and Dr. Simon Knight (Simon.Knight@uts.edu.au) at the University of Technology Sydney.

#### WHAT IS THIS RESEARCH ABOUT?

This research aims to discover how PhD students learn research writing and how students participate in this writing intervention that uses a writing analytic tool. The writing analytic tool is AcaWriter, developed by the Connected Intelligence Centre. It is a web application designed to provide insights to students on their writing. AcaWriter analyses text and provides feedback on the text. In this case, AcaWriter will analyse the use of rhetorical moves in your writing. The analytic tool will highlight the rhetorical moves that you have made in your writing. There is limited research on writing interventions for higher degree research (HDR) students and how writing analytic tools can help in the teaching and learning of HDR students' research writing. This research will help educators, instructors and learning designers create better writing support programmes, tools and interventions for PhD students.

#### WHY HAVE I BEEN ASKED?

You have been invited to participate in this study because you are a higher degree research student currently enrolled in a Masters (Research) or PhD.

#### IF I SAY YES, WHAT WILL IT INVOLVE?

If you decide to participate you will be:

- asked to participate in 2x workshops or webinars that will be up to 3 hours long. If you're unable to attend both workshops or webinars a truncated version is also available which will run for 1.5 to 2 hours, or asked to participate in the Research Writing UTS Open course which will take 1 to 2 hours of your time, which will involve learning and writing activities where you will be asked to write using the writing analytic tool and submit your writing for feedback (provided by the analytic tool);
- observed by the researcher while you take part in the intervention;
- asked to complete a short 10-20 minute survey prior to, and after, the workshop;
- asked to submit a sample of your writing prior to the workshop;

There are 37 questions in this survey

## Background information

This section will ask you for some background information about yourself.

What is your student number? \*

Please write your answer here:

What stage of your PhD are you at, approximately? \*

Choose one of the following answers

Please choose only one of the following:

- Commencing – less than a year
- Stage 1 - Confirmation of Candidature
- Stage 2 - Confirmation of Advanced Progress
- Stage 3 - Readiness to Submit Thesis for Examination

Are you a fulltime or part time student? \*

Choose one of the following answers

Please choose only one of the following:

- Full-time
- Part-time

Which faculty do you belong to? \*

Choose one of the following answers

Please choose only one of the following:

- Faculty of Arts and Social Sciences
- UTS Business School
- Faculty of Design, Architecture and Building
- Faculty of Engineering and Information Technology
- Faculty of Health
- Faculty of Law
- Faculty of Science
- Graduate School of Health
- Faculty of Transdisciplinary Innovation

- if you participate in the online course click stream data from the online learning systems will be collected and analysed;
- your writing tasks during and after the workshop will be analysed;
- invited post intervention to participate in an interview that will be audio recorded or a focus group that will be video recorded. The interview take up 1 hour of your time. The focus group may take up to 2 hours of your time. These will be recorded for research purposes. If you would like to retract your comments, you are able to do so. Please inform the researcher within one week of the focus group / interview. Your identity will be kept confidential. Recordings will be securely stored and destroyed at the end of the research project. Where quotes and other information from the records are used in research outputs, de-identified transcripts will be referred to;
- if you are interested you will also be invited to participate in a follow-up study.

#### ARE THERE ANY RISKS/INCONVENIENCE?

There are very few risks, but you should still do data breach, privacy, and feeling uncomfortable talking in a group are potential risks. All of the recordings – the audio and video and contact information will be saved electronically on infrastructure according to UTS eResearch group storage solutions; the data will be secured by UTS login and stored locally. You will be asked for your student ID, which will be replaced by a researcher unique ID in order to link datasets. Your identifiable information will be de-identified by removing your student ID and storing it separately alongside the researcher ID.

Interview times can be rescheduled if it is not convenient for you, if you do not feel comfortable participating in the focus group or do not want to be video recorded, then you may opt for an interview instead. You will also be asked to travel to UTS or your institution for the focus group/interview. Participants are asked to be respectful to others during the focus group.

Also, the software is not likely to give you the same type of feedback as a human tutor. There may be ways that the software is not well aligned with the requirements of your discipline. You will need to use your judgement on whether the feedback is helpful to you or not. As part of this research, we would like to know which feedback is and isn't helpful, so that we can minimise poor feedback and maximise good feedback. This will be the case with using the software whether you participate or not. If the software is not helping you, you should stop using it. You will not be penalised for not using it.

#### DO I HAVE TO SAY YES?

Participation in this study is voluntary. It is completely up to you whether or not you decide to take part.

#### WHAT WILL HAPPEN IF I SAY NO?

If you decide not to participate, it will not affect your relationship with the researchers, or the University of Technology Sydney, your institution, educator or supervisors. If you wish to withdraw from the study once it has started, you can do so at any time without having to give a reason, by contacting Sophie Abel (sophie.abel@student.uts.edu.au or <mailto:sophie.abel@student.uts.edu.au>)

#### CONFIDENTIALITY

By clicking next you consent to the research team collecting and using personal information about you for the research project. All this information will be treated confidentially. Your data will be de-identified. It will be stored electronically and be password protected. Only the research group will have access to the data. Your information will only be used for the purpose of this research project.

We plan to publish the results at conferences and in journal articles. In any publication, information will be provided in such a way that you cannot be identified.

#### WHAT IF I HAVE CONCERNS OR A COMPLAINT?

If you have any concerns about the research that you think I or my supervisor can help you with, please feel free to contact us at Kirsty.Kitto@uts.edu.au or sophie.abel@student.uts.edu.au

If you would like to talk to someone who is not connected with the research, you may contact the Research Ethics Officer on 02 9514 2478, or email Research.Ethics@uts.edu.au and quote this number:

ETH18-2835

- Institute for Sustainable Futures
- Connected Intelligence Centre
- Other

Have you worked in academia or research before? \*

Choose one of the following answers

Please choose only one of the following:

- Yes
- No

What is your first language? \*

Choose one of the following answers

Please choose only one of the following:

- English
- Italian
- Spanish
- Portuguese
- Dutch
- German
- Russian
- Vietnamese
- Japanese
- Indonesian
- Arabic
- Awadhi
- Hindi
- Urdu
- Bengali
- Thai
- Chinese (Mandarin)
- Chinese (Cantonese)
- Swahili
- Tamil
- Other

**What is the language in which you are most proficient for written tasks? \***

Please write your answer here:

**How would you rate your writing ability for writing research papers and your thesis? \***

Choose one of the following answers

Please choose only one of the following:

- Poor
- Below average
- Average
- Proficient
- Highly proficient

**What is your age? \***

Choose one of the following answers

Please choose only one of the following:

- 21-25
- 26-30
- 31-35
- 36-40
- 41-45
- 46+

**What gender do you most identify with? \***

Choose one of the following answers

Please choose only one of the following:

- Female
- Male

Check all that apply

Please choose all that apply:

- "How to write..." a thesis/phd/article books
- Grammar books
- Academic writing books
- Dictionaries
- Thesaurus
- None
- Other:

**Explain the benefits the book/s provided for your writing?**

**If you answered None in the previous question please explain why. \***

Please write your answer here:

**Do you use the following websites/blogs to help you with your research writing? \***

Check all that apply

Please choose all that apply:

- Thesis Whisperer
- Doctoral writing SIG
- #PhD Chat
- I don't use websites/blogs
- Other:

**Explain why you use these websites?**

**If you answered I don't use websites/blogs please explain why. \***

Other

**Do you have a google scholar profile, academia account, research gate profile or another online research specific account? \***

Please choose only one of the following:

- Yes
- No

**Learning Research Writing**

The following questions will ask you about the tools and resources that you use to help you with your research writing.

**Do you use any of these electronic tools to help you with your thesis / article writing? \***

Check all that apply

Please choose all that apply:

- Grammarly
- Writefull
- Evernote
- Word spell/grammar check
- Google translate
- I don't use electronic tools
- Other:

**Why do you use these tools? \***

Check all that apply

Please choose all that apply:

- For checking your grammar
- For checking your spelling
- To help with your expression
- To help you with note-taking
- To help you make your writing more clear and readable
- To help with English language
- I don't use electronic tools
- Other:

**Do you or have you used the following types of books to help you with your thesis / article writing? \***

Please write your answer here:

**Are there any other strategies (talking to friends, reading) that you have used to help you with your research writing? If so, what are these strategies and why do you use them? \***

Please write your answer here:

**Which parts of the writing process are challenging for you? Please select all that apply.**

Check all that apply

Please choose all that apply:

- Understanding requirements and expectations
- Pre-writing strategies (planning, generating ideas)
- Drafting
- Reflecting
- Revising
- Editing
- Working with sources
- Procrastination
- Writer's block
- Synthesis of ideas
- Meeting deadlines
- Other:

When you write, which of the following tasks are challenging for you? Please select all that apply.

Check all that apply

Please choose all that apply:

- Building an argument
- Developing your research problem statement
- Paragraph structure
- Wordiness
- Organisation / Structure
- Sentence structure
- Clarity
- Word choice / vocabulary
- Coherence and flow
- Writing style
- Grammar
- Punctuation
- Writing for your audience / discipline
- Incorporating ideas from outside sources
- Citing sources
- Other:

When you write a chapter or paper, how do you start and approach writing? \*

Please write your answer here:

What strategies do you use when you're writing a paper or chapter? \*

Please write your answer here:

	0	1	2	3	4	5+
How many were accepted in English?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How many were accepted in a language other than English?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How many were you sole author?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How many were you first author?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
How many were you co-author?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

What kind of revisions were needed to be made to the paper/s before being accepted for publication? \*

Only answer this question if the following conditions are met: Answer was 'Yes' at question 23 [WritingEx1] (Have you submitted a journal paper, conference paper or book chapter? Please also include papers that you have submitted that were not accepted. )

Check all that apply

Please choose all that apply:

- Revising Literature Review
- Revising Data Analysis
- Revising Methodology
- Rewriting whole sections
- Grammar
- Language
- No revisions
- Other:

Did you seek help from your supervisor/s, university staff member, friends, family with the revisions/writing?

Only answer this question if the following conditions are met: Answer was 'Yes' at question 23 [WritingEx1] (Have you submitted a journal paper, conference paper or book chapter? Please also include papers that you have submitted that were not accepted. )

Check all that apply

Please choose all that apply:

- Supervisor/s
- University staff member
- Academic language and learning staff (eg. Writing/Language support staff)
- Friends

### Writing experience

Now I'd like to ask you questions about your writing experiences and your views on writing support in universities. Thanks for making it this far!

Have you submitted a journal paper, conference paper or book chapter? Please also include papers that you have submitted that were not accepted. \*

Choose one of the following answers

Please choose only one of the following:

- Yes
- No

Were the journal / conference paper/s or book chapter submitted in English, a language other than English, or both? \*

Only answer this question if the following conditions are met: Answer was 'Yes' at question 23 [WritingEx1] (Have you submitted a journal paper, conference paper or book chapter? Please also include papers that you have submitted that were not accepted. )

Choose one of the following answers

Please choose only one of the following:

- English
- A language other than English
- Both

How many journal/conference paper/s or book chapters have you submitted? \*

Only answer this question if the following conditions are met: Answer was 'Yes' at question 23 [WritingEx1] (Have you submitted a journal paper, conference paper or book chapter? Please also include papers that you have submitted that were not accepted. )

Please choose the appropriate response for each item:

	0	1	2	3	4	5+
In English	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
In a language other than English	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

- Family
- Professional editor
- Other:

What did they help you with? \*

Only answer this question if the following conditions are met: Answer was 'Yes' at question 23 [WritingEx1] (Have you submitted a journal paper, conference paper or book chapter? Please also include papers that you have submitted that were not accepted. )

Check all that apply

Please choose all that apply:

- Structure
- Grammar
- Cohesion/Flow
- Expression
- Content (eg. missing information/more emphasis on other literature)
- Spelling
- Other:

How did they help you? (e.g. did they give you written feedback?) \*

Only answer this question if the following conditions are met: Answer was 'Yes' at question 23 [WritingEx1] (Have you submitted a journal paper, conference paper or book chapter? Please also include papers that you have submitted that were not accepted. )

Please write your answer here:

Have you ever gone to an academic language advisor, a writing specialist, writing centre staff, or an editor for help with your writing? \*

Choose one of the following answers

Please choose only one of the following:

- Yes
- No
- I don't know

**What kind of help did they provide? \***

Only answer this question if the following conditions are met:  
Answer was 'Yes' at question '30 (WritingEx7) (Have you ever gone to an academic language advisor, a writing specialist, writing centre staff, or an editor for help with your writing? )

Please write your answer here:

**Was their help/advice useful? \***

Only answer this question if the following conditions are met:  
Answer was 'Yes' at question '30 (WritingEx7) (Have you ever gone to an academic language advisor, a writing specialist, writing centre staff, or an editor for help with your writing? )

Choose one of the following answers

Please choose only one of the following:

- Yes
- No
- Other:

**What kind of writing support do they offer at your university? \***

Check all that apply

Please choose all that apply:

- Writing workshops
- One-on-one consultations
- Writing boot camps
- Writing retreats
- Month or Semester long writing course
- Other:

**Do you attend the writing workshops offered at your university? If so please explain why. If no, please also explain why. \***

Comment only when you choose an answer.

Please choose all that apply and provide a comment:

- Yes
- No

**What type of writing support do you think would be beneficial for Master of research and PhD students? \***

Please write your answer here:

**Who do you think should deliver/present this support? (faculty staff, language experts) \***

Please write your answer here:

## Appendix D: Supervisor & Graduate Research Staff Interview Schedule

Check that participants have:

- signed voluntary consent
- agreed to be audio-taped
- read the information sheet
- any questions before interview starts

### ***Pre-annotation exercise***

#### **Brief background**

How long have you been a supervisor? / How long have you been an academic literacies educator?

What is your discipline?

Is this the subject area that you completed formal studies in?

In your supervisor training, were you trained how to teach writing or help students develop their writing? / Have you been trained how to teach writing or help students develop their writing?

What role do you think writing plays in the process of initiating a PhD student into their discourse/research community?

#### **Writing Perceptions**

What is good writing?

How would you define good PhD writing?

What make a research article successful? What makes a thesis successful?

What key features are needed in a successful research article and thesis? Why are these features important in creating a successful article/thesis?

When reviewing your students' writing what features do you look for?

How do you give feedback on your students' writing? / How do you give feedback on students' writing – when they have come to you for help/advice?

How do you teach research / thesis writing to students?

Do you think your background or discipline influences how you define good writing? For example, perhaps you've worked industry where you've had to persuade stakeholders on the efficiency of your designs, services or products?

#### **Annotating exercise**

You will now have 30 minutes (15 minutes each) to read the two documents. Please highlight and annotate the sentences that make the texts good and/or bad?

#### **Post highlighting exercise**

Could you please tell me what was good about the first text and what was bad? (Repeat for second text)

- *Is the aim of the research clearly stated? Where? How?*
- *Is the author building towards an argument? Where? How?*
- *Has the author included the significance of their research?*

Could you please tell me why you highlighted these particular features in the text?

Do you think overall that text A and B are good examples of writing?

What feedback would you give to the authors about these texts?

In your experience - what kind of characteristics distinguish better/experienced writers from less experienced writers?

What difficulties do you encounter when reviewing your students' writing?

How important does the role of the audience play in research writing and thesis writing (final submission)?

Do you think that PhD students are aware of the importance audience/reader plays in their writing?

Other than communicating ideas, what other skills does writing help develop?

What kind of writing support do you offer your students? / What kind of writing support do you offer students when they seek your help?

How do your students learn academic writing? Especially, for your discourse/research community. / How do you help students learn academic writing?

Do you refer students to books, websites, tools, apps?

Would you use a writing analytic tool to help students learn good features of writing?

Do you think there should be more emphasis placed on writing as a skill to be developed during candidature? If so, what kind of writing support do you think students would benefit from?

Is there anything you would like to add to about writing for HDR students?



## Appendix E: Longitudinal HDR Students Interview Schedule

### One on One Follow-up Semi -structured Interview guide

Check that participants have:

- signed voluntary consent
- agreed to be audio-taped
- read the information sheet
- any questions before interview starts

Thank you for being taking part in this ongoing study. This is about an ongoing writing project that looks at the writing process involved writing a single manuscript and using AcaWriter. The following questions will be asked whenever we meet for an interview. Although the same questions will be asked, this is helpful to see how you develop as a writer, and how your writing develops during the process of writing the paper.

#### **AcaWriter Follow up:**

- 1. What stage are you at in the writing?*
- 2. How often did you use AcaWriter?*
- 3. What did you do with the AcaWriter feedback you received?*
  - 3.a If you tried to respond to it, by making edits, etc. what was the feedback about? Do you think it helped your writing? Did it help you understand some of the things that are important in research writing?*
  - 3.b If you received feedback that you did not take action on, why not? Did you disagree? You weren't sure how? It wasn't feedback you thought needed any specific action? Or you'll deal with it later?*

#### **General Feedback questions:**

- 4. What other feedback did you receive while writing your document/s?*
- 5. What kind of feedback do you find helpful?*
- 6. What additional feedback would you like to receive from AcaWriter?*

#### **Writing difficulties:**

- 7. What has been the most difficult aspect of writing so far? Why?*
- 8. What strategies did you put in place to help you with this/these writing difficulty/ies?*

#### **Writing support:**

- 9. What other forms of support and/or other resources have you used to help you with your writing? How helpful have these been?*

10. *What are your main writing concerns as you continue with your studies?*

11. *Do you have any ongoing plans for ways to continue to improve your writing?*

12. *What would you most like to improve about your writing? Why?*

**Writing Process:**

13. *How has your writing process changed since using AcaWriter? If so, what has changed and why?*

14. *Have you had any key moments in this writing experience (like 'breakthrough' or 'ahha' moments)? What happened and why were they so important to the writing?*

15. *What about your writing are you most satisfied with and why?*

16. *How would you define good writing? (for follow-up interviews, refer participants to their initial answers and ask if they would change their mind)*

## Appendix F: Revision Analysis Example

Participant 3

**Draft:** 5 to 6

**Feedback message:** *It looks like you are missing Move 1 – Establishing a research territory (E or B sentences). Here you should show how your research topic is relevant and important by introducing & reviewing previous research on your topic. For example, recent research indicates that the effects of climate change have.... (for more examples head to the resources tab)*

*It looks like you are missing Move 3 – Occupying the niche (S or N sentences). Here you should state how your research fills the gap or solves the research problem mentioned in Move 2. You can do this by stating the aim and purpose of your research. For example, this goal of this study, this research shows that., the purpose of this investigation....(for more examples head to the resources tab)*

**Feedback impact:** Direct

**Justification:** Participant tries to add a move 1 “Collaboration....”

[1]Collaboration is one of the 21st century competencies that higher education seeks to improve for the future workforce [ADDITION]. The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data.

**Draft:** 6 to 7

**Feedback message:** *It seems you have stated how your research fills the gap and/or solves the research problem [Move 3 – Occupying the niche (S or N sentences)] before you have indicated the gap and/or explained your research problem [Move 2 Establishing a nice (C or Q sentences)]. It is more effective to indicate the gap and explain the research problem before you state your solution and aim of your study. Aawriter suggests putting Move 3 – Occupying the niche (S or N sentences) after Move 2 Establishing a nice (C or Q sentences).*

*It looks like you are missing Move 1 – Establishing a research territory (E or B sentences). Here you should show how your research topic is relevant and important by introducing & reviewing previous research on your topic. For example, recent research indicates that the effects of climate change have.... (for more examples head to the resources tab)*

**Feedback impact:** Direct

**Justification:** The participant adds move 3 sentences at the end.

[1]Collaboration is one of the 21st century competencies that higher education seeks to improve for the future workforce.[2] The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data. [3] In this paper, we propose a theoretical approach to make sense of these complex data [ADDITION]. [4] through a model to analyse collaboration activities, built from concepts in activity-centered design and quantitative ethnography, aiming at representing and supporting the meaning-making of collaboration[ADDITION]. [5] Furthermore, we illustrate our proposed approach through a simulation-based case study [ADDITION]. [6] Further directions on this research will explore the transferability of the approach to other contexts, settings and data [ADDITION].

**Draft:** 7 to 8

**Feedback message:** *It seems you have stated how your research fills the gap and/or solves the research problem [Move 3 – Occupying the niche (S or N sentences)] before you have indicated the gap and/or explained your research problem [Move 2 Establishing a nice (C or Q sentences)]. It is more effective to indicate the gap and explain the research problem before you state your solution and aim of your study. Aawriter suggests putting Move 3 – Occupying the niche (S or N sentences) after Move 2 Establishing a nice (C or Q sentences).*

*It looks like you are missing Move 1 – Establishing a research territory (E or B sentences). Here you should show how your research topic is relevant and important by introducing & reviewing previous research on your topic. For example, recent research indicates that the effects of climate change have.... (for more examples head to the resources tab)*

**Feedback impact:** Direct

**Justification:** The participant is working on move 1.

Collaboration is one of the 21st century competencies that higher education seeks to improve for the workforce[DELETION]. Collaboration is one of the 21st century competencies that higher education seeks to improve for the future workforce[DELETION]. The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data. In this paper, we propose a theoretical approach to make sense of these complex data. through a model to analyse collaboration activities, built from concepts in activity-

**Draft:** 8 to 9

**Feedback message:** *It seems you have stated how your research fills the gap and/or solves the research problem [Move 3 – Occupying the niche (S or N sentences)] before you have indicated the gap and/or explained your research problem [Move 2 Establishing a nice (C or Q sentences)]. It is more effective to indicate the gap and explain the research problem before you state your solution and aim of your study. Aawriter suggests putting Move 3 – Occupying the niche (S or N sentences) after Move 2 Establishing a nice (C or Q sentences).*

*It looks like you are missing Move 1 – Establishing a research territory (E or B sentences). Here you should show how your research topic is relevant and important by introducing & reviewing previous research on your topic. For example, recent research indicates that the effects of climate change have.... (for more examples head to the resources tab)*

**Feedback impact:** Direct

**Justification:** The participant is working on move 1 – she has added new background sentence

[1] Collaboration is important for the future workforce, as this has been reported as one of the 21st century competencies [ADDITION]. Collaboration is one of the 21st century competencies that higher education seeks to improve for the workforce [ADDITION]. [2] When people collaborate, communication, time management and decision making are some of the skills that are developed through people's interactions [ADDITION]. The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data. In this paper, we propose a theoretical approach to make sense of these complex data. through a model to analyse collaboration activities,

**Draft:** 9 to 10

**Feedback message:** *It seems you have stated how your research fills the gap and/or solves the research problem [Move 3 – Occupying the niche (S or N sentences)] before you have indicated the gap and/or explained your research problem [Move 2 Establishing a nice (C or Q sentences)]. It is more effective to indicate the gap and explain the research problem before you state your solution and aim of your study. Aawriter suggests putting Move 3 – Occupying the niche (S or N sentences) after Move 2 Establishing a nice (C or Q sentences).*

*It looks like you are missing Move 1 – Establishing a research territory (E or B sentences). Here you should show how your research topic is relevant and important by introducing & reviewing previous research on your topic. For example, recent research indicates that the effects of climate change have.... (for more examples head to the resources tab)*

**Feedback impact:** Direct

**Justification:** The participant is revising move 1 sentence

Collaboration has become an important 21st century skill that higher education seeks to nurture, which is valuable for future workforce [ADDITION]. Collaboration is important for the future workforce, as this has been reported as one of the 21st century competencies [ADDITION]. When people collaborate, communication, time management and decision making are some of the skills that are developed through people's interactions. The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data. In this paper, we propose a theoretical approach to make sense of these complex data. through a model to analyse collaboration activities,

**Draft:** 10 to 11

**Feedback message:**

*It looks like you are missing Move 1 – Establishing a research territory (E or B sentences). Here you should show how your research topic is relevant and important by introducing & reviewing previous research on your topic. For example, recent research indicates that the effects of climate change have.... (for more examples head to the resources tab)*

**Feedback impact:** Direct

**Justification:** The participant is revising move 1 sentence

Collaboration has become an important 21st century skill for the future workforce [DELETION]. Collaboration has become an important 21st century skill that higher education seeks to nurture, which is valuable for future workforce[DELETION]. When people collaborate, communication, time management and decision making are some of the skills that are developed through people's interactions. The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data. In this paper, we propose a theoretical approach to make sense of these complex data through a model to analyse collaboration activities built from concepts in

**Draft:** 11 to 12

**Feedback message:**

*It looks like you are missing Move 1 – Establishing a research territory (E or B sentences). Here you should show how your research topic is relevant and important by introducing & reviewing previous research on your topic. For example, recent research indicates that the effects of climate change have.... (for more examples head to the resources tab)*

**Feedback impact:** Direct

**Justification:** The participant is revising move 1 sentence

Collaboration has become an important 21st century competency for the future workforce [ADDITION]. Collaboration has become an important 21st century skill for the future workforce[ADDITION]. When people collaborate, communication, time management and decision making are some of the skills that are developed through people's interactions. The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data. In this paper, we propose a theoretical approach to make sense of these complex data through a model to analyse collaboration activities, built from concepts in activity-centered design and

**Draft:** 12 to 13

**Feedback message:**

*It looks like you are missing Move 1 – Establishing a research territory (E or B sentences). Here you should show how your research topic is relevant and important by introducing & reviewing previous research on your topic. For example, recent research indicates that the effects of climate change have.... (for more examples head to the resources tab)*

**Feedback impact:** Direct

**Justification:** The participant has added a move 1 sentence – setting up the context.

[1] Collaboration has become an important 21st century competency for the future workforce. [2] When people collaborate, communication, time management and decision making are some of the skills that are developed through people's interactions. [3] There has been a growing interest on nurturing these skills adequately, by making things visible[ADDITION]. The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data. In this paper, we propose a theoretical approach to make sense of these complex data. through a model to analyse collaboration activities. built from concepts in activity-centered design and quantitative

**Draft:** 13 to 14

**Feedback message:**

*It looks like you are missing Move 1 – Establishing a research territory (E or B sentences). Here you should show how your research topic is relevant and important by introducing & reviewing previous research on your topic. For example, recent research indicates that the effects of climate change have.... (for more examples head to the resources tab)*

**Feedback impact:** Direct

**Justification:** The participant has revised the added move 1 sentence.

[1] Collaboration has become an important 21st century competency for the future workforce. [2] When people collaborate, communication, time management and decision making are some of the skills that are developed through people's interactions. [3] There has been a growing interest on nurturing these skills adequately, by providing feedback to students in order to reflect about their collaborative learning[ADDITION]. There has been a growing interest on nurturing these skills adequately, by making things visible[ADDITION]. The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data. In this paper, we propose a theoretical approach to make sense of these complex data. through a model to analyse collaboration

**Draft:** 14 to 15

**Feedback message:**

*It looks like you are missing Move 1 – Establishing a research territory (E or B sentences). Here you should show how your research topic is relevant and important by introducing & reviewing previous research on your topic. For example, recent research indicates that the effects of climate change have.... (for more examples head to the resources tab)*

**Feedback impact:** Direct

**Justification:** The participant has revised the first sentence and added a new move 1 sentence and deleted the previous edit

[1] Collaboration is important for the future workforce, as this has been reported as one of the 21st century competencies [ADDITION]. Collaboration has become an important 21st century competency for the future workforce[ADDITION]. [2] When people collaborate, communication, time management and decision making are some of the skills that are developed through people's interactions. [3] Given that collaboration is a complex task, which prompts multiple interactions through multiple modes, it is difficult to analyse and understand the whole activity at a glance[ADDITION]. There has been a growing interest on nurturing these skills adequately, by providing feedback to students in order to reflect about their collaborative learning[DELETION]. The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data. In this paper, we propose a

**Draft:** 15 to 16

**Feedback message/s:**

*It seems you have stated how your research fills the gap and/or solves the research problem [Move 3 – Occupying the niche (S or N sentences)] before you have indicated the gap and/or explained your research problem [Move 2 Establishing a niche (C or Q sentences)]. It is more effective to indicate the gap and explain the research problem before you state your solution and aim of your study. Aawriter suggests putting Move 3 – Occupying the niche (S or N sentences) after Move 2 Establishing a niche (C or Q sentences).*

*It looks like you are missing Move 1 – Establishing a research territory (E or B sentences). Here you should show how your research topic is relevant and important by introducing & reviewing previous research on your topic. For example, recent research indicates that the effects of climate change have.... (for more examples head to the resources tab)*

**Feedback impact:** Direct

**Justification:** Addition of a move 1 sentence

[1] Collaboration is important for the future workforce, as this has been reported as one of the 21st century competencies. [2] When people collaborate, communication, time management and decision making are some of the skills that are developed through people's interactions. [3] Given that collaboration is a complex task, which prompts multiple interactions through multiple modes, it is difficult to analyse and understand the whole activity at a glance. [4] Previous research have rely on capturing interactions in order to better understand the activity and establish patterns of collaboration[ADDITION]. The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data. In this paper, we propose a theoretical approach to make sense of

**Draft:** 16 to 17

**Feedback message/s:** *It seems you have stated how your research fills the gap and/or solves the research problem [Move 3 – Occupying the niche (S or N sentences)] before you have given background information on your research [Move 1 - Establishing the research territory (E or B sentences)]. It is more effective to state how your research fills the gap or solves the research problem at the end of your introduction, as this is an effective transition into the next section of your paper.*



**Feedback impact:** Directly

**Justification:** Participant is still working on Move 1 move, and has added a move 2 sentence

[1] Collaboration is important for the future workforce, as this has been reported as one of the 21st century competencies. [2] When people collaborate, communication, time management and decision making are some of the skills that are developed through people's interactions. [3] Given that collaboration is a complex task, which prompts multiple interactions through multiple modes, it is difficult to analyse and understand the whole activity at a glance. [4] Previous research have rely on observations to understand, analyse and establish patterns of collaboration [ADDITION] Previous research have rely on capturing interactions in order to better understand the activity and establish patterns of collaboration. [5] However, observers sometimes could miss important things that were impossible to catch only by observations[ADDITION]. The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data. In this paper, we propose a

**Draft:** 17 to 18

**Feedback message/s:** *It seems you have stated how your research fills the gap and/or solves the research problem [Move 3 – Occupying the niche (S or N sentences)] before you have given background information on your research [Move 1 - Establishing the research territory (E or B sentences)]. It is more effective to state how your research fills the gap or solves the research problem at the end of your introduction, as this is an effective transition into the next section of your paper.*

**Feedback impact:** Not addressing message

**Justification:** Participant has made surface changes in move 1 sentence and continues to work on Move 2 sentence.

[1] Collaboration is important for the future workforce, as this has been reported as one of the 21st century competencies. [2] When people collaborate, communication, time management and decision making are some of the skills that are developed through people's interactions. [3] Given that collaboration is a complex task, which prompts multiple interactions through multiple modes, it is difficult to analyse and understand the whole activity at a glance. [4] Previous research have relied on observations to understand, analyse and establish patterns of collaboration[SURFACE REVISION]. Previous research have rely on observations to understand, analyse and establish patterns of collaboration[SURFACE REVISION]. [5] However, observers sometimes could miss important things that were impossible to capture only by observations[ADDITION]. However, observers sometimes could miss important things that were impossible to catch only by observations[ADDITION]. The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild constitute a challenge in the research area to guide future researchers in the analysis

**Comparison from first draft to last draft**

Collaboration is important for the future workforce, as this has been reported as one of the 21st century competencies. When people collaborate, communication, time management and decision making are some of the skills that are developed through people's interactions. Given that collaboration is a complex task, which prompts multiple interactions through multiple modes, it is difficult to analyse and understand

the whole activity at a glance. Previous research have relied on observations to understand, analyse and establish patterns of collaboration. However, observers sometimes could miss important things that were impossible to capture only by observations. The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data. In this paper, we propose a theoretical approach to make sense of these complex data through a model to analyse collaboration activities, built from concepts in activity-centered design and quantitative ethnography, aiming at representing and supporting the meaning-making of collaboration. Furthermore, we illustrate our proposed approach through a simulation-based case study. Further directions on this research will explore the transferability of the approach to other contexts, settings and data.

#### **First Draft**

The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data.

#### **Last draft**

Collaboration is important for the future workforce, as this has been reported as one of the 21st century competencies. When people collaborate, communication, time management and decision making are some of the skills that are developed through people's interactions. Given that collaboration is a complex task, which prompts multiple interactions through multiple modes, it is difficult to analyse and understand the whole activity at a glance. Previous research have relied on observations to understand, analyse and establish patterns of collaboration. However, observers sometimes could miss important things that were impossible to capture only by observations. The difficulty to adequately record group interactions, which are complex due to the multiple modalities of communication (e.g. speech, mobility, gestures), and the technical limitations to capture collaboration in-the-wild, constitute a challenge in the research area to guide future researchers in the analysis of collaboration data. In this paper, we propose a theoretical approach to make sense of these complex data through a model to analyse collaboration activities, built from concepts in activity-centered design and quantitative ethnography, aiming at representing and supporting the meaning-making of collaboration. Furthermore, we illustrate our proposed approach through a simulation-based case study. Further directions on this research will explore the transferability of the approach to other contexts, settings and data.

#### **Result: Draft Improved**

Justification: Participant has added more information to the text. The participant has all three moves

## Appendix G: Post Survey Questions Iteration 2<sup>27</sup>

### Post Workshop Survey

This survey is to be completed after the HDR AcaWriter workshop.  
There are 24 questions in this survey

### Post Intervention Survey

What is your student ID? \*

Please write your answer here:

Name: \*

Please write your answer here:

AcaWriter helped me learn rhetorical moves \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree  
 Disagree  
 Undecided  
 Agree  
 Strongly Agree

My Introduction or Abstract (depending on the workshop you attended) writing skills improved after using AcaWriter \*

Choose one of the following answers

Please choose only one of the following:

- Strong Disagree  
 Disagree  
 Undecided

- Never  
 Sometimes  
 Mostly  
 Always

I agreed with AcaWriter's feedback (highlighting and feedback messages) \*

\*

Choose one of the following answers

Please choose only one of the following:

- Never  
 Sometimes  
 Mostly  
 Always

I understood the feedback that was provided by AcaWriter \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Agree  
 Agree  
 Undecided  
 Disagree  
 Strongly Disagree

The feedback messages helped me think about what I wanted to express and how to better express my ideas \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree  
 Disagree  
 Undecided  
 Agree  
 Strongly Agree

I took on board AcaWriter's feedback when I revised my draft \*

Choose one of the following answers

- Agree  
 Strongly Agree

The highlighting of the moves helped me think about the meaning that I wanted to express \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree  
 Disagree  
 Undecided  
 Agree  
 Strongly Agree

When I reviewed my draft using AcaWriter, the move that I meant to express (e.g. Move 1 or Move 2) was highlighted by a different colour. \*

Choose one of the following answers

Please choose only one of the following:

- Never  
 Sometimes  
 Mostly  
 Always

AcaWriter's highlighting selected the correct move (e.g. Move 1, Move 2) \*

Choose one of the following answers

Please choose only one of the following:

- Never  
 Sometimes  
 Mostly  
 Always

I disagreed with AcaWriter's feedback (highlighting and feedback messages) \*

\*

Choose one of the following answers

Please choose only one of the following:

Please choose only one of the following:

- Strongly disagree  
 Disagree  
 Undecided  
 Agree  
 Strongly Agree

AcaWriter's highlighting of the moves was useful \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree  
 Disagree  
 Undecided  
 Agree  
 Strongly Agree

AcaWriter's feedback messages were useful \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree  
 Disagree  
 Undecided  
 Agree  
 Strongly Agree

Revising my draft with AcaWriter helped me improve my Introduction and/or Abstract writing skills \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree  
 Disagree  
 Undecided  
 Agree  
 Strongly Agree

AcaWriter made me revise my writing and write more drafts \*

<sup>27</sup> Note there is an error with question *I understood the feedback provided by AcaWriter*. Due to this error this question was not reported on.

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree
- Disagree
- Undecided
- Agree
- Strongly Agree

I enjoyed using AcaWriter \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree
- Disagree
- Undecided
- Agree
- Strongly Agree

I was frustrated with AcaWriter sometimes \*

Choose one of the following answers

Please choose only one of the following:

- Never
- Sometimes
- Mostly
- Always

AcaWriter has helped me to identify rhetorical moves

\*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree
- Disagree
- Undecided
- Agree
- Strongly Agree

I think AcaWriter is a useful tool to improve research writing skills \*

How could AcaWriter be improved to support Higher Degree Research writing?

\*

Please write your answer here:

Thank you for taking part in this research.  
11-06-2021 – 23:51

Submit your survey.  
Thank you for completing this survey.

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree
- Disagree
- Undecided
- Agree
- Strongly Agree

I would use AcaWriter to help me write other sections of a research article or thesis, e.g. discussion, conclusion?

\*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree
- Disagree
- Undecided
- Agree
- Strongly Agree

What strategies did you use when interacting with / using AcaWriter?

\*

Please write your answer here:

What specific features of AcaWriter did you find beneficial? Why?

\*

Please write your answer here:

## Appendix H: Interview Schedule Iterations 2 and 3

### **INTERVIEW SCHEDULE – HDR STUDENTS – POST INTERVENTION**

Check that participants have:

- signed voluntary consent
- agreed to be audio-taped (interview)
- read the information sheet
- any questions before interview starts

Interview script:

*This interview will be audio recorded. Your responses will be de-identified and then transcribed for analysis. If you decide after the interview that you would like to retract your comment/s, please inform the researcher within one week from the interview date.*

#### **Questions**

Before coming to the workshop did you know what Rhetorical moves were?

What is your understanding of rhetorical moves now?

Did learning the moves help you read/review research articles?

Did you find that you learned rhetorical moves through the learning activities? (learning design) If so, what features of the learning activities helped you learn the moves?

Did AcaWriter help you focus on rhetorical moves? If so, how?

What features of AcaWriter made you focus on them?

Did AcaWriter help you learn the moves? If so, how?

What helped you learn the moves the most? Why?

Do you think you can apply this knowledge (rhetorical moves) to your writing now? How? Why?

Did AcaWriter prompt you to think about certain features of the moves that you might not have thought about before? If so what? And how?

Do you think AcaWriter helped you to think about how you were expressing the moves in your introduction?

Did AcaWriter change your writing process, vs how you approached writing before? E.g. did you submit your draft for feedback multiple times? Did it get you to think about your writing?

Did revising and submitting help you improve your draft? If so, how? And, why?

Did you use the feedback tab?

Did the feedback influence your revision process or strategies? How?

What did you do when the highlighting did not appear when you expected it to, or if it highlighted your sentences a different colour than you expected?

Did the feedback help you better express what you wanted to say?

What did you like about the feedback?

What did you dislike about the feedback?

What other kinds of feedback do you think would be helpful?

Did you use the resources, under the resources tab?

Do you think you improved your skill of research writing after attending the workshop/completing the course and using AWA? How? Why?

Did AcaWriter overall make you think more about your writing and your expression?

Would you use AcaWriter again? When? Why?

Did AcaWriter influence /change the way you usually go about writing?

How would you define good writing?

## Appendix I: Post Survey Questions Iteration 3<sup>28</sup>

### Post Workshop Survey Abstracts GRS Summer School

Thank you for taking part in the Abstract writing workshop piloting AcaWriter. This survey is to be completed at the end of the GRS Abstract workshop. Your input is extremely valuable.

There are 25 questions in this survey

### Post Intervention Survey

What is your student ID? \*

Please write your answer here:

Name: \*

Please write your answer here:

AcaWriter helped me learn rhetorical moves \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree  
 Disagree  
 Undecided  
 Agree  
 Strongly Agree

My Abstract writing skills improved after using AcaWriter \*

Choose one of the following answers

Please choose only one of the following:

Please choose only one of the following:

- Never  
 Sometimes  
 Mostly  
 Always

I agreed with AcaWriter's feedback (highlighting and feedback messages) \*

Choose one of the following answers

Please choose only one of the following:

- Never  
 Sometimes  
 Mostly  
 Always

The feedback messages helped me think about what I wanted to express and how to better express my ideas \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree  
 Disagree  
 Undecided  
 Agree  
 Strongly Agree

I took on board AcaWriter's feedback when I revised my draft \*

Choose one of the following answers

Please choose only one of the following:

- Strongly disagree  
 Disagree  
 Undecided  
 Agree  
 Strongly Agree

AcaWriter's highlighting of the moves was useful \*

Choose one of the following answers

- Strongly Disagree  
 Disagree  
 Undecided  
 Agree  
 Strongly Agree

The highlighting of the moves helped me think about the meaning that I wanted to express \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree  
 Disagree  
 Undecided  
 Agree  
 Strongly Agree

When I reviewed my draft using AcaWriter, the move that I meant to express (e.g. Move 1 or Move 2) was highlighted by a different colour. \*

Choose one of the following answers

Please choose only one of the following:

- Never  
 Sometimes  
 Mostly  
 Always

AcaWriter's highlighting selected the correct move (e.g. Move 1, Move 2) \*

Choose one of the following answers

Please choose only one of the following:

- Never  
 Sometimes  
 Mostly  
 Always

I disagreed with AcaWriter's feedback (highlighting and feedback messages) \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree  
 Disagree  
 Undecided  
 Agree  
 Strongly Agree

AcaWriter's feedback messages were useful \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree  
 Disagree  
 Undecided  
 Agree  
 Strongly Agree

Revising my draft with AcaWriter helped me improve my Abstract writing skills \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree  
 Disagree  
 Undecided  
 Agree  
 Strongly Agree

AcaWriter made me revise my writing \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree  
 Disagree  
 Undecided  
 Agree  
 Strongly Agree

AcaWriter made me write more drafts \*

Choose one of the following answers

Please choose only one of the following:

<sup>28</sup> The question AcaWriter's highlighting selected the correct move (e.g. Move 1, Move 2) was not reported on as in this iteration the abstract moves were not described as Move 1, Move 2, Move 3.

- Strongly Disagree
- Disagree
- Undecided
- Agree
- Strongly Agree

I enjoyed using AcaWriter \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree
- Disagree
- Undecided
- Agree
- Strongly Agree

I was frustrated with AcaWriter sometimes \*

Choose one of the following answers

Please choose only one of the following:

- Never
- Sometimes
- Mostly
- Always

AcaWriter has helped me to identify rhetorical moves \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree
- Disagree
- Undecided
- Agree
- Strongly Agree

I think AcaWriter is a useful tool to improve research writing skills \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree

- Disagree
- Undecided
- Agree
- Strongly Agree

I would use AcaWriter to help me write other sections of a research article or thesis, e.g. discussion, conclusion \*

Choose one of the following answers

Please choose only one of the following:

- Strongly Disagree
- Disagree
- Undecided
- Agree
- Strongly Agree

What strategies did you use when interacting with / using AcaWriter?

\*  
Please write your answer here:

What specific features of AcaWriter did you find beneficial? Why? \*

Please write your answer here:

How could AcaWriter be improved to support Higher Degree Research writing? \*

Please write your answer here:



## Appendix J: Post Intervention Questions Iteration 4 (feedback about the online course)

\* Are you a:

- PhD student  
 Masters by research student  
 Staff member  
 Other

If you're a staff member please state your position.

1 / 2

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\* Please rank the following statements about the online course that you have completed.

Compared to attending a traditional face to face (f2f) workshop (e.g. a 2 hour mix of lecture and exercises), this online course:

	1 This describes the online course best	2	3 This describes the online and f2f equally	4	5 This describes f2f best
is more convenient to take	<input checked="" type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
provides me with high quality support when I need it	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
teaches me more effectively about writing abstracts	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
is a more engaging experience	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5
is a way of learning I'd be likely to participate in again	<input type="radio"/> 1	<input type="radio"/> 2	<input type="radio"/> 3	<input type="radio"/> 4	<input type="radio"/> 5

Comments give us real insights into your experience, so we'd welcome a few notes explaining your responses:

• My learning experience

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
My abstract writing skills have improved from completing this course	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I learned new skills and knowledge after completing this course	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would recommend this course to other students	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

- Did this course help you improve your knowledge and skills of abstract writing? Please explain why it did or didn't help you:

- Which activities did you find most useful in this course?

- Would you welcome online writing courses about any other aspects of writing?

Can we contact you to participate in a 20 minute interview? (By phone or online) If yes, please provide your email address:

No

Yes, please provide your email address.

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Submit

## Appendix K: Post Intervention Survey Questions Iteration 4 (feedback about AcaWriter)

\* Are you a:

- PhD student  
 Masters by research student  
 Staff member  
 Other

If you're a staff member please state your position

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The following questions are about your learning experience with AcaWriter.

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
AcaWriter helped me learn the moves	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
My abstract writing skills improved after using AcaWriter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The highlighting of the moves helped me think about the meaning that I wanted to express	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

The following questions are about AcaWriter feedback.

	Never	Sometimes	Mostly	Always
When I reviewed my draft using AcaWriter, the move that I meant to express was highlighted by a different colour to what I expected	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
AcaWriter's highlighting selected the correct move	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I disagreed with AcaWriter's feedback (both highlighting and feedback messages)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I agreed with AcaWriter's feedback (both the highlighting and feedback messages)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

	Strongly Disagree	Disagree	Undecided	Agree	Strongly Agree
I understood the feedback that was provided by AcaWriter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
The feedback messages helped me think about what I wanted to express and how to better express my ideas	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I took on board AcaWriter's feedback when I revised my draft	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
AcaWriter's highlighting of the moves was useful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
AcaWriter's feedback messages were useful	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Revising my draft with AcaWriter helped me improve my abstract writing skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
AcaWriter made me revise my writing	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Using AcaWriter led me to redraft more than I normally would	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I enjoyed using AcaWriter	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I was frustrated with AcaWriter sometimes	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
AcaWriter has helped me to identify the moves in an abstract	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I think AcaWriter is a useful tool to improve research writing skills	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
I would use AcaWriter to help me write other sections of research article or thesis, e.g. discussion, conclusion?	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

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What strategies (reviewing, critical thinking, revising) did you use when interacting with AcaWriter?

What specific features of AcaWriter did you find beneficial, and why?

How could AcaWriter be improved to support Higher Degree Research writing?

Can we contact you to participate in a 20 minute interview? (By phone or online) If yes, please provide your email address.

- No
- Yes, please provide your email address.

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[Submit](#)