

# **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.