# Augmenting Pedagogic Writing Practice with Contextualizable Learning Analytics

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# Certificate of Original Authorship

I, Antonette Aileen Shibani Michael Xavier declare that this thesis, is submitted in fulfilment of the requirements for the award of Doctor of Philosophy, in the Connected Intelligence Centre 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.

This research is supported by the Australian Government Research Training Program.

Signature: Shibani

Date: 16/10/2019

Dedicated to my parents

Prof. Dr. Leema Rose, my darling mother and confidante, who taught me kindness, hard work, and gratitude towards all things in life.

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# Preface

The following peer-reviewed publications produced during the PhD candidature contribute to my thesis.

**Journal Papers**

- **Antonette Shibani**, Simon Knight, and Simon Buckingham Shum (Under review) Educator Perspectives on Learning Analytics in Classroom Practice.
- Simon Knight, **Antonette Shibani**, Sophie Abel, Andrew Gibson, Philippa Ryan, Nicole Sutton, Raechel Wight, Cherie Lucas, Ágnes Sándor, Kirsty Kitto, Ming Liu, Radhika Vijay Mogarkar, and Simon Buckingham Shum (Under review) AcaWriter: A Learning Analytics Tool for Formative Feedback on Academic Writing.
- Simon Knight, Andrew Gibson, and **Antonette Shibani** (Under review) Implementing Learning Analytics for Learning Impact: Taking Tools to Task.

**Conference Proceedings**

- Antonette Shibani (Under review). Automated Revision Graphs: A novel visualization method to study written text as graph.
- **Antonette Shibani**, Simon Knight and Simon Buckingham Shum (2019). Contextualizable Learning Analytics Design: A Generic Model and Writing Analytics Evaluations. In Proceedings of the International Conference on Learning Analytics and Knowledge (LAK'19), Tempe, Arizona. ACM. https://doi.org/10.1145/3303772.3303785
- Simon Knight, **Antonette Shibani** and Simon Buckingham Shum (2018). Augmenting Formative Writing Assessment with Learning Analytics: A Design Abstraction Approach. Full Paper presented at the 13th International Conference of Learning Sciences (ICLS'18), Festival of Learning cross-over track, London.
- **Antonette Shibani**, Simon Knight and Simon Buckingham Shum (2018). Understanding Revisions in Student Writing through Revision Graphs. Poster presented at the 19th International Conference on Artificial Intelligence in Education (AIED'18), London.

- **Antonette Shibani** (2018). Developing a Learning Analytics Intervention Design and tool for Writing Instruction. In Companion Proceedings of the Eighth International Conference on Learning Analytics & Knowledge (LAK '18), Sydney, Australia
- **Antonette Shibani** (2018). AWA-Tutor: A Platform to Ground Automated Writing Feedback in Robust Learning Design (Demo). In Companion Proceedings of the Eighth International Conference on Learning Analytics & Knowledge (LAK '18), Sydney, Australia.
- **Antonette Shibani** (2017). Combining automated and peer feedback for effective learning design in writing practices. In DSC Proceedings of the 25th International Conference on Computers in Education, New Zealand
- **Antonette Shibani**, Simon Knight, Simon Buckingham Shum and Philippa Ryan (2017). Design and Implementation of a Pedagogic Intervention Using Writing Analytics. In Proceedings of the 25th International Conference on Computers in Education. New Zealand: Asia-Pacific Society for Computers in Education

**Workshops**

- **Antonette Shibani**, Ming Liu, Christian Rapp and Simon Knight (2019). Advances in Writing Analytics: Mapping the state of the field. Workshop chaired at the Ninth International Conference on Learning Analytics & Knowledge LAK'19, Tempe, Arizona.
- Ming Liu, Simon Knight, **Antonette Shibani** and Sophie Abel (2018, November). From features to feedback: Designing automated feedback for student writing. Workshop chaired in ALASI'18, Melbourne.
- **Antonette Shibani**, Sophie Abel, Andrew Gibson and Simon Knight (2018, March). Turning the TAP on Writing Analytics. Workshop chaired in the Eighth International Conference on Learning Analytics & Knowledge, Sydney.
- Andrew Gibson, **Antonette Shibani** and Sophie Abel (2017, November). An Introduction to Text Analysis for Learning Analytics. Workshop chaired in the Australian Learning Analytics Summer Institute ALASI'17, Brisbane.

## Sources & Original Work

The thesis draws from original material of my own work in the publications listed above, to which I retain copyright permissions as an author of the work. Such prior publications when used in the thesis are explicitly cited where appropriate, and are not used in entirety. Publications of external authors are credited throughout the thesis with citations in text and references at the end of the thesis. Figures from external sources where authors granted permission for usage are cited in their captions.

## Ethics

The research designs in the study are approved by the University of Technology Sydney's Human Research Ethics Committee, and are based on ETH16-675: Academic Essay Self-Assessment Project (AESA Project). The ethics applications subsequently revised for the studies in the thesis have the protocol numbers ETH17-1176, ETH18-2263, ETH18-3080, and ETH19-3475. The most recent participant information sheets and consent forms can be requested by email[1].

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# List of Resources

Several resources have been produced as part of this thesis, which are publicly available (Check individual resource for copyright details).

**Videos:**

- AWA-Tutor demo: https://www.youtube.com/watch?v=K212XabCL5w
- AcaWriter demo: https://www.youtube.com/watch?v=P8_WuzQUs8s
- Introductory videos by the Law instructor: https://www.youtube.com/watch?list=PLcS9QDvS_uS6V-KknW098LQ5ru4wftgJ5&v=zUBcEJABCB0
- Introductory video by the Accounting instructor: https://www.youtube.com/watch?v=yAfu1fWNCNg

**User Guides**

- Appendix A: Hand out on rhetorical moves provided to Law students
- Appendix B: Self-Evaluation Exercise (SEE) prompts for rhetorical moves using AcaWriter
- Learning Design for Law (Includes a downloadable guide for students): http://heta.io/resources/wawa-improve-sample-text-plus-peer-discussion-civil-law/
- Learning Design for Accounting (Includes a downloadable guide for students): http://heta.io/resources/wawa-improve-business-report-writing-accounting/

**Questionnaires**

Appendix C: Instructor Interview Guide

Appendix D: Tutor Feedback Questionnaire

# Abbreviations

AES – Automated Essay Scoring

AI – Artificial intelligence

API – Application programming interface

AWA – Academic Writing Analytics (Tool)

AWE – Automated Writing Evaluation

AZ – Argumentative Zoning

CARS – Create a Research Space (Model)

CLAD – Contextualizable Learning Analytics Design

DBR – Design Based Research

EAP – English for Academic Purposes

ECD – Evidence Centred Design

EFL – English as a Foreign Language

ICT – Information and Communication Technology

ITS – Intelligent Tutoring Systems

LA – Learning Analytics

LD – Learning Design

NLP – Natural Language Processing

OECD – Organisation for Economic Co-operation and Development

RQ – Research Question

TAP – Text Analytics Pipeline

TEL – Technology Enhanced Learning

UI – User Interface

WA – Writing Analytics

XIP – Xerox Incremental Parser

# Abstract

Academic writing is a key skill that contributes to essential learning outcomes for higher education students. Despite its importance, students often lack proficiency in writing and find it challenging to learn. While previous research suggests that students' writing skills are enhanced through formative feedback, the time-consuming nature of providing formative feedback on individual student drafts, especially in large cohorts, makes it impractical for educators to provide detailed writing support in this way. A promising approach, therefore, is the use of *writing analytics* to provide automated formative feedback on writing. This particular form of *learning analytics*, using computational techniques and natural language processing, provides timely, immediate, and consistent automated feedback to help students improve their writing. However, for such tools to work effectively in pedagogic settings, and be adopted by practitioners, academics need to feel a sense of ownership over how the tool fits into their practice. This recognition motivates an increased emphasis on aligning learning analytics applications with learning design, so that analytics-driven feedback is congruent with the pedagogy and assessment regime.

The thesis investigates how writing practice can be augmented with a writing analytics tool called 'AcaWriter' by aligning it with learning design. The approach is evaluated across two disciplines in authentic higher educational settings using a design-based research approach. Mixed methods and multiple data sources are used to examine how students perceive and interact with automated feedback, and revise their writing. Based on this analysis, the thesis provides empirical evidence that students found the writing intervention and automated feedback from AcaWriter useful, and improved their subject-related writing skills, thus validating its applicability in writing contexts. It identifies varied levels of student engagement with automated feedback and ways to scaffold its application for effective use. Cross-fertilizing research and practice, the key insights gained from these design iterations are formalised as the *Contextualizable Learning Analytics Design* model. The model clarifies how the features, feedback and learning activities around AcaWriter can be tuned for different pedagogical contexts and assessment regimes, by co-designing them

with educators. The thesis also studies the perspectives of educators, who play a key role in implementing such learning analytics innovations in their classrooms. The thesis advances theory and practice in the development of flexible learning analytics applications, capable of providing meaningful, contextualized support that enhances learning, and adoption by practitioners in authentic practice.