Investigating Teachers' Technology Use to Enhance Student Understanding of Algebra

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I certify that the substance of this thesis has not already been submitted for any degree and is not currently being submitted for any other degree or qualification.

I certify that any help received in preparing this thesis and all sources used have been acknowledged in this thesis.

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ABSTRACT

In Australia, as in other countries, algebra occupies a central role in school mathematics. Like other mainstream mathematics programs, algebra is affected by the growing presence of digital tools in schools. Not only do technological tools change the nature of the tasks that are presented to students, they change the nature of the teaching as well. To take advantage of the potential of technology to enhance students' understanding of algebra requires not only tasks that are designed to push them beyond the limits of their current algebraic thinking and encourage further development of that thinking, but also approaches to teaching that facilitate such growth in students. Using a case study approach, teachers' use of digital tools was investigated with a view to enhancing students' understanding of algebra in secondary schools in New South Wales, Australia. In particular, teachers' roles, approaches, reasons for those approaches and ways to overcome any shortcomings were examined.

A number of findings emerged from the study. Firstly, the participants viewed their role as that of 'facilitators' in a digital technology-enabled algebra classroom. To enhance students understanding of algebra concepts in technology-enabled lessons, there is a need to further analyse and lift the quality of this 'facilitator' role by addressing teachers' pedagogical technology knowledge in relation to their roles as: allocator of time, catalyst, evaluator of student learning, explainer, manager, planner and conductor of classroom activities, a resource, a task setter, and a technical assistant. Secondly, respondents used particular tools in algebra because they found them convenient to use (easy to use, easily

accessible) or on the recommendation of peers or a faculty coordinator. These issues need to be taken advantage of at the school level to improve digital tool use in algebra. Finally, all the respondents supported the use of training in technology integration in algebra at professional development workshops to address weaknesses in teachers' skills and show them how to address their concerns in relation to the integration of digital technology in algebra. The study can serve as a base for other larger studies aimed at statistical generalisation in relation to these findings.

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ACRONYMS

ACARA	Australian Curriculum and Reporting Authority
ASRMI	Availability of School Resources for Mathematics Index
B.Ed	Bachelor of Education
CAS	Computer Algebra Systems
CBAM	Concerns-Based Adoption Model
CSO	Catholic Schools Office
DET	Department of Education and Training
EMAT	Teaching Mathematics with Technology
GTG	Generational Transformational Global/Meta-Level
ICT	Information and Communication Technologies
KLA	Key Learning Area
PCK	Pedagogical Content Knowledge
PTK	Pedagogical Technology Knowledge
PME	Psychology of Mathematics Education
SCAN	Systematic Classroom Analysis Notation
TI	Texas Instruments
TIMSS	Trends in International Mathematics and Science Study
UNE	University of New England
ZFM	Zone of Free Movement
ZPA	Zone of Promoted Action
ZPD	Zone of Proximal Development
WBBB	White Box-Black Box