UNIVERSITY
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Secondary mathematics education in the age of STEM: Tensions and possibilities for policy and practice in NSW.

by Jane Leigh Martin

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University of Technology Sydney
Faculty of Arts and Social Science

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CERTIFICATE OF ORIGINAL AUTHORSHIP

I, J*ane Leigh Martin,* declare that this thesis, is submitted in fulfilment of the requirements for the award of *DOCTOR OF PHILOSOPHY*, in the *SCHOOL OF EDUCATION, FACULTY OF ARTS AND SOCIAL SCIENCES* 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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Signature: Production Note: Signature removed prior to publication.

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Abstract

Models of integrated learning are commonly promoted in STEM education policies worldwide. The role of mathematics appears to sit uneasily in these models, with mathematical learning generally limited to process-driven applications offering little scope for conceptual development. With improvement in the mathematics achievement and ambition of secondary students fundamental to STEM education policies, an emerging research literature has questioned this ambiguous role of mathematics in integrated STEM. Focusing explicitly on mathematics, this study explores this tension by investigating the landscape of STEM education in NSW secondary schools that developed pursuant to the introduction of strategies promoting integrated STEM.

Using a mixed methods approach, insights into the perspectives, understandings and experiences of major stakeholders involved in secondary mathematics education – teachers, regulators, tertiary educators and external STEM providers and advisors - were gained by interviews, a web survey and document analysis. Analysis confirmed findings from previous research, including a confused understanding of integrated STEM education in the secondary school environment and a focus on technology or science in implemented programs. Mathematics content in integrated STEM was limited in quantity and scope and curriculum documents difficult to align and reconcile. Rejecting a 'teacher deficit' explanation of implementation challenges, this study questions the implementation assumptions of integrated STEM models, exposing vulnerabilities suggesting that they are ill-suited to discipline-specific education structures and do not represent sustainable models of change for secondary mathematics education. Further, the widespread finding that mathematics is trivialised in integrated STEM indicates that, on cost-benefit and epistemological bases, popular conceptions of integrated STEM may be inadequate to support a robust learning of mathematics. Nevertheless, although disillusioned with the role assigned to mathematics in integrated STEM, mathematics teachers recognised the benefits of the connected learning approach of STEM and sought to develop these approaches for mathematics within the mathematics classroom.

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