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# **'Technologists' Alongside: Impact on Student Understandings in Technology**

A thesis submitted in partial fulfilment  
of the requirements for the degree of Master of Education

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## ABSTRACT

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This research focuses on ascertaining the impact of technologists working alongside students; in particular the influence their involvement has on their understandings *of* and *about* Technology.

The research was conducted within an interpretive paradigm. Quantitative and qualitative data were gathered using a mixed methods approach which consisted of a written questionnaire, followed by purposive interviews. The participants in the study were students in years 11 and 12 in 2005. Data from these participants were also gathered in 2006.

The research findings identified that when students work alongside a technologist(s) to resolve problems embedded within real-life contexts, their concepts of technology and its purpose are enhanced. These findings also highlighted the importance of ensuring that student learning intentions (those learning outcomes which are planned) are shared between all parties involved in the learning environment (teachers, practicing technologists and students), so that interactions between students and technologists have a positive influence on student learning.

This research concludes that the involvement of practicing technologists, in student learning in technology education, offers the potential to enhance student's technological practice and their learning in technology generally.

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# CHAPTER ONE

## INTRODUCTION

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### 1.1 Overview of the Chapter

This chapter provides an introduction and background to the research report. Section 1.2 introduces the context in which this research was conducted. The section includes a brief overview of the New Zealand school structure and the history of technology education in senior secondary school. An overview of the technology curriculum, *Technology in the New Zealand Curriculum* [TiNZC] (Ministry of Education, 1995) is presented alongside recent developments for this curriculum. Qualifications for technology in senior secondary (years 11-13) and two projects that are currently supporting the delivery of technology education in New Zealand schools, *Futureintech* and *Growth and Innovation Framework (GIF) - Technology Education* initiative are also presented. Section 1.3 presents a rationale for the research, Section 1.4 the research questions, and Section 1.5 provides an overview of the thesis structure and a discussion on the potential significance of this research.

### 1.2 Context of this Research

Technology in the New Zealand Curriculum (Ministry of Education, 1995) is now in its tenth year of being offered as a compulsory part of the school curriculum for all students in years 1-10, in New Zealand primary, intermediate and secondary schools.

#### *The New Zealand Secondary School*

Secondary schools were established in New Zealand to educate students from school years 9-13<sup>1</sup>. In rural communities and schools of special character (for

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<sup>1</sup> New Zealand children begin their compulsory education at age 5. Prior to this they may enrol in Early Childhood Education Centres (ECEC). Children usually enrol in ECEC from age 3.

example private schools, schools based on religious grounds) secondary schools may also include students in years 7-8.

Up to and including year 10, secondary school students receive a compulsory core curriculum, defined by the New Zealand Curriculum Framework (Ministry of Education, 1993a). This includes study in each of the seven Essential Learning Areas – English and Languages, Social Studies, Science, Technology, Mathematics, The Arts, Physical Education and Health. From years 11-13 secondary schools offer a variety of specialist focused subjects to prepare students for ongoing tertiary education and/or entry into the workplace.

Senior secondary students (years 11-13) are provided access to qualifications listed on the New Zealand Qualifications Framework<sup>2</sup> (NZQF). The NZQF was introduced to provide a “system for organizing and understanding the relationships between, and purposes of, qualifications across the education sector” (Ministry of Education, 1999, p.4). As such, the NZQF offers a ‘seamless’ opportunity for New Zealanders to be awarded qualifications, in secondary schools and in post-school education and training.

The New Zealand Qualifications Authority (NZQA), a government department that is independent of the Ministry of Education (MoE), administers the NZQF. The qualifications on the NZQF specifically available for secondary school students include the National Certificate in Education (NCEA) at Level 1, 2 and 3, and Scholarship. Students access these qualifications by either demonstrating competency against: ‘achievement standards’ and/or ‘unit standards’.

### *Technology in Secondary Schools*

In 1999, *Technology in the New Zealand Curriculum* (Ministry of Education, 1995) was gazetted as a compulsory learning area in New Zealand’s national curriculum for all students from years 1-10 and as an optional subject for study in senior secondary school (years 11-13). The aim of technology education as identified in

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<sup>2</sup> The NZQF is comprised of 10 levels – Level 1 is the least complex and Level 10 the most. Levels 1-3 are standards expected of senior secondary education and basic trades training. Levels 4 - 6 approximate to advanced trades, technical and business qualifications. Levels 7 and above approximate to advanced qualifications of graduate and postgraduate standard.

the TiNZC (Ministry of Education, 1995) is to enable students to achieve technological literacy through development of:

- *technological knowledge and understanding;*
- *technological capability;*
- *understanding and awareness of the relationship between technology and society.*

Prior to 2002, the majority of teachers of senior secondary students resisted introducing technology into school curricula, due to there being no qualifications available within general education to credential students for their achievements in technology (Harwood, 2002; Mawson, 1998). This situation was addressed when technology achievement standards were registered on the NZQF and became available for examination in 2002.

TiNZC (Ministry of Education, 1995) is currently being reviewed under the New Zealand Curriculum and Marautanga<sup>3</sup> Project (*NZCMP*). This project is reviewing all compulsory and optional curricula taught in New Zealand schools. The latest draft of the Technology Curriculum Learning Area Introduction<sup>4</sup> (2006) has reframed the 1995 technology strands into three interrelated but distinct strands - understanding the *Nature of Technology*, *Developing Technological Knowledge* and understanding and undertaking *Technological Practice* (Ministry of Education, 2006). The intent of these strands is to allow students to develop a broad technological literacy that enables them to “participate as informed citizens” (Ministry of Education, 2005, p.1).

To provide senior secondary students (years 11-13) access to NCEA qualifications, Level 1-3 technology achievement standards were implemented beginning 2002<sup>5</sup>. A number of the level 2 and 3 achievement standards require students to analyse the technological practice of a professional technologist(s) as a means to informing the

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<sup>3</sup> *Marautanga* is the māori name for the Curriculum Framework that umbrellas the Essential Learning Areas written in Te Reo Māori – New Zealand's indigenous language.

<sup>4</sup> The New Zealand Curriculum Project aims to reframe, refocus and revitalise the New Zealand curriculum by clarify what's important for student to learn in the Essential Learning Areas, placing importance on quality teaching, promoting flexible approaches to curriculum and explaining the curriculum to parents. The project aims to implement its revised curriculum in 2007.

<sup>5</sup> Level 1 – 2002  
Level 2 – 2003  
Level 3 and scholarship - 2004

development of their own technological outcome(s). They also ask students to analyse technological products developed by professional technologists and the production processes used for their manufacture.

### *Projects supporting Technology Education*

Two initiatives, *Futureintech* and *Growth and Innovation Framework – Technology Education Initiative* (GIF- TEI) have recently been introduced in New Zealand. An expected outcome of Futureintech is to assist and support teachers (and students) to create and maintain links between students and practicing technologists. The GIF – TEI aims to enhance student learning in technology by augmenting teacher practice. One identified mechanism for doing this is to increase the participation of practicing technologists, from the business and the tertiary sectors, in student learning in technology.

Futureintech (FiT) is an initiative of the Institution of Professional Engineers New Zealand (IPENZ). It was instigated in 2003 with funding from the New Zealand Trade and Enterprise (NZTE). The NZTE has guaranteed funding for FiT to 2009. Futureintech employs facilitators that assist teachers to establish and maintain industry links with their teaching programmes. The GIF – TEI was launched in April 2005. The Growth and Innovation Framework (GIF), a fund administered by the Ministry of Economic Development, provided the backing for this project. The Beacon Practice- Technology (BPT) project is the largest project to date to come out of the GIF TEI. This project has identified a group of teachers who have consistently provided opportunity for, or have the potential to allow, students to demonstrate ‘best practice’ in technology. Teachers in this initiative are provided with facilitated professional development, with an expectation that material will be made available to develop into resources and disseminate to all teachers of technology. I am currently contracted by the New Zealand Ministry of Education to provide facilitator support for teachers involved in the BPT project. A focus of this support is to assist teachers to establish links between practicing technologists and their programmes of learning in technology.

### 1.3 Rationale for this Research

The idea that students' educational outcomes are enhanced when an expert works alongside them is not new. Learning theories such as Anchored Instruction (Vygotsky, 1978), Apprenticeship Model (Rogoff, 1990) and Expert Knowledge Theory (Bereiter, 1992) advocate that modelling by and interaction with experienced practitioners is key to student learning. The TiNZC (Ministry of Education, 1995) statement (see Section 1.2.2) suggests that student learning in technology is benefited when students are provided with an opportunity to work in authentic contexts, by working with communities of technological practice outside of education. Compton and Jones (1998) and Jones and Carr (1993) support this suggestion when they recommend that teachers need to offer students an opportunity to work in authentic contexts in order to experience practices that lead to the development of technological outcomes. Technology achievement standards at Level 3 of the NCEA, registered on the NZCF in 2006, examine the knowledge students attain from analysing the practices of professional technologist. These standards were written to align with TiNZC (Ministry of Education, 1995) and the belief that it is beneficial to have students working with communities of technological practice outside of education.

While providing students with access to practicing technologists has generally been accepted within the technology education community, there is no New Zealand classroom based research that validates this as being beneficial to the development of students understandings *of* or *about* technology. There is also no international classroom based research available that supports this belief.

This research sets out to specifically identify what impact, if any, practicing technologists have on students' understanding of technology and technology education when they work alongside students to resolve 'authentic' issues. The findings of this research will be of interest to projects involved in establishing educational partnerships between practicing technologists and students, which aim to enhance learning opportunities for students in technology. Findings from the research will also be available to inform future planning and policy making for the delivery and assessment of technology at senior secondary school by the MoE and the NZQA, as well as offer a contribution to the international literature on

technology education. These findings may also be of assistance to teachers in helping them to make informed decisions about involving practicing technologists in their planning of technology programme(s) and/or its delivery.

No research has been conducted to date that refutes or supports that having practicing technologists participating in student learning in technology is beneficial to their overall learning in technology. This study therefore seeks to address this gap in the literature.

## 1.4 Research Aim and Questions

The overall aim of this research is to determine if there is an impact on student understandings *of* and *about* technology when practicing technologist(s) are provided opportunity to work alongside them. The research questions were:

1. what are the initial understanding(s) of technology held by senior secondary school students?
2. what are the initial understanding(s) of the purpose of technology education held by senior secondary school students?
3. do these understandings change after students undertake a programme in technology that involves the participation of a practicing technologist(s)?

## 1.5 Structure of the Research Report

This chapter (*Chapter One*) provided an introduction and background to the research and introduced the aim and objectives of the research.

*Chapter Two* provides a review of relevant literature upon which this research is based. This literature review presents an overview of Technology Education in the New Zealand Curriculum (Ministry of Education, 1995) and current initiatives that have been introduced to support its delivery. It also considers international and New Zealand research conducted on student understandings/concepts of technology and technology education. The chapter concludes with a brief review of the literature on the learning theories; Anchored Instruction (Vygotsky, 1978),

Apprenticeship Model (Rogoff, 1990) and Expert Knowledge Theory (Bereiter, 1992).

*Chapter Three* explores the literature concerning methodological approaches and research methods in educational research. This literature establishes a methodological framework for the study. The chapter concludes with a description and justification of the methods used in this research, an overview of the participants and discusses the ethical considerations that underpin the research.

*Chapter Four* presents the research findings obtained from 27 senior secondary school student research participants on their initial understanding(s) of technology and technology education. Both quantitative and qualitative findings are presented from data that were analysed using both statistical analysis, and a thematic approach. The thematic approach allowed common themes to be drawn from written comments to open-ended questions which were presented in a survey questionnaire and follow-up purposive interviews. This chapter ends with a summary of the findings and answers the first two research questions.

*Chapter Five* presents research findings obtained from 27 senior secondary school student research participants on their understanding(s) of and about technology and technology education post their working alongside practicing technologist(s). Data from the written questionnaire and follow-up interviews with participants were analysed to establish the findings, which were categorised under the common themes identified in *Chapter Four*. The chapter concludes with a summary of the research findings and answers the third research question.

*Chapter Six* addresses the overall aim from the research findings and explores these findings in relation to the literature presented in *Chapter Two*. This chapter also discusses the implications this research has on using practicing technologists to enhance student learning in technology and how this may impact on future projects such as FiT and GiF- TEI. The chapter ends with suggestions for future research and a concluding comment.