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Vocational teachers’ conceptions of, and approaches to, ICT in professional education

Shahadat Hossain Khan

A thesis submitted in fulfilment of the requirements for the degree of Doctor of Philosophy

September 2014
Author’s Declaration

This is to certify that:

1. This thesis comprises only my original work towards the Doctor of Philosophy degree
2. Due acknowledgment has been made in the text to all other material used
3. The thesis does not exceed the word length for this degree
4. No part of this work has been used for the award of another degree
5. This thesis meets the University of Sydney’s Human Research Ethics Committee (HERC) requirements for the conduct of research.

Signature:

Name: Shahadat Hossain Khan

Date: September 2014

I have included a list of publications informed by my research on this thesis as Appendix 7.
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Abstract

The aim of this research was to investigate vocational teachers’ ways of thinking about ICT-enhanced teaching and teaching approaches associated with the use of ICT in teaching. The study focused on teachers’ ways of apprehending the role of ICT in professional work. Phenomenography, a qualitative research approach that places emphasis on the importance of people’s experience of a phenomenon, was selected as a research methodology for this study. A cohort of 23 teachers from three Technical and Further Education (TAFE) institutions in NSW, Australia, participated in semi-structured, in-depth interviews. These interviews were used to identify the qualitatively different ways vocational teachers understand and conceptualise the phenomenon of ICT use in TAFE and workplace settings. Interviews were analysed using an iterative seven-step process. Through this process, five conceptions of, and five approaches to, ICT-enhanced teaching were revealed, and three conceptions of ICT in workplaces were discerned. Dimensions of variation among the categories of conceptions were presented and discussed, which extended previous knowledge by identifying new dimensions. Findings of this research enhance the existing teacher-centred and learning-centred frameworks of teachers’ conceptions. The study shows that approaches to ICT-enhanced teaching cover a range of aspects including: conveying information, promoting students’ active learning in development of knowledge and skills, and meeting the needs of industry. New knowledge on the way vocational teachers understand the role of ICT in workplaces also emerged through the study. These findings provide useful information for people who work in: the development of vocational educational, teaching of industrial practices, and academic development
programs. The thesis proposes further lines of exploratory research: to investigate discipline-focused ICT-enhanced teaching in vocational education.

Keywords: Vocational teaching. ICT-enhanced teaching. Phenomenography. Workplace.
# Table of Contents

Author’s Declaration ........................................................................................................ ii  
Acknowledgements ........................................................................................................ iii  
Abstract ........................................................................................................................... v  
Table of Contents .............................................................................................................. vii  
List of Tables .................................................................................................................... xi  
List of Figures .................................................................................................................... xiv  
Abbreviations .................................................................................................................... xv  

## CHAPTER 1 – INTRODUCTION

1.1 Rationale and background of the research questions ............................................. 1  
1.2 Theoretical basis and methodology ....................................................................... 8  
1.3 Background of the research context ....................................................................... 9  
1.4 Contributions to existing research and theory ...................................................... 12  
1.5 Contributions to practice ....................................................................................... 14  
1.6 Definitions of the main terms ................................................................................. 15  
1.7 An outline of subsequent chapters ........................................................................ 17  

## CHAPTER 2 – LITERATURE REVIEW

2.1 Introduction ............................................................................................................ 20  
2.2 Vocational teaching, practice and the role of ICT .................................................. 21  
  2.2.1 Vocational teaching: is it different from university teaching? ....................... 21  
  2.2.2 Vocational practice: is it different from professional practice? ................. 24  
  2.2.3 ICT and vocational teaching ............................................................................ 26  
  2.2.4 The role of ICT in the workplace professional practices ............................ 30  
2.3 Conceptions of teaching in tertiary education ....................................................... 38  
  2.3.1 Conceptions of teaching in face-to-face settings ........................................... 39  
  2.3.2 Conceptions of teaching in blended settings ............................................... 50  
  2.3.3 Conceptions of teaching in professional education .................................... 63  
  2.3.4 Summary ......................................................................................................... 66  
2.4 Approaches to teaching in tertiary education ....................................................... 68  
  2.4.1 Approaches to teaching in face-to-face settings .......................................... 69  
  2.4.2 Approaches to teaching in blended settings ................................................. 79  
  2.4.3 Approaches to teaching in professional education .................................... 83  
  2.4.4 Summary ......................................................................................................... 86
2.5 Conceptions of ICT in professional practices ................................................. 90
2.5.1 Summary ........................................................................................................ 103
CHAPTER 3 – METHODOLOGY .............................................................................. 105
3.1 Introduction .......................................................................................................... 105
3.2 Aims and research questions .............................................................................. 105
3.3 Overview of the research method ........................................................................ 108
  3.3.1 Selection of research method .......................................................................... 108
  3.3.2 Background of phenomenography .................................................................. 109
  3.3.3 Relationships between subjects, aspect of the world and researchers ............. 112
  3.3.4 Components of experience in phenomenography ......................................... 113
  3.3.5 Final outcome spaces in phenomenography .................................................. 117
  3.3.6 Phenomenography or phenomenology ............................................................ 120
3.4 Study design and analytical process ...................................................................... 125
  3.4.1 Selecting the sample ....................................................................................... 125
  3.4.2 Data collection ............................................................................................... 131
  3.4.3 Pilot and peer-review ...................................................................................... 135
  3.4.4 Data analysis ................................................................................................... 138
3.5 Trustworthiness .................................................................................................... 151
  3.5.1 Validity ........................................................................................................... 151
  3.5.2 Reliability ........................................................................................................ 155
3.6 Ethical considerations ............................................................................................ 157
CHAPTER 4 – VOCATIONAL TEACHERS’ CONCEPTIONS OF ICT-ENHANCED
  TEACHING ........................................................................................................... 159
4.1 Introduction ........................................................................................................... 159
4.2 Overview of teachers’ conceptions of ICT-enhanced teaching ............................ 159
  4.2.1 Category A: ICT is used to meet external expectations ................................. 160
  4.2.2 Category B: ICT is used to gain access to information and resources ............ 163
  4.2.3 Category C: ICT is used as a delivery tool ..................................................... 166
  4.2.4 Category D: ICT is used as a medium for active learning ............................. 170
  4.2.5 Category E: ICT is used for preparing students for future profession .......... 173
4.3 Relationship between categories of description .................................................... 175
  4.3.1 Dimension 1: The role of teachers in ICT-enhanced teaching ...................... 177
  4.3.2 Dimension 2: The role of students in ICT-enhanced teaching ...................... 180
  4.3.3 Dimension 3: Impact of technology on student and teacher knowledge ....... 184
4.3.4 Dimension 4: Who benefits from ICT in teaching? .......................... 188
4.4 Summary and relationships among the categories ................................. 193
CHAPTER 5 – VOCATIONAL TEACHERS’ APPROACHES TO ICT-ENHANCED TEACHING .................................................................................................................. 198
5.1 Introduction ............................................................................................. 198
5.2 Approaches to ICT-enhanced teaching ...................................................... 198
  5.2.1 Overview of teachers’ approaches to ICT-enhanced teaching .............. 199
5.3 Categories of description .......................................................................... 200
  5.3.1 Approach A: A teacher-focused, information-oriented strategy with the
  intention of effectively delivering subject content ........................................ 200
  5.3.2 Approach B: A teacher-focused, feedback-oriented strategy with the
  intention of achieving intended course outcomes ....................................... 203
  5.3.3 Approach C: A teacher-focused, practice-oriented strategy with the
  intention of linking theoretical and practical knowledge ............................ 206
  5.3.4 Approach D: A student-focused, facilitation-oriented strategy with the
  intention of providing active learning for developing students’ understanding ... 210
  5.3.5 Approach E: A student-focused, industry-oriented strategy with the
  intention of developing students’ knowledge and skills to meet industry needs .... 214
5.4 Summary and relationships among the categories .................................. 218
CHAPTER 6 – VOCATIONAL TEACHERS’ CONCEPTIONS OF ICT IN PROFESSIONAL WORK .................................................................................................................. 221
6.1 Introduction ............................................................................................. 221
6.2 Overview of teachers’ conceptions of ICT in professional practices ............ 221
  6.2.1 Category A: ICT could be used for various work-related tasks .......... 222
  6.3.2 Category B: ICT helps to accomplish a job more effectively ............. 225
  6.3.3 Category C: ICT is an essential tool in professional activities ............ 229
6.3 Relationship between categories of description ...................................... 231
  6.3.1 Dimension 1: Accessing and receiving information ....................... 232
  6.3.2 Dimension 2: Performing professional tasks .................................... 235
  6.3.3 Dimension 3: Communication ....................................................... 237
  6.3.4 Dimension 4: Professional development ....................................... 241
6.4 Summary and relationships among the categories .................................. 243
CHAPTER 7 – DISCUSSION AND CONCLUSIONS ........................................ 247
7.1 Discussion of findings .............................................................................. 247
7.1.1 What does ICT-enhanced teaching mean to TAFE teachers? .......................... 247
7.1.2 How do TAFE teachers approach teaching with ICT? ................................. 255
7.1.3 What does ICT mean to TAFE teachers when it is used in professional activities? .................................................................................................................. 261
7.2 Associations between conceptions of, and approaches to ICT-enhanced teaching and conceptions of ICT in the workplace ......................................................... 269
7.3 Implications ........................................................................................................... 276
7.3.1 Implications for professional development, curriculum development and teacher benefit........................................................................................................... 276
7.3.2 Implication to practice, research and methodology (theory) ....................... 279
7.4 Limitations ........................................................................................................... 282
7.5 Suggestions for future research ................................................................. ........................ 285
7.6 The researcher experience .................................................................................. 287
7.7 Conclusions ........................................................................................................ 290
References ................................................................................................................ 294
Appendices .................................................................................................................. 313
Appendix 1. Participant Information Statement (PIS) ................................................. 313
Appendix 2. Participant Consent Form ........................................................................ 315
Appendix 3. The interview schedule .......................................................................... 316
Appendix 4. Individual participant’s information ...................................................... 319
Appendix 5. Letter of invitation to participants ............................................................ 320
Appendix 6. The development of the categories of description across time ............ 322
  Appendix 6.1 The development of the categories of description over time:
  conceptions of ICT-enhanced teaching ................................................................. 322
  Appendix 6.2 The development of the categories of description over time:
  approaches to ICT-enhanced teaching ................................................................. 324
  Appendix 6.3 The development of the categories of description over time:
  conceptions of ICT in workplace ......................................................................... 328
Appendix 7. Works published from this thesis ............................................................ 332
Appendix 8. Detailed review of studies focusing on ICT in vocational education context ......................................................................................................................... 333
Appendix 9. Detailed review of studies focusing on ICT in professional practices 336
Appendix 10. Human Research Ethics Committee (HREC) approval latter .......... 340
List of Tables

Table 1.1 Profile of publicly funded vocational training providers, source: (NCVER, 2014, p. 2) ........................................................................................................................................... 10
Table 2.1 Transformation of automobile service, from Qin, Long, Zhang, and Huang, 2013, p. 178 ................................................................................................................................. 35
Table 2.2 Australian statistics related to ICT skills, based on ACS (2013, p. 7) ........... 37
Table 2.3 Dimensions relating categories of conceptions of teaching, from Kember, 1997, p. 262 ................................................................................................................................. 45
Table 2.4 Dimensions relating categories of conceptions of teaching, from Åkerlind, 2004, p. 372 ................................................................................................................................. 46
Table 2.5 Dimensions relating categories of conceptions of teaching, from González, 2011, p. 76 ................................................................................................................................. 47
Table 2.6 Comparison of conceptions of teaching in face-to-face teaching context based on prior research ...................................................................................................................... 49
Table 2.7 Outcomes of prior research on conceptions of teaching in a blended context* .................................................................................................................................................. 58
Table 2.8 Dimensions relating categories of conceptions of teaching, from González, 2010, pp. 71-72 ......................................................................................................................... 59
Table 2.9 Dimensions relating categories of conceptions of teaching, from Lameras et al. 2012, p. 149 ............................................................................................................................. 61
Table 2.10 Cross tabulation of approaches to teaching by intention and strategy, from Trigwell et al. 1994, p. 78 ............................................................................................................. 74
Table 2.11 Cross tabulation of approaches to teaching by intention and strategy, from Prosser et al. 2005, p. 145 ........................................................................................................... 76
Table 2.12 Cross tabulation of approaches to teaching by intention and strategy, from Prosser et al. 2008, p. 7 .............................................................................................................. 77
Table 2.13 Cross tabulation of approaches to teaching by intention and strategy (based on González, 2012) .................................................................................................................... 78
Table 2.14 Outcomes of prior research on approaches to teaching based on intention and strategy frameworks .................................................................................................................. 85
Table 2.15 Comparison of conceptions of ICT in professional work based on prior research ........................................................................................................................................... 102
Table 3.1 Previous phenomenographic studies by context, country, and sample size. 127
Table 3.2 Participants’ demographic information ......................................................... 130
Table 3.3 Participants’ demographic information of pilot study ...................................... 137
Table 4.1 Variation of teachers’ role in ICT-enhanced teaching ...................................... 177
Table 4.2 Variation in the way teachers see a student role in ICT-enhanced teaching 180
Table 4.3 Variation in impact of ICT on knowledge in the ICT-enhanced teaching ... 184
Table 4.4 Variation in benefits from ICT-enhanced teaching ........................................... 189
Table 4.5 Relationship among categories of description s of ICT-enhanced teaching 194
Table 4.6 Expansion of awareness of using ICT in vocational teaching ...................... 195
Table 4.7 Outcome space: referential and structural components of using ICT in vocational teaching ........................................................................................................... 196
Table 5.1 Outcome space: intention and strategy components ........................................ 219
Table 6.1 Varieties of roles of ICT in accessing and receiving information in professional practices .................................................................................................................. 232
Table 6.2 Variation in the role of ICT in performing professional tasks ......................... 235
Table 6.3 Variation of the role of ICT for communication purposes within professional practices .............................................................................................................................. 238
Table 6.4 Variation of the role of ICT in professional development activities ............ 241
Table 6.5 Relationships between categories of description (ICT in workplace)......... 244
Table 6.6 Outcome space: referential and structural components of using ICT in the workplace.............................................................................................................................. 245
Table 7.1 The findings of the study in relation to prior research on conceptions of teaching in face-to-face contexts ........................................................................................ 250
Table 7.2 The findings of the study in relation to prior research on conceptions of teaching in blended contexts.................................................................................................... 253
Table 7.3 Comparative analysis between present study and the outcomes of prior research on approaches to teaching based on intention and strategy frameworks 257
Table 7.4 The findings of the study on conceptions of ICT in professional work in relation to prior research ............................................................................................................ 263
Table 7.5 Associations between conceptions of, approaches to ICT-enhanced teaching ................................................................................................................................. 270
Table 7.6 Associations between conceptions of ICT-enhanced teaching and conceptions of ICT in the workplace .................................................................................................. 272
Table 7.7 Associations between approaches to ICT-enhanced teaching and conceptions of ICT in workplace................................................................. 274
List of Figures

Figure 1.1 The Australian education system (source: Australian Trade Commission, 2012) ......................................................................................................................... 9

Figure 2.1 Impact of ICT in small and medium-sized industries (Consoli, 2012, p. 95) .................................................................................................................... 33

Figure 2.2 DEEWA employment projections for 2011-12 to 2016-17 for ICT occupations (ACS, 2013, p. 76) ...................................................................................... 38

Figure 2.3 Two approaches to teaching (Kember, 1997, p. 264) .......................................................................................................................... 70

Figure 2.4 Components and dimensions of approaches to teaching (Kember & Kwan, 2000, p. 476) ................................................................................................. 72

Figure 2.5 Approaches to teaching and approaches to online teaching (González, 2009, p. 312) ........................................................................................................ 80

Figure 3.1 Relationship between objects, subjects and researcher (Bowden, 2005, p. 13) .................................................................................................................. 113

Figure 3.2 Component of Experience (Marton & Booth, 1997, p. 88) .............. 114

Figure 3.3 Experience of teaching based on (Ellis, Goodyear, et al., 2006) ........ 115

Figure 3.4 Intention and strategy components when teaching with ICT. .............. 116

Figure 4.1 The three components of external expectations .................................. 160

Figure 4.2 Different aspects of accessing information ........................................... 163

Figure 4.3 Different ways of seeing ICT as a delivery tool in Category C ............. 166

Figure 4.4 View of active learning in Category D .................................................... 170

Figure 4.5 View of industry-focused active learning in Category E .................... 174

Figure 5.1 Structural and referential components of Approach A ....................... 201

Figure 5.2 Structural and referential components of Approach B ....................... 203

Figure 5.3 Structural and referential components of Approach C ....................... 207

Figure 5.4 Structural and referential components of Approach D ....................... 210

Figure 5.5 Structural and referential components of Approach E ....................... 215

Figure 6.1 Elements that influence productivity in industry ............................... 228
Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>3D</td>
<td>Three Dimensional</td>
</tr>
<tr>
<td>CAD</td>
<td>Computer-Aided Design</td>
</tr>
<tr>
<td>CAM</td>
<td>Computer-Aided Manufacturing</td>
</tr>
<tr>
<td>CNC</td>
<td>Computer Numerical Control</td>
</tr>
<tr>
<td>DEEWR</td>
<td>Department of Education Employment and Workplace Relations</td>
</tr>
<tr>
<td>HE</td>
<td>Higher Education</td>
</tr>
<tr>
<td>ICT</td>
<td>Information and Communication Technology</td>
</tr>
<tr>
<td>NCVER</td>
<td>The National Centre for Vocational Education Research</td>
</tr>
<tr>
<td>TAFE</td>
<td>Technical and Further Education</td>
</tr>
<tr>
<td>TVE</td>
<td>Technical and Vocational Education</td>
</tr>
<tr>
<td>TVET</td>
<td>Technical and Vocational Education and Training</td>
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<tr>
<td>VE</td>
<td>Vocational Education</td>
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</table>
CHAPTER 1 – INTRODUCTION

This thesis investigates different ways in which vocational teachers experience ICT-enhanced teaching in vocational education, and the use of Information and Communication Technology (ICT) in professional practice. This chapter provides an overview of the thesis in seven sub-sections. The first sub-section describes the background of the research problem space including gaps found in the existing research literature. The first sub-section ends with a presentation of the research questions. The second sub-section describes the methodology used to investigate these problems. The third sub-section presents the background of the research context while the fourth and fifth sub-sections describe the contribution to the research and to practice. The sixth sub-section elaborates on the definitions of the main terms, to clarify their usage in this thesis. Finally, the chapter ends with an outline of the subsequent parts of this thesis.

1.1 Rationale and background of the research questions

Over the last 20 years the widening uptake of, and growing demand for, ICT in tertiary education has created an important area for educational research (Drent & Meelissen, 2008; Granger, Morbey, Lotherington, Owston, & Wideman, 2002; Mumtaz, 2000; Pulkkinen, 2007; Selwyn, 2007; Wood, 1995). Many studies have provided evidence about the positive effects of using ICT in teaching and learning situations (T. Collins, 2013; Mumtaz, 2000; Selwyn, 2007; Williams, Coles, Wilson, Richardson, & Tuson, 2000). ICT can enhance existing instructional methods and in some cases introduce new methods, such as networked learning (Goodyear, 2005), self-paced
learning (Roberts, 2003; Tullis & Benjamin, 2011) and online discussion (Bender, 2003). Likewise, the use of ICT can facilitate active learning (Dori & Belcher, 2005), the engagement of students in collaborative learning (Kreijns, Kirschner, & Jochems, 2003; Warschauer, 1997) and the improvement of students’ problem-solving skills (Jonassen, 2000). The use of ICT, therefore, has entered into mainstream practices in both university (Ellis, Hughes, Weyers, & Riding, 2009) and vocational education (Armatas & Papadopoulos, 2013; Kotsik, Tokareva, Boutin, & Chinien, 2009). Considering these developments, a significant amount of research has been conducted on ICT usage in tertiary education (Kirkup & Kirkwood, 2005; McNair & Clarke, 2007; Selwyn, 2007). Many of the aforementioned studies report that teachers in tertiary education employ ICT to support and reinforce their teaching practices.

Studies have also found that technology alone cannot lead students to learn (Koehler & Mishra, 2005). How students learn and how learning is approached with the help of new technology does not solely depend on students themselves. Teachers’ effective use of ICT in their teaching can also facilitate student learning (Ellis et al., 2009; Lei, 2010). Student learning and learning outcomes are linked with teaching practices: quality teaching can promote quality learning (Prosser & Trigwell, 1999). Parpala and Lindblom-Ylänne (2007) stated that “good teaching can be defined as an extended awareness of the relationship between learning and teaching” (p. 356). It is evident that teachers are seen as key agents when it comes to creating learning environments that facilitate students’ active learning, and in the promotion of engagement in learning (González, 2010; Prosser & Trigwell, 1999). Therefore, research should pay attention to investigating teaching practices in order to improve the quality of tertiary teaching (Biggs & Tang, 2011; Prosser & Trigwell, 1999).
research has found that teaching practices are influenced by teachers’ associated understanding of teaching (Kember, 1997, 2009; Prosser & Trigwell, 1999). It has also been found that different teachers follow different teaching strategies in similar teaching contexts; and a reason suggested for this is teachers’ varying views of teaching (Kember & Kwan, 2000; Trigwell & Prosser, 1996b). These teaching views and practices of how to teach are named “conceptions” and “approaches”, respectively, in a phenomenographic research practice (A detailed discussion about phenomenographic research appears in Chapter 3.). Before discussing further, the meanings of conceptions and approaches need to be clarified. Pratt (1992) defines conceptions of teaching as:

“specific meanings attached to phenomena, which then mediate responses to situations involving those phenomena. We form conceptions of virtually every aspect of our perceived world, and in so doing, use those abstract representations to delimit something from, and relate it to, other aspects of our world. In effect, we view the world through the lenses of our conceptions, interpreting and acting in accordance with our understanding of the world.” (p. 204)

Researchers Marton and Pong (2005) describe a conception as:

“The basic unit of description in phenomenographic research... [This] has been given various names, such as ‘ways of conceptualising’, ‘ways of experiencing’, ‘ways of seeing’, ‘ways of apprehending’, ‘ways of understanding’, and so on.” (p. 336)

Teachers’ and students’ ways of thinking about teaching and learning are referred to as conceptions. Approaches refer to how people go about something (Marton & Booth, 1997). In the educational field, it means how teachers and students go about their
teaching and learning. Postareff and Lindblom-Ylänne (2008) defined approaches to teaching as the strategies teachers adopt for their teaching.

Teachers’ conceptions of, and approaches to, teaching contribute to the quality teaching and learning (Åkerlind, 2004, 2008; Parpala & Lindblom-Ylänne, 2007; Prosser & Trigwell, 1999). Over the last two decades substantial number of studies have been conducted to investigate how university teachers conceptualise and approach teaching (Åkerlind, 2004; Dall’Alba, 1991; Ellis et al., 2009; Fox, 1983; González, 2011; Gow & Kember, 1993; Kember, 1997; Kember & Kwan, 2000; Lammers, Levy, Paraskakis, & Webber, 2012; Martin & Balla, 1991; Pratt, 1992; Prosser, Trigwell, & Taylor, 1994; Samuelowicz & Bain, 1992, 2001; Van Rossum & Taylor, 1987). Most of these studies were interview-based investigations, which identified a number of different conceptions of, and approaches to, teaching in different teaching and learning contexts (e.g., face-to-face, blended, online). Most of these empirical studies were conducted in the university sector. They provided: (i) commonalities by identifying similar meanings of categories, (most fall under teacher-centred/content oriented and student-centred/learning oriented broad orientations); and (ii) differences by revealing new and extended categories that have uncovered some novel aspects in the existing literature. For instance, Kember (1997) proposed an intermediate category, an interaction between the teacher and the student while González (2011) identified a novel aspect, developing (student) critical thinking.

Against this background of a large volume of research on university teaching, research on teachers’ conceptions of, and approaches to, teaching in vocational education is a recent area of investigation. In Australia, Technical and Further
Education (TAFE) is the main provider of vocational education (ACS, 2013; AWPA, 2012; Bennett, Shah, & Nair, 2013; Bliuc, Casey, Bachfischer, Goodyear, & Ellis, 2012; Finnie & Norrie, 2013; Hagan, 2004). Teachers in TAFE, as in the rest of the tertiary education system, are also experiencing increasing pressures, advancement of technology, new and innovative teaching initiatives, students’ demands, and other social demands (Bennett et al., 2013; Bliuc et al., 2012). In light of these pressures, the potential benefits of ICT-enhanced teaching (e-learning, blended learning, mobile learning, technology inside and outside classroom) are well recognised in TAFE institutions, and many of the TAFE institutions have already gained the acceptance of ICT progression into their teaching (Armatas & Papadopoulos, 2013; T. Collins, 2013). However, teaching at TAFE is, in some aspects, different from teaching within the university sector, due to their different purposes and focuses. TAFE teaching is predominantly focused on skills and directed to immediate employment (Rosalind Carter & Ellis-Gulli, 2014; Wheelahan, 2010). Therefore, TAFE teachers are generally expected to provide an additional focus on workplace oriented teaching.

The value of ICT is not only recognised for its pedagogical benefits in tertiary education, but is also recognised for its role in professional activities. For instance, during the last few decades, ICT has entered many areas of industry practice, and a considerable number of studies have been undertaken to investigate its use in different industries (Cardona, Kretschmer, & Strobel, 2013; Cherubini, Iasevoli, & Michelini, 2015; Consoli, 2012; Gossart, 2015). For example, records of how ICT is used in small and medium sized rural enterprises (Steinfield, LaRose, Chew, & Tong, 2012), the construction industry (Alkalbani, Rezgui, Vorakulpipat, & Wilson, 2013; Ruddock, 2015),

---

1 In this thesis terms such as ‘professional activities’, ‘industrial activities’, ‘workplace activities’ are used interchangeably.
the automotive industry (Cherubini et al., 2015; Qin, Long, Zhang, & Huang, 2013), and many other industries (Poulis, Poulis, & Dooley, 2013; Stare, Jaklič, & Kotnik, 2006) show that ICT performs diverse roles in various professions and workplaces. These studies have also indicated that the workforce needs a level of proficiency of ICT skills to cope with recent industrial trends (Bishop, 2015; Loveday, 2010; Mavromaras, 2013; Richardson & Haylock, 2012). For instance, many industries are now considered to be technology-driven because most of their operations, performance, growth, expansion and producing new products heavily depend on ICT (e.g., Alkalbani et al., 2013; Cherubini et al., 2015; Steinfield et al., 2012).

TAFE in Australia is one of the main skill oriented educational providers where apprentices develop the required ICT skills to meet industry demands (Bliuc et al., 2012; Dymock & Tyler, 2013). Students who intend to enter the workplace, are provided with required knowledge and skills in a formal vocational education setting. Therefore, vocational institutes are faced with a growing pressure to incorporate different ICT supported teaching and learning experiences to meet industrial requirements and to prepare their graduates to use ICT in their future professions. In this context, TAFE teachers need to play a significant role by incorporating ICT-related knowledge and skills in teaching to adequately prepare their students.

Within this context, two specific aspects of ICT in vocational education need to be considered: (i) investigating TAFE teachers’ conceptions of, and approaches to, ICT-enhanced teaching; and similarly, (ii) knowing more about TAFE teachers’ understanding of ICT as it relates to the workplace. Both of these areas are closely

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2 In this thesis terms such as ‘apprentice’, ‘trainee’, ‘practitioner’ and ‘student’ are used interchangeably.
linked due to the nature of instructional approaches used in vocational education, which are tightly connected to workplace practice, that is, vocational teaching practice is directed to job-oriented teaching and transferable workplace skills (Rosalind Carter & Ellis-Gulli, 2014). As a result, TAFE teachers are confronting growing pressure to ensure that the future workforce will possess the required competency. To face this challenge, teachers’ ICT-enhanced teaching practices need to be directed towards ICT supported professional activities. It is therefore important to investigate TAFE teachers’ conceptions of, and approaches to, ICT-enhanced teaching and simultaneously their different ways of understanding ICT use in workplace practices. Additionally importance are given on their conceptions of ICT influences, their pedagogical practices and students’ learning outcomes (Kember, 2009; Prosser & Trigwell, 1999). As Poortman, Reenalda, Nijhof and Nieuwenhuis (2014) state, vocational teachers need to facilitate student academic skill development that students will apply in industry later.

Thus, the present research builds on prior studies on (i) teachers’ conceptions of, and approaches, to teaching (Ellis et al., 2009; Kember, 1997; Prosser et al., 1994; Trigwell, Prosser, & Taylor, 1994); and (ii) professionals’ conceptions of technology (Barnard & Gerber, 1999; Munck, Fridlund, & Mårtensson, 2011). This study expands the previous research by concurrently investigating TAFE teachers’ conceptions of, and approaches to ICT-enhanced teaching and their understanding of ICT in the workplace. The underlying aim of this investigation is to present empirical evidence that provides an insight into relationships between teachers’ views about ICT in these different, but closely intertwined in teachers’ working contexts: ICT in teaching and ICT in professional work. The aim is translated into the following research questions:

1. What does ICT-enhanced teaching mean to TAFE teachers?
2. How do TAFE teachers approach teaching with ICT?

3. What does ICT mean to TAFE teachers when it is used in professional activities?

In addition, after examining each aspect separately, this study will further investigate the relationships among these three questions.

1.2 Theoretical basis and methodology

Phenomenography, in this study, is considered both as a research methodology and as a theoretical perspective to investigate the research problems. Phenomenography intends to identify the qualitatively different ways people understand and conceptualise an aspect of the world (Marton, 1981). In this study, phenomenographic methods are adopted to develop a set of categories of description from vocational teachers’ experiences of ICT-enhanced teaching, and their associated understandings of the role of ICT in professional practice. To achieve these aims, phenomenographic semi-structured interviews are conducted with 23 teachers from three TAFE institutions in New South Wales (NSW), Australia. Participants are recruited voluntarily and purposively in order to achieve a range of experiences in relation to the investigated phenomena. Recorded and transcribed interviews are analysed using established phenomenographic procedures: an iterative process of reading and re-reading, the development of categories and the formulation of an “outcome space” to structure the categories (Åkerlind, 2005a). Detailed information about methodology and methods can be found in Chapter 3. In order to understand the research context, there is a discussion in the following section. The purpose is to familiarise the reader with the study context and to provide an overview of the TAFE sector.
1.3 Background of the research context

Tertiary education in Australia is divided into two separate strands: higher education and vocational education (Figure 1.1). TAFE belongs to the second strand. The university sector mainly offers Higher Education (HE), which is administered by both federal and state-level authorities. A variety of courses is presented through higher education ranging from one-year diplomas to masters and doctoral degrees. Vocational Education (VE) is delivered primarily through TAFE institutes. TAFE stands for “Technical and Further Education” and is similar to a Vocational College (Germany), a Polytechnic (UK, Hong Kong, Bangladesh), a Technical College, and a Community College (USA).

![Diagram of the Australian education system](source: Australian Trade Commission, 2012)

A large number of privately registered training organisations also provide
vocational courses, e.g., Southern Cross Catholic Vocational College (SCCVC), the Wesley Mission and a range of agencies primarily catering for overseas students trying to gaining training, work and residency in Australia. These courses range from certificate studies, advanced diplomas, to degree courses, which are a more recent addition (Kloppenborg, 2010). The number of vocational education providers in Australia as reported in 2014, consists of 60 units of TAFE, 9 other government providers, 423 community education providers, and 1670 other registered providers (Table 1.1). However, TAFE appears to play a central role in the provision of vocational education in Australia. In fact, Bliuc et al. (2012) reported that the TAFE sector is one of the largest vocational providers in the world.

Table 1.1 Profile of publicly funded vocational training providers, source: (NCVER, 2014, p. 2)

<table>
<thead>
<tr>
<th>State/territory</th>
<th>Number of training providers</th>
<th>Training providers reporting to jurisdiction</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>TAFE</td>
<td>Other Government Providers</td>
</tr>
<tr>
<td>New South Wales</td>
<td>11</td>
<td>1</td>
</tr>
<tr>
<td>Victoria</td>
<td>18</td>
<td>0</td>
</tr>
<tr>
<td>Queensland</td>
<td>13</td>
<td>1</td>
</tr>
<tr>
<td>South Australia</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>Western Australia</td>
<td>11</td>
<td>7</td>
</tr>
<tr>
<td>Tasmania</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Northern Territory</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Australian Capital Territory</td>
<td>1</td>
<td>0</td>
</tr>
</tbody>
</table>

| Distinct number of training providers | 60 | 9 | 423 | 1670 | 2094 |

TAFE offers courses that are focused on practical and workplace related skills-oriented learning. These courses focus on the employability of students and their ability to meet the demands of particular labour markets. These demands are highlighted in the broad aims of TAFE NSW, identified by the NSW Audit Office (2001), and include: training students for employment in skilled, trade, post-trade, para-professional and professional areas; providing special courses, testing and consultancy services that are
supplied to industry often on a fee-for-service basis; providing a number of preparatory, general education and remedial programs for people wishing to continue or resume their education; and conducting various programs for groups in the community with special needs, such as aboriginal people, women wishing to re-enter the workforce, single mothers, the aged, the unemployed, people with physical or intellectual disabilities and people from non-English speaking backgrounds.

In New South Wales (NSW), where this study is conducted, TAFE is the main provider offering vocational qualifications (Bliuc et al., 2012). It has been providing VE programs for more than 100 years. In NSW, there are 11 separate institutions (Table 1.1), with more than 500,000 students and teachers (Bliuc et al., 2012). TAFE NSW provides both long- and short-term courses, and offers students a face-to-face education (full-time, part-time), flexible and distance learning, as well as online learning. Some courses such as business accounting and photography are offered in both face-to-face and online modes. Courses can be delivered in a range of ways, with classes taken either in college, in the workplace or in a classroom. It can also be self-paced learning through distance learning/online learning (TAFE, 2012b). All courses are designed in co-operation with national industry skills’ councils.³

TAFE NSW, similar to TAFE Australia, offers vocational qualifications from certificate level to advanced diploma level, and very recently, to degree level or university pathway programs. The Certificate courses teach basic theoretical knowledge and skills to students who enrol in a new area in which they have no prior knowledge or experience. TAFE NSW recently added a number of degree programs in higher

³ It is the industry-led board funded by the Australian Government that works together with education, industry and government for the improvement of skills and workforce development.
education, such as childcare studies, accounting, information technology, engineering, interior design, 3D art animation and financial planning (Rosalind Carter & Ellis-Gulli, 2014). Additionally, TAFE NSW is involved with professional development and career acceleration programs. It also supports and encourages innovation to enhance the quality of teaching and learning provided to students (TAFE, 2012a). More importantly, teachers are encouraged to provide a teaching-learning environment that facilitates students developing their skills with a focus on professional practice. In summary, the courses offered at TAFE NSW aim to provide the knowledge and skills required for employment and to help apprentices pursue higher education in universities.

1.4 Contributions to existing research and theory

The research literature has little to say about the conceptions of, and approaches to, teaching adopted by TAFE teachers. One questionnaire-based phenomenographic study (Bliuc et al., 2012) has identified useful categories of description in vocational blended teaching, but did not explore the relationship among the listed categories of description. No effort was made to bridge the gap between instructional approaches (teaching practice) and workplace practices. However, research on teachers’ conceptions of ICT in professional activities for which they prepare their students is scarce. In this context, the researcher's intention is not to investigate how well ICT could be used in the workplace rather the intention is to identify different ways of using ICT in the workplace. In the literature, a number of studies have investigated the former problem (how well ICT could be used in the workplace) (e.g., Biagi, 2013; Cardona et al., 2013; Jung, Na, & Yoon, 2013; Peansupap & Walker, 2005; Tarutė & Gatautis, 2014). As yet, none of the studies have been conducted in relation to the latter problem - the different
ways of using ICT in the workplace - through phenomenography as a theoretical and methodological framework. Although a few studies focused on the nursing profession and contributed new conceptions in this domain. (Section 2.5 provides a detailed discussion). Thus, the field of the present research based on the above three research questions is expected to contribute towards theoretical and methodological developments by filling an existing gap.

This study further contributes to existing theory, specifically it provides empirical evidence to show the relationships between teachers’ understanding of ICT-enhanced teaching and their associated approaches to ICT-enhanced teaching. For example, the teachers who conceive of ICT-enhanced teaching as a ‘student-centred/industry-oriented’ most often use a ‘student-focused, industry-oriented strategy’. This study provides empirical data that extends these relationships by linking with teachers’ different ways of conceptualising the role of ICT in the workplace. For instance, the teachers within these relationships (e.g., ‘student-centred/industry-oriented’ to ‘student-focused, industry-oriented strategy’) are more likely to hold an understanding about the role of ICT in workplace that ranges from effective to obligatory. Thus, this study provides evidence showing vocational teachers’ conceptions of, and approaches to, ICT-enhanced teaching related to their understanding of ICT in the workplace. These relationships contribute to minimise the disconnections between vocational instructional approaches (teaching practices) and workplace practices. Section 7.2 & 7.3 provide a detailed discussion.
1.5 Contributions to practice

What follows is a summary of two contributions of this research are discussed: enhancing pedagogical practice in vocational education; and reducing the existing gap between instructional and workplace practice.

Enhancing pedagogical practice in vocational education: Research on conceptions and approaches can uncover some practical implications of teaching and learning practices in tertiary education (Samuelowicz & Bain, 2001). On the basis of previous research, it is expected that teachers’ conceptions of teaching influence how they arrange and manage their teaching and learning environment (Norton, Richardson, Hartley, Newstead, & Mayes, 2005). For example, teachers who value student-centred understanding are more likely to arrange activities that help students to engage in their learning (Prosser & Trigwell, 1999). Creating technology-enhanced teaching and learning environments may be influenced by the teachers’ conceptions. This is supported by Samuelowicz and Bain (2001), who reported that academic staff conceptions have implications for new teaching initiatives such as teaching related to technology and the Internet. Research on conceptions of technology has reported the potential influence on specific professional practice such as nursing (Barnard & Gerber, 1999). Similarly, it is intended that the findings of this study contributes to the existing teaching practice in the vocational education sector. Thus, it is hoped that the findings will enhance vocational teachers’ pedagogical practice (Section 7.2.2 provides a detailed discussion).

Reducing the existing gap between instructional and workplace practice: Previous studies reported there is a significant gap which exists between teaching practices in
vocational education and workplace practices (Allais, 2012; Boud & Brew, 2013; Eraut, 2004). The findings of the current study provide useful information about the different ways of using ICT in the workplace that could assist to minimise the gap between ICT-enhanced teaching practice in vocational education and expected ICT-skilled workforce practice in the workplace. Potential contributions from this research further listed as follows:

- The results from this study could contribute to academic development programs, and provide useful information for people who are working in the development of vocational education and teaching.
- The findings could assist in the promotion of effective student learning in relation to industry related knowledge and skills.

1.6 Definitions of the main terms

**Blended Learning:** Blended learning refers to the combination of face-to-face and online learning, where online technology is used to complement other learning activities (Ellis & Calvo, 2004; Ellis, Goodyear, Prosser, & O'Hara, 2006). For this study, blended learning is considered as a combination of face-to-face and online teaching-learning situations that use any form of online technology (e-learning, web learning and distance learning).

**ICT:** This is the acronym for Information and Communication Technology. In this study, ICT is defined as a combination of all forms of technology (both hardware and software) such as computers or any digital device used in teaching and in professional activities; for instance, interactive whiteboard, and the Internet, phone, fax, printer,
email, networking tools, different forms of software, machinery and equipment supported by digital technology. However, items belonging to older mechanical devices and tools such as slide rulers, machines with a manual operation, are not considered ICT in this study.

*Professional education:* In this study, professional education is defined as a concept that includes vocational education offered by TAFE institutions in Australia. Similarly, profession is defined as an occupation that requires knowledge and skills that are provided by vocational education. (Section 2.2.2 provides a detailed discussion.)

*ICT–enhanced teaching:* In this research, ICT–enhanced teaching refers to the teaching context where teachers use different types of technology in the teaching and learning process. These technologies may be used in either face-to-face, blended learning or purely online teaching and learning contexts.

*Phenomenography:* A qualitative research approach that investigates people’s experience of a particular phenomenon in terms of an emerged set of categories (Marton, 1981). Ference Marton defines phenomenography as “a research method for mapping the qualitatively different ways in which people experience, conceptualise, perceive, and understand various aspects of, and various phenomena in, the world around them” (1986, p. 31). In this study, this research approach is used to identify people’s experience of a particular phenomenon in a limited set of categories. These phenomenographic categories generally exhibit features that are qualitatively distinct from each other.
Conceptions: A conception is defined as a way of understanding or experiencing a phenomenon. Thus, conceptions are the different ways in which people understand, experience, perceive or conceptualise phenomena of interest. In this study, conceptions are vocational teachers’ understanding of ICT-enhanced teaching and their understanding of ICT in professional activities.

Categories of description: Categories of description are the characteristics of conceptions. Categories of description represent the conceptions or different ways of understanding a phenomenon. In a phenomenographic study, conceptions are derived from people’s understanding and categories of description are formed.

1.7 An outline of subsequent chapters

This subsection gives an overview of the structure of this thesis. There are seven chapters, organised as follows:

Chapter 1, Introduction, presents the overview of the thesis.

Chapter 2, Literature review, is organised into five sections. The first section presents the introduction of the chapter. The second section discusses the role of ICT in vocational teaching and professional practices. This section also includes a synthesis review of selected studies, based on the role of ICT in vocational teaching and the role of ICT in the professions. The third section presents different conceptions of teaching in tertiary education - discussing the major studies of teachers’ conceptions of teaching, both face-to-face and blended teaching contexts. The next section provides a detailed discussion of several studies that focus on approaches to teaching, again considering
face-to-face and blended teaching contexts. The last section presents studies related to people’s views of technology in professional work.

Chapter 3, *Methodology*, discusses the theory on which the research is based and the methods used in this research. It is structured into six sections. The first section presents the introduction of the chapter. The second section outlines the aims and the research problems of the current study. The third section starts with an explanation of why phenomenography was selected as a research approach to investigate the three research questions. This is followed by a detailed discussion about phenomenography as a research approach. The next section explains the overall study design, including the participant selection procedure and how the phenomenographic interviews were conducted. It includes a pilot study and peer-review feedback. This section also includes a detailed discussion of the data analysis process. The chapter concludes with a description of trustworthiness and ethical aspects of the research.

Chapters 4 to 6 present the results of this study. The vocational teachers’ conceptions of ICT-enhanced teaching are described in Chapter 4, while their approaches to ICT-enhanced teaching are presented in Chapter 5. Finally, the findings on the vocational teachers’ conceptions of ICT in professional practices are reported in Chapter 6. These chapters also present the relationships that were identified between the categories of description.

The discussion and conclusions are presented in Chapter 7. This chapter is structured into seven main sections. The first section discusses the findings of the study in the context of previous empirical research, and summarises the claims to new
knowledge revealed. The second section describes the associations between conceptions of, and approaches to ICT-enhanced teaching and conceptions of ICT in the workplace. The third and fourth sections discuss the main implications and the limitations of the study respectively while the fifth section suggests future research areas. Then the researcher explains his experience towards conducting this study in the following section. The final section provides a conclusion to the study.
CHAPTER 2 – LITERATURE REVIEW

2.1 Introduction

The purpose of this chapter is to present a review of studies in tertiary education related to the aims of the present research. The review will provide information to justify the conduct of the present study. More specifically, the review will examine how past studies have been conducted, what methodologies have been used to discover related problems, what findings have been revealed and what conclusions have been drawn. This will help to identify existing gaps in the literature and thus support the need to conduct this proposed study.

The chapter is organised in five sections. The first section presents the introduction of this chapter. The next section starts with a general overview of the TAFE teaching context, followed by a description of the role of ICT in vocational education and professional practices. The third section presents literature regarding teachers’ conceptions of teaching in the tertiary education sector along with studies conducted in professional education. It includes both face-to-face and blended teaching contexts. The fourth section discusses studies that focus on teachers’ approaches to teaching in tertiary education. It explores teachers’ teaching experiences in (i) face-to-face, and (ii) blended education contexts. The fifth section focuses on phenomenographic studies that investigated conceptions of technology in professional practices. Each section ends with a summary to show how prior research relates to the present study.
2.2 Vocational teaching, practice and the role of ICT

The aim of this section is to discuss the nature of teaching practices in vocational education. It also describes the use of ICT in vocational teaching and professional activities.

2.2.1 Vocational teaching: is it different from university teaching?

One question could be asked when vocational education generally, and TAFE education in particular, compared with university education is – “Is teaching at TAFE different from teaching at university?” Since TAFE colleges and universities differ in their purpose and focus, it is logical to assume that TAFE teachers approach their teaching in a different way from university teachers (Rosalind Carter & Ellis-Gulli, 2014). Admittedly, teaching in both sectors has commonalities: both focus on supportive or facilitative teaching-learning approaches, and aim to achieve better student learning outcomes (Wheelahan, 2010).

TAFE teaching, however, does follow a different pedagogical framework from university teaching. Rosalind Carter and Ellis-Gulli (2014) argue that vocational pedagogy is directed towards employment-focused teaching and transferable skills; in other words, students gain skills through vocational teaching and later employ these skills in the workplace. TAFE pedagogy emphasises individualised and supportive teaching methods towards the practical applications of what is being taught. University teaching, in contrast, follows the pedagogy of being well informed and of developing the inclination to discover, and builds on specific knowledge. It encourages intellectual
contribution, the use of critical thinking and the synthesis of existing knowledge to contribute to the expansion of existing knowledge (Rosalind Carter & Ellis-Gulli, 2014).

Additionally, teaching at TAFE focuses on industry-oriented activities and engagements with the aim to acquire industry-related practical skills. This requires more hands-on practice and laboratory and job-related exercises than university teaching. Furthermore, it entails workplace assessment; that is, evaluating students’ learning while they are immersed in activities in the workplace in order to check their level of competency against industry standards. Teaching at TAFE supports a vocational curriculum, and is structured on a national competency framework, which means its focus is on achieving a required level of skills, knowledge and attitudes identified by the industry. In contrast, teaching at the university level requires academic engagement; it is less directly related to workplace learning and is mainly conducted in academic settings (both face-to-face and online). University teaching focuses on developing an understanding of the major concepts and theories of a discipline, and requires more essay writing, theoretical understanding, detailed knowledge, literature reviews, as well as independent thinking and argumentation (Rosalind Carter & Ellis-Gulli, 2014; Kloppenborg, 2010; Moodie & Wheelahan, 2009). It generally involves classroom assessments, which are guided and administered by teachers in the classroom environment. Moreover, it is supported by a curriculum which is grounded in theory-based application (Kloppenborg, 2010; Wheelahan, Moodie, Billett, & Kelly, 2009).

In relation to students characteristics, Kloppenborg (2010) pointed out that TAFE students come from more diverse backgrounds and have widely differing learning needs and starting points (entry points) compared to university education in where students
have less diverse backgrounds in terms of age, prerequisite knowledge and skills, aim of entering educational institutions. For example, many low socio-economic status (SES), aboriginal, rural students and mature-aged students enter vocational education as their second chance of education (Abbott-Chapman, 2011). TAFE students are looking for skills to enter the labour market for the first time or are those who are thinking of re-entering the labour market after being absent for a considerable period of time. These latter are possibly people who have lost jobs and need to renew their skills for employment or those currently employed who have to upgrade their skills to adjust to the present demands of their industry. Agrawal (2009) in this connection described TAFE as a “traditional and transitional TVET system”. The author added that TAFE is the most accessible tertiary education in Australia. Students enter into TAFE in practice after twelve years of education. He also identified six streams of vocational courses that TAFE institutes offer, namely professional, para-professional, trades, other skilled, preparatory, and adult or further education. Graduates from TAFE are employed in different sectors in the professions, including lower level technicians and skilled workers and in some cases, managerial positions. NCVER (2002) reported that university graduates (75.3%) are five times more likely to be employed in the professional and managerial occupations than TAFE graduates (14.5%) (p. 4).

By contrast, the entry qualification for university education can vary widely by a unit of course. It is found that, students from high socio-economic background are more likely to enter into university education (Abbott-Chapman, 2011). Generally, students who seek sound theoretical knowledge, analytical skills and have high ambitions in their career to get employment in mid or top level managerial post, prefer to enter a university.
TAFE teachers are required to have knowledge of the interconnectedness of the workplace as well as their own specific vocational expertise, which is partly true for the university teaching, especially those teaching professional courses (Fuller & Chalmers, 1999; Kloppenborg, 2010). However, university teachers are expected to have strong theoretical knowledge for problem analysis and decision-making. Moreover, they should have skills for conducting research activities to contribute to the expansion of the relevant discipline and existing theory. Although teaching at TAFE is different from teaching at the university level in many ways, both these areas are under pressure to improve their teaching practices.

2.2.2 Vocational practice: is it different from professional practice?

The terms “vocational” and “professional” may have different meanings in different countries (Anderson, 2008). In some cases, both words have the same purpose and meaning (Richard Carter, 1985; Cogan, 1955; Rojewski, 2009; Zuga, 2009); in other cases, there is a distinction between them (Amasuomo, 2014; Anderson, 2008).

Professional education usually refers to higher level education focused on particular occupations, such as law, medicine, engineering, architecture, and social work (Anderson, 2008). Similarly, Grubb and Lazerson (2005) define professional education as higher education, or more generally, as occupational education which has a socially higher status than courses for tradespersons and technicians. Other studies define professional education as combining both university and vocational education. For example, Carter (1985) reported that professional education in the United Kingdom generally embraces both university and polytechnic.
Vocational education, on the other hand, is primarily about preparing people through teaching practical skills and necessary knowledge for employment in a particular occupation or trade (Moodie, 2002). The detailed definition as stated by the European Union is:

“any form of education which prepares for a qualification for a particular profession, trade or employment or which provides the necessary training and skills for such a profession, trade or employment is vocational training, whatever the age and the level of training of the pupils or students, and even if the training programme includes an element of general education” (cited in Anderson, 2008, p. 107).

In the literature, the difference between professional and vocational education is mainly found in relation to the level of study and the professional job status. For example, Anderson (2008) in his study referred to the terms vocational as “lowlands” and professional as “highlands” (p. 107). In this view, low-level education, mainly in post-secondary levels, which is part of tertiary education such as vocational colleges, institutions, or polytechnics, and particularly TAFE in Australia, is treated as vocational education. Higher level of education, mainly university, is seen as the main provider of high status personnel in the professional work sphere. For a better understanding about the terms vocational education and professional education, the researcher has classified both of them based on Dahlstedt and Bevelander’s (2010) article: TAFE education directing to a profession is classified as vocational education whereas vocational education directing to a profession at the university level is classified as professional education.
In this study, professional education is defined broadly to include vocational education offered by TAFE institutions in Australia. A number of other studies have also used the term professional education instead of vocational education in similar cases (Rojewski, 2009; Zuga, 2009). This study does not claim that vocational education in TAFE and professional education in university are identical; rather, the aim of this discussion is directed at drawing a common ground for vocational and professional education. Words *vocational* and *professional* are used in this study interchangeably.

2.2.3 ICT and vocational teaching

A substantial number of studies provides evidence that ICT is widely used as a pedagogical tool in TAFE classrooms (Armatas & Papadopoulos, 2013; Pellone, 1991; Sansey, 2005). ICT tools have several advantages over other educational media currently used for teaching at TAFE. For example, computers in the classroom facilitate the presentation and management of lectures in the following ways: enabling students to take down notes, printing resource materials, and receiving immediate feedback and reinforcement (Bliuc et al., 2012; Pellone, 1991). Likewise, ICT tools allow the faculty to collaborate with their students, particularly in providing flexible learning opportunities or in allowing students to cover course materials at their own pace (T. Collins, 2013; McKenry, 2013). Zarini (2009) stated four main roles of ICT in professional education in his book chapter *international approaches to skills development through ICTs* : (i) it links theory and practice better; (ii) it enhances the level of students’ knowledge, skills and competences; (iii) it provides apprentices with ICT enhanced training for a better perspective on the world of work; and (iv) it
increases efficiency in performing tasks.

There are many ICT-supported software packages used widely in VE teaching and learning situations. Prominent among these tools are computer simulations that are used both in professional education and professional practice itself. These help students learn about technical events and processes that would otherwise be impossible due to high cost, feasibility, or safety issues (Michael, 2001). For example, an automotive Supplemental Restraint System (SRS) is a system simulator that allows practical demonstrations of a SRS airbag, imitating real-life situations for the trainers in profession. The simulation admittedly does not provide a real training environment or learning situation equivalent to engagement in actual work place experience, but such ICT supported simulation tools are used widely to facilitate training for novices in professional education.

Teachers and students in vocational education use different sorts of technology in different vocational courses. The use of technology is not limited to the face-to-face teaching context. In order to show the use of ICT in different contexts, this review synthesises the four distinct areas to capture the exiting literature. The main aim is not to present a detailed literature review regarding the effective use of ICT in vocational education because this study is not investigating the effectiveness of ICT usage in vocational education rather the main focus is to identify vocational teachers’ different ways of understanding ICT in teaching, thereby, offering a glimpse (detailed in Appendix 8) into the benefits and limitations of using ICT in various teaching contexts of vocational education.
**ICT in face-to-face context:** ICT may be used in many vocational courses in a face-to-face teaching context, and both teachers and students are expected to get benefits from this (Armatas & Papadopoulos, 2013; Pellone, 1991). For example, Armatas and Papadopoulos (2013) reported significant benefits, for both students and educators, from using ICT in vocational courses with industrial attachment. For example, *students* could understand the relationship between theory and practice and how their knowledge and skills connected with work. As a result, students could transfer the knowledge and skills they learned in the classroom to the workplace. The *staff members* also benefited when they shared their experiences and worked with contemporary digital devices. However, finding an accommodating industry as a potential partner is the main challenge to integrate ICT courses with industrial involvement. This challenge is connected with several reasons such as sometimes industry partners may feel over-burden in terms of time and personnel required during their engagement; industries and vocational institutes experience difficulties in matching their level of interests.

**E-learning/online learning:** Vocational education does also benefit from using technology in the form of e-learning/online learning (T. Collins, 2013; Jansen & Adams, 2008). The aim of this kind of teaching is to provide flexible learning. For instance, Jansen and Adams (2008) identified that students benefit from the use of ICT in *flexible delivery and self-paced* learning. Indeed, they (i) get their preferred space for learning; (ii) assess their learning at their convenience to determine readiness for final assessment; (iii) achieve a higher level of knowledge and skills by focusing on their practical tasks; and (iv) share their knowledge and skills. Despite these advantages, the authors identified several constraints when introducing flexible delivery; namely, that students were upset when they could not adapt to the flexible delivery, that the success
of the delivery depended mostly on the students’ self-directed participation, and in some cases, that it was time-consuming (for instance, preparing an online database for learning and assessment requires a significant amount of time from the teachers).

Blended context: Blended teaching context plays an important role in vocational education for two reasons: (i) vocational students are diverse in nature and need blended methods for meeting their diverse needs; and (ii) administrations are encouraged to use it as blended teaching and learning provide many advantages. For example, McKenry (2013) identified several benefits resulting from using a blended approach. These include blended learning providing students with flexibility, meaning that students can learn from any place; students having opportunities to engage in self-paced learning; and students taking the opportunity to undergo a digital development program.

Mobile learning: Mobile devices could be used effectively in vocational education (L. Collins & Eagle, 2013). Most teachers and students have their own mobile devices from which they can access teaching and learning materials at anytime and any place. In relation to this, L. Collins and Eagle (2013) identified mobile learning (m-learning) as an effective platform when incorporated with face-to-face delivery, particularly regarding sharing and collaboration. Both students and teachers can build their confidence and improve their knowledge and skills in vocational courses. The findings, however, acknowledged that teachers and students become frustrated when m-learning is solely used for delivery.

From the above studies, the researcher surmised that ICT-supported teaching and learning systems in vocational institutions are continuing to progress, and there are some potential benefits. Many of the vocational institutions have already preferred the potential benefits of incorporating ICT in their teaching (T. Collins, 2013). However,
disadvantages have also been identified by studies (Armatas & Papadopoulos, 2013; Jansen & Adams, 2008). Teachers’ understanding of ICT-enhanced teaching in vocational education is an important aspect due to two main reasons: (i) it connects with teaching practice and students’ learning (Kember, 2009; Prosser, Trigwell, Ramsden, & Lueckenhagen, 2005); and (ii) vocational institutions continually uptake ICT in their teaching and learning. Despite its importance, teachers’ understanding of ICT-enhanced teaching in this context has not been fully explored, particularly from a phenomenographic perspective. Therefore, a research question has been generated in the present study – *What does ICT-enhanced teaching mean to TAFE teachers?*

However, another aspect needs to be addressed in relation to vocational teachers’ understanding of the role of ICT in the workplace. It is important that their understanding goes beyond the classroom and extends to an understanding of ICT’s place in the workplace, particularly as this may influence students’ learning outcomes, and thereafter, readiness for entering workforce. Therefore, this study seeks to identify teachers’ conceptions of ICT as used in the workplace. The next section will provide a brief synthesis of the literature on how ICT is used in professional work and implications for professional practices.

2.2.4 The role of ICT in the workplace professional practices

The main purpose of this sub-section is to highlight the importance of ICT in the workplace, and to identify the ICT related skills required by the industry. The impact of using ICT in professional practices is also discussed.
One of TAFE’s goals is to equip future professionals with the skills they need in the workplace (Clarke & Volkoff, 2007). In the last decade, ICT has been deployed across many areas of industry. In computer-aided design, for instance, drawing can be done with a computer using software; various types of software and hardware are used in the graphic arts and media sector including graphic design, page layout and image processing (Danielson & Politis, 2004). There is also a range of new and enhanced telecommunication services that require workers to gain new ICT skills (Loveday, 2010). ICT-supported equipment can perform the work of mortising, moulding, sanding and finishing, automotive workshop and engineering (Danielson & Politis, 2004; Robert, 2011).

In general, two types of ICT skills are available to perform professional practices: generic and specific profession-oriented ICT skills. The former includes word-processing, typing, printing, use of databases/spreadsheets, desktop publishing, and the use of the Internet for searching relevant elements to acquire knowledge and skills, to do research, and for purposes of communication. Graduates from VE programs need to acquire these generic profession-oriented ICT skills that are needed as their entry credentials into the workplace (Amasuomo, 2014; Mavromaras, 2013). The latter constitutes ICT skills directed to a particular occupation, such as the ability to (i) use MATLAB building models and simulations in electrical engineering and some other professions; and (ii) access diagnostic information as well as use software for clinical or specific professional purposes. ICT skills further require to use CNC equipment, to work with CAD/CAM and to operate equipment with digital system in mechanical engineering and other engineering professions (Chris & Boris, 2002; Peansupap & Walker, 2005). Therefore, specific professions need both type of ICT skills.
Professional education needs to focus on gaining specific ICT skills to meet current industrial prerequisites. For instance, the graphic arts industry mostly requires generic ICT skills (printing, use of databases) but also other specific graphic industry-related ICT skills (image processing, image storage and retrieval). Other industries, such as the automotive industry, depend on machines and equipment, so may require a more extensive use of ICT skills.

The need for ICT skills and the way of using ICT differs across industries (Poulis et al., 2013; Southern & Tilley, 2000). A significant number of studies have been conducted to address this issue (the use of ICT in different industries) (Arif, 2010; Armatas & Papadopoulos, 2013; Buhalis, 2004; Cörvers & Meriküll, 2007; Gera, Gu, & Lin, 2001; Poulis et al., 2013; Spöttl & Becker, 2004; Vokes, Brennan, Bayliss, & Beck, 2013). However, the main purpose of this review is to provide a synthesis discussion on the impact of ICT in different professional areas. The detailed review is presented in Appendix 9. It gives a general idea about the benefits of using ICT in professional work and further explores the nature of using ICT in this context. It particularly highlights the studies which focus on the use of ICT in small technology-driven industries. Additionally, this review provides two more examples from two different professional workplaces: one from an applied engineering discipline, the automotive industry, and another from an applied arts discipline, the graphic arts and media sector. Through these three areas, the researcher aims to present a wide scope of ICT uses in different industries.

Small and medium-sized industries: Technology is used in many industries and several studies showed that ICT is widely adopted by many small and medium-sized
industries, thereby giving a positive result in relation to performance, customer services, expansion of industries and economic growth (Alkalbani et al., 2013; Steinfield et al., 2012; Tarutė & Gatautis, 2014). For example, the positive impact of using ICT is found in small and medium sized rural enterprises (Steinfield et al., 2012); and the construction industry (Alkalbani et al., 2013; Ruddock, 2006); as well as in different product and systems industries (Hernández Pardo, Bhamra, & Bhamra, 2012). Supporting those claims, Consoli (2012) identified four major roles of ICT in small and medium-sized industries, namely: performance, growth, expansion and new products (Figure 2.1)

![Impact of ICT on organizations](image)

*Figure 2.1 Impact of ICT in small and medium-sized industries (Consoli, 2012, p. 95)*

**Automotive industry:** The automotive industry is considered a technology-driven industry because most of its operations (performing activities) depend heavily on ICT. For instance, Spöttl and Becker (2004) conducted a project in the *automotive sectors* and revealed that ICT (hardware and software) was used extensively in all sectors and sub-sectors, which include design, production, assembly, service, quality control and
quality checks. The thorough review of this study is presented in Appendix 8. ICT and its supported tools provide progressive facilities and benefits in this industry. This is exemplified by the offering of digital and flexible manufacturing facilities (Jung et al., 2013; Richardson & Haylock, 2012), by providing opportunities for connecting millions of customers that create a crucial success factor in automotive marketing (Cherubini et al., 2015), and by supporting the electric control unit (ECU) which is a crucial service for most automotive vehicles (Jung et al., 2013). The central control of the ECU is integrated with ICT support in a controller area network (CAN), global positioning system (GPS), local area network (LAN) and media-oriented system transport (MOST). In addition, ICT and its features such as the internet of things (IoT), and cloud computing, facilitate technological innovation and transformation in the automobile sector (Qin et al., 2013). The usage of ICT in the transformation of automobile service is summarised in Table 2.1.

Table 2.1 indicates that the workforce directly and indirectly, relies on ICT during in the automotive sector. Therefore a large number of professionals need knowledge of ICT applications, ICT skills and other (non-ICT) knowledge related to automobile production and repairs.

*Graphic arts and media sector:* The recent advances in technology and consumers’ demands have significantly influenced the graphic arts and media sector (Danielson & Politis, 2004). During the last decade, this sector has been moving towards full digital workflows (the total working process) and digital printing, demonstrating a strong uptake of technology. In relation to this advancement, the Danielson and Politis (2004) study identified many job positions that require ICT knowledge in the graphic arts and
media industry – graphic designer, scanner operator, pre-press operator, pre-press network administrator, website designer, multi-media application designer, plate maker for offset and flexographic printing, as well as pre-press operator for specific applications for packaging design flexo, finisher, binder, and packaging operator. It subsequently identified many ICT usages in the graphic arts and media industry: applications for hardware specific, network administration and support, file formats and connectivity, connection of devices and workstations, database processing, storage and retrieval of assets (images) from data banks, use of machines connected to computers and application of vendors’ specific interfaces, and knowledge of data input in production planning systems and the like.

Table 2.1 *Transformation of automobile service, from Qin, Long, Zhang, and Huang, 2013, p. 178*

<table>
<thead>
<tr>
<th>Auto service</th>
<th>Traditional model</th>
<th>Transformed model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>Test-drive, negotiate, check credit, shop auto loan, and sign contract.</td>
<td>• Experience center: experience new models and state-of-art technologies</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Education center: gain knowledge related to model selection, car maintenance, and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>driving safety, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Social networking: get together with people who share the similar interests related</td>
</tr>
<tr>
<td></td>
<td></td>
<td>to automobile design, driving, and maintenance, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Entertainment center: virtual driving games, kids club, etc.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Mobile commerce: offer pre-sale activities and sales operations via mobile devices</td>
</tr>
<tr>
<td>Service</td>
<td>Wait for customer to take the car to the garage, fix it, and notify the customer</td>
<td>• Track vehicle usage and road condition, assist driver to make instant decisions.</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Provide remote services such as tele-diagnose</td>
</tr>
<tr>
<td></td>
<td></td>
<td>• Initiate personalized service by offering entertainment, news, commercial</td>
</tr>
<tr>
<td></td>
<td></td>
<td>information based on driver preference</td>
</tr>
</tbody>
</table>

The skilled personnel who work in the above professions are graduates from both
university and the VE sectors. The higher-level workers, for example, managers and designers, are qualified via university education, whereas skilled workers like technicians and machine operators, who are directly involved in operations, come from the VE sector. The above studies show that vocational education supplies the skilled graduates who play a vital role in meeting the current needs of the workplace.

The demand for an ICT-skilled labour force increases continually due to the changed economical movement (Finnie & Norrie, 2013). Hence, a significant number of studies and reports have indicated the demand for an ICT-skilled workforce for the economic development of a country (ACS, 2013; AWPA, 2012; Gera et al., 2001; Hagan, 2004; Mavromaras, 2013). Studies conducted in Germany, the United States (US), Canada, United Kingdom (UK), the European Union (EU) and Australia, reported that ICT demands link with the economic development of a country (Berman, Bound, & Machin, 1997; Cövers & Meriküll, 2007; Gera et al., 2001; Srour, Taymaz, & Vivarelli, 2013). Hagan (2004) stated that ICT is "the dominant engine for productivity improvement and business opportunities" and "a key factor for generating future employment" (p.119). The demand for ICT skills is widespread. Industries like banking, finance, manufacturing, transportation and many others depend on skilled ICT professionals (Finnie & Norrie, 2013). Workforces with the required level of ICT skills bring benefits to both employers and employees, as indicated by increased productivity and job satisfaction (AWPA, 2012). The Australian Computer Society (ACS, 2013) conducted a study to find out the present status of ICT workers. This report also predicted the future demand for ICT-skilled workers in Australia. Table 2.2 shows the increase in number of ICT-skilled workers within one year.
ACS (2013) further presented the DEEWR’s projection of five-year ICT-skilled workers employment growth for the period 2011-12 to 2016-17 to justify the demand for ICT-skilled workers. Figure 2.2 shows the six areas of occupations where ICT-skilled workers are projected to increase in five years.

Table 2.2 Australian statistics related to ICT skills, based on ACS (2013, p. 7)

<table>
<thead>
<tr>
<th>Measurement</th>
<th>Statistics</th>
<th>Period</th>
<th>Source</th>
<th>Trend</th>
</tr>
</thead>
<tbody>
<tr>
<td>Digital Economy annual Contribution to the Australian Economy</td>
<td>$100.62 Billion</td>
<td>August 2011</td>
<td>CIIER, Deloitte Access Economics, IBISWorld</td>
<td>ACS calculated measurement in 2011 (the first calculation in Australia)</td>
</tr>
</tbody>
</table>

The increase is summarised below:

- 8 000 (9.3%) workers will be needed for software and applications programmers;
- 5 700 (10%) workers will be needed for ICT support technicians;
- 5 600 (12.6%) workers will be needed for ICT managers;
- 3 000 (8%) workers will be needed for database and systems administrators and ICT security;
- 1 500 (4.1%) workers will be needed for electronics trades workers; and
- 4 300 (13.2%) workers will be needed for ICT business and systems analysts.
Summary: The use of ICT in Australian industry is continually increasing and is seen as a likely influence on economic development. The rapid growth of the economy and the innovative use of technology in different industries are linked to the high demand for ICT-skilled workers. Vocational education is the major provider of skilled workers to meet this demand and vocational teachers play a significant role by incorporating ICT-related knowledge and skills in their teaching.

2.3 Conceptions of teaching in tertiary education

Previous studies on conceptions of teaching in higher education can be categorised into two broad areas: research on teachers’ conceptions of teaching in face-to-face settings (Kember, 1997; Kember & Kwan, 2000; Prosser & Trigwell, 1999; Samuelowicz & Bain, 1992, 2001); and research on teachers’ conceptions in blended contexts (Ellis et al., 2009; González, 2009; Roberts, 2003). The review of these studies
is presented in the following sections.

2.3.1 Conceptions of teaching in face-to-face settings

In one of the earliest studies, Dall’Alba (1991) interviewed twenty teachers from four departments (Economics, English, Medicine and Physics) in Australian universities. She identified the following seven teaching conceptions:

i. presenting information;

ii. transmitting information (from teacher to student);

iii. illustrating the application of theory to practice;

iv. developing concepts/principles and their relations;

v. developing the capacity to be expert;

vi. exploring ways of understanding from particular perspectives; and

vii. bringing about conceptual change.

Dall’Alba presented a logical hierarchy, an orderly arrangement of the seven conceptions, from a simple to a more complete understanding of teaching. At the lowest level of conception, the focus was on teachers conveying necessary information. Teachers were seen simply as transmitters of information to students who acted as recipients of information. By contrast, at the highest level of conception, students’ active participation towards their own understanding of the lesson was emphasised. The progression depicted a pivotal shift from teacher-focused to student-focused teaching. However, Dall’Alba recommended that further analysis should be done so that categories (iii) and (vi) could be clarified and defined more elaborately.
A similar study was conducted a year later by Samuelowicz and Bain (1992), who used semi-structured interviews with 13 academics in the field of sciences from two universities in UK and Australia. They identified five conceptions. In ascending order, these are as follows:

i. imparting information;

ii. transmitting knowledge;

iii. facilitating understanding;

iv. changing students’ conception; and

v. supporting student learning.

Unlike Dall’Alba (1991), Samuelowicz and Bain (1992) elaborated on these conceptions and proposed a corpus of five core dimensions of teaching, namely learning outcome, knowledge, students’ conceptions, teaching, and contents, in order to clarify boundaries between the identified conceptions. These dimensions also helped to group the conceptions into broader “teacher-centred” and “learning-centred” categories. They also identified an intermediate orientation between these two. These authors extended their framework in their 2001 study that covered a larger sample of thirty-nine teachers from a broader range of disciplines. Participants were drawn from nine departments of three different universities. In this study they found seven conceptions of teaching. The conceptions were presented from a less to a more complete understanding of teaching. Teaching was seen as –

i. imparting information;

ii. transmitting structured knowledge;

iii. providing and facilitating understanding;

iv. helping students develop expertise;
v. preventing misunderstandings;

vi. negotiating understanding; and

vii. encouraging knowledge creation.

A comparison of these two works of Samuelowicz and Bain shows that the orientation proposed in the earlier (1992) framework was basically repeated in the later study (2001), with the addition of two conceptions that emerged from the larger sample and wider disciplines. It is important to note that in the 1992 study, the authors proposed “facilitating understanding”, which was an intermediate between teacher-centred and learning-centred frameworks. In the 2001 study however, the authors did not find such a transitional or intermediate orientation useful. They felt there was no need for a middle position. Instead, they proposed that the concept “facilitating understanding” could be split into two conceptions: first, “providing and facilitating understanding”, which was basically an element of the teacher-centred orientation; and second, “helping students develop expertise”, that came under learning-centred. Further, they suggested the “changing students’ conception” could be split into two separate conceptions: “preventing misunderstandings” and “negotiating understanding”, both of which were deemed learning-centred.

Prosser, Trigwell and Taylor (1994) conducted a phenomenographic study in Australia in which they interviewed 24 teachers who were lecturing first year chemistry and physics within two Australian universities. They identified six conceptions of teaching:

i. transmitting concepts of the syllabus;

ii. transmitting the teachers’ knowledge;
iii. helping students acquire concepts of the syllabus;
iv. helping students acquire teacher knowledge;
v. helping students develop conceptions; and
vi. helping students change conceptions.

The authors argued that each of the conceptions was qualitatively different. They also noted that their categories were broadly consistent with those of Samuelowicz and Bain (1992), but with a few differences. For a start, they did not locate any intermediate orientation or identify a conception “supporting student learning”. Moreover, they did not place their conceptions into a “teacher-centred and learning-centred” frameworks. Instead they proposed the subsets “conceptual development change” and “transmission-acquisition” and fitted their six conceptions into these two broad categories. The former emphasised student learning while the latter focused on knowledge transmission by the teachers.

Similar research has been carried out in different contexts (e.g., countries) by other researchers, for example, M. J. Dunkin (1990), M. J. Dunkin and Precians (1992), Fox (1983), Martin and Balla (1991), and Pratt (1992). The findings of most of these studies have been consistent with the two broad orientations of conceptions: teacher-centred and student-centred. A more detailed categorisation had been presented by Kember (1997) who reviewed thirteen papers that investigated university teachers’ conceptions of teaching. He included the works of Dall’Alba (1991), Samuelowicz and Bain, (1992), Prosser et al. (1994) and others from seven different countries. He suggested that most of these concur on five conceptions of teaching as follows:

i. *Teaching as imparting information:* It is the most teacher-centred orientation
where teachers alone present the information. The students on the other hand, are considered to be recipients who basically act as “containers” into whom all the knowledge is “poured”.

ii. *Teaching as transmitting structured knowledge:* This conception presents the teachers’ role still as transmitting knowledge but the significance of their organising the information to make it easier for the students to understand is recognised. Students still act as receivers of knowledge but their understanding is emphasised by receiving knowledge from teachers. The teachers’ task is structuring knowledge and the students’ task is understanding the knowledge as facts.

iii. *Teaching as an interaction between the teacher and the student:* This is a transitional conception where importance is given to the interaction between the teacher and the students.

iv. *Teaching as facilitating understanding on the part of the student:* This conception is student-centred or student-oriented. It focuses on the students’ understanding based on their active involvement in the learning process. The teachers’ role is to help students develop their understanding themselves.

v. *Teaching as bringing about conceptual change and intellectual development in the student:* This is the most complete conception of teaching. Teachers not only help students to understand the subject matter but they also create an environment where students become more responsible (compared to previous conceptions) for their own learning in terms of conceptual change, and consequently their intellectual development is enhanced.

Kember (1997) was also interested in describing a relationship between these five
categories of conceptions. He proposed five key dimensions: teacher, teaching, student, content and knowledge, which could be used to depict how the conceptions in the teacher and learning process deviated from each other (Table 2.3). The author further grouped the above five conceptions under two broad orientations: teacher-centred/content-oriented, and student-centred/learning-oriented, together with an intermediate conception, “teacher-student interaction”, which he identified as a transitional bridge between the two orientations. In this intermediate conception, both teachers and students are engaged in the teaching and learning process, thus, it appears as a linking category between teacher-centred and learning-centred orientations. Kember (1997) also claimed that future research on teachers’ conceptions might not bring any further significant additions to the literature as his review covered studies conducted in many countries and a varied range of universities which particularly focus on face-to-face teaching context.

Åkerlind (2004) however, challenged Kember’s (1997) claim and showed that newer studies could continue to explore teachers’ conceptions and provide new elements. She interviewed 28 teachers at a traditional, research-intensive university in Australia and identified four conceptions of teaching –

i. teacher transmission focused;

ii. teacher–student relations focused;

iii. student engagement focused; and

iv. student learning focused.

Along with these, Åkerlind (2004) identified four dimensions of teaching experience: role of student, benefit for students, benefit for the teacher and breadth of benefit, to help understand the relationship of these conceptions. These are summarised
in Table 2.4 below.

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Imparting information</th>
<th>Transmitting structured knowledge</th>
<th>Teacher-student interaction</th>
<th>Facilitating understanding</th>
<th>Conceptual change</th>
</tr>
</thead>
<tbody>
<tr>
<td>Teacher</td>
<td>Presenter</td>
<td>Presenter</td>
<td>Presenter and tutor</td>
<td>Facilitator</td>
<td>Change agent/developer</td>
</tr>
<tr>
<td>Teaching</td>
<td>Transfer of information</td>
<td>Transfer of well structured information</td>
<td>Interactive process</td>
<td>Process of helping students to learn</td>
<td>Development of person and conceptions</td>
</tr>
<tr>
<td>Student</td>
<td>Passive recipient</td>
<td>Recipient</td>
<td>Participant</td>
<td>Lecturer responsive for students’ learning</td>
<td>Lecturer responsive for student development</td>
</tr>
<tr>
<td>Content</td>
<td>Defined by curriculum</td>
<td>Lecturer needs to order and structure material</td>
<td>Defined by teacher</td>
<td>Constructed by students within teacher’s framework</td>
<td>Constructed by students but conceptions can be changed</td>
</tr>
<tr>
<td>Knowledge</td>
<td>Possessed by lecturer</td>
<td>Possessed by lecturer</td>
<td>Discovered by students but within lecturer’s framework</td>
<td>Constructed by students</td>
<td>Socially constructed</td>
</tr>
</tbody>
</table>

She identified three new dimensions to discover teachers’ conceptions, which were not found in the previous literature (note that “role of student” was already cited by Kember in 1997). Those three dimensions are “benefits for students”, “benefits for teachers” and “breadth of benefit”. The first two show what students and teachers gain from teaching. The latter refers to the potential range of benefits to not only a single group (students), but the students and teachers group or larger groups (students, teachers and society) simultaneously. The categories of conceptions that she identified using phenomenographic research were also dissimilar to previous studies. For example, she identified a “teacher-student relations focused” category, which emphasised teachers’
ways of building a relationship with students. She claimed that it is an aspect not elaborated in previous research, as the author stated, “unlike any other study of university teaching, two new dimensions in ways of experiencing teaching were found...” (p. 373).

Table 2.4 Dimensions relating categories of conceptions of teaching, from Åkerlind, 2004, p. 372

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Teacher transmission focused</th>
<th>Student-relations focused</th>
<th>Student engagement focused</th>
<th>Student learning focused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role of student</td>
<td>Passive recipients</td>
<td>Responsive recipients</td>
<td>Active recipients</td>
<td>Active creator</td>
</tr>
<tr>
<td>Benefits for students</td>
<td>Knowledge as facts</td>
<td>Knowledge and skills</td>
<td>Knowledge, skills and enjoyment</td>
<td>Knowledge, skills, enjoyment and development</td>
</tr>
<tr>
<td>Benefits for teacher</td>
<td>Nothing or new content knowledge</td>
<td>New content and teaching enjoyment</td>
<td>New content and teaching enjoyment</td>
<td>New content, enjoyment and understanding</td>
</tr>
<tr>
<td>Breadth of benefit</td>
<td>Students only or students and teacher</td>
<td>Students and teacher</td>
<td>Students and teacher</td>
<td>Students, teacher and field</td>
</tr>
</tbody>
</table>

González (2011) conducted a phenomenographic study with a sample of 18 teachers from two research-intensive Australian universities. This study revealed four conceptions of teaching:

i. transmitting the basic information of the discipline;

ii. transmitting lecturers’ understanding;

iii. developing students’ understanding; and

iv. changing students’ understanding and developing critical thinking.

González’s (2011) four conceptions of teaching were similar to the categories of the previous studies. His proposed categories supported the teacher-centred and student-centred frameworks. His study then presented four dimensions of variation: role of the
lecturer, role of the students, content and motivation (Table 2.5). The author identified a new dimension of variation, “motivation”, that emerged from the relationship among categories of description. He also described the hierarchical relationship among the conceptions, which was consistent with the idea that “the higher level conceptions include the lower ones” (González, 2011, p. 77). Both González (2011) and Åkerlind (2004) added new findings to the exiting literature and, therefore, their work encourages future research exploration in this area.

Table 2.5 Dimensions relating categories of conceptions of teaching, from González, 2011, p. 76

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Transmitting basic information of the discipline</th>
<th>Transmitting lecturer’s understanding</th>
<th>Developing students’ understanding</th>
<th>Changing students’ understanding-developing critical thinking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role of the lecturer</td>
<td>Provider of information</td>
<td>Provider of own understanding</td>
<td>Facilitator</td>
<td>Facilitator-challenger</td>
</tr>
<tr>
<td>Role of the students</td>
<td>Passive recipients</td>
<td>Passive recipients</td>
<td>Active learner</td>
<td>Active developer of understanding</td>
</tr>
<tr>
<td>Content</td>
<td>Delimited by syllabus - external demands</td>
<td>Delimited by the lecturer</td>
<td>Constructed by students within lecturers’ framework</td>
<td>Constructed by students</td>
</tr>
<tr>
<td>Motivation</td>
<td>Not considered</td>
<td>Not considered</td>
<td>Emphasised</td>
<td>Emphasised</td>
</tr>
</tbody>
</table>

Table 2.6 contains a summary of the findings drawn from the previous studies reviewed above. The table shows that the findings of Prosser et al. (1994), Samuelowicz and Bain (2001), Åkerlind (2004), and González (2011) were generally consistent with each other. Each of the conceptions may have been differently labelled but all were consistent with Kember’s (1997) classification of conceptions of teaching into two broad orientations: teacher-centred/content-oriented, and student-centred/learning-oriented. However, one aspect seemed controversial. The literature revealed a “teacher-student interaction” postulated as an intermediate orientation by Kember (1997) which
Samuelowicz and Bain (2001) argued there was no need to identify as an intermediate orientation. Consequently, the teacher-centred/content-oriented, and student-centred/learning-oriented frameworks seem not entirely fixed. There is the possibility of identifying an intermediate orientation into it.

Moreover, the literature review indicated that subsequent studies have sought to discern new facets of teaching which have not been found in earlier studies. Åkerlind (2004), for instance, suggested three new dimensions while González (2011) proposed another new dimension, “motivation”, indicating that there are still more to learn. None of the above studies investigated teachers’ conception of vocational teaching. Consequently, the present study not only sought to explore vocational teachers’ conceptions of ICT-enhanced teaching but also sought to identify different dimensions in order to provide further supporting evidence for the teacher-centred/student-centred frameworks. The next sub-sections elaborate further the need to conduct this study based on the previous literature in blended contexts.
Table 2.6 *Comparison of conceptions of teaching in face-to-face teaching context based on prior research*

<table>
<thead>
<tr>
<th>Teacher-centred</th>
<th>Intermediate</th>
<th>Learner-centred</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transmitting concepts of the syllabus</td>
<td>Imparting information</td>
<td>Providing and facilitating understanding</td>
</tr>
<tr>
<td>Transmitting the teachers’ Knowledge</td>
<td>Transmitting structured knowledge</td>
<td>Teacher–student relations focused experience</td>
</tr>
<tr>
<td>Helping students acquire concepts of the syllabus*</td>
<td>Helping students acquire teacher knowledge**</td>
<td></td>
</tr>
<tr>
<td>Helping students acquire teacher knowledge**</td>
<td>An interaction between the teacher and the student</td>
<td></td>
</tr>
<tr>
<td>**</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Note: *This conception depends on teaching activity where teachers are dominating their teaching activity but teachers consider students' involvement in the teaching–learning activity so students can acquire better learning from the textbook (syllabus: teachers prefer to remain within syllabus).** 

This conception depends on teaching activity where teachers are dominating their teaching activity but teachers consider students' involvement in the teaching–learning activity so students can acquire better learning from teachers' knowledge.
2.3.2 Conceptions of teaching in blended settings

Blended learning refers to a combination of face-to-face and online learning (Ellis & Calvo, 2004; Ellis, Goodyear, et al., 2006). In the literature, blended learning is broadly interpreted. Oliver and Trigwell (2005) present three definitions: (i) an integrated combination of traditional learning and web-based online practices; (ii) a combination of media and tools used in an eLearning environment; and (iii) a combination of multiple pedagogic approaches irrespective of technology employed in it. Ellis and Calvo (2004) describe blended learning as the use of learning technologies as tools for discussion that have both face-to-face and online aspects; while Ellis, Goodyear, Prosser and O'Hara (2006) define blended learning as the combination of eLearning and face-to-face learning in an organised way.

This study refers to blended learning as a combination of face-to-face and online teaching, and learning using all forms of technology. This technology may be integrated and used in e-learning, web learning, and distance learning. It focuses on a teaching context where both face-to-face and online teachings are considered. Due to the growing application of blended learning, recent research has been investigating teachers’ conceptions of teaching using ICT. However, very few phenomenographic studies in particular areas (Ellis et al., 2009; Ellis, Steed, & Applebee, 2006; González, 2009, 2010; Roberts, 2003), such as web learning (Roberts, 2003), e-learning (González, 2010), virtual learning environments (Lameras et al., 2012) are found in the literature.

The study of Roberts (2003), conducted at the Modern Scottish University
(MSU), identified three conceptions of teaching using the web –

i. used as a source of subject information;

ii. used for individual and independent self-paced learning; and

iii. used for group analysis/interaction, decision-making and dialogue.

The first conception is teacher-centred in which the web is used by teachers for accessing subject content or knowledge as well as for uploading lecture notes, presentations, and course materials. In contrast, the latter two conceptions are student-centred as they focus on students’ engagement. Students, in the second conception, are engaged independently or their engagement is individualised, whereas in the third one, students’ engagement in learning is extended from individualised to a group. Learning is found collaborative or anchored in interaction between and among teachers, students and other participants.

Three years later, Ellis, Steed and Applebee (2006) conducted a phenomenographic study which focused on blended teaching. They interviewed 22 teachers from two campus-based Australian universities. The authors identified four conceptions where blended teaching was seen as:

i. replacing a part of the teacher’s responsibility;

ii. providing students with information;

iii. developing students understanding through media alignment; and

iv. helping students develop and apply new concepts.

Subsequently, the authors divided these conceptions into two broad categories: “fragmented conceptions” and “cohesive conceptions”. The former are content driven,
and concentrate on the accumulation and reproduction of knowledge without much focus on understanding. The latter are learning driven and focus on the learner’s conceptual understanding. Researchers generally presented conceptions as a hierarchy from lower order to higher order. In this case, conceptions (i, ii) are considered incomplete or fragmented (lower order), while conceptions (iii, iv) are considered complete or cohesive (higher order).

Following Roberts’ (2003) study, González (2009) investigated seven lecturers’ conceptions of online teaching. The lecturers were from the faculty of health sciences in a research-intensive Australian university. He discovered three conceptions of using the web:

i. for individual access to learning materials and information, and for individual assessment;

ii. for learning-related communication (asynchronous and/ or synchronous);

and

iii. as a medium for network-based learning.

Two of González’s (2009) findings, above, are similar to those of Roberts’ (2003). Roberts’ first conception, the web used as a source of subject information, is similar to González’s (2009) using the web for individual access to learning materials and information. Both the categories focused on “providing information” in an information-focused orientation. Also, Roberts’ third conception, web used for group analysis/interaction, decision-making and dialogue, is related to González’s use of the web for learning-related communication, as both the conceptions focus on interaction and communication in a learning-focused orientation. However, Roberts’ third
conception is hierarchically more complete than González’s (2009) second conception, because it not only emphasises communication but also focuses on group analysis and decision-making aspects. Consequently, Gonzalez’s *web as a medium for networked learning* is considered as a medium for communication, discussion, knowledge-building and sharing of information among teachers and students. In this conception, González (2009) added new elements, such as knowledge-building, in the networked learning.

A similar phenomenographic study was conducted by Ellis, Hughes, Weyers and Riding (2009). They selected 19 academics who were teaching university courses, involving face-to-face and online learning settings from two universities: one in UK and the other in Australia. They interviewed teachers to investigate their conceptions of *learning technologies*, and their application of these learning technologies during teaching. According to Ellis et al. (2009), “learning technologies are defined as those technologies used to help students to attain the learning outcomes of their course” (p.110). They found that teachers’ conceptions of learning technologies in four qualitatively different ways:

i. *as tools for access*: Primarily this means that technologies are viewed as ways to help learners access information. In this conception, a learning technology is a tool that provides a method for acquiring information rather than for support and improvement of learning.

ii. *as tools for information delivery*: It is, as a form of receptacle that carries information. Learning technologies are taken as tools that act as a form of information delivery system for the students.

iii. *as ways of providing active learning opportunities*: This involves creating
opportunities for enhancing and supporting students’ experience of learning. This conception not only emphasises the technology, but also the students’ learning outcomes.

iv. *as ways of building knowledge or to assist in the construction of knowledge:* In this view, by using online tools, information can be shared and discussed among students and teachers. In this conception, there is more focus on student learning.

Additionally, in this study Ellis et al. (2009) extended the description of the two broad categories as the cohesive and fragmented classification of learning technologies. They described these two components as follows:

“Cohesive conceptions of learning technologies are those that relate the technologies in some way to learning, showing an awareness of how use of the technologies by students can support their learning. Fragmented conceptions of learning technologies are those that separate the idea of the learning technologies from a strong awareness of how they relate to learning experiences and the development of comprehension” (Ellis et al., 2009, p. 113).

A comparison of the four conceptions of Ellis et al. (2009) with those of Roberts (2003) and González (2009), shows that the findings unveiled in previous studies were basically replicated by Ellis et al. (2009), although the studies were carried out in different countries, different contexts (web, e-learning and blended) and independently of each other. However, there were some differences evident. Previous studies (González, 2009; Roberts, 2003) identified one lower order conception: Roberts (2003) identified “the web as a source of information”, and González (2009)
identified “the web for individual access to learning materials and information, and for individual assessment”. In contrast, Ellis et al. (2009) identified two, namely “learning technology as tools for access” and “learning technologies as tools for information delivery”. Another noticeable difference was that Ellis et al.’s (2009) study focused on teachers’ understanding of learning technology in blended teaching. In contrast, both the studies of Roberts (2003) and González (2009) focused on web-based teaching. Therefore, these differences could be found due to changing the teaching context.

González’s (2010) second phenomenographic study focused on university teachers’ conceptions of teaching using *eLearning*. He interviewed 18 teachers from two Australian universities and identified four qualitatively different conceptions of teaching in e-learning:

i. *eLearning as a medium to provide information* to students regarding both academic content and administrative matters. In this conception, teachers are the ones playing an active role as they provide the information online while the students are passive recipients.

ii. *eLearning as a medium for “occasional” online communication* focus on communication. In this conception, teachers are the ones who act as the main source of information delivered online, whereby students have the chance to make further queries regarding course content to the teachers.

iii. *eLearning as a medium for engaging students in online discussions* where analysis, discussions, and brainstorming can take place among them. This engagement can facilitate students’ understanding of the subject matter at hand.
In this conception, eLearning shifts from providing information to engaging students in active learning, where teachers act as facilitators.

iv. eLearning, as a medium, supports knowledge-building tasks for students. In this conception, the teachers are facilitators of online learning environments while the students are active learners who construct their own understanding by creating reports, blogs and sharing information with others.

Further, González’s (2010) study classified the above conceptions into two broad categories. One category covers the first two conceptions, where eLearning is considered as a tool for transmitting information to students in which teachers play the main role to convey the information by using technology. This can be classified as a teacher-centred category. The other broad category covers the last two conceptions, where eLearning is considered a tool for facilitating students’ learning or for engaging them in knowledge building and sharing it with others. Thus, this can be called a student-centred category.

Some differences exist between the categories identified by González (2010) and the categories in similar studies (Table 2.7). For instance, the category “eLearning as a medium for ‘occasional’ online communication” was not evident in the previous similar studies of Roberts (2003), Ellis et al. (2006), and Ellis et al. (2009). In this conception, online communication is not encouraged. Rather, it is used only when there is a need for general administrative announcements. In contrast, González, in an earlier study (2009), identified that the category “the web for learning-related communication (both asynchronous/synchronous)” is qualitatively higher than González’s (2010) second conception. Thus, González’s (2010) study has presented a
new aspect (occasional communication) of e-teaching. Furthermore, in relation to face-to-face teaching, his findings confirmed findings of the previous studies that identified the teacher-focused and student-focused frameworks (e.g. Kember, 1997; Kember & Kwan, 2000; Samuelowicz & Bain, 2001; Trigwell & Prosser, 1996a; Trigwell, Prosser, & Waterhouse, 1999). It should be noted that, in a blended learning context, “teacher-centred” was generally labelled as “technology-centred” (Table 2.7).
Based on Gonzalez, 2010 categorised (divided) them into two rows: conceptions focused on provision of information and conception focused on communication-collaboration-knowledge building whereas here they are categorised into two rows as: technology focused and student learning focused.

**Occasional communication:** Here, online communication is not encouraged. It is used when it is needed for administrative purposes.

<table>
<thead>
<tr>
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<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Technology Focused/Technology–Centred</strong></td>
<td>Less complete, focused on imparting of information</td>
<td>The web as a source of information</td>
<td>Blended teaching as replacing part of the responsibility of being a teacher</td>
<td>The web for individual access to learning materials and information, and for individual assessment</td>
<td>Learning technology as tools for access</td>
</tr>
<tr>
<td><strong>Student Learning Focused/Student–Centred/Learning–Centred</strong></td>
<td>More complete, focused on communication-collaboration-knowledge building</td>
<td>The web used for individual and independent self-paced learning</td>
<td>Blended teaching as developing student understanding through aligning media to intended learning outcomes</td>
<td>The web for learning-related communication (asynchronous/synchronous)</td>
<td>Learning technologies as ways of providing active learning opportunities</td>
</tr>
<tr>
<td></td>
<td>The web used for group analysis, decision-making and dialogue</td>
<td>Blended teaching as helping students develop and apply new concepts</td>
<td>The web as a medium for networked learning</td>
<td>The web as a medium for building knowledge</td>
<td>Learning technologies as ways of building knowledge</td>
</tr>
</tbody>
</table>
Similar to the previous studies in a face-to-face context discussed in Section 2.3.1, González’s (2010) identified five key dimensions of variation to help elaborate the relationship among the categories, namely (i) role of the teacher, (ii) role of the students, (iii) course, (iv) participants interactions, and (v) perception of embeddedness with face-to-face component (Table 2.8). Two of these dimensions (iii and iv) were not found in the previous studies. Possible reasons for the identification of new dimensions by González (2010) could be: change in the research context from face-to-face to e-learning in higher education; and (ii) teachers’ conceptions of e-learning as a novel area in phenomenographic research.

Table 2.8 Dimensions relating categories of conceptions of teaching, from González, 2010, pp. 71-72

<table>
<thead>
<tr>
<th>Dimension</th>
<th>Providing information</th>
<th>Occasional online communication</th>
<th>Engaging in online discussions</th>
<th>Supporting knowledge building tasks</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role of teacher</td>
<td>Provides information</td>
<td>Sets up discussion boards/makes announcements/answers occasional questions</td>
<td>Sets up spaces for high level understanding tasks/guide discussions/promote understanding</td>
<td>Sets up spaces for discussion, collaboration and knowledge building/facilitate – guide the process</td>
</tr>
<tr>
<td>Role of students</td>
<td>Passive recipients – individual learning activities</td>
<td>May ask questions through online discussions boards or email</td>
<td>Participate actively in online tasks (structured discussions)</td>
<td>Share, build, collaborate, develop, and create.</td>
</tr>
<tr>
<td>Course</td>
<td>One way (lecturer to student)</td>
<td>Two-way (student to lecturer to student/student to student)</td>
<td>Two-way (student to lecturer to student/student to student)</td>
<td>Two-way (student to lecturer to student/student to student)</td>
</tr>
<tr>
<td>Participants interaction</td>
<td>Very low</td>
<td>Low</td>
<td>High</td>
<td>Very high</td>
</tr>
<tr>
<td>Perception of embeddedness with face-to-face component</td>
<td>Very Low</td>
<td>Low</td>
<td>High</td>
<td>Very high</td>
</tr>
</tbody>
</table>
Recently, Lameras, Parakakis and Webber (2012) conducted a phenomenographic study designed to explore teachers’ understanding of virtual learning environments (VLEs) in a specific context, that is, the study was conducted in Greece where teaching in higher education normally follows the teacher-centred approach. This study was based on a sample of 25 teachers from the computer science discipline who had taught mixed subjects (software engineering and computer science-related issues) in six different universities. The study revealed four categories of conceptions that are presented below from less complete to more complete. The teachers viewed the use of VLEs for:

i. information transfer;

ii. application and clarification of concepts;

iii. exchange and development of ideas, and resource exploration and sharing; and

iv. collaborative knowledge-creation, and development of process awareness and skills.

The above categories of conceptions are similar to the previous studies, particularly those focused on a blended teaching context (Ellis et al., 2009; González, 2009; Roberts, 2003). However, Lameras et al. (2012) claimed that development of “students process awareness and skills” in the fourth category was a new conception not found in other phenomenographic studies. In this conception, students are actively involved in collaboration and community participation for learning and acquiring skills. Subsequently, the study identified three broad classifications of conceptions:

i. teacher-focused/content-oriented;

ii. student-focused/content-oriented; and

iii. student-focused/process-oriented.
The last classification is a new addition to the existing frameworks on conceptions of teaching. Conception (iv) (collaborative knowledge-creation, and development of process awareness and skills) identified a new element of “process awareness and skills” and falls into student-focused/process-oriented, whereas the other three conceptions broadly fall into the teacher-focused and student-focused frameworks.

Along with the above four conceptions, Lameras et al. (2012) identified five dimensions of variation in order to clarify the relationship among the four conceptions of teaching through VLEs, namely: (i) role of the teacher; (ii) role of the students; (iii) relation between models; (iv) epistemic status of subject matter; and (v) students’ level of study (Table 2.9). It is important to note that three of the dimensions (iii, iv and v) were not discussed clearly in the previous studies, considering both face-to-face and blended settings. Therefore, Lameras et al. (2012) presented new conceptions and
extended dimensions which contributed new knowledge in the existing literature. This provides evidence that it is useful to continue to explore future research in tertiary education.

In summary, Table 2.7 shows the studies of teaching conceptions in blended settings. All these studies present the conceptions as a hierarchy that moves from less complete to more complete conceptions of teaching. The former (less complete) can be classified as fragmented conceptions, where teachers place more emphasis on supplying information to students, rather than getting them engaged in active learning. In these conceptions, technology is considered as a tool. The latter (more complete) conceptions mainly focus on engaging students in knowledge-building tasks through communication (both synchronous and asynchronous). In cohesive conceptions, technology is considered as a method for engaging students (González, 2010).

The above two broad categories of conceptions (fragmented and cohesive) can be added to the two broad categories “technology-centred” and “learning-centred” (Table 2.7) which is proposed in the previous research (e.g. Ellis et al., 2009; Ellis, Steed, et al., 2006; González, 2009, 2010; Roberts, 2003). First, technology-centred conceptions primarily consider technology as a tool for instruction to deliver necessary information. Second, learning-centred conceptions consider technology as a way of enhancing knowledge, sharing views and ideas through engagement with others (both teachers and students) which represent the most complete understanding of technology in teaching.
2.3.3 Conceptions of teaching in professional education

Over the last twenty-five years, a significant amount of research has been carried out to investigate teachers’ conceptions and their approaches to teaching. Most of the studies have been done in university settings, where conventional face-to-face teaching and learning and blended learning (eLearning, web based, networked) are standard. Little research has been conducted in Vocational Education (VE) settings. The following section reviews the literature that has focused on teachers’ conceptions of teaching in VE context.

Dirkx, Kielbaso, and Smith (2004) conducted a study to identify and describe the personal beliefs of teachers regarding knowledge and its development within the technology-supported environments of VE programs, including how these beliefs were reflected in the teacher’s personal use of technology. The qualitative study took place in a vocational community institute where information technology was used significantly throughout the instructional process. Six teachers were selected purposively from three technical education areas – manufacturing, business, and service. Data were collected from interviews, classroom observations, curriculum, instructional materials and teaching tools. The study found that teachers considered technology as a means to deliver subject content as well as to support the teaching and learning process by providing more interesting teaching than in previous times (without using technology). It also showed that technology was regarded as a time efficiency tool in their teaching. This is somewhat in line with previous studies where technology or blended learning is considered as a medium for providing information (e.g., Ellis et al., 2009; Ellis, Steed, et al., 2006; González, 2009, 2010; Roberts, 2003). Dirkx’s study, however, also revealed
that technology was not seen by the teachers as a medium for constructing or producing knowledge. Students’ active learning or engagement was not linked to technology by the teachers in this study. Therefore, the findings that emerged from Dirkx et al.’s (2004) study are not reflected fully in previous phenomenographic studies in tertiary education, where technologies were seen as a medium to engage students in their knowledge-building (e.g. Ellis et al., 2009; Ellis, Steed, et al., 2006; González, 2010). This difference might be found due to the small sample (six teachers) or the particular disciplines (manufacturing, business, and service) that used technology in teaching as a means to deliver subject content.

Stein, Shephard, and Harris (2011) investigated educators’ conceptions of e-learning in tertiary education in New Zealand. In this study, 114 survey questions were received from the participated educators and later 20 interviews were conducted in order to clarify the survey responses and to achieve deeper understanding of the investigated phenomenon. This study, finally, identified five conceptions of e-learning in tertiary education:

- e-learning is seen as-
  
  i. tools, equipment, hardware and software;
  
  ii. a means through which learning interaction is facilitated;
  
  iii. learning;
  
  iv. a means through which to reduce distance; and
  
  v. a collaborative enterprise.

Tertiary educators viewed e-learning in Category (i), as a supporting tool to help teaching and learning, whereas in Category (ii) and Category (iv), they perceived e-
learning as a way to enhance the teaching and learning process. More particularly, in Category (ii), the main emphasis is on interaction between teachers, students and course material. In Category (iv), the main focus is on the flexibility of teaching and learning. E-learning in Category (iii) is viewed as a way of achieving the main goal of education; that is, learning. Category (v) perceived e-learning as a medium through which teachers, students and administrative personnel continually collaborate in teaching and administrative matters. The above five conceptions, which were revealed in tertiary education in New Zealand, are broadly consistent with the other studies in university education. However, differences are found in Stein et al.’s (2011) study: (i) it did not identify the dimensions of variation; (ii) the third category, e-learning is seen as learning, is a broader understanding of e-learning because it includes both teacher-centred and student-centred facets of teaching. The main element (learning) of this category is comparable to other phenomenographic studies. How learning occurred in this category is not clearly explained.

Recently, Bliuc, Casey, Bachfischer, Goodyear and Ellis (2012) investigated vocational teachers’ views of blended learning and their approaches to blended teaching. A total of 81 teachers from TAFE NSW with experience in using blended learning were invited to participate in a questionnaire-based phenomenographic study. They identified five conceptions of blended learning, namely:

i. blended learning to empower students for lifelong learning;

ii. blended learning for students’ needs and learning goals;

iii. blended learning to improve students’ access to learning and to meet their practical needs;

iv. blended learning as an aggregation of face-to-face, online and other types of
technologically-driven delivery; and

v. blended learning as the use of technology-teaching tools.

These findings presented some new understanding of blended teaching in vocational education. For example, the categories “empowering students for lifelong learning” and “focusing on students’ needs and learning goals that address their individual needs”, were not identified in the previous similar phenomenographic studies of Roberts (2003), González (2009), Ellis et al. (2009), and González (2010). However, Bliuc et al. (2012) revealed categories which contained similar aspects to other studies. For instance, “blended learning as an aggregation of face-to-face, online and other types of technologically-driven delivery” includes similar aspect to “learning technologies as tools for information delivery”, identified by Ellis et al. (2009). Furthermore, the category “blended learning as the use of technological teaching tools” presents “any type of electronic delivery”, which is quite similar to aspects of “tools for access”, “medium for providing information” and “tools, equipment, hardware & software” identified by Ellis et al. (2009), González (2010) and Stein et al. (2011) respectively. Thus, the study of Bliuc et al. (2012) identified both commonalities and differences of identifying new aspects (empower students for lifelong learning and meet their practical needs) in relation to vocational teachers’ conceptions in blended context.

2.3.4 Summary

This review of the literature on teachers’ conceptions in tertiary education, which has covered both face-to-face and blended teaching studies, has shown first of all, that there is scope for new research into teachers’ conceptions of teaching. For instance,
González (2011) recently identified a new dimension of teaching in the face-to-face context and González (2009) also identified a new category of conception “networked learning” in the blended teaching context, while Lameras et al. (2012) presented a new broad conception of blended teaching which they labelled “process oriented”. Further, Ellis et al. (2009) and Stein et al. (2011) carried out a similar study and their study did not focus on the dimensions of variation among the revealed categories of conceptions. Second, identifying variation among the categories of description is an important aspect of the phenomenographic approach. This review has shown that this aspect (dimensions of variation) which explores the internal relationship among the revealed conceptions has been neglected by most of the prior studies in blended teaching, both in university and vocational education. Third, research on conceptions of ICT-enhanced teaching in tertiary education (both university and vocational education) has also been found to be rare. This literature review has included such studies in the realm of blended learning (Ellis, Steed, & Applebee, 2006) or e-learning (González, 2009, 2010; Roberts, 2003; Stein et al., 2011) but there is none in ICT-enhanced teaching. Fourth, this review has shown that prior phenomenographic studies have produced useful empirical evidence for improving teaching in tertiary education. Very few phenomenographic studies exist in the field of vocational education. Bluic et al.’s (2012) study, although it did focus on vocational education, did not explore the relationship among the listed categories of conceptions. Besides, methodologically it was a questionnaire-based phenomenographic study and they did not include any interviews or observations to validate the results. Whereas, phenomenographic interviews will help to grasp the in-depth awareness and understanding of the participants (Åkerlind, 2005a; Marton, 1981).

The above discussion indicates that there is still much to learn about the various
facets of vocational education. As Dirkx et al. (2004) noted in their study “more research is clearly needed on how teachers and trainers think about and use computer technologies within their education-for-work and workplace learning programs” (p. 29). They claimed that newer studies contribute to professional development programs, and curriculum development process. This current study attempts to fill the gap by investigating teachers’ conceptions of ICT-enhanced teaching in a vocational education context with a particular focus on identifying potential variation among the categories. The research question asked is - What does ICT-enhanced teaching mean to TAFE teachers?

2.4 Approaches to teaching in tertiary education

The term “approaches” generally refers to how people go about something (Marton & Booth, 1997). In the educational field, Postareff and Lindblom-Ylänne (2008) defined approaches as the strategies teachers adopt for their teaching. In this study, the term refers to how vocational teachers go about their teaching when ICT is used, including their strategies and teaching practices. Teachers’ conceptions of teaching, however, are separate entities and are not included in teachers’ approaches to teaching (the separate definitions of conception and approach are provided in Section 1.1). Previous research likewise distinguished them (Eley, 2006; González, 2009; Kember & Kwan, 2000; Trigwell et al., 1994). These studies investigated conceptions and approaches separately.

Research on approaches to teaching in tertiary education can be categorised into two broad areas: research on teachers’ approaches to teaching in face-to-face settings (Kember & Kwan, 2000; Samuelowicz & Bain, 1992; Trigwell et al., 1994) and research on teachers’ approaches in a blended context such as a combination of face-to-face and
online teaching, or e-learning and online discussion (Ellis et al., 2009; González, 2009; Roberts, 2003).

2.4.1 Approaches to teaching in face-to-face settings

Kember and Kwan (2000) selected 17 university lecturers based on their rank, years of teaching and industrial or professional experience. These teachers were recruited from three departments: engineering, social science and paramedical, and were engaged in semi-structured interviews. The authors identified two main approaches to teaching, namely: content-oriented or teacher-centred teaching, and learning-oriented or student-centred teaching.

*Content-oriented teaching* is more focused on information transfer to students. Teachers usually prefer to rely on extrinsic motivational factors, such as supplying notes and references, as well as utilising more tests and quizzes for assessment. Teachers, in this approach, tend to derive examples from their own experiences.

The dominant aspect of *learning-oriented teaching* is the facilitation of students’ learning, that is, to help them develop or expand their understanding. Teachers usually use intrinsic motivational factors, such as encouraging students to gain their own knowledge, helping their students individually and using a flexible system of assessment. Teachers’ goal is to improve students’ collective experiences by encouraging them to exert effort to learn or to initiate their own learning activities. These two approaches are shown in Figure 2.3.
Kember and Kwan (2000) further elaborated the above two approaches as presented in Figure 2.4. They illustrated the approaches to teaching by using a continuum or one-dimensional motivational component based on five strategic elements, the details of which are presented below.

According to Kember and Kwan (2000), motivation has two components: extrinsic and intrinsic. Extrinsic motivation is found in content-centred approaches, that is, when teachers rely on external motivators to motivate students such as examinations, final qualification, final grade or citing actual marks given to students as a motivational strategy in their teaching. Intrinsic motivation is found in learning-centred approaches. For example, it is found usually when teachers try to create students’ own interests and build students’ internal willingness to develop knowledge and understanding.

The content-centred poles of the continuum (Figure 2.4) focus on teacher-led instructions, where teachers provide learning materials to the students, like notes, handouts and library references. These instructional tasks (notes, handouts and library references) may also be presented in the learning-centred poles, but the teacher’s focus there is on encouraging students to discover knowledge on their own. A content-centred approach to teaching is more concentrated on the whole class, whereas a learning-centred
approach is focused on an individual student. With regard to assessment, the content-centred approach usually uses frequent quizzes and tests to make sure that the learning goals have been achieved. By contrast, learning-centred approaches usually use different assessment techniques to address different students’ needs and interests. Another distinct difference between the poles is on “accommodation for students” characteristics. Students’ weaknesses are taken care of differently in the content and learning-centred approaches. In the content-centred approach, students are mostly treated equally although there are some cases where teachers cater to individual student weaknesses. But in the learning-centred approaches, teachers tend to use different strategies to address the weaknesses of students individually. Lastly, in relation to source of knowledge in the continuum, in the content-centred approach, teachers generally depend on their own knowledge to enhance students’ knowledge acquisition, whereas in the learning-centred approach, teachers emphasise and encourage students to build their knowledge.
<table>
<thead>
<tr>
<th>CONTENT-CENTERED</th>
<th>TEACHING APPROACH</th>
<th>LEARNING-CENTERED</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emphasis on motivators extrinsic to the lecturer’s teaching such as syllabus, examination marks, qualifications, etc.</td>
<td><strong>MOTIVATION</strong></td>
<td>Recognizing that motivating students is an intrinsic part of the teaching role</td>
</tr>
<tr>
<td>Lecturer supplying notes, examples, handouts, library references, etc.</td>
<td><strong>STRATEGY</strong></td>
<td>Lecturer encouraging students to discover and construct knowledge</td>
</tr>
<tr>
<td>More toward the whole class</td>
<td><strong>Instruction</strong></td>
<td>Conscious attempt to deal with individual students both for academic and pastoral need.</td>
</tr>
<tr>
<td>Frequent tests and quizzes</td>
<td><strong>Focus</strong></td>
<td>More flexible assessment often with choices</td>
</tr>
<tr>
<td>Treating the same or catering for weaknesses</td>
<td><strong>Assessment</strong></td>
<td>Attempt to remediate students’ weaknesses</td>
</tr>
<tr>
<td>Lecturer giving examples from own experience</td>
<td><strong>Accommodation for student characteristics</strong></td>
<td>Utilizing and respecting student experience</td>
</tr>
<tr>
<td></td>
<td><strong>Source of experience/Knowledge</strong></td>
<td></td>
</tr>
</tbody>
</table>

*Figure 2.4 Components and dimensions of approaches to teaching (Kember & Kwan, 2000, p. 476)*
Trigwell et al. (1994), however, identified five different approaches to teaching. Their study was based on the interview results of 24 university physical science teachers. It focused on identifying teachers’ experiences of teaching in first year science courses based on an intention and strategy frameworks. More particularly, the five approaches to teaching were identified in terms of teachers’ intentions (the way teachers think), and teaching strategies or practices. These were:

Approach A: A teacher-focused strategy aimed at transmitting information to students;

Approach B: A teacher-focused strategy aimed at students acquiring the concepts of the discipline;

Approach C: A teacher/student interaction strategy aimed at students acquiring the concepts of the discipline;

Approach D: A student-focused strategy aimed at students developing their own conception; and

Approach E: A student-focused strategy aimed at students changing their conceptions.

The first two approaches are teacher-focused strategies, in which Approach A focuses on teaching, rather than learning. It conveys facts and information about the discipline. Approach B is an expansion of A with teachers thinking that students need to be active in the teaching and learning process. Approach C is a teacher-student interaction strategy, where teachers engage their students with them because they believe that students need to be active in the teaching and learning process. The last two approaches are student-focused. Approach D emphasises students developing their knowledge themselves while Approach E is an expanded version of Approach D, based
on teachers’ belief that students are expected to construct as well as to re-construct their knowledge. In both Approaches (D and E), teachers are seen mostly as facilitators of student learning. The above-mentioned five approaches can be categorised into three broad strategies:

1) teacher-focused;
2) student/teacher interaction-focused; and
3) student-focused.

Trigwell et al. (1994), noted that the five approaches represent four intentions, namely:

i) information transmission;
ii) concept acquisition;
iii) conceptual development; and
iv) conceptual change.

Table 2.10 presents the approaches showing the relationship between intention and strategy.

<table>
<thead>
<tr>
<th>Intention</th>
<th>Teacher-focused</th>
<th>Student/teacher interaction</th>
<th>Student-focused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Information transmission</td>
<td>A</td>
<td>B</td>
<td>D</td>
</tr>
<tr>
<td>Concept acquisition</td>
<td></td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Conceptual development</td>
<td></td>
<td></td>
<td>D</td>
</tr>
<tr>
<td>Conceptual change</td>
<td></td>
<td></td>
<td>E</td>
</tr>
</tbody>
</table>

Basically, a teacher-focused strategy is focused on conveying information to students, while teachers play an active role in the teaching and learning process, and where students do not need to be active and their prior knowledge is not considered
important in concept acquisition. In student/teacher interaction-focused strategy, both teachers and students play active roles in the teaching and learning process. The primary focus of this strategy is to have students participate in teaching-learning activities. By contrast, the characteristic features of a student-focused strategy are conceptual development and change. Teachers in this strategy assist students in learning by developing or changing their understanding of phenomena. In this strategy, the primary role of teachers is to structure and facilitate the teaching and learning process.

Later, Prosser and Trigwell worked with Martin, Ramsden, and Lueckenhauzen (2005) to investigate university teachers’ experience of teaching by conducting a phenomenographic study. They interviewed 31 academics from four broad fields and identified five approaches to teaching, namely:

- **Approach A**: Teacher-focused strategy aimed at conveying disciplinary information to the students;
- **Approach B**: Teacher-focused with a student activity strategy aimed at conveying disciplinary information to the students and engaging their participations in the process;
- **Approach C**: Teacher-focused with a student activity strategy aimed at helping students to acquire the concepts of the discipline rather than just conveying information;
- **Approach D**: Student-focused with a student activity strategy aimed at helping students to develop their understanding of the discipline rather than just helping them to acquire the concepts; and
- **Approach E**: Student-focused with a student activity strategy aimed at helping students to develop and change their understanding.
Prosser et al. (2005) placed the above five approaches into three broad strategies:

1) teacher-focused;

2) teacher-focused with student activity; and

3) student-focused with student activity.

These authors did not present an intermediate strategy, like “student/teacher interaction-focused” that was found in the study of Trigwell et al. (1994). Rather, they proposed a “teacher-focused with student activity” strategy where teachers play the main role. This study extended their third strategy to “student-focused with student activity based on Trigwell et al.’s (1994) third strategy (student-focused), where students play the main role. They also presented the above approaches as four intentions, which are identical to the intentions presented by Trigwell et al. (1994). Table 2.11 presents these approaches to teaching.

Table 2.11 Cross tabulation of approaches to teaching by intention and strategy, from Prosser et al. 2005, p. 145

<table>
<thead>
<tr>
<th>Intention</th>
<th>Teacher-focused</th>
<th>Strategy</th>
<th>Student-focused</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Teacher activity</td>
<td>Teacher-focused Student activity</td>
<td>Student activity</td>
</tr>
<tr>
<td>Information transmission</td>
<td>A</td>
<td>B</td>
<td></td>
</tr>
<tr>
<td>Concept acquisition</td>
<td></td>
<td>C</td>
<td></td>
</tr>
<tr>
<td>Conceptual development</td>
<td></td>
<td>D</td>
<td></td>
</tr>
<tr>
<td>Conceptual change</td>
<td></td>
<td>E</td>
<td></td>
</tr>
</tbody>
</table>

Prosser, Martin, Trigwell, Ramsden, and Middleton (2008) extended the previous study of Prosser et al. (2005) and identified the same three broad strategies and four intentions but with an exception of one additional category, which is described below.
Table 2.12 illustrates the relationship between intention and strategy, which includes the visible movement of Approach D.

Prosser et al. (2008) placed the additional approach into the “teacher-focused with student activity strategy”, with the intention of “concept acquisition” (Table 2.11). The authors explained that this was the result of the split of Approach C into two, as presented in the previous study (Prosser et al., 2005). The first part of Approach C was teacher-focused with a student activity strategy aimed at helping students to acquire the concepts of the discipline. This category mainly focuses on different aspects of the subject. These aspects are connected and related to *parts to other parts* of the subject. The second part becomes Approach D, which was also a teacher-focused with student activity strategy, aimed at helping students to acquire the concepts of the discipline. It not only includes concepts of the discipline but also emphasises the entire field of the study. The subject contents are not only related to other parts but also to the entire field of study. Thus, Approach D is placed above Approach C, as Approach D is more complete than Approach C. However, the intentions remained identical in both studies. Previous Categories D and E (Table 2.11) are replaced by Categories E and F (Table 2.14) without changing their overall meaning.

<table>
<thead>
<tr>
<th>Table 2.12 Cross tabulation of approaches to teaching by intention and strategy, from Prosser et al. 2008, p. 7</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intention</strong></td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Information transmission</td>
</tr>
<tr>
<td>Concept acquisition</td>
</tr>
<tr>
<td>Conceptual development</td>
</tr>
<tr>
<td>Conceptual change</td>
</tr>
</tbody>
</table>
The phenomenographic study of González (2012) investigated university teachers’ approach to teaching in face-to-face context by following the intention and strategy frameworks where he identified three approaches to teaching:

Approach A: A teacher-focused strategy aimed at providing disciplinary knowledge to the students;

Approach B: A student-focused strategy aimed at developing students’ understanding of knowledge; and

Approach C: A student/learning-focused strategy aimed at developing students’ critical thinking.

Table 2.13 shows the approaches reflecting the relationship between intention and strategy.

González (2012) placed the approaches into two broad strategies, namely:

1) teacher-focused; and

2) student-focused.

He identified three intentions, such as:

i) provide knowledge of the disciplines;

ii) develop students’ understanding; and

iii) develop students’ critical thinking and/or expanding their world view.

<table>
<thead>
<tr>
<th>Intention (why?)</th>
<th>Strategy (how?)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Providing knowledge of the discipline</td>
<td>Approach A</td>
</tr>
<tr>
<td>Developing students’ understanding</td>
<td>Approach B</td>
</tr>
<tr>
<td>Developing students’ critical thinking</td>
<td>Approach C</td>
</tr>
</tbody>
</table>
2.4.2 Approaches to teaching in blended settings

Teachers in tertiary education increasingly use technology in their teaching (Donnelly, McGarr, & O'Reilly, 2011; Ellis et al., 2009; González, 2009). Researchers, therefore, have attempted to identify teaching approaches in blended teaching settings, like González (2009) who presented three approaches to teaching online, the first two being “informative-individual learning focused” and “communicative-networked learning-focused”. The former entails lecturers using the web to carry out a content-centred teaching while the latter involves the lecturers using online tools to carry out a learning-centred teaching. The third approach was proposed as an intermediate one, referred to as “transitional”. This approach focused on both the content being taught and the learning through discussion. The author confirmed that the transitional approach was consistent with the frameworks of Kember (1997) and Kember and Kwan (2000), who identified the intermediate approach in a face-to-face context. González (2009) claimed that Kember and Kwan (2000) did not find any evidence of “student-teacher interaction” i.e., the intermediate orientation. Indeed, he provided supporting evidence for placing a “transitional” (intermediate) approach in between the two approaches. He presented the names of two participants (Paul and Maria), who had a transitional approach (Figure 2.5).

Ellis et al. (2009) conducted research on approaches to teaching based both on face-to-face and online contexts. They identified four approaches to teaching in a blended learning context as follows:

Approach A: Managing student activity. In this approach, teachers use technology to complete instructional tasks, rather than enhance learning outcomes. In this context, technology mainly assists in the management of teaching activities.
Approach B: *Trying things out.* This approach allows teachers to experiment with technology to find out whether or not it is going to bring about an improvement in teaching, students development and learning outcomes.

Approach C: *Integrating experiences of learning.* In this category, technology combines online and face-to-face teaching contexts for better focus on the students’ learning.

Approach D: *Encouraging students’ autonomy in learning.* This approach mainly attempts to create situations where students take initiatives that reflect their own perspectives.

### APPROACHES TO TEACHING USING THE WEB

<table>
<thead>
<tr>
<th>Approaches to Teaching (Kember &amp; Kwan 2000)</th>
<th>Informative/Individual learning focused</th>
<th>Communicative/Networked learning focused</th>
</tr>
</thead>
<tbody>
<tr>
<td>Content-centred</td>
<td>John</td>
<td>Paul</td>
</tr>
<tr>
<td>Transitional</td>
<td></td>
<td>Maria</td>
</tr>
<tr>
<td>Learning-centred</td>
<td></td>
<td>Christine, Jane</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Joseph, Helen</td>
</tr>
</tbody>
</table>

*Figure 2.5 Approaches to teaching and approaches to online teaching (González, 2009, p. 312)*

The authors placed the above approaches into two broad groups. The *technology-focused* approach that views technology as media for delivering information (Approaches A, B). Technology then, is considered as a tool for conveying information and managing teaching activities. There is generally no opportunity for students to collaborate or communicate with each other to build up their own understanding by using technology. The *student-focused* approach, which views technology as media to engage students in
knowledge-building activities, as well as in sharing their views and ideas with others (Approaches C, D). This approach provides space for students to engage in online discussions, participate in information-gathering activities and communicate or exchange ideas for the development of their understanding of the subject.

The approaches developed by González (2009), are coherent with Ellis et al.’s (2009) broad approaches, although the studies labelled these differently. The informative-individual learning focused approach (González, 2009) is consistent with the technology-focused approach (Ellis et al., 2009), as both focus on technology to convey information, while the communicative-networked learning-focused approach (González, 2009) is similar to the student-focused approach (Ellis et al., 2009), as both strategies emphasise the development of students’ understanding. However, González proposed an intermediate approach (transitional) that did not emerge in the study of Ellis et al., which demonstrates that newer research can reveal new aspects of teaching approaches.

In the recent phenomenographic work of González (2012), he extended his investigation of university teachers’ approach to e-teaching by following the intention and strategy frameworks. He identified the following five approaches to teaching:

Approach A: An information-focused strategy aimed at providing course materials and administrative information;
Approach B: An information-focused strategy aimed at providing access to quality material;
Approach C: A communication-focused strategy aimed at providing a space for general communication (asking questions, making announcements, keeping in touch);
Approach D: A communication-focused strategy aimed at providing a space for engaging students in deep thinking; and

Approach E: A collaborative-focused strategy aimed at providing a space for building knowledge.

The author classified the above approaches into three broad strategies, namely:

1) information-focused strategy;
2) communication-focused strategy; and
3) collaboration-focused strategy.

He also placed these approaches into five intentions:

i) provide easy access to course materials and administrative information;
ii) provide access to up-to-date/quality materials;
iii) provide a space for asking questions, making announcements, keeping in touch;
iv) engage students in deep thinking; and
v) provide a space for building knowledge.

As seen in the above review, González (2012) was the first who identified approaches to e-teaching in higher education by using an intention and strategy frameworks. The approaches to e-teaching, identified in this study, present elements ranging from information transmission to students’ active engagement in communication and collaboration. Although similar to González’s (2009) findings, these recent (2012) findings go beyond by identifying another collaboration-focused strategy. This study differs from Ellis et al.’s (2009) technology focused strategy by identifying an information-focused strategy with its core emphasis on conveying quality information (Approach B).
2.4.3 Approaches to teaching in professional education

Vocational education teachers’ approaches to teaching are a recent area of investigation in phenomenographic research. Over the last two decades, the focus has generally been on university teaching, as evidenced by the considerable number of studies in the literature on approaches to teaching in tertiary education (González, 2012; Kember & Kwan, 2000; Prosser et al., 2008; M. Prosser et al., 2005). However, very little empirical data on the approaches to teaching in vocational education has been found in the literature. Likewise, almost no evidence of previous research relating to vocational teachers’ approaches to ICT-enhanced teaching has been found despite a search of several educational databases, specifically, ERIC: Education Resources Information Center (1966 - present) via ProQuest, Google Scholar, VOCED (Vocational Education and Training Research Database), JSTOR (Journal Storage), and NCVER (National Center for Vocational Education Research). This section reviews one study, which is focused on vocational teachers’ approaches to teaching.

Bliuc et al. (2012) conducted their investigation on vocational teachers’ approaches to blended teaching using the intention and strategy frameworks. They identified five approaches to teaching:

Approach A: Teaching aimed at providing accurate and detailed online content;

Approach B: Teaching aimed at meeting students’ practical needs;

Approach C: Teaching aimed at student support in relation to the social and psychological aspects of the interaction as well as technical aspects;

Approach D: Teaching aimed at providing learning tailored to students’ needs based on a plan negotiated between student and teacher; and
Approach E: Teaching aimed at providing an opportunity to enrich the learning experience and to provide innovative ways to learn.

They also placed the above approaches alongside five intentions:

i) To provide detailed and accurate materials;

ii) To make students’ practical needs easier and more convenient;

iii) To ensure appropriate levels of computer literacy to enhance contact between students and the teacher, and promote the psychological wellbeing;

iv) To use affordances of the blended context to better meet learning needs; and

v) To improve the quality of student learning and develop complex skill.

Bliuc et al. (2012), presented five intentions but did not present any associated strategy to indicate how to achieve the above five approaches. This study is similar to Trigwell et al. (1994), and González (2012) in relation to finding intention, but it differs in terms of not identifying specific strategies to achieve the approaches.
<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Teacher-focused</td>
<td>1. Teacher-focused</td>
<td>1. Teacher-focused</td>
<td>1. Teacher-focused</td>
<td>1. Information-focused</td>
<td>Not specified</td>
</tr>
<tr>
<td>2. Student/teacher interaction</td>
<td>2. Teacher-focused, student activity</td>
<td>2. Student-focused</td>
<td>2. Communication-focused</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Intention</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1. Information transmission</td>
<td>1. Information transmission</td>
<td>1. Provide knowledge of the disciplines</td>
<td>1. Provide easy access to course materials and administrative information</td>
<td>1. Provide detailed and accurate materials</td>
<td></td>
</tr>
<tr>
<td>2. Concept acquisition</td>
<td>2. Concept acquisition</td>
<td>2. Develop students’ understanding</td>
<td>2. Provide access to up-to-date/quality materials</td>
<td>2. Make students’ practical needs easier and more convenient</td>
<td></td>
</tr>
<tr>
<td>3. Conceptual development</td>
<td>3. Conceptual development</td>
<td>3. Develop students’ critical thinking-world view</td>
<td>3. Provide a space for asking questions, making announcements, keeping in touch</td>
<td>3. Ensure appropriate levels of computer literacy to enhance contact between students and the teacher and promote the psychological wellbeing</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>5. Provide a space for building knowledge</td>
<td>5. Improve the quality of student learning and develop complex skills</td>
<td></td>
</tr>
</tbody>
</table>
2.4.4 Summary

Table 2.14 presents a summary of the findings of five studies that investigated teachers’ approaches to teaching in both face-to-face and blended contexts based on the intention and strategy frameworks. The synthesis of the ideas drawn from the reviewed are:

Kember and Kwan (2000), and Kember (1997) presented two approaches, content-centred and learning-centred, which are similar to the strategies teacher-focused and student-focused, identified by Trigwell et.al. (1994), and Prosser et al. (2005), (2008). They also identified teacher-student interaction (Table 2.14). However, González’s study (2012) on face-to-face teaching identified a teacher-focused and student-focused strategy, with the exclusion of an intermediate orientation.

This literature review also shows that approaches to face-to-face teaching in tertiary education can be categorised into two broad areas: a student-focused teaching strategy and a teacher-focused teaching strategy. In relation to identifying intention, commonalities and differences are found among the studies. Trigwell et.al. (1994), and Prosser et al. (2005), (2008) presented the same intentions over a period of time, namely: information transmission, concept acquisition, conceptual development, and conceptual change. In contrast, González (2012) identified only three intentions, which have slightly broader meanings compared to the previous studies. For example, “develop students’ critical thinking and/or expanding their worldview” is a broader intention than the “conceptual change” intention identified by Trigwell et al. (1994), and Prosser et al. (2005).
The literature on approaches to teaching in a blended context in tertiary education identified different approaches to teaching. Ellis et al. (2009) identified two broad approaches to teaching, “technology-focused” and “student-focused”, whereas González (2009), identified three approaches “informative-individual learning focused” and “communicative-networked learning” with an intermediate orientation called “transitional”. González (2009) argued that the frameworks (content-centred and learning-centred) in the studies of Kember (1997), and Kember and Kwan (2000) was not proposed for teaching in a blended context, but was rather developed for face-to-face teaching. In contrast, his frameworks and that of Ellis et al. (2009) were viewed as likely to fit into the blended teaching context. In relation to this, González (2009) claimed that his framework is robust enough to be used in an online teaching context. However, these two studies did not attempt to find approaches to teaching in a blended context using the intention and strategy frameworks. To understand teachers’ approaches to teaching deeper, it is worth investigating both the intention and strategy components, including their relationship. In this regard, Trigwell et al. (1994) claimed that in order to improve teachers’ teaching practices both intention and strategy components need to be investigated because both components have an influence on teachers’ approaches to teaching. Changing the strategy alone is not enough to improve teachers’ teaching activities because teachers’ teaching strategy is internally derived based on their intention.

The literature showed that, at the time of this study, only two research articles addressed approaches to blended teaching based on the intention and strategy frameworks (Bliuc et al., 2012; González, 2012). González’s (2012) three strategies as discussed before, were noted to be consistent with his earlier study (González,
2009), with the exception of identifying a “collaboration-focused” strategy. However, as a broader concept, his strategy supports the “information transmission/teacher-focused” and “conceptual change/student-focused” frameworks. For instance, an information-focused strategy is viewed as a teacher-focused strategy, whereas communication-focused and collaboration-focused strategies are viewed as student-focused strategies. Consequently, González (2012), for an e-teaching context, developed five new intentions as discussed before, which were linked with five approaches. Importantly, these intentions were not identified by González (2009) and Ellis et al. (2009). For instance, González’s (2012) identified the approaches to e-teaching by framing the analysis based on the intention and strategy frameworks whereas González’s (2009) analysis process did not follow the same frameworks.

Bliuc et al. (2012), the second study, did not list teacher-focused and student-focused strategies despite the authors’ claim that their proposed approaches were consistent with the existing student-focused and teacher-focused frameworks. Nonetheless, Bliuc et al. (2012) identified new aspects regarding approaches to blended teaching which did not emerge in the previous studies, such as vocational teachers focused on students’ practical needs as well as their social and psychological needs. These aspects were not found in the previous literature. There are two possible reasons why Bliuc et al. (2012) were able to identify new empirical data: (i) Vocational education is a novel context for phenomenographic research. This is the only relevant study located in this review which investigated the phenomenon, that is, approaches to blended teaching in vocational education (Bliuc et al., 2012); and (ii) Vocational education is mostly oriented towards workplace-based activities (Bliuc et

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4 An aspect is considered as a facet or a characteristic or a quality that is related to teaching approach here.
Thus, teaching in a vocational context demands a focus on enhancing student practical knowledge and skills. Despite there being little research on approaches to teaching in a blended context, some similarities and variations would appear to emerge from current evidence. For example, Bliuc et al.’s (2012) study shows similarities to prior research findings in a university context as well as adding novel approaches to the existing literature. Newer studies are likely to bring about new knowledge and facets not explored by previous researchers.

The purpose of the above discussion was to identify potential knowledge gaps in the literature. The review of literature on teacher approaches to teaching in tertiary education covered both face-to-face teaching and blended teaching studies, has shown **first** of all, that there is scope for new research into teacher approaches to teaching. As recently as 2012, González added new insights into how teachers approach their work by identifying new strategies and intentions in e-teaching in university education. **Second**, the literature review has shown that phenomenographic approach is a useful way of obtaining empirical evidence in this field. **Third**, it is apparent from the literature that in improving teacher approaches to teaching in the tertiary education sector, both intention and strategy components need to be investigated. **Fourth**, there is an absence of phenomenographic research focused on approaches to ICT-enhanced teaching in vocational education.

It is also apparent from the review of the literature on teacher approaches to teaching, that research on teaching in vocational education is a novel concept, particularly undertaking such research from a phenomenographic perspective. Thus, this current study investigates teacher approaches to ICT-enhanced teaching in vocational education.
vocational education. To achieve this, the research question asked is - How do TAFE teachers approach teaching with ICT?

2.5 Conceptions of ICT in professional practices

Marton (1981), and later on Dall’Alba (2000), highlight three different lines (areas) of phenomenographic research. They are: general aspects of learning, domain specific research on education, and pure research (which focuses mostly on daily lives; see detailed discussion in Chapter 3). This latter line also investigates people’s conceptions of different aspects of their everyday problems, and their experiences in particular situations. Examples of this type of research can be found in the study of women's anti-violence work (Alexander, 2011), leadership in a network of communities (MacGillivray, 2010), or market needs (Filep & McDonnell, 2005). The present review aims at presenting a synthesis of such studies broadly pertaining to ICT in the workplace, including technology, medical technology, information literacy, ICT.

The role of ICT in the workplace, from a phenomenographic perspective, has not been extensively discussed in the literature. A limited number of relevant studies was found from a search of several educational databases, specifically, ERIC: Educational Resources Information Center (from 1966 to present) via ProQuest, Google Scholar, VOCED (Vocational Education and Training Research Database), JSTOR (Journal Storage), and NCVER (National Center for Vocational Education Research).
The first study in this particular context was conducted by Barnard and Gerber (1999). Its main purpose was to identify contemporary surgical nurses’ understanding of technology in their profession. Technology, in this study, is defined as the use of modern machinery and equipment in the nursing profession. Twenty surgical nurses were interviewed with a semi-structured interview protocol. Eight categories were identified to define technology as:

i. *machinery and equipment*: Technology is viewed as machinery and equipment, and is defined in this category in terms of its physical nature in contemporary surgical nursing.

ii. *changes to skills*: Nurses, in this conception, understand technology as a way to help with their nursing practices, and requires certain skills. Therefore, they need to examine their existing skills with the present use of technology in the profession. If technology changes or new technology is updated, then they need to acquire new skills.

iii. *increasing knowledge*: Technology is viewed as a way to feed their knowledge. To handle the technology, a certain level of knowledge is required, and in some cases technology inspires nurses to update their knowledge.

iv. *respect and autonomy*: Technology, in contemporary surgical nursing, is viewed as a means to achieve respect from society, and it further increases autonomy in their profession.

v. *control of clinical practice*: Technology, in this conception, is viewed as a means to control their nursing practices. Nurses rely on technology to work in a busy working environment, and to gain confidence in their clinical duties.

vi. *clinical resources of the practice environment must meet the needs of technology*: The need for technology is understood as a way to build a
relationship with the overall environment of the care unit. Specifically, the use of medical technology in the contemporary surgical profession should fit in with the care unit, the overall arrangement between people, the machinery, the equipment, the patients, the policies, the resources, the politics, the funding, the electricity and the building design.

vii. *including the patients’ experience and clinical presentation:* Nurses, in this conception, perceived technology as less important than the patient. Nurses need to focus more on the health of their patients than on technology.

viii. *alteration to the free will of nurses:* In this conception, technology is viewed as a way to change nurses’ ability to offer their best care. For example, technology may, to some extent, alter individual goals, professional approaches to care, and principles of professional (contemporary surgical nursing) practices.

These authors not only examined technology in terms of *machinery and equipment*, but also in terms of how it was experienced, that is, presenting aspects of a higher order: change and increase of skills and knowledge, environment of care, clinical ability of the nurse, professional status, and wish to accept technology. The authors also identified relationships between the categories. However, their investigation was limited to the nursing profession, and, in terms of technology, the main focus was on machinery and equipment in this particular profession.

Kabo and Adawi (2011) conducted a phenomenographic study which was based on engineering students’ conceptions of the *notion of technology*. They interviewed ten students from the engineering physics department of a research-
intensive university in Gothenburg, Sweden, and the study identified six qualitatively different conceptions of technology:

Technology viewed as:

i. artefacts with certain characteristics;

ii. artefacts with a purpose to satisfy certain needs;

iii. how artefacts work and are constructed;

iv. an independent discipline;

v. applied science; and

vi. reciprocal to science.

They identified these six conceptions from less complete to more complete understanding, based on the logical relationship between the categories. However, in relation to the main aim of the present study, Kabo and Adawi’s (2011) study uncovers two important aspects: (i) the main focus was on the nature of technology and it was not particularly focused on profession; and (ii) they investigated students’ conceptions, whereas the present study investigates the teachers’ conceptions of the role of ICT in professional work.

Bruce (1999) conducted a phenomenographic investigation into the experience of Information Literacy (IL) among professionals who were working in Australian universities, whereas the other two studies discussed above emphasised “technology”. The author defined IL as “the ability to recognise information needs and to identify, evaluate and use information effectively” (p. 33). She identified seven different experiences of IL in workplace:

i. information awareness and communication: IL helps professionals to stay
informed and communicate with others;

ii. finding information from appropriate sources: IL helps individuals search the right kind of information;

iii. executing a process: It is related to information process. IL helps to involve professionals in decision-making or problem-solving by using the information;

iv. controlling information: The main focus is to manage the information. IL helps to make a connection between the information and the related projects or activities in the profession.

v. building up a personal knowledge based on a new area of interest: IL helps building up knowledge, which depends on individual interest.

vi. working with knowledge but with a personal perspective, adopted so that novel insights are gained: IL helps individuals to work with personal existing knowledge, and creates new forms of knowledge and insights in finding new solutions.

vii. using information wisely for the benefit of others: IL helps individuals to combine personal knowledge, experience, values and ethics, to bring benefits to others.

The study also suggested the necessary conditions within which IL may operate effectively in an information society. These are critical thinking, awareness of personal and professional ethics, information evaluation, conceptualising information needs, organising information, interacting with information professionals, and making effective use of information in problem-solving, decision-making and research (Bruce, 1999). Contrary to the previous study (Barnard & Gerber, 1999), Bruce’s (1999)
study conducted its investigation among various types of professionals, with a particular focus on IL. Similar focus is found in another, study by Forster (2013), who conducted a phenomenographic study aimed at investigating academics’ experience with information literacy (IL) in the nursing profession, that is, to show how IL is experienced by nurses. This was a pilot study based on three participants from the field of nursing education, who also had many years of clinical experience. This study displayed seven preliminary categories of description:\(^5\):

i. *collection of evidence:* IL is used for collecting evidence to justify change in practice;

ii. *accumulation of evidence:* IL is used for accumulating evidence in order to establish the most ethically appropriate care;

iii. *gathering of evidence:* IL is used for gathering evidence to support cultural change in the clinical environment;

iv. *obtaining of information:* IL is used for obtaining information to contribute towards a multidisciplinary team;

v. *building professional competence:* IL is used for building professional competence through various scientific knowledge;

vi. *accumulation of sufficient and appropriate evidence:* IL is used for accumulating evidence to justify care strategies to, and re-assure, patients and family; and

vii. *providing evidence:* IL is used for providing evidence, in order to establish and support an autonomous status for independent and defendable clinical opinions.

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\(^5\) These seven categories of description are expressed a second order perspective.
The above conceptions on the use of IL are mostly consistent with the study of Bruce (1999), particularly in the area of accessing information, building professional knowledge and competency, contributing and interacting with other professionals, and providing support to the professions. However, Forster’s (2013) pilot study solely focused on the nursing profession, and identified categories that mostly emphasised evidence. He described the above-mentioned seven categories as preliminary findings, and suggested that more complete findings may contribute new insights into the nursing profession. It is apparent that the phenomenographic method facilitates the expansion of knowledge about daily situations, such as the experiences of professionals using IL in their profession.

These two phenomenographic studies (e.g., Bruce, 1999; Forster, 2013) cited above, concentrated on professionals’ experiences with Information Literacy (IL). However, they did not focus on the role of ICT in the workplace. In the literature, there is a clear distinction between IL, and ICT. The former refers to the ability to recognise the information needed, to identify the possible sources of information, and to use, as well as to evaluate, information effectively (Bruce, 1999; Forster, 2013), whereas ICT is defined in general, as follows:

“It generally relates to those technologies that are used for accessing, gathering, manipulating and presenting or communicating information. The technologies could include hardware (e.g. computers and other devices); software applications; and connectivity (e.g. access to the Internet, local networking infrastructure, and videoconferencing)” (Lloyd, 2005, p. 3).

The present study refers to ICT as a combination of all the forms of technology
(both hardware and software). Specifically, this study looks at ICT from two contexts. Firstly, it places ICT in a vocational teaching context that embraces the use of any sort of *digital devices* in teaching, such as computers, any software related to teaching and learning, e-learning/teaching and online learning/teaching tools, mobile learning/teaching tools, interactive whiteboard, and the Internet. Secondly, it puts ICT in a professional practice context in which ICT is considered to be the use of *digital tools and devices* in the workplace, such as phone, fax, printer, email, networked for internal and external collaboration and communication, internet access, teleconferencing, different forms of software (generic and specific), machineries, and equipment supported by or derived of digital technology. Consequently, it is important to clarify that older technology, such as pencils, whiteboards, slide rulers, nuclear reactors, machines with manual operation, steam engines, are not considered to be ICT in this study.

Engström, Lindqvist, Ljunggren, and Carlsson’s (2009) study did not use the phenomenographic approach, but was included in this review for two reasons. It mainly focused on staff members’ perceptions of ICT, and it investigated ICT in professional fields. Both these reasons are reflected in the present study. The authors conducted an interview-based qualitative study wherein fourteen staff members from the dementia care unit were interviewed in groups. Data were collected in three stages: before, during and after implementation of ICT in the workplace. The authors considered two types of technology as ICT: monitors/alarms and communication technology. This study identified categories inside two broader themes:

1. moving from fear of losing control to perceived increase in control in three categories:
1. *hesitation:* some staff members are reluctant about the use of ICT.

2. *a desire to change:* some staff members in this category acknowledge the positive impact of using ICT and they want to implement ICT to benefit from it.

3. *perceiving advantages and improvements:* staff members describe ICT’s potential advantages and benefits during and after its implementation in the dementia care profession.

ii. struggling with insufficient/deficient systems in two categories:

1. *perceiving shortcomings;* and

2. *perceiving insufficient knowledge and difficulties in handling the ICT.*

Munck, Fridlund and Mårtensson (2011) conducted a phenomenographic study which focused on *medical technology.* They defined medical technology as a device that is “used to diagnose, prevent, monitor, treat or alleviate diseases, or compensate for an injury or disability” (p. 846). They interviewed sixteen district nurses who were working in both hospital and palliative homecare settings in southern Sweden. This study identified five conceptions in which medical technology:

i. *leads to vulnerability:* Medical technology, in this conception, is understood to increase vulnerability. More specifically, the use of technology-supported medical devices introduces new tasks and increases demands in the nursing profession, and thus raises uncertainty in this profession.

ii. *demands collaboration:* The use of medical technology in the palliative homecare profession seems to demand collaboration and support among co-workers, patients and relatives.
iii. *demands self-reliance:* District nurses describe their understanding of medical technology in relation to security and individual experience. Nurses need to be confident and competent enough to handle the medical technology before visiting a patient’s home.

iv. *requires awareness:* This conception is related to the safe use of medical technology in the patients’ homes. Awareness is required for the patients’ safety.

v. *provides freedom for patients:* District nurses, in this conception, express the view that patients have more freedom to make decisions (in terms of location of care and treatment), appreciate to the use of medical technology in the palliative homecare profession.

These categories are particularly reflected in the district nurses’ responsibilities, understanding, awarenesses, and the risks (uncertainty) and benefits of using ICT in their profession. Out of these five categories, the first four concentrate on three aspects: uncertainty, demands (collaboration and security) and awarenesses, while only one (provides freedom for patients) describes the role of medical technology in the homecare profession. The authors concluded that medical technology is beneficial to the patients in terms of providing flexible opportunities and independence. But the study did not explain how the professionals (nurses) may be benefited.

In Almerud, Alapack, Fridlund and Ekebergh (2008)’s phenomenological study, the main focus was to find out the relationship between technology and the care provided by a caregiver in the Intensive Care Unit (ICU). They invited ten participants (eight nurses and two physicians) to take part in an open-ended interview. After a
phenomenological analysis, this study uncovered three main themes:

**Mastery or servitude under technology:** Technology-supported machines in ICU are considered as a master who has the power of life and death. In ICU, technology-supported machines provide very authentic and reliable medical reports, which are otherwise difficult to achieve.

**To be secure in insecurity and insecure in security:** The mastery of technology-supported equipment in ICU is limited in order to guarantee the safety of the patients. The machine follows instructions and provides security depending on the followed instructions. If the caregiver is incompetent, then the equipment becomes unsafe for the patients.

**To make the human technological and the technology human:** Technology-supported machines are made for the patients’ benefit, and caregivers should not entirely rely on these machines. In relation to this context, the findings report that “there is a risk, according to the caregivers, that you trust the apparatus and forget the patient” (Almerud et al., 2008, p. 134). Although this study is based on a phenomenological perspective, it is worth including in this review because it investigated the professionals’ experience of technology at ICU. In this study, the author considered technology which is mainly used in medical equipment and machines at ICU.

Apart from the above studies, which are mostly conducted with a phenomenographic and phenomenological approach, this review also includes a recent study by Poulis et al. (2013). They conducted a qualitative case study to investigate the innovative use of ICT in shipping companies. The reason for including
this study in this review is that it investigates people’s views on the use of technology in the shipping industry, which are directly connected with people’s experiences. The authors identified two contrasting attitudes to the use of ICT in the shipping industry: (i) traditional shipping companies did not employ technology in their operation at all. The reasons suggested were a reluctance to invest in new technology and innovative ideas, and a lack of knowledge and skills to perform ICT supported functions; and (ii) modern shipping company owners utilised all possible innovations related to ICT, as they believed the use of technology is crucial to their industry. Indeed, it facilitates communication between ship and crew from anywhere in the world, it conveys the necessary information, and the management can check many of their activities using ICT. The study reported that “the ship owner can check everything: where the ship is, where it is going, what the technical details are, how many seamen are on board, their certificates, their training, their salaries and the like” (Poulis et al., 2013, p. 604). This study also reported that modern shipping companies used ICT to achieve competitive advantages over traditional shipping companies. The one important claim from this study is that people from the same industry viewed the use of ICT in differently.
<table>
<thead>
<tr>
<th>Study</th>
<th>Context</th>
<th>Categories of description</th>
<th>Dimensions of variation</th>
<th>Referential-Structural components</th>
</tr>
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<tbody>
<tr>
<td>Barnard and Gerber (1999)</td>
<td>contemporary surgical nursing</td>
<td>A. information awareness and communication</td>
<td>1. machinery and equipment</td>
<td>Clearly presented</td>
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<td></td>
<td>experiences of IL in workplace</td>
<td>B. finding information from appropriate sources</td>
<td>2. readiness for clinical practice</td>
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<td></td>
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<td>C. executing a process</td>
<td>3. the outcome of technology use in clinical practice, and</td>
<td>Not clear (could not find)</td>
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<td>D. controlling information</td>
<td>4. volition and nursing practice</td>
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<td>E. building up a personal knowledge based on a new area of interest</td>
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<td>F. working with knowledge but with a personal perspective, adopted so that novel insights are gained</td>
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<td>G. using information wisely for the benefit of others</td>
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<td>Bruce (1999)</td>
<td>experiences of IL in workplace</td>
<td>Technology:</td>
<td>Did not presented</td>
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<tr>
<td>Kabo and Adawi (2011)</td>
<td>engineering students</td>
<td>A. artefacts with certain characteristics</td>
<td>This study identified logical relationship among the categories. The dimensions of variation were not investigated</td>
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<td>Munck et al. (2011)</td>
<td>district nurses</td>
<td>Medical technology:</td>
<td>Did not presented</td>
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<td>A. leads to vulnerability</td>
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<td>E. provides freedom for patients</td>
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2.5.1 Summary

This review of the literature on people’s understanding of technology has shown, first of all, that there is certainly scope for new research into vocational teachers’ conceptions of ICT in professional activities. For example, two phenomenographic studies (see Bruce, 1999; Forster, 2013) focused on professionals’ experiences with Information Literacy, while other studies mostly investigated the nursing profession and the use of particular kind of technology. None of the studies reviewed focused on the role of ICT in the workplace. In this study, ICT is defined more broadly and is not limited to particular machinery or equipment. On the contrary, it includes all sorts of digital devices used in any profession.

Second, this review has shown that using a phenomenographical approach is a useful way of obtaining empirical evidence in the related field, more specifically in professional practices. For example, Barnard and Gerber (1999) claimed that their study was the first phenomenographic study of technology in the nursing profession, and that they identified new knowledge and insights (eight categories) in nursing research. They also claimed that it has impacts on nursing theory, practice, education and research. Consequently, from the studies discussed in this review, it is deduced that teachers’ understanding of the role of ICT in the workplace is worth investigating in order to bring novel and beneficial knowledge in this particular context (professional practice).

Third, as this review pointed out, most of the studies of professional practices did not identify the dimensions of variation among the revealed categories. In other
words, the authors did not investigate how the proposed categories related to each other. Exception, however, is found in Barnard and Gerber’s (1999) study, which identified four levels of dimensions, namely: machinery and equipment, clinical practice, outcome of the use of technology in clinical practice, and volition in nursing practice.

The amount of research on the role of ICT in the workplace is very limited. Prior research, cited in this review, did not investigate technology in multidisciplinary professions, but focused on specific disciplines and professions, such as nursing and on information literacy. In addition, most of the studies in professional practice did not identify dimensions of variation and referential and structural components. Most phenomenographic studies, in this review focused on the categories of description. Exploring the relationship between the proposed categories and identifying referential and structural components are considered significant aspects in phenomenographic research as both provide a clear understanding of the investigated phenomenon. However, these aspects were not investigated in the above phenomenographic studies (Table 2.15). In an attempt to fill this gap, one of the aims of this study was to explore vocational teachers’ perceived understanding of the role of ICT in professional practice. Therefore the study has set the following research question: What does ICT mean to TAFE teachers when it is used in professional activities?
CHAPTER 3 – METHODOLOGY

3.1 Introduction

The purpose of this chapter is to present the methodology used in this research. In the second, the aims and research questions are presented. The third section starts by presenting a general discussion of phenomenography, including the reason for selecting it as relevant to the present study. The section continues with a detailed discussion of the nature and aims of phenomenography as a research methodology, and concludes with how this methodology relates to the present study. In the fourth section, the detailed research design and analytical process are described. The section starts with a presentation of the research plan, which has three main phases: a pilot study and peer review; selection of participants; and data collection. The following subsection outlines the detailed procedure involved in analysing the phenomenographic data. The last two sections discuss the validity, reliability and ethical aspects of this study.

3.2 Aims and research questions

The purpose of this study is to investigate TAFE teachers’ conceptions of ICT-enhanced teaching and their understanding of the role of ICT in professional work. It also seeks to investigate their approaches to teaching when using ICT.
The objectives of the study are to:

1. Investigate TAFE teachers’ conceptions of teaching when ICT is used.
2. Discern TAFE teachers’ approaches to teaching when ICT is used.
3. Identify the conceptions of TAFE teachers about the use of ICT in professional activities.

During the last two decades, a substantial number of studies have been conducted to understand how university teachers conceptualise their teaching (Åkerlind, 2004; Ellis et al., 2009; González, 2011; Kember, 1997; Kember & Kwan, 2000; Trigwell et al., 1994). These were interview-based investigations that identified a number of different outcomes in different teaching contexts and contributed to the improvement of teaching practices in tertiary education (Åkerlind, 2008; Prosser & Trigwell, 1999). For instance, the major studies conducted in face-to-face contexts are Dall’Alba 1991; Kember, 1997; Kember and Kwan, 2000; Prosser and Trigwell, 1999; and Samuelowicz and Bain, 1992, 2001. Most fall into two broad orientations: teacher-centred / content-oriented that mainly focus on delivery of the content to the students and student-centred/learning oriented that primarily focus on students’ active participation in the teaching and learning process that facilitates developing more conceptual understanding. Some leading studies on teachers’ conceptions involved investigations in both online and blended contexts (face-to-face and online) (Ellis et al., 2009; Ellis, Steed, et al., 2006; González, 2009, 2010; Lameras et al., 2012; Roberts, 2003). For instance, Ellis et al. (2009) investigated learning technologies, González (2009) focused on distance learning, and González (2010) and Roberts (2003) emphasised e-learning (web-based learning). The majority of these studies support both teacher-centred / content oriented and student-centred / learning
oriented frameworks.

Research on approaches to teaching in a face-to-face context in tertiary education can be categorised into two areas: *teacher-focused* and *student-focused* teaching strategies. However, the literature on approaches to teaching in a blended context in tertiary education reported slightly different approaches. For instance, Ellis et al. (2009) identified *technology-focused* and *student-focused*, whereas González (2009) identified *informative-individual learning focused* and *communicative-networked learning focused*. However, these two studies did not attempt to find approaches to teaching in a blended context using the *intention and strategy* framework. To better understand teachers’ approaches to teaching, it is worth investigating both the intention and the strategy components, and the relationship between them. At the time of the current study, only two research articles (Bliuc et al., 2012; and González, 2012) addressed approaches to blended teaching that were based on the aforementioned intention and strategy framework.

With these few studies in the existing literature, research on teachers’ conceptions of, and approaches to, ICT-enhanced in vocational education is just at the start of investigating its complexity. Therefore there is a space for conducting new research into these phenomena, particularly when face-to-face and online are combined. In relation to this background, the present study sought to investigate both of these aspects (conceptions and approaches) to identify different ways of experiencing ICT-enhanced teaching in a vocational context. The current study was also interested to investigate vocational teachers’ perceived understanding about the role of ICT in the workplace. The underlying reason for choosing this phenomenon is
to bridge the gap between teachers’ experience and understanding towards ICT-enhanced teaching practices and their associated understanding about the usefulness of ICT in the workplace (for which they prepare their students). Further, vocational teachers’ conceptions of ICT in the workplace are an emerging area in the existing literature. As yet, none of the studies located focuses on this particular phenomenon in the multidisciplinary professions (various workplaces). By linking these two problem areas, the current study endeavours to contribute to filling that near void by investigating teachers’ conceptions of, and approaches to ICT-enhanced teaching and their conceptions of ICT in the workplace. These translate into the following research questions:

1. What does ICT-enhanced teaching mean to TAFE teachers?
2. How do TAFE teachers approach teaching with ICT?
3. What does ICT mean to TAFE teachers when it is used in professional activities?

3.3 Overview of the research method

The following section describes phenomenography as a research methodology that belongs to the qualitative research paradigm. It also describes reasons for selecting phenomenography for this study.

3.3.1 Selection of research method

The research method was selected based on the nature of the study as depicted in the research questions. Some authors suggest that human behaviour, such as
understanding, feelings, emotions, experiences, and thoughts, can be investigated effectively through the use of qualitative methods (Fielding & Schreier, 2001; Thorne, 2000). In this study, TAFE teachers’ understanding, experiences, and thoughts about ICT-enhanced teaching and its usefulness in the profession were investigated through a qualitative research design.

Difference between qualitative and quantitative research methods are discussed extensively in the literature, along with their advantages and disadvantages (e.g., Buchanan, 1992; Smith, 1983), therefore, this discussion is not provided here. Instead, a discussion is provided to explain why this study chose phenomenography as a qualitative research approach. The section below describes the phenomenographic approach in more detail in order to further clarify the research method employed in this study.

3.3.2 Background of phenomenography

Phenomenography has been used in research on student learning, student approaches to learning and on learning outcomes (Ellis, Goodyear, Calvo, & Prosser, 2008; Säljö, 1979; Van Rossum & Schenk, 1984). Additionally, a considerable amount of research investigates teacher conceptions of, and approaches to, teaching in tertiary education (Äkerlind, 2004; González, 2011; Kember, 1997; Prosser et al., 1994; Samuelowicz & Bain, 2001). Both of these research areas have benefited from the use of phenomenography that originated in the mid-1970s with the work of Ference Marton and his colleagues at the University of Gothenburg in Sweden. The term phenomenography was used for the first time in the early 1980s by Ference
Marton (Marton, 1981). Since then this empirical research method has been used by researchers in many other countries. For example, the following studies show that many countries have employed this research approach: teachers’ conceptions of teaching were investigated in the United Kingdom (Samuelowicz & Bain, 1992); university teachers’ conceptions of science teaching were conducted in Australia (Prosser et al., 1994), high-school students’ experiences of learning were researched in Hong Kong (Marton, Watkins, & Tang, 1997), research on conceptions of teaching was also conducted in Australia (González, 2011), and conceptions of teaching held by school science teachers and cross-cultural comparisons were investigated in Hong Kong and China, respectively (Gao & Watkins, 2002).

Phenomenography is designed to investigate people’s qualitatively different experiences of the world in terms of categories of description (Marton, 1981, 1986). Ference Marton defines phenomenography as:

“a research method for mapping the qualitatively different ways in which people experience, conceptualise, perceive, and understand various aspects of phenomena in, the world around them” (1986, p. 31).

Phenomenography as a research approach often depicts how people understand, distinguish, recognise, imagine, conceive or experience different aspects (characteristics) of the world around them, that can clearly be articulated in one word, “conception” (Carbone, Mannila, & Fitzgerald, 2007; Marton & Pong, 2005). It is also a research approach based on a second-order perspective. Experiences or conceptions are revealed by the participants unlike a first-order approach in which experiences are generated from researchers’ descriptions. That is, phenomenography
elicits experiences from people about a specific phenomenon rather than collecting observations of people in relation to that phenomenon.

Using this method, the researchers make assumptions that people experience or conceive a particular event in a limited number of qualitatively different ways (Bowden, 2000; Marton, 1986). That is, researchers seek out qualitatively different meanings, but logically interconnected conceptions of a particular context that a group of people experience (Marton, 1994). In relation to teaching and learning contexts, the aim of the phenomenographic research approach was described specifically by Prosser (2000) as follows: “to develop an understanding of the relations between the teacher’s and student’s experiences of teaching-learning, with the eventual aim of improving the quality of student learning” (p. 35).

Marton (1981), and later Dall’Alba (2000) mentioned three different lines of phenomenographic research. The first line focuses on the qualitatively different ways of experiencing or comprehending learning and how it links with different approaches taken on by the learners, including the outcomes of learning, as described by Marton (1981) as “general aspects of learning.” The second line is about associating such research with a “specific domain”, for example, physics, science, engineering, medical science, vocation (nursing, automotive). The third line is portrayed as “pure” phenomenographic research that concentrates on people’s experiences or understanding of different features of their reality, not necessarily in relation to subjects concerning education, but more focused on their daily lives. For example, people questioned about their conceptions concerning political scenarios, market prices and taxation (Lin, 2011; Priyowidodo, 2013). Over the last three decades, a
large body of research has been conducted using this research method in education; hence, the former two lines became more dominant than the last one.

The present study focused on two separate areas, the use of ICT in vocational teaching; and the role of ICT in the workplace. When viewed along the lines of phenomenographic research, the use of ICT in vocational teaching follows the second line, that is, it is domain-specific research (i.e., teaching) while the use of ICT in the workplace follows the third line of pure phenomenographic research.

3.3.3 Relationships between subjects, aspect of the world and researchers

Experience, which is comprised of conceptions, understanding, perception, and apprehension, is not a separate entity; rather, it is relational (Bowden, 2005). Phenomenographic research does not consider the subject, that is, the person or people, and aspects of the world (phenomenon) as a separate entity in a given context; rather, phenomenography always seeks a relation between these two entities. As previously mentioned, the way subjects experience a given phenomenon in the world as a relation between them is titled as a “relational approach” (Limberg, 2000). It is through an understanding of the close relationship between subjects and aspects of the world that the researcher can understand a subject’s experiences (Figure 3.1).

Thus, the subjects and aspect of the world of a study are not independent; rather, they are intertwined. A case in point is Ornek’s (2008) work where the existence of relationship between subject and aspect of the world was illustrated in conception of the number nine. When children were asked to create the number nine, one came up
with 6+3, another calculated 8+1, another replied 5+4, and another said 7+2. Their decisions likely came from their experiences related to the number 9, or it could be their different views or many other possibilities. In all the scenarios, though, the conception of the number nine is found with a pair of numbers. In this example, a child simply cannot deal with counting numbers without understanding or having experienced it in some way. Thus, the subject (a child) and the object/phenomenon (counting numbers) are not independent; rather they are connected and intertwined.

![Figure 3.1 Relationship between objects, subjects and researcher (Bowden, 2005, p. 13)](image)

3.3.4 Components of experience in phenomenography

In order to understand people’s experience, Marton and Booth (1997) described referential and structural aspects of experience (Figure 3.2). The referential aspect deals with the meaning of the object of interest. It is defined as a particular phenomenon being understood or experienced. The structural aspect is defined as how people act towards something, how they go about or carry out something (González, 2011; Marton & Tsui, 2004).
The structural aspect of an experience has two components, an outer structure and an internal structure of an object. The outer or external structure is the way of experiencing a specific phenomenon which is called the *external horizon*. It involves discerning an object from the outer context. The internal structure of how people experience a particular phenomenon, is named the *internal horizon*, that discerns how the parts of that phenomenon are interrelated with the whole object (Marton & Booth, 1997). Therefore, the structural and referential aspects of people’s experience of a specific phenomenon are embedded within the external and internal horizons.

![Figure 3.2 Component of Experience (Marton & Booth, 1997, p.88)](image)

The structural and referential aspects are dependent and intertwined (Marton & Pong, 2005). As Trigwell (2000) states, structural and referential aspects are “internally related components of an experience” (p. 74). In phenomenographic research, the referential aspect is often labelled the “what” aspect of an experience, whereas the structural aspect is labelled the “how” aspect of an experience (Marton & Booth, 1997).

In an educational research context, teaching experiences can be categorised as: referential aspects - for example, what teachers think about teaching and their experiences or comprehension of teaching; and structural aspects - how teachers carry
out or go about their teaching (Ellis, Goodyear, et al., 2006). The structural aspect can be further divided into two components: structural and referential. The former corresponds to the strategy being used, that is, how an individual performs an act or does something. The latter corresponds to the intention embedded within a particular strategy, that is, why an individual chooses to perform an act in a specific way (Figure 3.3). Åkerlind et al. (2005) stated that a participant’s underlying intentions and purposes should be investigated by asking questions with the word ‘why’. As mentioned previously, the structural aspect called the “how” component relates to the approaches to teaching (Trigwell, 2000; Trigwell & Prosser, 1996b).

![Figure 3.3 Experience of teaching based on (Ellis, Goodyear, et al., 2006)](image)

A number of studies have been used these structural (strategy) and referential (intention) frameworks to investigate how the students approaches to learning in both face-to-face and online contexts (Ellis, Goodyear, et al., 2006; Prosser & Trigwell, 1999). Considering these referential and structural components, Trigwell and Prosser (1996b, 2004) investigated approaches to teaching in a face-to-face context that they labelled as: intention and strategy. The present study focused on analysing the approaches to ICT-enhanced teaching in vocational education following Trigwell and
Prosser’s framework (1996b, 2004). Particularly, the second research question, regarding how TAFE teachers approach teaching with ICT, was investigated using this framework. The next paragraph clarifies the meaning of the terms intention and strategy in relation to the present study.

Vocational teachers adopt a range of approaches to using ICT in teaching and learning situations. In this particular context, an intention is associated with a referential component, that is, why vocational teachers adopt a specific strategy. What the teacher does by using ICT is directly connected with a strategy component (see Trigwell & Prosser, 1996b, p. 78). Therefore, intention and strategy are crucial aspects in describing the approaches to teaching, as investigated in this study (Figure 3.4).

![Teaching Using ICT Diagram](image-url)

*Figure 3.4 Intention and strategy components when teaching with ICT.*
3.3.5 Final outcome spaces in phenomenography

Similar to other research methods, phenomenographic research follows a particular set of principles. To produce trustworthy outcomes from this research approach, Bowden (2000) suggested that the study should begin with a clear intention, and it should be organised with a particular purpose. The aim of phenomenographic research is to produce a set of categories, as pointed out by Marton:

“whatever phenomenon or situation people encounter, we can identify a limited number of qualitatively different and logically interrelated ways in which the phenomenon or the situation is experienced and understood” (1994, pp. 4425-4426).

These categories are generally logically and hierarchically organised (Marton, 1994), and are referred to as ‘categories of description’. They are derived after careful interpretation of the subjects’ experiences of a particular situation. In this context, Bowden et al. (2005) added that it is important to keep categories of description apart from individual researchers’ experiences. That is, categories of description are not derived from the researcher’s own understanding about the phenomenon. Researchers need to: (i) avoid focus on individual participant’s experiences; and (ii) interpret the participants’ experiences as a group. Collier-Reed, Ingerman and Berglund (2009) exemplify this process when they state that participants should not be able to identify their individual contributions from the categories of description. Thus all the categories of description present the conceptions (different ways of understanding particular phenomena). The terms conceptions and categories of description within a phenomenographic research approach may give rise to confusion among the readers
Therefore, the researcher’s intention is to clarify the meaning of each term and to present the relationship between them.

Conceptions: Identifying participants’ conceptions is the central aim of a phenomenographic research approach. A conception is defined as a way of understanding or experiencing a phenomenon. Researchers Marton and Pong (2005) describe a conception as:

“the basic unit of description in phenomenographic research... [This] “has been given various names, such as ‘ways of conceptualising’, ‘ways of experiencing’, ‘ways of seeing’, ‘ways of apprehending’, ‘ways of understanding’, and so on...” (p. 336)

Thus, conceptions are the different ways in which people understand, experience, perceive or conceptualise phenomena of interests. Conceptions, in this research approach, present a form of knowledge related to a particular phenomenon that a group of people experienced. In the case of this study, conceptions are vocational teachers’ understanding of ICT-enhanced teaching and their understanding of ICT in professional activities. These conceptions are presented in a limited number of categories that are defined as ‘categories of description’ (Marton & Booth, 1997).

Categories of description: ‘Categories of description’ are the characteristics of conceptions. ‘Categories of description’ are defined as different ways of understanding a particular phenomenon (Marton & Booth, 1997). That is, a single ‘category of description’ presents only one possible way in which a group of people experienced the phenomenon.
In a phenomenographic research approach, a set of ‘categories of description’ emerges and each category represents salient features that distinguish them from each other. Sandbergh (Sandbergh, 1997) said, “conceptions are typically presented in the form of categories of description” (p. 204). This notion is also supported by Marton and Booth (1997), “we can have in mind that which is described (ways of experiencing) or the way in which it is described (categories of description). We cannot separate them, of course.” (p. 127).

As both ‘conceptions’ and ‘categories of description’ are closely connected, it is important to clarify the ways in which the two terms appear in this study. Identified categories will be considered as the ‘categories of description’. All ‘categories of description’ will together form conceptions. However, where only one ‘category of description’ is mentioned, it will be considered as a single conception. For example, Category 1 will be a way of experiencing ICT-enhanced teaching in this study, which may be considered as a conception at times. Similarly, the five categories of description may be considered as the five conceptions.

Categories of description include some variations that distinguish one particular category from another. These categories depict different ways of experiencing a phenomenon collectively and represent a “structured set” (Åkerlind, 2005a). Therefore, categories of description express structural relationships between different categories. Such relationships are often formed and expressed through charts, tables, that function as “outcome spaces”, which are the final result of the phenomenographic research (Marton, 1994). Researchers’ aim is not to articulate only a set of different meanings for a phenomenon; rather, they seek to identify various structured meanings...
of categories that have both logical and, in most cases, hierarchical connections with one another. The outcome space presents an overall experience of a given phenomenon that the participants explained. Ideally, it constitutes all the possible range of understanding that the participants have experienced in a given situation (Åkerlind, 2012). Marton and Booth (1997) introduced three criteria for evaluating the quality of the outcome spaces: (i) something unique or a distinct characteristic about the way of experiencing the phenomena that should be reflected in the individual category of outcome space; (ii) the categories are logically linked and have a relationship that is mostly hierarchical; and (iii) the outcome space should be parsimonious, that is, the main variations in experience are presented by as few categories as possible.

Due to few common features and relational perspectives, phenomenography and phenomenology could be considered as two potential research approaches for the present study. The sub-section below provides the detailed discussion to clarify why one of the two qualitative approaches is the most appropriate for this study.

3.3.6 Phenomenography or phenomenology

Research approaches such as phenomenography and those based on phenomenology are qualitative research methods that typically involve thorough investigation of subjective phenomena such as perception, understanding, thought processes and emotions (Olaogun & Fatoki, 2009). As Strauss and Corbin (1998) explain, both approaches exercise “non-mathematic process of analysis, for the purpose of discovering concepts and relationships in raw data and then organising
these into a theoretical explanatory scheme” (p.11). More importantly, both research methods have the relational, experiential and contextual characteristics (Marton, 1986). Therefore both phenomenography and phenomenology are used to describe people’s experiences of phenomena (R. Dunkin, 2000), that is, the word ‘phenomenon’ is found in both of these approaches (Larsson & Holmström, 2007). Therefore they appear to be similar to each other, often create confusion among readers. However, phenomenography has distinct aspects that make it different from phenomenology.

One of these distinct aspects is that phenomenology is interested in each individual’s experience. Phenomenology investigates the individual’s experience of a particular phenomenon, whereas phenomenography studies experiences of the same phenomenon collectively. Phenomenography is used to “explore the range of meanings within a sample as a group, not the range of meanings for each individual within the group” (Åkerlind, 2012, p. 117). In phenomenology, the phenomenon is investigated as such, whereas the investigation in phenomenography focuses on the different ways people can understand the same phenomenon (Larsson & Holmström, 2007). In relation to this study, phenomenography discerns a range of understandings of ICT-enhanced teaching in TAFE. It aims to reveal TAFE teachers’ different ways of understanding ICT-enhanced teaching where the focus is on combined variations among the entire sample of participants. In contrast with phenomenology, the focus would have been on individual perspectives about ICT-enhanced teaching in TAFE without considering variations among all the participants. In addition, the use of phenomenography allows the presentation of the phenomena in a set of categories, which focuses on the variety of experiences among all the sampled teachers. The aim of phenomenology, conversely, is to clarify the meaning of phenomena by its actual
Phenomenography takes a non-dualistic ontological perspective, “there is not a real world ‘out there’ and a subjective world ‘in here’…” (Marton & Booth, 1997, p.13). It includes the focus of internal experience in relation to a particular phenomenon. Phenomenology does not take into account particular experiences of people in relation to specific phenomena, and it is not interested in collective experiences.

Besides, investigation of variations among the participants is not possible in phenomenology as it involves relatively small samples and its focus is on individual experience. In contrast, phenomenography typically considers larger samples and identifies different ways of peoples’ experiences towards a particular phenomenon (R. Dunkin, 2000). Further, the two methods differ in their ways of posing questions to participants of the study. For example, in relation to this study, a phenomenologist would ask ‘What is your experience as a teacher of ICT-enhanced teaching in TAFE?’ but a phenomenographer would ask ‘What does ICT in teaching mean to you?’

Phenomenography in this study would be the research approach through which the TAFE teachers perceive their understanding about ICT-enhanced teaching and the usage of ICT in workplace on a more cognitive level. But in phenomenological study, these phenomena would have been described per se based on pre-reflective work experiences that provide us with an understanding of what the phenomena are going to be in reality (Larsson & Holmström, 2007). Thus, the overall aim of the above two approaches differs from each other. Considering all the above distinctions,
phenomenography is a better match with the purpose of this study than is the application of phenomenological research method. Additionally, the nature of the present study, which is further linked with the following aspects, reinforces to select phenomenography as its research approach.

In phenomenography, the subject and object of research in a given situation are not independent; rather, they are connected and intertwined (discussed in Section 3.3.3). In the present study, the main focus was to investigate TAFE teachers’ understanding or experience towards ICT-enhanced teaching. ICT-enhanced teaching is a phenomenon (objective) and a teacher (subject) cannot be separated from it. Therefore, ICT-enhanced teaching in TAFE in itself cannot have an individual meaning without having teachers who experiences it. Both (ICT-enhanced teaching and teachers who experienced it) are linked in this phenomenographic study.

In theory, TAFE teachers can conceive of ICT-enhanced teaching in an infinite number of ways. However, in order to create a useful general understanding, only a limited number (2 to 6) of ways would be considered (Larsson & Holmström, 2007). The purpose of the present study was to discern TAFE teachers’ different ways of experiencing ICT-enhanced teaching and their different ways of understanding ICT in the workplace, in a limited set of categories of description.

TAFE teachers can theoretically conceive ICT-enhanced teaching in an infinite number of ways. However, in order to create a useful general understanding, only a limited number (2 to 6) of ways would be considered (Larsson & Holmström, 2007). Considering this argument, the purpose of the present study was to discern TAFE
teachers’ different ways of experiencing ICT-enhanced teaching and their different ways of understanding ICT in the workplace, in a limited number of categories of description.

This method presents students’ and teachers’ conceptions that are built on their different levels of understanding of learning and teaching, which in turn provide powerful insights for improving tertiary education (Entwistle, 1997). Larsson and Holmström (2007) reinforced this concept in relation to professional education and development when they claimed that phenomenography is a useful research tool for improving teaching, learning and competency development. It is evident that phenomenographic studies contribute new knowledge about different conceptions and approaches to teaching and learning in different contexts. These findings have contributed to improve teachers’ pedagogical practices and students’ learning outcomes (Prosser & Trigwell, 1999). For example, most of the empirical research on teachers’ conceptions of, and approaches to teaching (both face-to-face and blended contexts) has been done in the university sector. The sector has benefited from this research approach (Åkerlind, 2004, 2008; González, 2011, 2012).

In summary, phenomenography follows a qualitative research approach that is relational, empirical and non-dualistic in nature. Phenomenography was chosen as the most appropriate research method in order to investigate the research problem (three research questions) that was set for this study. The next sections of this chapter explain the research design and analytical procedures through which the findings in this study were revealed.
3.4 Study design and analytical process

3.4.1 Selecting the sample

The selection of participants for a phenomenographic project is generally based on the purpose of the study and the awareness of participants related to the investigated phenomena. Marton and Booth (1997) advised, “a phenomenographic study always derives its descriptions from a small number of people chosen from a particular population” (p.125). Understanding a particular phenomenon is discerned from participants who are aware of the distinct feature. Green (2005) noted that the selection of participants is focused on considering maximum variation in their ways of seeing a particular phenomenon. Therefore, participants need to have various levels of experience and a wide range of variation across different features such as age, gender, experience, discipline, and institutions. Previous studies in phenomenographic research selected participants who had direct experience of investigated phenomena (Bliuc et al., 2012; Ellis et al., 2009; González, 2009, 2010; Lameras et al., 2012). Similarly, in the present study, TAFE teachers were chosen as participants who had direct experience of using ICT in their teaching (Åkerlind, 2005b; Green, 2005; Marton & Booth, 1997).

The sample size - or number of participants should neither be too big as to lead to a problem of managing a large volume of data, nor should it be too small as to restrict the variations of experiences. Trigwell (2000) recommended 15 to 20 interviewees for phenomenographic research and stated that reasonable variation could be provided by a minimum of 10 to 15 participants. However, a maximum of 20
to 25 would allow the researcher to manage data effectively (Åkerlind et al., 2005; R. Dunkin, 2000). For example, Prosser et al. (1994) interviewed 24 teachers about their conceptions of teaching; Ellis et a. (2009) interviewed 19 academics about their conceptions of learning technologies and González (2011) selected 18 teachers to investigate their conceptions of teaching. The Table 3.1 shows the prior phenomenographic studies with a maximum of 24 sample size.

The researcher of this study chose the sample size within the range of 15 to 25 participants as adequate for a substantial level of variation in experience while keeping data management reasonable for a study by a single researcher. All interviewed teachers were required to have previous teaching experience at any TAFE institution. This was then narrowed down to only those teachers who used ICT in their teaching. In order to incorporate the largest possible variation in experience, participants were selected from various: disciplines, levels of experience, teaching positions, ages and gender. The selection guidelines were followed for recruiting participants:

- TAFE teachers who were from different disciplines;
- TAFE teachers who had various levels of experience in using ICT in their teaching;
- TAFE teachers with varying academic positions, such as part-time teachers, full-time teachers;
- A balanced number of male and female TAFE teachers; and
- Teachers who were from three different TAFE institutions for a wider range of experiences.
Based on these guidelines, this study selected 23 participants from three different TAFE institutions, labelled as TAFE 1 (T1); TAFE 2 (T2); and TAFE 3 (T3). These labels were used to keep the participants and their institutions anonymous. This choice of different institutions ensured a broad coverage of TAFE teaching programs that included a variety of disciplines, such as: ICT, Electrical, Mechanical, Refrigeration, AutoCAD, Civil Engineering Manufacturing, Accounting, Finance, Business Studies, Event Management and Tourism and Community Service. The selection of participants constituted purposive sampling and focused on variation in participants’ characteristics (R. Dunkin, 2000). The following criteria were used to select participants:

*Teaching role:* Participants had to be currently teaching, either part-time or full-time, in one of the TAFE institutions earlier mentioned.

*Use of ICT:* Participants needed to have used or are still using ICT in their teaching.

*Availability:* Participants needed to be available during the data collection phase.
of the present study, September 2012 to April 2013.

Language: Participants needed to be fluent in English.

Voluntary participation: Participants had to agree to participate voluntarily.

After getting approval from the University of Sydney Human Research Ethics Committee (HREC) and the previously mentioned institutions, the researcher communicated by email with the Head Teachers from the desired disciplines in each TAFE. An appointment was requested to discuss further their participation (how to invite the potential teachers) in the research. The Head Teachers were informed about the nature and purpose of study and at meetings where the researcher brought a copy of approvals indicating that their institution granted permission to conduct the research. The researcher requested Head Teachers to forward an invitation letter along with Participant Information Statement (PIS) to all the teachers in their departments. This was to find participants that met the selection criteria and guidelines. The PIS clearly explained that participation was voluntary and that teachers could withdraw from the study at any time without explanation and without affecting their relationship with the University, or their TAFE institution (Appendix 1).

After circulating the invitation letter to target participants, interested teachers communicated with the researcher by email expressing their interest in the present research. In response, a Participant Consent Form (Appendix 2) was forwarded in which a request was made for them to allocate a time and suggested public place that would be most convenient for them to attend an interview. The researcher continued to recruit participants using a purposive sampling technique until a sufficiently broad coverage and variation of the participants’ characteristics (gender and experience)
was reached.

A total of 23 participants from the three institutions were selected for this study. Within this sample, sixteen teachers were male and seven were female. Table 3.2 shows participants’ demographic characteristics.
Table 3.2 *Participants’ demographic information*

<table>
<thead>
<tr>
<th>Teacher ID</th>
<th>Institution ID</th>
<th>Gender</th>
<th>Discipline</th>
<th>Employment level</th>
<th>Teaching with ICT mode</th>
<th>Experience of teaching with ICT</th>
</tr>
</thead>
<tbody>
<tr>
<td>P01</td>
<td>T3</td>
<td>Male</td>
<td>ICT</td>
<td>Full time</td>
<td>Blended</td>
<td>16 - 20 years</td>
</tr>
<tr>
<td>P02</td>
<td>T2</td>
<td>Male</td>
<td>Electrical</td>
<td>Full time</td>
<td>Face-to-face</td>
<td>21 or more years</td>
</tr>
<tr>
<td>P03</td>
<td>T2</td>
<td>Male</td>
<td>Electrical</td>
<td>Full time</td>
<td>Face-to-face, blended, online</td>
<td>16 - 20 years</td>
</tr>
<tr>
<td>P04</td>
<td>T1</td>
<td>Male</td>
<td>Mechanical engineering</td>
<td>Part time</td>
<td>Face-to-face</td>
<td>11 - 15 years</td>
</tr>
<tr>
<td>P05</td>
<td>T2</td>
<td>Female</td>
<td>ICT</td>
<td>Full time</td>
<td>Blended</td>
<td>16 - 20 years</td>
</tr>
<tr>
<td>P06</td>
<td>T2</td>
<td>Female</td>
<td>Community service</td>
<td>Full time</td>
<td>Face-to-face</td>
<td>6 - 10 years</td>
</tr>
<tr>
<td>P07</td>
<td>T2</td>
<td>Male</td>
<td>Mechanical</td>
<td>Full time</td>
<td>Face-to-face</td>
<td>6 - 10 years</td>
</tr>
<tr>
<td>P08</td>
<td>T2</td>
<td>Male</td>
<td>Manufacturing and engineering</td>
<td>Full time</td>
<td>Face-to-face</td>
<td>16 - 20 years</td>
</tr>
<tr>
<td>P09</td>
<td>T3</td>
<td>Male</td>
<td>ICT</td>
<td>Full time</td>
<td>Face-to-face, blended</td>
<td>21 or more years</td>
</tr>
<tr>
<td>P10</td>
<td>T3</td>
<td>Female</td>
<td>Accounting</td>
<td>Full time</td>
<td>Face-to-face, blended, online</td>
<td>11 - 15 years</td>
</tr>
<tr>
<td>P11</td>
<td>T2</td>
<td>Male</td>
<td>Event management and tourism</td>
<td>Part time</td>
<td>Face-to-face</td>
<td>0 - 5 years</td>
</tr>
<tr>
<td>P12</td>
<td>T1</td>
<td>Female</td>
<td>Accounting</td>
<td>Full time</td>
<td>Face-to-face</td>
<td>0 - 5 years</td>
</tr>
<tr>
<td>P13</td>
<td>T2</td>
<td>Male</td>
<td>Information Technology</td>
<td>Full time</td>
<td>Face-to-face</td>
<td>11 - 15 years</td>
</tr>
<tr>
<td>P14</td>
<td>T1</td>
<td>Male</td>
<td>Finance</td>
<td>Full time</td>
<td>Face-to-face, online</td>
<td>11 - 15 years</td>
</tr>
<tr>
<td>P15</td>
<td>T2</td>
<td>Male</td>
<td>Business studies</td>
<td>Full time</td>
<td>Face-to-face</td>
<td>0 - 5 years</td>
</tr>
<tr>
<td>P16</td>
<td>T1</td>
<td>Female</td>
<td>Civil Engineering</td>
<td>Part time</td>
<td>Face-to-face</td>
<td>0 - 5 years</td>
</tr>
<tr>
<td>P17</td>
<td>T1</td>
<td>Male</td>
<td>AutoCAD</td>
<td>Full time</td>
<td>Face-to-face</td>
<td>6 - 10 years</td>
</tr>
<tr>
<td>P18</td>
<td>T1</td>
<td>Male</td>
<td>Business and Finance</td>
<td>Full time</td>
<td>Face-to-face, online</td>
<td>6 - 10 years</td>
</tr>
<tr>
<td>P19</td>
<td>T2</td>
<td>Female</td>
<td>ICT</td>
<td>Full time</td>
<td>Face-to-face, online</td>
<td>6 - 10 years</td>
</tr>
<tr>
<td>P20</td>
<td>T1</td>
<td>Male</td>
<td>Accounting</td>
<td>Full time</td>
<td>Face-to-face</td>
<td>21 or more years</td>
</tr>
<tr>
<td>P21</td>
<td>T2</td>
<td>Male</td>
<td>Business services</td>
<td>Part time</td>
<td>Face-to-face</td>
<td>6 - 10 years</td>
</tr>
<tr>
<td>P22</td>
<td>T2</td>
<td>Male</td>
<td>Refrigeration</td>
<td>Full time</td>
<td>Face-to-face</td>
<td>0 - 5 years</td>
</tr>
<tr>
<td>P23</td>
<td>T3</td>
<td>Female</td>
<td>Information Technology</td>
<td>Full time</td>
<td>Face-to-face, online</td>
<td>0 - 5 years</td>
</tr>
</tbody>
</table>
In summary, the main characteristics of the sample are presented below:

- **Disciplines**: Teachers were selected from different disciplines, such as ICT, Electrical, Mechanical, Refrigeration, AutoCAD, Civil Engineering Manufacturing, Accounting, Finance, Business studies, Event management and Tourism, Community service.
- **Vocational institutions**: Teachers were invited from three different TAFE institutions for a wider range of experiences.
- **Experience**: Teachers had a minimum of one year teaching experience with ICT.
- **Teaching position**: In order to create variation in academic positions, full-time, part-time and Head Teachers were recruited.
- **Teaching mode**: Teachers had experience of face-to-face, or combination of face-to-face and online teaching.
- **Gender**: 16 males and seven females were recruited.

3.4.2 Data collection

Interviewing is the preferred data gathering technique in phenomenographic research (Åkerlind, 2005b, 2012; Marton & Booth, 1997). Phenomenographic data may also be gathered by other techniques (Walsh, 2000), for example, the researcher can interpret people’s conceptions by observing and recording their behaviour under certain controlled situations (Marton, 1986); or they can be investigated by using open-ended questionnaires, focus groups, written survey (Bliuc et al., 2012; Yates, Partridge, & Bruce, 2012). However, most phenomenographic studies use interviews as a technique of data collection (Åkerlind, 2005a; Limberg, 2000). This study
selected *interviews* as its data gathering technique. The previous studies recommended that interviews in phenomenography provide the greatest potential to collect and clarify data (Åkerlind, 2005a; Bowden, 2000). That is, information could be clarified during an interview in ways not possible as easily through other methods of data collection. Moreover, the present study considered the other recommended guidelines for interviewing the participants, which is discussed below:

Data collection can be fruitfully conducted through an open-ended semi-structured interview protocol that focuses on research problems, followed by a number of set questions. Bowden (2000) recommended two main types of necessary questions about the phenomenon: questions related to the research problem that is investigated; and questions related to what is meant by “X”? These questions need to be constructed to explore participants’ in-depth understanding towards the particular topics of investigation. According to Marton and Booth (1997), during the data collection stage, more emphasis is given to the interviewee’s experience of a particular aspect in a state of in-depth understanding. The interview should be adequately open-ended to allow the interviewees to describe their own understanding or experience as completely as possible. The present study followed this recommendation and constructed a semi-structured open-ended interview protocol before conducting the interviews. The interview schedule had five sections with a set of questions and prompts (refer to Appendix 3 for a complete discussion).

The study followed recommendations for asking follow-up questions that would prompt participants to further explain their answers to the specific questions or topics (Åkerlind et al., 2005; Prosser, 2000). The researcher had a set of broadly framed
follow-up questions in order to clarify what the interviewees said about the main question, such as, *Could you explain that further?*; *Why is it important?*; *What do you mean by that?*; *Could you provide one more example?*; and *Is there anything else you would like to add about this?* These questions helped the researcher to reveal participants’ in-depth understanding about ICT use. As literature suggests (Bowden, 2000) there are three typical situations that require follow-up questions: when interviewees explained the topic very briefly; when interviewees discussed the topic ambiguously; and when interviewers need more examples related to particular topics or problems. This study asked the follow-up questions when interviewees’ answers fell into one of these situations.

Another aspect related to the data collection is to deal with the interviewer (or who is conducting phenomenographic interviews). It is usually preferred that the same researcher conducts all interviews. For example, Green (2005) identified two benefits for having the same interviewer conduct the all interviews: to increase of consistency with regard to the questions being asked; and to control the researcher’s biases while asking follow-up questions. In this study, the researcher conducted all interviews without assistance.

Bracketing interviewer’s own unplanned leading questions or incorporating his/her own ideas, is another important aspect in this research method. Without this practice, it is possible to hinder interviewees’ natural expression towards the phenomenon in interview questions (Åkerlind et al., 2005; Green, 2005). As Green (2005) recommends, interviewers should be made aware that their asking of questions should be limited to investigate only interviewees’ understanding and experience.
towards a particular topic and they need to avoid introducing new ideas. Therefore, researchers should not ask any follow-up questions that are not specifically relevant to the investigated phenomenon and should avoid questions that are biased in nature. As Mann et al. (2007) recommend, the interviewer should also consider that judging or criticising interviewees’ answers as being right or wrong is inappropriate. These recommendations were carefully considered and incorporated in the data collection activities of the present study. The researcher aim was not to show his own views about the phenomenon studied but to provide a friendly atmosphere for interviewees to explore their experiences.

Data collection took place from September 2012 to April 2013. During this time, twenty-three teachers from the above institutions were invited to take place in semi-structured interviews. Before the interviews, the researcher handed over a PIS sheet to each participant. The PIS provided additional information about the research project and was a means to collect the participant’s consent. Most interviews took place in each interviewee’s office. Only two interviews were conducted in other places. One had been conducted in a quiet place - a coffee shop as per the request of the interviewee as he had been on leave. The other interview took place in an empty classroom as the teacher did not have a permanent office in her department.

The interviews were 40-60 minutes in duration and were digitally audio recorded. Before each interview, the researcher followed three steps: permission was sought from participants to audio record; participants were informed about the confidentiality of the whole interview; and a brief explanation was given about the nature of the study and the explanation of the key terms used in the interview which
might be confusing to the interviewees, for example: What does ICT stand for in this study, and how the term profession was defined in this study.

In summary, the following guidelines were followed during the data collection period:

- The researcher conducted each interview with an open and friendly atmosphere, which allowed the interviewees to explore their understanding, experiences or ideas as fully as possible (Åkerlind et al., 2005; Bowden, 2000).
- The researcher took special care and followed specific guidelines to avoid incorporating new ideas when asking follow-up questions during the interview (Åkerlind et al., 2005; Prosser, 2000).
- The researcher conducted each interview session without assistance (Green, 2005).
- The researcher bracketed his own experience, own ideas or conceptions (Åkerlind et al., 2005; Green, 2005; Prosser, 2000). The researcher took a non-leading role to create an environment where the interviewees could explain their experiences elaborately.
- Data collection took place on a one-on-one interview basis. If the participant clearly described his/her awareness during the semi-structured interview session, then, no follow-up or probing questions were asked (Green, 2005).

3.4.3 Pilot and peer-review

In phenomenographic research, it is strongly recommended that the novice researcher conduct a pilot study before starting the main project (Åkerlind et al.,
2005). Therefore, a pilot study was undertaken before the start of data collection for this study. This pilot was not a traditional one as it was conducted in two stages: pilot interviews and peer-feedback.

The aim of the pilot was to become familiar with phenomenographic interviewing; to develop the necessary skills to conduct the interviews; to gain experience about the phenomenon of interest; and to trial the semi-structured interview protocol for data collection. Four participants’ colleagues who had relevant experience were asked to participate in the pilot study (Table 3.3). The following criteria were followed when inviting participants for the pilot study:

- All participants were required to have previous experience in ICT-enhanced teaching;
- One participant was specifically recruited for her wide experiences in phenomenography. The researcher was a novice in phenomenographic data collection. The recruitment of an experienced phenomenographer enabled the researcher to receive feedback and suggestions on how to improve required interviewing skills.
- Another participant was specifically recruited due to her experience in teaching professional courses. This recruitment in the pilot study was to become familiar with professional personnel before commencing the study. The researcher requested her suggestions and feedback on the clarity of the interview protocol from the perspective of a professional.

For the pilot study, the semi-structured interview schedule was used. The same topics were covered so that the researcher could gain experience of conducting
phenomenographic interviews prior to final data collection. Before starting the interviews, participants were informed about the aim of the pilot study and the researcher gave detailed instructions about the interview protocol so that the participants were not confused during their interview. After conducting the pilot, the peer-feedback stage commenced. Participants were requested for their feedback with regards to the following aspects:

- Is there anything required (need to add any other interview questions) to achieve the research questions which might be missed out in this semi-structured interview protocol?
- Is there any particular suggestion for the interviewer to improve interviewing skills?
- Is there anything else you would like to explain about the overall interview or interview situation?

Table 3.3 Participants’ demographic information of pilot study

<table>
<thead>
<tr>
<th>Participant ID</th>
<th>Institution</th>
<th>Position</th>
<th>Gender</th>
<th>Experience in ICT-enhanced teaching</th>
<th>Reason for selection for pilot</th>
</tr>
</thead>
<tbody>
<tr>
<td>P1</td>
<td>S</td>
<td>Lecturer</td>
<td>Female</td>
<td>Yes</td>
<td>Had expertise in phenomenography</td>
</tr>
<tr>
<td>P2</td>
<td>S</td>
<td>PhD student</td>
<td>Male</td>
<td>Yes</td>
<td>Final stage of PhD completion and had experience in methodology</td>
</tr>
<tr>
<td>P3</td>
<td>S</td>
<td>PhD student</td>
<td>Female</td>
<td>Yes</td>
<td>Had experience in profession</td>
</tr>
<tr>
<td>P4</td>
<td>S</td>
<td>PhD student</td>
<td>Male</td>
<td>Yes</td>
<td>Had experience in ICT</td>
</tr>
</tbody>
</table>

After completing the pilot study, the semi-structured interview schedule was slightly modified based on participants’ feedback and the difficulties encountered during the pilot study. For example, the question, “In what ways do you think students
are involved when it comes to using ICT in teaching?‖ was included in the semi-structured protocol after having received feedback from the pilot study. The importance of including the above follow-up question was pointed out by the participant who had experience in phenomenography. The underlying reason for adding this follow-up question was to explore teachers’ awareness about the use of ICT in their teaching approaches. More specifically, it facilitated further explanation about teachers’ experience in relation to how students respond while teachers use ICT in teaching.

The researcher met with the supervisory team in order to finalise the interview protocol. The researcher and supervisory team discussed the participants’ feedback and the quality of the conducted interviews during the pilot study. Additionally, this pilot provided the researcher with adequate opportunities to practice before conducting the interviews for the main study. The researcher listened to the audio-recorded interviews that had been collected during the pilot study, over and over again, to check the interviewing techniques and to become familiar with ways of prompting or probing during the interview process.

3.4.4 Data analysis

After collecting the data, the most important and challenging part of phenomenographic research is to analyse the interview data (Åkerlind, 2012; Prosser, 2000). The present study relied on interviews for data collection and therefore, transcripts were the main evidence for the analysis process. In this context, verbatim transcription is important, not only because of the content of the participants’
responses, but also because of the manner and the context of what was said (Mann et al., 2007). Thus, transcripts represented the participants’ experiences towards the investigated problems in a particular context. How the participants explained topics and the related context is important. As Mann et al. (2007) stated, “the same term or phrase could be used in different contexts to mean different things by different subjects, or conversely, different subjects may use different terms or phrases to mean similar things” (p. 17). Therefore, all interviews were transcribed by the researcher in order to get much deeper understanding about the collected data. These transcriptions were directly facilitated to discover the categories of description.

In phenomenographic research there is no single technique for data analysis (Marton, 1986). For example, González (2010) employed five steps for analysing the data: reading interview transcripts several times, focused reading and adding annotations, construction of an initial list of categories, re-reading of transcripts with preliminary categories in mind, and lastly, finalisation of categories of description (p. 65). Sjöström and Dahlgren (2002) employed seven steps: familiarisation, compilation, condensation, preliminary grouping, comparison, naming, and contrastive comparison. It is important to note that these steps do not conflict with González’s (2010) five steps. González (2010) presented a concise way to accommodate the above seven steps. The current study chose to follow the steps of Sjöström and Dahlgren (2002) in analysing data because the technique employed focused on nursing research, an area of professional education. Although this study was carried out in a wider area of professional education with a particular focus on ICT, it is nonetheless quite in line with Sjöström and Dahlgren’s (2002) study. Therefore, the analysis process considered the steps as outlined in the following
Familiarisation step: After transcribing all interviews, the researcher considered several options before starting the analysis. The first option considered was about the “commencement of the phenomenographic analysis” or, “when do the researcher begin the phenomenographic analysis?” In order to meet the first option, the present study followed John Bowden’s (2005) recommendation that the phenomenographic analysis should not be started until all the interviews had been conducted and completed. Bowden suggests that if the analysis is being simultaneously conducted with remaining interviews, then there might be the risk of altering later interviews, explicitly, unconsciously or unintentionally. Therefore, the researcher started the analysis process after all the interviews had been conducted. Before doing so, all transcripts were left in a pile for two weeks, similar to the technique adopted by Trigwell (2000). The main aim of doing so was to keep the researcher separated from the transcripts for a brief period after conducting 23 interviews and transcribing all audio recordings. This process helped the researcher to refresh his mind and assisted him to start with an open mind. It further helped to find out the suitable time to start analysis without any interruption.

The researcher already had initial familiarity with the raw data as he had transcribed all interviews, but still needed to read these several times in order to become more familiar with their content. In this step, he concentrated on two things: to correct any mistakes made on the transcripts, and to generate personal notes (Appendix 4) for each transcript. These notes contained the participant’s information, and important points that were recorded after each interview. After these notes were
made, all transcripts were carefully checked against their audio files for accuracy and any errors were fixed.

Compilation step: This second step required a more focused reading in order to deduce similarities and differences of meaning from the transcripts. The primary aim of this step was to compile teachers’ answers to the questions asked during the interviews. A few choices needed to be made during this step, such as what amount of transcript needs to be considered at each attempt; and, how many transcripts need to be considered at the beginning of the analysis. In relation to these aspects, the phenomenographic research approach presented commonalities and variations in their practices, as elaborated below.

Amount of transcript to be considered at each time: three practices were found in previous phenomenographic literature in terms of the amount of transcript needed to be considered during analysis: the whole individual transcript (Bowden, 2000), large sections of each transcript related to a particular issue (Prosser, 2000; Trigwell, 2000), and smaller chunks or quotes on each transcript related to a particular interview question (Marton, 1986; Svensson & Theman, 1983). In the last practice, the utterances or smaller portions are selected and marked from each individual transcript depending on each interview question. Selected utterances, from each transcript, are organised together to form a group of data, known as the, “pool of meaning”. In this approach, an attempt is taken to keep the utterances separated from all transcripts which results the selected data to be decontextualised from the transcripts. Åkerlind (2012) argued that this approach decreases the significance put upon the context – which might influence the actual meaning of the phenomenon.
Bowden (2000) did not extract smaller quotes or any parts of the transcripts, rather, he focused on them as a whole. In this practice, all transcripts are read through in “one go”. The argument behind this approach is that a meaning of phenomena in relation to each transcript that is more precise can be uncovered with the help of the context than without it (Åkerlind, 2012). However, working with whole transcripts carries the danger of highlighting individual interviewees, whereas the decontextualised approach has to focus on the collective interviewees. Further, decontextualisation can also be favoured in order to attain greater clarity of the main meaning of investigated interview questions. When the whole transcript method is applied, researchers may lose the main meaning when they are changing transcripts (Åkerlind, 2012).

The third option depicts how to interpret a large section of each transcript related to a particular task or particular research question. Prosser (2000) suggests dividing the whole transcript into large sections related to a particular issue or a research problem, and extracting the categories from each large section. This strategy concentrates on conceptions and approaches from the same transcript that is in agreement within the larger context. This approach ensures that understandings relate to an appropriate context in order to attain both similar and different meanings from larger sections, by bearing all ideas in mind. Additionally, there might be relationships of meaning across large sections. For example, conceptions of teaching section might be better understood by focusing not only sections about conceptions but also by focusing on sections about approaches at the same time. Trigwell (2000) suggests not only concentrating on one large section but also to consider the other sections of the transcript when it is needed, so that the contextual influence remains
the same. The current study followed the approach recommended by Prosser (2000) and Trigwell (2000). Each transcript was divided into two separate parts. The first part focused on TAFE teachers’ conceptions of, and approaches to, ICT-enhanced teaching. It was further divided into three large sections - background information, conceptions of ICT-enhanced teaching, and approaches to ICT-enhanced teaching. The second part focused on TAFE teachers’ experience or understanding of ICT in profession. The researcher divided interviews into the four large sections (background information, conceptions of ICT-enhanced teaching, approaches to ICT-enhanced teaching, and conceptions of ICT in profession). In this step, all transcripts were re-read to select the relevant content. It was easily managed as the interview protocol was semi-structured and the follow-up questions were in almost the same sequence as the large sections.

How many transcripts need to be considered at the beginning of analysis: variation exists in previous phenomenographic studies about the number of transcripts that are considered at the beginning of analysis. Many researchers use a sample of around 5-10 transcripts at the beginning of the analysis process (Prosser et al., 1994; Trigwell et al., 1994). That is, a full analysis of these few transcripts was completed before analysis of the rest of the transcripts.

The researcher followed a similar but adapted method and started with large sections from 10 transcripts, which dealt with the conceptions of ICT-enhanced teaching without considering other large sections (i.e. approaches to ICT-enhanced teaching and conceptions of ICT in profession). This was easier to manage the small set of transcripts initially, and feedback was sought after this process from supervisors.
and peer-reviewers as well as other relevant members of the researcher’s academic community. After this initial analysis and feedback, the rest of the transcripts were then analysed. The researcher analysed the remaining two large sections (i.e. approaches to ICT-enhanced teaching and conceptions of ICT in the profession) by working on the entire set of 23 interviews. During the analysis of approaches to ICT-enhanced teaching, the researcher followed Trigwell’s (2000) recommendation to focus on other parts of the transcript, whenever it was needed to eradicate confusion associated with any one section. This process provided an enriched understanding about the contextual elements of each interview. The researcher again read the large chunks of text related to conceptions of ICT in the profession and followed a similar approach as recommended by Prosser (2000) and Trigwell (2000). Through the above process, the researcher identified the collective understanding and important elements with regard to each research question and moved to the next step.

Condensation step: In this stage, the researcher focused on the selection of extracts that seemed to be most relevant and meaningful for the study. The main aim of this step was to make the data more manageable and understandable. The researcher started reading the entire transcripts again and considered all large sections together to enrich his understanding and to increase the clarity of data. The primary purpose of this step is to distil meanings that might be spread across different parts of interviews. That is, how the parts can be put together in relation to the whole.

During this reading, the researcher considered the entire transcripts rather than just the large sections in order to develop deeper understanding about the context and to adjust any missing piece of explanation. This time, the focus was on three issues:
what the participants discussed; how they answered the interview questions, becoming familiar with individual large sections with regard to the entire transcript; and the third focus was linking to relevant information from the entire transcript. For example, if the participants elaborated upon any important phenomenon later, that part was highlighted during this reading and linked into the relevant sections. At the end of the interview, participants were asked ‘Is there anything else you would like to describe regarding ICT in teaching or in the profession?’ Most participants responded by describing experiences, that they had not mentioned or had forgotten to explain before. The researcher highlighted that missing explanation and linked it to the relevant sections.

**Preliminary grouping step:** The fourth step focused on locating and classifying similar answers into the preliminary groups. After focusing on similarities and differences in the previous steps, the researcher identified the significant aspect that emerged from the transcripts to be listed as a preliminary category. During this stage, the researcher read and looked through the teaching materials that were collected after each interview (see show me in the section 3.4.2). This practice provided a glimpse of teachers’ way of using ICT in teaching and was used as an important aid to deduce the meanings of described in an individual transcript about the phenomenon of ICT-enhanced teaching. At the end of this stage, all the categories formed a list of preliminary categories and each category represented a distinct meaning.

During this step, the researcher followed an ‘open minded attitude,’ a common recommendation for phenomenographic data analysis (Åkerlind, 2005a; Bowden, 2005; Prosser, 2000; Walsh, 2000). This recommendation suggested that the
categories of descriptions or preliminary outcomes should be discovered, and not derived from existing frameworks or preconceptions. The researcher followed this recommendation as explained by Bowden (2005), following specific controls during the analysis process: “(1) the use of no other evidence except the interview transcripts; and (2) the bracketing of the researcher’s own conceptions relation to the phenomenon” (p. 15). Therefore, in this study, a sincere effort was made by the researcher to analyse the transcripts with an open mind by bracketing the researcher’s own understanding about ICT-enhanced teaching and profession. With the given considerations, the analysis presented an initial list of categories of description.

Preliminary comparison of categories: The preliminary comparison of categories involved the revision of the initial list of categories to bring forth a comparison among the preliminary listed categories. The main aim of this step was to set up boundaries among the categories and preliminarily finalised categories of description. This is an iterative process that relies on continuous reading and re-reading of the transcripts and it involves continuous sorting and rearrangement of data (Åkerlind, 2005a; Barnacle, 2005; Bowden, 2005). The categories of description should be checked repeatedly with the interview data. Based on the above recommendations, the preliminary categories were checked several times with the transcripts in order to make sure that the essence of each category was justified and supported by interview data. Thus, the categories of description were drawn by a discovery process (Walsh, 2000). At the beginning of a new reading cycle, the researcher made sure that he had an open mind and avoided interruptions. This process ensured that every new reading contributed meaningfully to the preliminary categories of description. He did not stop reading the transcripts after developing the
first draft of categories, keeping in mind Bowden’s (2005) statement: “I don’t believe you could read the transcripts once and then write the final categories of description” (p. 29). At the end of this step, the preliminary categories of description had been confirmed.

**Naming the categories:** The aim of naming the categories is to emphasise the essence of categories depending on the groups’ internal key elements and the distinguishing features shared among them. During this step, the researcher encountered an option of association through teamwork and collaboration. This is mentioned in the literature with some phenomenographers recommending to discern the outcome space through collaboration (Bowden, 2005; Trigwell, 2000). Group analysis or teamwork is seen as a source to improve the development of outcome space by considering combined efforts with broader perspectives and sharing as well as altering different perspectives on the data (Åkerlind, 2012). In contrast to this recommendation, some researchers argue that an individual is able to contribute considerably in phenomenographic analysis (Åkerlind, 2012; Barnacle, 2005). For example, individual researchers are more deeply associated and familiar with the data; and feedback from others can still be requested during the analysis process. Åkerlind (2012) claims that the large number of existing phenomenographic doctoral theses justifies that high-quality phenomenographic research can be conducted as an individual researcher without focusing on teamwork. By following Åkerlind’s (2012) claim, the analysis of this study was done initially by an individual researcher. Later, it was discussed with a peer group (colleagues: current PhD students, post-doc researchers and PhD alumni) who had previous experience in phenomenography. The aims of peer group discussion were to check whether the categories of description
represented authentic meaning, to correct the mistakes, and to extend the possible range of perspectives. Hence, the final outcome spaces and names of the categories were developed through back-and-forth discussion with peers and the supervisory team. For example, categories of description, Version 1 was developed with individual effort. Version 1 emerged after stage five. Later on, categories of description, Version 2 was developed after discussing with the peer group. Later, Version 3 and onward had emerged through the continuous feedback from the supervisory team to finalise the categories of description (Appendix 6). The main focus of the discussion with the supervisor team was to critically debate to finalise the categories of description. It was an opportunity to critique through an interpretative process and to find verifiable ways in which the categories were developed.

**Final outcome space:** This is the last step, where the researcher developed the final outcome space based on the internal relationships and qualitatively different ways of understanding ICT in teaching and teachers’ professional experience. During this stage, he followed the three aspects recommended by Åkerlind, et al. (2005) below:

- The description of “outcome space” either in prose or graphic form, or both;
- The detailed elaboration of the categories of description; and
- The detailed analysis of the relationships among categories.

There is another variation found in the literature in terms of priority given to finding out the categories of description and relationship among the categories (Åkerlind, 2005a). Bowden (2005) argued that the analysis for a structural relationship should be started only after the categories of description are finalised,
whereas a few studies started to search for structural relationships from the beginning of the analysis (Åkerlind et al., 2005). In this study, the researcher followed Bowden’s (2005) argument to determine the relationships among the categories of description. First, the researcher finalised the categories of description and then the relationships among the categories were drawn. The final relationship-structuring was supported entirely in terms of citations from the transcripts. During this time, the researcher was conscious of imposing his own structure. In order to avoid this, four steps were taken into consideration for finding out the structural relationship:

(1) The analysis began once the categories of description were constituted. Åkerlind (2005a) argues that constructing the relationship too late in the analysis carries the potential danger that the categories and relationships will not be adequately constituted in the final outcome space. Therefore, caution was taken to conduct this analysis of the relationship early. The researcher developed the relationship based on the identified categories of description just after completion of Naming the categories stage.

(2) The relationships were established based on the empirical data. No relationship could be drawn or developed if it were not justified by quotes from the transcripts.

(3) In this stage, the researcher again went back to the teaching materials that were collected after each interview (see show me in the section 3.4.2). The intention was to go through the teaching materials that the participants usually used during their instructions. It was an aid to find out any inconsistency that may occur during the formation of the structural relationship.

(4) The categories of description and relationships were finalised with the support of supervisory teams and presented to the relevant research communities.
In summary, the following guidelines were followed during the analysis process:

- The researcher transcribed all 23 interviews in order to gain a thorough understanding of the contents and contexts of the data.
- The researcher started the analysis process after all interviews had been conducted (Bowden, 2005).
- During data analysis, the researcher followed the seven steps suggested by Sjöström and Dahlgren (2002).
- The researcher aimed to maintain an “open-minded attitude” as recommended for phenomenographic data analysis (Åkerlind, 2005a; Bowden, 2005; Prosser, 2000; Walsh, 2000).
- The analysis was based on the collective transcripts rather than a series of individual transcripts (Åkerlind et al., 2005). It focused on participants’ collective experiences or understandings of the investigated problems.
- The preliminary analysis was carried out by the individual researcher (Åkerlind, 2012; Barnacle, 2005) with the intent of seeking feedback from peer groups and the supervisory team.
- The analysis was followed by Barnacle’s (2005) recommendation of “stay with the transcripts”. The focus was on discovering the categories based on the interview data.
- The categories of descriptions were identified by analysing the collective meaning from the transcripts based on the iterative process. Therefore, the final outcome space was revealed through a discovery process (Walsh, 2000), involving continuous reading and re-reading of the interview data.
• Peer review and the feedback of the supervisory team were maintained in order to minimise the possible issues associated to construction of categories and the drawing out of relationships among them (Walsh, 2000).

3.5 Trustworthiness

When assessing the outcomes and implications of a research project, trustworthiness is an important element, especially when the project is within a qualitative research paradigm. The rigour of the research process is explicitly underpinned by it (Collier-Reed et al., 2009). Therefore, establishing trustworthiness in phenomenographic research is imperative. It is generally ensured by checking validity and reliability in this research approach (Åkerlind, 2012; Marton, 1994; Roisko, 2007; Sandberg, 2005). It is important to state that some qualitative researchers regard questions of validity and reliability as conflicting with the nature of qualitative research. In some cases, they discuss credibility, trustworthiness, authenticity instead of presenting validity and reliability (Lietz, Langer, & Furman, 2006; Morrow, 2005). However, this study provides a brief review of some perspectives on this issue. It includes the steps taken to ensure the trustworthiness in where the particular focus is on establishing validity and reliability, which is discussed below:

3.5.1 Validity

Validity in phenomenographic research is regarded as the degree to which the research findings are capable of replication in relation to the phenomenon under
investigation (Åkerlind, 2012). In this research approach, two types of validity checks are commonly practised: the communicative validity check and the pragmatic validity check (Åkerlind, 2012; Kvale, 1996; Mann et al., 2007).

A communicative validity check refers to the researcher’s ability to show the research community that appropriate research methods have been employed in the study and the final interpretation of the results has been inferred correctly (Åkerlind, 2012; Kvale, 1996). In qualitative research, the interpretation of the final outcomes is not judged as true or false, it is more about how well the researcher’s findings interpret the people’s experience of particular phenomena. Sandberg (2005) included similar ideas when stating that the “truth as intentional fulfiment [in phenomenography] can be achieved when the researcher’s interpretation allows the research object to appear on its own conditions within the perspective taken” (p. 52). Therefore, to achieve this validity, researchers in any study seek to investigate the ways in which the participants experience the phenomena. Researchers need to be aware of convincing the relevant communities that the results are appropriately defensible and faithful (Åkerlind, 2012). In this particular research, there were four main audiences involved in the communicative validity check: the community of learning and teaching in tertiary education, the audiences and practitioners from technical and vocational education, those who had an interest in ICT in this particular field, and phenomenographic researchers. Validity can also be checked at research seminars attended by the researcher, at conference presentations and by acceptance of papers in peer-reviewed journals (Åkerlind, 2012). In other words, the work can be tested in the research community as it develops.

To obtain communicative validity, this researcher accepted every opportunity to
receive feedback from the above-mentioned communities regarding the preliminary and final results of each outcome space. The results of this study were presented in one peer-reviewed conference and sections of this study have been accepted by one peer-reviewed conference, four internal research seminars, and two poster presentations in an annual research fest as detailed below. It is important to mention that, while choosing the conferences and other venues for presenting the output of this study, the researcher initially focused on deciding what to present. The study was divided into four major sections in relation to check this validity, such as research methodology and design of the study, conceptions of ICT-enhanced teaching which was connected with the first research question, approaches to teaching based on the second research question, and conceptions of ICT in the professions, which was connected with the third research question. The researcher decided to present these four sections to at least four relevant research communities, to validate the work as well as to obtain their suggestions.

(1) The research methodology and design section was presented in:

- A poster presentation in the annual research fest 2011, organised by CoCo on November 03, 2011;
- CoCo seminar series on September 12, 2012; and

(2) The conceptions of ICT-enhanced teaching in vocational education section was presented in

- CoCo Research Students Colloquium session on 13 August 13, 2013;
• A poster presentation in the Science and Technology of Learning (STL) Research Fest 2013, annual research fest organised by STL network, the University of Sydney, on November 07, 2013; and

(3) The approaches to ICT-supported teaching in vocational teaching section was presented in
• A weekly workshop “Thesis and dissertation writing: A workshop series for research students” on September 5, 2013; and
• The Research Students Forum, Faculty of Education and Social Work, the University of Sydney, on Thursday 31, October 2013.

(4) The conceptions of ICT in professional work section:
• Was presented at CoCo Research Students Colloquium session, University of Sydney on 06 May 2014.

A pragmatic validity check refers to how useful and meaningful outcomes of the research are for the intended audiences (Åkerlind, 2012; Kvale, 1996). The outcomes received positive feedback regarding the findings in venues where the work was presented. This study identified new insights (see Chapter 7) into TAFE teachers’ understanding of ICT-enhanced teaching and their approaches to teaching, plus novel empirical data about TAFE teachers’ understanding of the role of ICT in their professions. This type of research has been explored on a very limited scale, and its outcomes are useful for people working in areas of staff development, and ICT support for both professional education, and professional practice. Previous research
identified that teachers’ conceptual changes have a measurable impact on professional development (Ho, Watkins, & Kelly, 2001; Ramsden, 1991). Thus, the practical significance of the study findings is on teachers’ professional development in professional education with a focus on ICT-enhanced teaching.

Other aspects that need to be considered to increase the validity of a study include maintaining an open mind throughout the analysis process. In this regard, the researcher was cautious and kept in mind the importance of not imposing any existing structure during the discovery process. Another way validity was established was to compare the outcomes of the study with those of previous phenomenographic studies (Åkerlind, 2012; González, 2011). In the present case, this was done by cross-study support (see detailed discussion provided in Chapter 7).

3.5.2 Reliability

Reliability, in qualitative research, refers to the replicability of results, that is, if a second researcher investigates the same research problem following identical methodology, then he/she would reach the similar findings (Roisko, 2007). This can be achieved through the use of appropriate methodological procedures to obtain quality and consistency in data collection and analysis (Åkerlind, 2012; Kvale, 1996). Two types of reliability checks are commonly used in interview-based qualitative research, namely the coder reliability check that engages two or more researchers independently making code interview transcripts and then comparing the output, and the dialogic reliability check, where researchers reach a final outcome space through mutual discussion after constructive criticism (Åkerlind, 2012). However, in relation
to the use of these two methods in phenomenographic study, Åkerlind (2012) pointed out that “Both checks are used within phenomenographic research to varying degrees of popularity; neither is uniformly used” (p.125). These reliability checks have also been criticised by others, and it has been argued strongly that they are inappropriate for use in phenomenographic research (Åkerlind, 2012; Prosser, 2000; Sandbergh, 1997). However, Åkerlind (2012) proposed an alternative strategy to enact a reliability check in this research in which the interpretive steps provide a clear discussion with appropriate examples and incorporate details that readers can easily understand.

This study preferred dialogic reliability check along the line proposed by Åkerlind (2012) over inter-judge reliability check due to two main reasons: inter-judge reliability fails to consider the researcher’s procedures in achieving outcome spaces; and (ii) methodologically, it is inconsistent with phenomenography. Initially peer groups and later on supervisory teams ensured the dialogic reliability check in this study. After preliminary conceptions and approaches were decided on, these were discussed with peer groups that had experience of phenomenographic data analysis. This step is discussed in detail in the analysis Section (3.4.4). To further ensure reliability, all interpretive steps were discussed with, and examples were given to, the supervisory team to confirm the emerged set of categories. Besides, quotations from interviewees were given to establish and support the final outcome spaces. Whenever any confusion or ambiguity was encountered, the researcher consulted with the supervisory team and with other peer groups.
3.6 Ethical considerations

Within qualitative research, there is a potential danger related to disclosure that entails the coordination of informed consent, anonymity, and confidentiality (Mishna, Antle, & Regehr, 2004; Parry & Mauthner, 2004). These aspects were carefully considered in this study. This study obtained approvals of the Human Ethics Research Committees (HERC) of the participating TAFE institutions and from the University of Sydney (Appendix 10). The researcher followed the approved procedures set out below:

Initially, the participants were contacted via email with a letter of invitation (Appendix 5), along with the PIS. The invited interviewees were informed about the nature, scope and implications of this research. The detailed recruiting procedure is discussed in Section 3.4.1. The PIS clearly explained that participation was voluntary and participating teachers could withdraw from the study at any time without affecting their relationship with the University of Sydney or the TAFE institution and without the need for explanation.

An additional important concern was anonymity. In order to ensure anonymity in this research, the researcher used an identification number for each participant, which concealed his or her personal details. Except the researcher, nobody had access to the meaning of the identification number. Information in the thesis is carefully worded so that no particular individual can be identified.
All interviews were conducted by the researcher and audio recorded that were later stored and managed securely by the researcher. The researcher transcribed all 23 interviews. Only the researcher had access to the data. More importantly, audio recordings of the participants and any other information related to participants has not been disclosed in any way. Every effort has been made to de-identify all information presented.
CHAPTER 4 – VOCATIONAL TEACHERS’
CONCEPTIONS OF ICT-ENHANCED TEACHING

4.1 Introduction

One of the aims of this study is to explore teachers’ conceptions of ICT-enhanced teaching in vocational education. In order to achieve this, the present research project focuses on the following research question: What does ICT-enhanced teaching mean to TAFE teachers?

This chapter describes the results of the analysis of vocational teachers’ conceptions of ICT-enhanced teaching based on the above research question, which is divided into three sections. The first section contains an introduction and a description of each category. The second section establishes the relationships among these categories and the third section summarises the findings of the study including referential and structural components.

4.2 Overview of teachers’ conceptions of ICT-enhanced teaching

Five qualitatively different conceptions emerged through the analysis process, as outlined in Chapter 3 and they are:

Category A: ICT is used to meet external expectations;
Category B: ICT is used to gain access to information and resources;
Category C: ICT is used as a delivery tool;  
Category D: ICT is used as a medium for active learning; and  
Category E: ICT is used for preparing students for their future profession.

The following sections present each category in detail.

4.2.1 Category A: ICT is used to meet external expectations

Category A represents the vocational teachers’ view on the use of ICT in teaching in order to satisfy external expectations. These expectations are various social demands that include administrative, organisational and departmental expectations; institute curricula and subject matter requirements or other associated needs in relation to the use of ICT in teaching. These expectations are expressed directly or indirectly by the external sources who are not involved in teaching. Consequently, the use of ICT in teaching might not arise directly from the teachers’ needs or it is not set by the teachers to achieve teaching objectives. Category A has several distinct aspects as shown in Figure 4.1, and then discussed.

![Diagram](image)

*Figure 4.1 The three components of external expectations*

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6 Here and throughout the chapter, the discussion is based on second-order perspective, which means that explanation and discussion are derived from the participants’ views and their ways of seeing the phenomenon.
The first type of external expectation is coming from faculty or organisational requirements. Teachers are expected to use ICT in classroom activities due to departmental requirements. For instance, in some cases, teachers are advised to use ICT by the Head Teacher and this is the reason to employ ICT in teaching, which is reflected in below response:

We get pushed [by the Head Teacher] very hard to deliver very flexibly and blended learning [by using ICT]. (P01-T2)

A related view is derived from the participants’ responses indicating that using ICT is more economical when compared to conventional teaching without using technology and this meets organisational needs. Participants perceived the use of ICT in teaching to be more economical when compared to conventional teaching without using technology. For example, participants reported that maintenance and usage cost of teaching materials such as whiteboards, markers, cleaning chemicals were more costly than using PowerPoint. According to participant teachers, it is less expensive to conduct classes with the support of ICT tools. Therefore, institutions with the same assumptions, expect that teachers would incorporate these technologies into teaching.

Well, primarily it is [the use of ICT] driven by cost. There is a growing sense in the organisation: photocopying is seen as expensive; whiteboard markers and maintenance and cleaning the boards is an expense … more and more shifts towards remote learning, and ICT is conducive to that [use in these aspects]. (P15-T2)

A second type of external expectation is that of students, who express their expectations that teachers use technology in classrooms. For instance, participants in
this study were aware of students’ interests in ICT and their expectations that teachers would be technologically literate. Teachers perceived students as technologically more advanced, thus, they expressed the need to follow the students’ inclination towards the use technology:

*At first I was using only the overhead projector, but it was really old fashioned.*

*Students did not like it.* (P08-TI)

The last major external expectation expressed was that the use of ICT is embedded in some subject matter and thus teachers need to use ICT to teach it. Some participants viewed that without a computer or specific software, they could not teach certain subjects. Computer programming, Engineering drawing and Web design were a few examples of these subjects in vocational curricula. Therefore, the application of ICT to teaching is considered as an external source. This means that teachers are unable to carry out their daily teaching activities when the necessary technology is unavailable and there are no alternative teaching methods.

*I teach computing subjects also. That you cannot do without that [ICT]. You have to teach them computing because there you are teaching a specific software or a particular function of a software.* (P20-T1)

Based on these distinct aspects of expectations, the concept of ICT-enhanced teaching in Category A emphasises teachers’ decisions to use ICT as externally driven and with a tendency to meet social demands and external realities. In this category, the decision to use ICT-enhanced teaching is less related to intrinsic teaching and learning goals and more related to the external expectations and demands to adopt ICT-enhanced teaching.
4.2.2 Category B: ICT is used to gain access to information and resources

Category B represents the understanding that ICT is a tool for obtaining information for teaching. Teachers consider ICT as a resource bank. Often, participants in this study expressed their view of ICT-enhanced teaching by discussing three roles performed by ICT as discussed below (Figure 4.2):

*Figure 4.2 Different aspects of accessing information*

In Category B, ICT is viewed as a convenient and readily-available source of information. Teachers access necessary information easily at any time and any place from different sources by using ICT tools, such as: YouTube, Google, Google Scholar or other search engines. For example, the study participants reported that it is difficult to locate information in books, and sometimes books do not have information organised in a way they could readily access:

*Think[ing] about having to look at the books, by the time you look at the books, the pages are difficult. If you could be online, you type it in, and it will come [up] straight [away]. (P17-T1)*

It was perceived by participant teachers to be more efficient to use ICT tools to
search for information and necessary resources than to access hard copy, as reflected in the following quotation:

*It is definitely convenience as I have said “information at your fingertips”. So I think the readiness of information, the information you want is there. It is available. It is an ocean of information there, so all you need to spend your time is finding that specific information, and then create or produce that information in such a form that students can understand. But sometimes it is readily usable, the readiness, like YouTube. You can get specific topics explained via YouTube and you can use that straight away, so, readiness is one thing, and convenience, readiness…. Easy to access from anywhere, you can access it from home and you can transport it easily.* (P07-T2)

Vocational education teachers viewed ICT as providing the means to acquire knowledge and/or to keep up to date with their existing knowledge. Being aware of the rapid expansion of vocational knowledge, teachers find it is necessary to frequently update their knowledge and skills. Within this category, participants expressed the need to search online for required content about a topic whenever they lacked information, or lacked understanding about a topic.

*Let’s say I have got a difficulty in one topic,[then] I can go to YouTube or something else or may be go to Google and just type in something and then get that [desired topic].* (P17-T1)

Teachers recognised the use of ICT to update or gain new knowledge:

*Alright, I’ll tell you one of the things. I was teaching statistics a few days ago and this was about probability. And, we know about independent events, and it was mutually exclusive and there was something called ‘Dependent events’. So*
there is dependent probability and independent probability. I know conceptually
independent events are even that one impact does not impact on the other. How
do I differentiate on a mathematical basis, that independent probability from a
dependent probability? How do I differentiate? I learned these many years ago,
but I did not know conceptually how do I differentiate that. And I was trying to
figure it out, figure it out, figure it out. But then I searched the net, then [from]
one place I quickly learned. And then I realised, in independent probabilities,
when you have two independent events, if you multiply the independent
probabilities, you can multiply and get the final answer is [sic] the
probability of that [sic] independent events happening. But if they are dependent,
then you got to multiply one by the conditional probability and other. Now that
is how we identify. So if you look at a probability set, and you find out obviously
that particular can happen, then you check it. And that is a way to test it. Now I
tell the students what is one from the other, but I did not explain to them how it
can be tested mathematically, now I learnt that. I learnt it yesterday. (P20-T1)

Some vocational teachers’ viewed the use of ICT tools as valuable for updating
information in their notes. Participants perceived ICT as a suitable tool for storing
their lecture materials and notes safely and emphasised the usefulness and
convenience of using ICT. For example, teachers update their notes, store their notes
through Dropbox and other storage devices, and access and revise these easily
whenever necessary. The essence of this view is illustrated by the following
quotation:

From the teachers’ point of view, it is really good because [...] You can update
your notes and keep archives and you can keep revising your notes these days,
having PowerPoints and then having the ability to update it [sic] and improve it [sic]. It is good to have that technology with you as a teacher. (P07-T2)

In summary, vocational education teachers perceive ICT as a supportive tool for accessing information, downloading necessary documents and resources when they prepare notes for lectures as well as sharing these notes with their students. They keep up to date and learn new knowledge by taking advantage of various online resources: websites, digital books, YouTube, and other ICT-supported tools.

4.2.3 Category C: ICT is used as a delivery tool

Within Category C, teachers consider ICT as a delivery tool for teaching. This is evident in teachers’ responses when they discussed various ICT roles in delivering courses: ICT can be used to deliver face-to-face instruction; ICT can be used as an integrated course delivery platform; and ICT is used as an alternative delivery system. These elements are described in detail with related quotations in the following section (Figure 4.3):

![Figure 4.3 Different ways of seeing ICT as a delivery tool in Category C](image)
The use of ICT can be seen as an instrument to enhance the delivery of face-to-face instruction. In this category, vocational teachers view the objective as using technology to reinforce their own teaching and learning. They perceive the use of technology in the classroom to support their teaching through different presentation tools. For example, teachers in most cases use PowerPoint presentations, interactive whiteboards and simulation software for effective presentation of lessons, and/or to facilitate their instructions:

Well, resources such as PowerPoint, videos which I’ve downloaded ... I can run through it on the smart board and they can see it right in front of themselves. Plus, they have a copy. It is much easier. (P21-T2)

ICT in this category has another supportive role: to motivate and sustain students’ attention as well as to make the lesson interesting. The participants reported that they were able to draw students’ attention and manage the classroom by using technology in an effective way. Thus, teachers in this context, consider ICT as a basic tool for providing interesting instruction within a limited amount of time. The essence of this view is expressed in the following response:

In the classroom, you have limited time. You are not going to write down everything there on the board. That just wastes time and students get bored. But if you provide the PowerPoint, you include the video and you have more interaction with the students and get their attention, they would be more willing to come to class. So, that is why, for face-to-face delivery, we use ICT. (P23-T3)

Also, within Category C, ICT is conceived of as an integrated course delivery platform. Vocational teachers, in some cases, are seen to use various Learning
Management Systems (LMS) in their courses for effective instruction. The participants discussed the value of LMS in teaching. For example, teachers used Moodle for: instant access to information, sharing lectures, preparation and acquisition of course content during and after classes, uploading and downloading videos.

I put a lot of my resources up on the website, Moodle, for students to access. (P06-T2)

I am doing quite a bit with Moodle, and there are a lot of fellows scouring the Internet, getting good movies, good resources off the air, and putting them into Internet and into Moodle sites to get the students to have a look at them and to use them in their delivery. (P01-T2)

The use of ICT is viewed as an alternative delivery method for instruction. Vocational teachers occasionally present the content of subjects online. The aim of using ICT, in this context, is to provide instruction for those students who may not always be able to attend regular classes due to work constraints (those who work and study at the same time) or due to other circumstances. Participants focused on the usefulness of ICT tools to provide instruction:

So, we do some of our courses that are a blend, so students come for a week, and attend the lectures, and then go away and fortnightly attend the online sessions, using Adobe Connect. (P06-T2)

For the evening student, if they miss some point [lectures], and I think this part is hard and needs more explanation, I will send an email through Adobe Connect, “All right, tonight from 5 pm to 6 pm, we are going to have an online
meeting [lectures], I’d like you guys to join in,” and during this time I can explain stuff [hard part of the lecture]. (P23-T3)

In Category C, similar to Category B, vocational education teachers perceive that the use of ICT helps them to expand their existing teaching resources. They reported that using technology in their teaching not only saves them time in preparing teaching materials but also provides them with an effective way of delivering the lesson. ICT also provides teachers the access to available or already prepared materials such as video lectures, online readings and quizzes, so they could accomplish their instruction effectively. However, Category C differs from Category B, as it emphasises not only accessing teaching materials, but also effective delivery of instruction.

*Blended* [learning with the use of various ICT tools] *in the classroom, is a fairly effective way of teaching and it overcome a problem for me which is always preparing new materials rather than extending previous materials, and I was able to use all these beautifully prepared materials, video lectures, online reading, quizzes.* (P03-T2)

Overall, Category C focuses on ICT as a tool that contributes to effective instruction. ICT is viewed as a *delivery tool* to support and enhance instructional tasks and to create interesting teaching. The use of ICT provides a space for online delivery for students who cannot attend classes. In addition, ICT is understood as an integrated delivery tool for uploading and sharing course materials with students.
4.2.4 Category D: ICT is used as a medium for active learning

Category D emphasises the creation of an active learning environment - an interactive medium for engaging students in their learning in a myriad of ways such as group discussions, brainstorming, various project-based activities, and the use of analytic software to complete their tasks. Category D not only focuses on using technology in teaching, but also describes “hands-on” practice. The essence of developing students’ understanding by engaging them in active learning is captured in Figure 4.4 and in the following quotation:

*There is a lot more hands-on practice through virtual technologies or through interactive technologies that allow us [teachers] to engage better with the learners and help that development.* (P12-T2)
The focus on using ICT is to facilitate learning that shifts from the provision of accessing information and delivery to the encouragement of students to become actively involved in their learning. Students are engaged in different activities where they learn through sharing and exchanging their information, ideas and opinions. Thus, teachers are creating an environment where students are directly involved in learning processes that are more independent, self-paced and active:

If you are looking at your teaching strategy, it is not the talk and chalk what we used to call it. You stand in front of a class, and you talk. It needs to be much more interactive, I think, especially if you are trying to reach a younger audience. They need to be able to be engaged. They need to able to actively participate in teaching…. You cannot expect them to sit in a classroom for two hours and understand what you are saying, so it needs to be really active and engaging and I think ICT components can be really helpful for them. (P06-T2)

Within this category, teachers’ roles are more about facilitation of students’ learning rather than being experts and merely delivering subject matter. These views imply that teachers are not directly responsible for providing detailed subject content, materials, or lectures; rather, they offer active learning spaces in which, in most cases, students are responsible for their own learning and take necessary steps to meet their individual needs. For instance, in order to create effective learning environments, teachers emphasise student engagement that involves students supporting and interacting with one another by posting questions, raising problems and actively participating in group debate. In this context, students’ previous knowledge and experience can have an impact on the way they participate or take responsibility for their own learning:
I am not the fountain of knowledge. In the old days, when I used to go to school, the lecturer knew everything. And he would tell you all about it. These days we are working with mature age students who have come with a wealth of knowledge and experiences themselves. The only way we are going tap into that is by interaction, whether that is because you are having a debate in class or you post a question and let them discuss it. (P06-T2)

Another noticeable aspect of Category D is relationship building. Teachers and students are seen to build rapport towards a trusting and even relationship. In this context, teachers encourage students to be actively involved in their learning:

*The traditional sort of teacher-student relationship was about: teachers out there and students out there and knowledge was poured out. It is not like that anymore. I mean, I go into rooms where people have been working in the industry, working with customers, or marketing or business…. It is a much more even relationship. So what we have to do is engage in different ways. Get them to talk about things, trying things out, reflecting.* (P18-T1)

In Category D, the focus is shifted from the delivery of knowledge, as carried out by teachers, with students expected to receive that knowledge in Categories A, B, and C, to student engagement in which they think, feel, and act independently with teacher facilitation. Therefore, in this category, the understanding is shifted from a teacher-centred teaching to a student-centred learning. Teaching is regarded as more facilitative than before. The teaching and learning process is more focused on learners and the learning process, and students are responsible for most of their own learning.
4.2.5 Category E: ICT is used for preparing students for future profession

In Category E, ICT is viewed as a medium and link through which students can develop professional knowledge and skills for their future careers. One of the roles of using ICT is to ensure that students are prepared to participate in the changing workplace of their chosen career. ICT is seen as a medium of instruction to connect students to their future profession. For instance, students access up-to-date information related to their profession in their preparatory courses or build mastery in their professional knowledge and skills by using technology in their learning:

So it is also important for us to make sure that our students are ready for the technology when they go out in the workforce. We need to prepare them for that as well. (P06-T2)

The participants from an accounting department perceived that graduates would be benefited from TAFE teaching if they could achieve ICT skills related to their accounting profession, thereby, giving them an added opportunity to perform their professional activities easily in workplace.

I am really proud, my students can actually go to professions and say, “I can do this, I can do this”. One of my students who is working already told me that she is in the payroll area, and the boss ask her to prepare pay slips for people [staff], but she got an idea [how to prepare pay slips using a computer] from the computing and she’s using this one. Previously to prepare the whole payroll, it took like, a half day for her; now it takes only 10 minutes for her. (P8-T1)

Some aspects of Category E, such as group discussions, project-based activities, debates, in which students are actively involved, are somewhat similar to those of
Category D, where the teachers act primarily as facilitators of student learning (see Figure 4.5). However, Teachers in this category, provide an active learning environment where students develop their understanding and skills for their future professions. Therefore, within this category, the main focus is to meet the needs of industry. Teachers achieve this by creating a space and opportunities for their students where students can learn and achieve different ICT-related skills that are needed in the current workplace:

We have to respond to our industry. Our industry is computer-based now. There are no two ways about it. Everything we do is computer-based in the most of our industry. If we had to teach the students without technology, then we (our students) will be behind. We are not meeting the challenges and needs of our students. We are not preparing for the industry to begin working. (P08-T2)

![Diagram](image)

*Figure 4.5 View of industry-focused active learning in Category E*
Category E emphasises not only students’ active engagement but also networking, collaboration and interaction in the workplace (see Figure 4.5). It describes a particular interest on professional competencies needed for future careers. It is important to inform students about recent changes and modification that are currently happening in workplace. Students use different social media (LinkedIn, Facebook) to communicate and connect with teachers, students and industry practitioners. They update their knowledge and skills through different professional forums and user groups, as explained by the following participant who said:

*I, for example, make sure that they have a LinkedIn account as part of it. That is a tool because I think they should use that in their professional future, and how important that is to keep up to date with what is happening in industry through different industry forums and user groups, and that’s important because of the area that I teach in. (P09-T2)*

Vocational teacher understanding of using ICT in this category shifts from student-centred learning to industry-focused learning. Teaching is regarded as facilitative, collaborative and workplace oriented. The emphasis is on the expanding application of ICT in professions as it might be required for future careers. Students’ online engagement, collaboration, and social networking are not only a tool for student learning, it is essential content that focuses on learning professional skills required by industry.

4.3 Relationship between categories of description

This section presents a discussion about the identified relationships among the categories of description along the four dimensions of variation. These relationships
between categories of description were established based on the central awareness. Each dimension was constructed based on its focal aspect that was generally found in each category. Identifying each dimension also required empirical evidence which was ensured by the interviews data (Åkerlind, 2005b). For example, a teacher role was considered as a focal aspect which was generally seen in five categories. Besides, this feature further supported through the transcripts (interview data). It is important to note that each category of description presented unique and distinctive features and thus, deviated from each other. The five qualitatively different ways of understanding ICT-enhanced vocational teaching were marked by variation along four interrelated dimensional themes:

1. The role of teachers;
2. The role of students;
3. The impact of technology on student and teacher knowledge; and
4. Who benefit from the use of ICT in teaching.

In addition, the nature of vocational teachers’ conceptions of ICT-enhanced teaching was further explored through internal and external horizons. The internal horizon was denoted by the central awareness of the participants. In this study, first three dimensions (the role of teachers, the role of students and the impact of technology on student and teacher knowledge) were included as the internal horizon. The external horizon was defined as the way in which ICT-enhanced teaching was connected to its context (Barnard & Gerber, 1999). In this study, the fourth dimension (who benefit from the use of ICT in teaching) is considered as its external horizon.

The four themes are described below, and together with the focus on the
relationship among the five previously presented categories, provide a broader understanding of ICT-enhanced teaching.

4.3.1 Dimension 1: The role of teachers in ICT-enhanced teaching

The theme of Dimension 1 is represented by an expanding focus from Categories A to E, in which teachers are seen as responding to changes in the external environment to acting as facilitators creating a space for students’ own learning.

To elaborate, in Category A, the role of the teachers is to respond to external expectations. Their use of ICT is influenced by extrinsic factors such as the demands of the organisation, the head of the institution or by student expectations. Teachers’ actions are externally driven toward the use of technology rather than being intrinsically driven. Teachers feel that it is “pretty silly” not to embrace technology in their teaching:

*The students these days … go to technology for information themselves, so because of that, it would be pretty silly not to follow that trend and try and go in the direction that the students are learning.* (P01-T2)

<table>
<thead>
<tr>
<th>Category</th>
<th>Role of teachers</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. External expectations</td>
<td>Respond to external environment</td>
</tr>
<tr>
<td>B. Access to information and</td>
<td>Access and share information</td>
</tr>
<tr>
<td>resources</td>
<td></td>
</tr>
<tr>
<td>C. Delivery tool</td>
<td>Provide information through effective instructions</td>
</tr>
<tr>
<td>D. Active learning</td>
<td>Create an environment for facilitating students’ engagement</td>
</tr>
<tr>
<td>E. Preparing students for future</td>
<td>Set up a space for activities where students can develop</td>
</tr>
<tr>
<td>profession</td>
<td>their understanding and skills for their future workplace</td>
</tr>
</tbody>
</table>
In Categories B and C, the role of teachers in the teaching context is presented as that of information providers, however differences exist between these categories. In Category B, teachers are seen to perform two distinct roles in the teaching and learning process. In the first role, teachers are considered as operating as a source of information to students, teachers continually update their knowledge using ICT. Second, teachers share this acquired information with students. The primary role of teachers in this category is to access necessary information and then convey it to students.

I would rather use a Google tool, and if I found something very interesting like a PDF file, I’ll download it and share it with my students. (P23-T3)

In Category C, the teacher’s role is to deliver information to students effectively by using ICT. Teachers are aware that their role is not solely to provide the information to students, but that they need to ensure that students understand it, that they are to focus on the quality of instruction. For example, the use of YouTube videos to bring real world examples into their instruction can provide students with information that they can better understand, in ways that some teachers report:

When I make references to things, they just would not understand. Because they are too young, or they do not have enough world experiences or enough life experiences to do these sorts of things. So, I make reference to things and they do not understand it. And I can either explain it to them, which is a bit okay, but it does not give the same thing, or I can just jump online, pull up a YouTube video and show them exactly what I mean. (P02-T3)
For Categories D and E, the role of a teacher is seen as shifting from “providing information” to “facilitating students learning”. Particularly, in Category D, the teacher’s role is to set up an environment for students’ engagement, that is, an environment of active learning, where teachers are mostly facilitators. In this context, teachers do not consider themselves as instructors who solely deliver lectures; rather, they view themselves as catalysts, providing favourable spaces, and creating opportunities and scenarios through which students engage in different activities and develop their own understanding.

_I may be doing activities in class to make sure they reached their understanding, interacted with other students, interact with someone else about learning something._ (P14-T1)

_I do not see myself as a teacher. I see myself more as a facilitator with the learning. And I don’t want to be the person that lectures. And I sometimes catch myself sitting there, talking to them._ (P12-T2)

Category E depicts teachers as facilitators in the teaching and learning process similar to Category D, but it places emphasis on setting up a space for activities where students can expand their knowledge and skills related to professional needs. The key purpose is to help students prepare better for their future career. For example, the participants, from an ICT department, reported the activities which he had created for the students:

_I might have an activity for a student to build a website and that is an activity that I set out for them to do on their own. What we do in this industry is to tap into what resources we have around us._ (P13-T2)
4.3.2 Dimension 2: The role of students in ICT-enhanced teaching

Dimension 2 reflects the expanding focus from Category A to E, where teachers’ understanding of students’ roles range from primarily being recipients of information to being responsible to develop and build their knowledge and skills.

Table 4.2 *Variation in the way teachers see a student role in ICT-enhanced teaching*

<table>
<thead>
<tr>
<th>Category</th>
<th>Role of students</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. External expectations</td>
<td>Students mainly receive information</td>
</tr>
<tr>
<td>B. Access to information and resources</td>
<td>Students access and receive information</td>
</tr>
<tr>
<td>C. Delivery tool</td>
<td>Students receive information and complete given tasks</td>
</tr>
<tr>
<td>D. Active learning</td>
<td>Students are responsible for their own learning</td>
</tr>
<tr>
<td>E. Preparing students for future profession</td>
<td>Students are responsible for developing industry related knowledge and skills</td>
</tr>
</tbody>
</table>

In Category A, teacher perceived that students show their expectation that teachers need to be technologically literate. Teachers think that students prefer lectures to be delivered using the latest technology. Within this category, students are seen mostly as recipients who are not actively involved in teaching and learning. Students have the opportunity to express their interest in ICT-enhanced teaching. For example, the participants reported that students wanted to see videos, pictures and digital readings provided by teachers:

*That is the technology, that is what the students want, as I said, more the visual things. They do not want to read it now, they want to see pictures, and they want to see videos. And with that in mind, that is what we (teachers) are trying to achieve.* (P09-T2)
So, for instance, if you use the previous audio visual projectors we had, the overhead projectors with the slides where you put it on the glass then you project it and that sort of thing - that is also technology but that is not updated and if you use that sort of technology, your students will not really appreciate it and they would consider you as backward. (P07-T2)

In Categories B and C, students are seen principally as recipients of information. In Category B, students are receivers, that is, they generally access and receive information which is provided by teachers. For instance, students could receive information in the form of class notes, PowerPoint presentations or any sort of teaching materials that are shared online by teachers. However, as participants report, the students seemed to sit and listen, rather than engaging in class activities.

I put a lot of my resources up on the website Moodle, for students to access. So, if they are not coming to class, they can still access the information. (P06-T2)

Similarly, in Category C, students are seen as receivers who are acquiring information from their teachers as in Category B. In addition, students are seen as playing another role, that is, they participate in the teaching and learning process when teachers give them activities in which to participate. These activities are frequently in the form of asking questions or answering instant quizzes, and they can draw students’ attention and recap students’ understanding of a topic.

There is a limit of textbooks to show all real data, but if we actually search out data from the Internet and show them, and that is more understanding for the students because they can say, “oh! Not only that way, you can actually write that another way as well.” Especially the subjects I am teaching are of
reporting. Because it is not really one type of reporting. There are many types of reporting; therefore it is much easier for students. Previously students telling me, how come this one says this way, because the book says this way, the book says this way, so I want to get away from always using books, and then show them there are many other ways actually around [to get information]. It helps a lot of students actually. (P08-T1)

Financial reports are quite complicated and therefore they can easily miss out [on understanding] and therefore, they can ask some questions ... but if it’s on the board [by] using computer, then even if they miss [some point], they know what I am talking about because I am pointing out the point, so I can get their attention, I can get the focus from students. (P08-T1)

In Categories D and E, the students’ role is assumed to be that of an active learner. Students, in Category D, are seen to engage in range of different activities within ICT environments. In Category D, it is understood that vocational education is generally a practice-oriented learning environment where students are encouraged to become involved and to manage their own learning activities. Students need to work out solutions to problems by themselves, with teachers as their coaches in the learning process.

I am not doing the job for them, and I tell them that, “Don’t come asking me to do the job”. I am the customer. In business, your customer has, that is all right. Okay, the customer knows what they want, but they are not worried about the detail of how you achieve it. So that puts them in a problem all the time to get this. And it is the same, by the time they have finished, they have learned. (P04-T1).
Likewise, in Category E, students are seen as independent learners who solve industry-related problems, collaborate, and who participate in different activities, such as sharing experiences with peers, teachers and experts from industry, and undertaking industry-related project work. Therefore, students’ learning tasks are emphasised with the aim of developing their competency in relation to required skills in their future careers:

*It’s also the underpinning skills that we are not teaching that are also very important, which they do develop and learning to troubleshoot, learning to cross this barrier, learning to overcome issues in industry, is something important that they have to learn. It’s not just about “hey sir, hey miss, this isn’t working, where’s my problem?” It’s about giving the students the opportunity to look [at what] this is all about, you have to think about, going back and looking at it trying to work it out, and if you have got any more problems, then we will help.* (P13-T2)

Students are seen as responsible for their learning in both Categories E and D but there is a difference between the two. In Category E, student engagement is workplace-focused, with student learning related to developing knowledge and skills required for their professional work. In contrast, in Category D students’ participation is directed to learning and developing problem-solving skills. These are not necessarily focused on immediate or specific industry needs.
4.3.3 Dimension 3: Impact of technology on student and teacher knowledge

Dimension 3 represents the continuing focus on Categories A to E and shows how ICT influences both student and teacher knowledge when teachers use ICT resources in their teaching.

Table 4.3 Variation in impact of ICT on knowledge in the ICT-enhanced teaching

<table>
<thead>
<tr>
<th>Category</th>
<th>Impact of technology on student and teacher knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. External expectations</td>
<td>No significant impact of technology on teacher and student knowledge</td>
</tr>
<tr>
<td>B. Access to information and resources</td>
<td>Mainly teacher knowledge</td>
</tr>
<tr>
<td>C. Delivery tool</td>
<td>Both teacher and student knowledge</td>
</tr>
<tr>
<td>D. Active learning</td>
<td>Mainly student knowledge</td>
</tr>
<tr>
<td>E. Preparing students for future profession</td>
<td>Mainly student knowledge</td>
</tr>
</tbody>
</table>

In Category A, there is little or no impact of technology on both teacher and student knowledge. The content that is taught by the teachers is not significantly different, whether they use technology as a teaching tool or not. Participants discussed that using ICT in many skill-based courses was not favourable for conveying necessary knowledge:

*I am talking trade level that is Certificate III level, it is basically skills oriented.*

*Knowledge, yes, but skills are more important. It is difficult to teach a skill other than face-to-face…. Yes, you could show them videos of how to weld or how to braise, but it’s meaningless. My experience is that it helps very little. If it helps, I do not know how!* (P22-T2)
In brief, the understanding that has emerged from this Category is that the exception is in relation to practical skills, where current ICT-supported methods are perceived as unhelpful or *helps very little*. In relation to conveying theoretical knowledge, teachers even did not find any difference between their use of PowerPoint slides and the conventional method of *writing things on the board*.

*When you get up there and you are just putting up PowerPoint slides or something along those lines, there is no difference in the technology between that and putting up overhead slides and writing things on the board. There is nothing new; it is just a different way of doing the same thing.* (P03-T3)

In Category B, technology is seen as having an impact on teachers’ knowledge. Teachers use technology to update their knowledge depending on subject requirements, and enhance their knowledge through use of the Internet. For example, the participants mentioned that they used Google in order to gain necessary information for lesson preparation. Therefore, this category focused on ICT resources to enhance teachers’ knowledge:

*I use a lot of Google (search engine), because during the time I prepare for my class, even though I am a teacher, but that does not mean I know everything. I want to find out more and so I do research.* (P23-T3)

The role of technology in students’ knowledge is not clearly seen in this conception.

Category C reflects an extended view of the impact of technology on teachers’
and students’ knowledge. This is particularly important in relation to teachers because ICT tools influence their knowledge and they play an essential role in constructing and organising knowledge for students. Teachers update their knowledge by searching and accessing new materials for conducting their classes:

*The work that I am doing is more enjoyable. I find this is a lot of fun. I want to do it. So the way I construct my classes is: I go through every single time, and I am learning something new every time. I am finding this new material. I am reading about a subject, and all I am doing is putting together a collection of things that I have done and I give this to my students.* (P02-T3)

In contrast, ICT tools seem to have less direct impact on students’ knowledge than teachers’ knowledge since the process depends on how much knowledge students gain from teachers’ instructions.

In Categories D and E, the theme of responsibility for developing knowledge shifts from teachers to student. In Category D, students enhance their knowledge with the support of technology. They are perceived to be actively involved in their learning, such as in group discussions, analysis of problems, online learning, and project works. Teachers help students to engage in their own learning with the support of ICT. Thus technology supports students’ construction of their knowledge. At the same time, teachers’ knowledge could also be enhanced with the new information that students gather. For example, students are involved in finding information while teachers assist them to remain task focused. One participant described working as a mediator to help students to access relevant and valid information. During the filtering and facilitating process, teachers may gain or create new bundles of knowledge.
I like to get the students to go out and explore and find information for themselves ... and then my job is to help them filter that information and assess that information, put it all together, bring it together in a classroom environment and use that to teach each other. (P01-T3)

Category E reflects an inclusive view of student knowledge. Technology has an important impact on constructing student knowledge, similar to Category D, but in Category E has an additional focus on industry practices. Students are perceived as career-oriented, thus, their activities to develop their knowledge are focused on professional activities. Within this category, knowledge and skills associated with various professions are perceived as “changing rapidly” and continually. Textbooks might not always capture this dynamic nature of professional knowledge and practice. The use of ICT is seen to play an important role in terms of engagement, collaboration and searching for new knowledge and skills to respond to these changes.

Students engage with ICT to find solutions rapidly:

They will find them as a part of their learning ... it is about the research, using the technology, specifically the internet, as a research tool. Our industry is changing so rapidly from minute to minute, second to second that the information in textbooks is not always current, doesn’t always have the best of examples in there, whereas engaging with the technology, engaging online, allows them to find solutions rapidly, look at discussion forums, what articles are around, and what will help them find the solution to that hurdle in the road. (P13-T2)
The impact of technology on teachers’ knowledge is not notable in this category. Likewise for Category D, teachers may gain knowledge from the interaction with students in terms of using technology. In order to develop knowledge, both the Categories D and E indicate that teachers are flexible and open to students’ activities. In contrast, Categories A, B and C emphasise the teachers’ activities, and the teachers become the main conveyers of subject information to students.

4.3.4 Dimension 4: Who benefits from ICT in teaching?

Dimension 4 constitutes the expanding focus on conjectures from Category A to E with regard to who primarily benefits from ICT use in teaching and learning, starting from the benefitting educational institutions and students to students, institutions and industries.

To elaborate, in Category A, both institutions and students are seen as mainly benefiting from the use of technology in teaching and learning process. For example, using ICT in this category brings benefits to: educational institutions, as it might benefit in terms of reducing costs of the teaching and learning process; and students, as they may benefit from an ICT-enhanced teaching environment:

Our organisation is in crisis, its funding has been severely reduced. So, things such as photocopying are seen as expensive. Whiteboard markers and maintenance and cleaning the boards are an expense. So the view would be … more and more shifts towards remote learning, and ICT is conducive to that – the lower expense there is, the unit cost per student per hour so costs diminish.

(P15-T2)
In Category A, teachers are not necessarily seen to benefit from changes in the ICT-supported teaching and learning process as teachers’ roles involve responding to changing environments.

Table 4.4 *Variation in benefits from ICT-enhanced teaching*

<table>
<thead>
<tr>
<th>Category</th>
<th>Who benefits from ICT in teaching</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. External expectations</td>
<td>Institutions and students</td>
</tr>
<tr>
<td>B. Access to information &amp; resources</td>
<td>Mainly teachers</td>
</tr>
<tr>
<td>C. Delivery tool</td>
<td>Both teachers and students</td>
</tr>
<tr>
<td>D. Active learning</td>
<td>Mainly Students</td>
</tr>
<tr>
<td>E. Preparing students for future professions</td>
<td>Mainly students, institutions and industries</td>
</tr>
</tbody>
</table>

Category B reflects a different view with regard to “who benefits” from the use of technology in vocational education. Teachers are seen as benefiting because they use ICT tools to plan and prepare lectures and to update their knowledge to current practice:

*I do it [using ICT] all the time. For me, ICT is all about, it is all about learning.*

*I do a lot of reading [online]. I learn more about economics, what is the current situation. Not just historically, but how it matches with the theory behind that.*

*Or if I go into a classroom and talk about anything in statistics, then I go back and learn more of it to keep me up to date. And that goes for every subject I teach, whether it be, whether it be engineering, or otherwise, it is just nice to learn these things.* (P20-T1)

Student benefits however, are not clearly articulated in this Category. Student benefits are related to their accessing information and resources provided by teachers. These benefits are described in the following:
I would rather use a Google tool, and if I found something very interesting like a PDF file, I’ll download it and share it with my students. (P23-T3)

In Category C, the perceived benefits from the use of ICT are directed to both teachers and students. Within this category, teachers benefit explicitly when they use technology in teaching. Likewise in Category B, teachers update their knowledge by using technology. The participants emphasised that they used ICT in teaching for self-development:

I have started to incorporate ICT in my teaching. I have used more ICT for my own development towards teaching. Up until the last three, four years I have used it more in my delivery, but I have used it for a much longer period for my own self-development to be able to deliver stuff in class. (P19-T2)

Using ICT also brings some other potential features for vocational teachers. Teachers can access resources easily and can reduce the amount of time they spend to prepare lesson plans. Therefore, ICT tools such as PowerPoint, YouTube videos, and interactive whiteboards, are considered as time-saving tools in teaching. Teachers perceived the use of ICT tools as “enhancers” where their teaching tasks become easier and, at the same time, better met student interests and needs. ICT helps teachers not only to create a lesson with information and practical examples, but also to make class activities interesting. That is, students are seen as benefiting, as they are motivated and attentive towards ICT-enhanced teaching:

Before [using ICT], I used to print out the financial reports of each public company and try to explain them, but it was hard to follow. But if they see that on the screen, it is more broadened. They can see everything and they
can see where I am at, where I am going. So it is much understandable for students and much easier for me as well. (P06-T1)

Like PowerPoint, it is very easy, but in the classroom, you have limited time. You are not going to write down everything there on the board. That just wastes time and students get bored. But if you provide the PowerPoint, you include the video and you have more interactions with the students and get their attention, they would be more willing to come to class. So that is for the face-to-face delivery, we use ICT. (P23-T3)

In Category D, the perceived benefits primarily shift to students. Students are the main beneficiaries because they are engaged in learning. Therefore, the use of ICT tools, in teaching and learning process, has a positive impact on student development in terms of resource-investigation and the sharing of ideas for project work. The participants indicated that students use ICT tools when involved in activities such as problem-solving, information researching and brainstorming to derive answers:

They [students] are involved and able to find the answer and I think that is a strong learning outcome [that is, the outcome is important because it] is for them to be guided on the path of finding the answer themselves, because I think they better believe what they find, than rely on somebody else to provide that information for them. So I think they are deeply involved in getting the information. (P12-T2)

In contrast to the cited positive benefits for students, ICT’s positive impact on the work of teachers and institutions is not explicitly stated. For instance, teacher benefits are mostly related to their involvement with ICT, but they are not necessarily
engaged with technology. Teachers guide student learning, and facilitate student access to accurate information and to the means to solve problems. This may bring implicit benefits to teachers.

In Category E, the benefits of using ICT tools in vocational teaching are not limited to teachers and students; it also includes industry. Generally, students and industries are seen as primarily benefiting from the teaching and learning process. For example, learning activities are organised in ways that help students to achieve certain knowledge and skills that are needed for professional work in workplace settings. As a result, students gain the necessary competency for their future professions and consequently industries receive a competent workforce from vocational institutions.

Well, the ICT is again the tools they need, it’s the heart of the course, the technology they need to learn, it provides the skills which are required for the industry, and the technology that is needed for employment. (P13-T2)

We are a practical industry, all about hands on, where students will look at the problem, devise a solution and essentially go and build it. (P13-T2)

Similar to Category D, ICT’s positive effect on teachers is not explicitly articulated in this conception. In this category, there is a substantial expansion of beneficiaries in relation to a larger community including students, industries and vocational institutions. This is in contrast to the previous categories where the benefits were mainly focused on teaching and learning:

So we are starting to notice that in the event industry some clients, suppliers and venues are starting to interact between their students liking posts, ready to enable students asking questions and answering students’ questions. (P12-T2)
4.4 Summary and relationships among the categories

In summary, the findings reveal that vocational education teachers consider the use of ICT for teaching vocational courses in five different ways:

Category A: ICT is used to meet external expectations;
Category B: ICT is used to gain access to information and resources;
Category C: ICT is used as a delivery tool;
Category D: ICT is used as a medium for active learning; and
Category E: ICT is used for preparing students for their future profession.

A relationship was also found among the five categories of description, that is, these five categories of description are internally (first three dimensions) and externally (fourth dimension) deviated from each other with four dimensions of variation: the role of teachers; the role of students; the impact of technology on student and teacher knowledge; and who benefits from the use of ICT in teaching. The relationship presented in Table 4.5 suggests a broad understanding of the experiences of ICT-enhanced teaching in vocational education. Additionally, this study shows that each category is qualitatively distinct in nature.

Table 4.6 explains further the process in which expansion occurs in the teachers’ understanding of ICT-enhanced teaching. For instance, the theme ‘role of teacher’ presents expansion in vocational teacher teaching from delivery of information to facilitation of student learning. The theme ‘role of student’ represents the expansion of the focus from passive (students depend on the teacher) to active (students take responsibility for their own learning). The theme ‘impact of technology on student and teacher knowledge’ shows an expanding focus on the knowledge of students and
teachers from little impact to a significant impact. The last theme ‘who benefits from ICT in teaching’, represents the benefits expanding from institutions, students to institutions, students and industries.

Table 4.5 Relationship among categories of description s of ICT-enhanced teaching

<table>
<thead>
<tr>
<th>Role of teacher</th>
<th>Category A</th>
<th>Category B</th>
<th>Category C</th>
<th>Category D</th>
<th>Category E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Respond to external environment</td>
<td>Access and share information</td>
<td>Provide information through effective instructions</td>
<td>Create an environment for facilitating students’ engagement</td>
<td>Set up a space for activities in order to develop students’ understanding and skills for future workplace</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Role of student</th>
<th>Category A</th>
<th>Category B</th>
<th>Category C</th>
<th>Category D</th>
<th>Category E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mainly receive information</td>
<td>Access and receive information</td>
<td>Receive information and complete given tasks</td>
<td>Responsible for their own learning</td>
<td>Responsible for developing industry related knowledge and skills</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Impact of technology on student and teacher knowledge</th>
<th>Category A</th>
<th>Category B</th>
<th>Category C</th>
<th>Category D</th>
<th>Category E</th>
</tr>
</thead>
<tbody>
<tr>
<td>No significant impact</td>
<td>Mainly teacher knowledge</td>
<td>Both teacher and student knowledge</td>
<td>Mainly student knowledge</td>
<td>Mainly student knowledge</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Who benefits from ICT in teaching</th>
<th>Category A</th>
<th>Category B</th>
<th>Category C</th>
<th>Category D</th>
<th>Category E</th>
</tr>
</thead>
<tbody>
<tr>
<td>Institutions and students</td>
<td>Mainly teachers</td>
<td>Both teachers and students</td>
<td>Mainly Students</td>
<td>Mainly students, institutions and industries</td>
<td></td>
</tr>
</tbody>
</table>

Vocational teachers’ conceptions of ICT-enhanced teaching have both referential and structural components. The meaning of these components is discussed before presenting the relationship between them. For instance, the referential component in this study implies that the meaning of the conceptions is identified by using the ‘what aspect’. The ‘what aspect’ of ICT-enhanced teaching deals with what the vocational teachers perceived about the phenomenon. The structural component makes the order (structure) of the conceptions based on the ‘how aspect’. This refers to how the explanation (structure) is given towards the identified conceptions. For example, the ‘how aspect’ of ICT-enhanced teaching deals with how the vocational
teachers act on teaching. This explanation is in line with other phenomenographic studies (e.g., Marton & Booth, 1997; Prosser & Millar, 1989; Prosser et al., 1994; Reid & Petocz, 2006).

Table 4.6 *Expansion of awareness of using ICT in vocational teaching*

<table>
<thead>
<tr>
<th>Dimensions of variation</th>
<th>Expansion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Role of teacher</td>
<td>Delivering</td>
</tr>
<tr>
<td>Role of student</td>
<td>Passive (depend on the teacher)</td>
</tr>
<tr>
<td>Role of student</td>
<td>Active (responsible for their own learning)</td>
</tr>
<tr>
<td>Impact of technology on student and teacher knowledge</td>
<td>Little</td>
</tr>
<tr>
<td>Who benefits from ICT in teaching</td>
<td>Institutions and students</td>
</tr>
<tr>
<td></td>
<td>Students, institutions and industries</td>
</tr>
</tbody>
</table>

Based on the above discussion, Table 4.7 (the *outcome space* of the phenomenographic study) summarises the referential and structural components and their relationship of using ICT in vocational teaching. This study discerned three broader structural components of using ICT in vocational teaching. They were: a ‘teacher-centred/content-oriented’ component (Categories A, B and C), a ‘student-centred/activity-oriented’ component (Category D), and a ‘student-centred/industry-oriented’ component (Category E). The five categories of description ranged from a ‘teacher-centred/content-oriented’ to ‘student-centred/activity-oriented (and/or) industry-oriented’ understanding of ICT-enhanced teaching. The first three Categories A, B and C were considered as producing simple or less complete understanding because the main focus was on the teachers’ task of conveying necessary information,
whereas the students’ conceptual development (by their active involvement in teaching-learning) was given very little attention.

An additional important aspect that needs to be highlighted is that participating teachers, who had views that included from Category C, also held views that belonged to Category A and B. For example, one participant from an accounting department held views that included features from Category C:

*PowerPoint, videos which I’ve downloaded ... I can run through it on the smart board and they [students] can see it right in front of themselves. Plus, they have a copy. It is much easier.* (P21-T2)

The same participant also expressed views that belonged to Category B.

*I am always looking for improvement ... [and] I am very much into a continuous quality improvement [by updating my knowledge], which I do appreciate.* (P21-T2)

Table 4.7 *Outcome space: referential and structural components of using ICT in vocational teaching*

<table>
<thead>
<tr>
<th>Referential (‘what’ of the conceptions)</th>
<th>Structural (‘how’ of the conceptions)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Teacher-centred/ content-oriented</td>
</tr>
<tr>
<td>Meet external expectations</td>
<td>A</td>
</tr>
<tr>
<td>Gain access to information and resources Delivery tool</td>
<td>Media for active learning</td>
</tr>
<tr>
<td></td>
<td>D</td>
</tr>
</tbody>
</table>

The last two Categories (D and E) were considered as indicating a more complete understanding (compared to the first three Categories) because the main
focus of the teachers’ tasks shifted to the students’ development by engaging them in active learning. Category E was placed structurally in the ‘student-centred/industry-oriented’ component because its expanding awareness was wider than for Category D. Student active learning and engagement were seen in both the categories but there was a clear distinction between them. For example, industry-focused students’ involvement was mainly seen in Category E. Similarly, the participants, who had understandings that include views from Category E, may also hold views that belong to Category A, B, C or D and so on. This study shows that each of these categories is qualitatively distinct in nature. For instance, each of the categories includes elements that make them distinct in characteristics and different from each other (see detailed discussion in section 4.2).
5.1 Introduction

One of the aims of this study is to explore vocational teachers’ approaches to ICT-enhanced teaching in vocational education. In order to achieve this, the present study is focused on the following research question: *How do TAFE teachers approach teaching with ICT?*

This chapter provides the results of the analysis of vocational teachers’ approaches to ICT-enhanced teaching based on the above research question. Chapter 5 is structured into three sections, starting with an introduction that focuses on the definition of approaches to ICT-enhanced teaching. The second section focuses on a detailed description of the categories used. The last section concludes with a summary of the findings.

5.2 Approaches to ICT-enhanced teaching

Approach in teaching refers to how teachers go about teaching (Marton & Booth, 1997). In this study it means how vocational teachers employ ICT in their teaching. The approach to ICT-enhanced teaching is described in relation to the existing *intention* and *strategy* framework. This framework is a well-established
methodological framework in phenomenographic research for studying teachers’ and students’ approaches to education. This idea was developed by Michael Prosser and Keith Trigwell in 1994 and was later applied in many studies (see Ellis, Goodyear, et al., 2006; González, 2012; Prosser & Trigwell, 1999; Trigwell & Prosser, 1996b, 2004; Trigwell et al., 1994). In the classical phenomenographic framework, the intention and strategy components correspond to both the external and the internal horizon (Ellis, Goodyear, et al., 2006). In this thesis, the literature review described the roots and reasoning behind this framework (see Section 2.4). How this methodological framework is adapted and applied for researching teachers’ approaches is further explained in the methodology chapter (see Section 3.3.4).

5.2.1 Overview of teachers’ approaches to ICT-enhanced teaching

The present study reveals five intentions and five strategies after analysing the interview data:

Intentions:

1. Effectively delivering subject content;
2. Achieving intended course outcomes;
3. Linking theoretical and practical knowledge;
4. Providing active learning for developing student understanding; and
5. Developing students’ knowledge and skills to meet industry needs.

Strategies:

1. Teacher-focused, information-oriented;
2. Teacher-focused, feedback-oriented;
3. Teacher-focused, practice-oriented;
4. Student-focused, facilitation-oriented; and

5. Student-focused, industry-oriented.

From the fusion of these intentions and strategies, five approaches to ICT-enhanced teaching have been developed as categories of description, namely:

Approach A: A teacher-focused, information-oriented strategy with the intention of effectively delivering subject content;

Approach B: A teacher-focused, feedback-oriented strategy with the intention of achieving intended course outcomes;

Approach C: A teacher-focused, practice-oriented strategy with the intention of linking theoretical and practical knowledge;

Approach D: A student-focused, facilitation-oriented strategy with the intention of providing active learning for developing students’ understanding; and

Approach E: A student-focused, industry-oriented strategy with the intention of developing students’ knowledge and skills to meet industry’s needs.

5.3 Categories of description

The sections below describe details of each approach to ICT-enhanced teaching in vocational education that are developed from the intention and strategy frameworks.

5.3.1 Approach A: A teacher-focused, information-oriented strategy with the intention of effectively delivering subject content
In this approach, the teacher adopts a teacher-focused, information-oriented strategy (Figure 5.1). The intention of using ICT, in this approach, is to convey necessary information in order to enhance effective delivery of content.

*So I do the PowerPoint, and there are some quizzes we put up. So easy in the computer or projector to project information on the wall.* (P18-T1)

![Figure 5.1 Structural and referential components of Approach A](image)

The teachers utilise myriad technologies in classes to convey necessary subject knowledge and concepts. ICT tools such as PowerPoint presentations, YouTube videos, search engines and shared drives, allow teachers to deliver subject content and to share course materials. A range of software assists teachers to explain complex concepts in a subject. For example, the participants from an electrical engineering department noted that they used ICT tools to visualise different complex magnetic waves and to analyse them in diverse ways:

---

7 Here and throughout the chapter, the discussion is based on second-order perspective, which means that explanation and discussion are derived from the participants’ views and their ways of seeing the phenomenon.
Well, one of the main reasons [using ICT] is the concept that we cannot see. So magnetic wave shapes are invisible. So, if we can draw all the patterns and show them how the patterns react, we find that a lot more useful rather than drawing lines on the boards and putting arrows like that. (P01-T2)

ICT, in this approach, makes teaching tasks easier, and helps teachers to present the lesson effectively. It also supports teachers to draw student attention and to manage the classroom activities. Thus, teachers are able to sustain student attention throughout the class period. For example, some teachers were aware that many of the students did not concentrate when teachers were busy writing on the board:

*If I write on the board, I have to turn my back … and they actually talk. But the computer is set out, I can look at students as well, so I can actually know [see] what they are doing and I can actually get attention from them as well, not only saving time, so it is much more efficient.* (P08-T1)

In most cases, Approach A concentrates on the use of ICT for teaching in which teachers are the main people responsible for conveying pertinent course content. Teachers are seen as subject matter experts who are the main source of information. Teachers manage lectures, deliver essential information, and show video presentations to students. In contrast, students are perceived as relatively passive and who listen to teachers’ instructions. For example, students gain information from teachers, receive teacher-made notes, and view teachers’ instructions:

*Very simple, IT enables me to use my own notes, so I am just, conveying my notes to them.* (P22-T2)
It is ready access of information and then you [teacher] can deliver it effectively to students. (P07-T2)

In Approach A, the interaction between teachers and students is not explicitly stated. Teachers organise instruction and delivery of subject content using technology, while students are primarily receivers of subject content. Within this approach, students are not generally seen in the group discussion, collaboration in learning or engaged with technology.

5.3.2 Approach B: A teacher-focused, feedback-oriented strategy with the intention of achieving intended course outcomes

Approach B is similar to Approach A, in terms of adoption of a teacher-focused strategy but the orientation is shifted to feedback (Figure 5.2).

![Diagram: Approach B](image)

*Figure 5.2 Structural and referential components of Approach B*
The intention of this approach is to achieve specific teaching and learning outcomes. Approach B places emphasis on assessment and provision of immediate feedback to students regarding their level of understanding of the content recently taught. For example, participants discussed providing feedback to students:

*When we [teachers] are having our 6 week re-assessments, there is a simple theory test in there which they [students] are all interested in [sic] because that really has raised the level of passing by allowing them to do that study. And we tend to do that. We find that they [students] won’t go home with a paper, unless they know what the answer is, or unless they have answered it and they know that they are right, otherwise they are not motivated to do the work.* (P01-T2)

Similar to Approach A, Approach B involves the delivery of content or necessary information about the subject through various ICT-supported tools such as PowerPoint, YouTube, Learning Management System (LMS), GoogleDocs, Dropbox, and the like. In addition, lessons are concluded with teacher-made tests in order to give *immediate feedback* to students:

*Well, I am writing the questions on Moodle. I am editing and delivering the PowerPoints and that lesson. And I am finding questions and giving feedback and just doing what a normal teacher or a face-to-face teacher would normally do.* (P01-T2)

The purpose of this approach is to summarise the main concepts, to reinforce student learning and to give students feedback. Teachers, in this approach, use different techniques to achieve this purpose. For instance, teachers might use online
quizzes or include questions or other instant assessment techniques in their presentations after each lecture:

*It is not necessarily that blended, it’s not necessarily, that flexible. It is fairly,... it is basically, “I’m in front of them, and giving them information and getting questions out of them immediately and giving them immediate feedback.”*

(P01-T2)

In addition, within this approach, some teachers use different techniques to motivate students, such as presenting different types of rewards, and expressing verbal appreciation, in order to sustain students’ interest and participation.

*I give them prizes, and sometimes it’s a chocolate or a water bottle or a key-ring and I act like though it’s small stuff and just give them encouragement.*

(P23-T3)

Approach B also includes remedial teaching technique - another aspect of achieving learning objectives. The purpose of a remedial technique is to help students to catch up on what they are not able to understand in a lesson or, it can involve teachers offering additional assistance to students to overcome specific learning or understanding weaknesses. After receiving students initial assessed results, teachers can offer corrective support, provide feedback to correct misunderstandings and can reinforce student knowledge by providing additional lectures, help, and suggestions:

*The exam is online and all are multiple choice questions, and students answer it and after a while they can see the mark. Then they know where they are, they know their own learning process. And also for me, I extend and say “all right, they have learnt this part there” and in some other part, they get very low*
marks, and it means I need to give them more help and assistance for that part.

(P23-T3)

As in Approach A, teachers are perceived to be the primary source of information and subject matter, that is, experts who manage instructions. In most cases, students are not perceived to be engaged in teaching. Students gain subject knowledge and information that is provided by teachers. However, an additional aspect of student participation is found in Approach B. It focuses on students visible participation in monitoring learning outcomes. For instance, students are required to accomplish tasks set by teachers.

In short, Approach B focuses on student understanding rather than focusing solely on conveying the content. Therefore, the distinct feature of Approach B is the emphasis on student learning outcomes. Student-teacher interaction is through teacher assessment and feedback techniques. Conversely, student group discussion, debate, opportunities for exploring their own perspectives, collaboration, or engaging with technology are not specifically used in this approach.

5.3.3 Approach C: A teacher-focused, practice-oriented strategy with the intention of linking theoretical and practical knowledge

Approach C is one in which teachers embrace a teacher-focused, practice-oriented strategy (Figure 5.3).
The aim of this approach is to combine theoretical and practical knowledge in teaching and learning context. Teachers’ general focus is to provide necessary knowledge with related activities to ensure that students obtain and understand subject content. Teachers’ tasks, in terms of delivering information to students in Approach C, are the same as in previous approaches. This indicates that it follows the same strategy component, that is, teacher-focused (Approaches A and B). In previous approaches, the knowledge drawn from teaching mainly depends on teacher instruction. In contrast, in Approach C, subject is taught by linking theoretical concepts with practical activities.

Therefore, Approach C is an extension of previous strategies which illustrates the linking of theoretical and practical knowledge. This strategy begins with a subject topic. For example, at the beginning, teachers provide students with the necessary information (aim and objective of the topic), which is followed by the presentation of the main points and outcomes of the lesson, and afterwards an explanation of the
content and related activities. Teachers then assign relevant practical work to students to be performed either in groups or individually, to ensure that they understand the taught content:

When I start a topic, I explain [to] them the aim of the topic, what is the objective of this topic, and the outcome they are going to achieve at the end of the day. Then normally, we continue with the basic principles and we go through. At times the students are asked some questions, and we communicate as we go by. So once the topic is covered, then they just go straight to the exercise we work on. So there is more towards ..., because we are practical based, they have to generate drawings: that is the ultimate goal. They are to follow the standards, so we teach them the standards. (P17-T1)

In Approach C, teachers focus mainly on conveying basic theory of a subject and manage the instruction of theory and practice using ICT. This approach reflects an additional facilitative role for teachers. For example, after explaining theory, the teacher assists students to understand that theory in terms of helping them to access more information or to give them related activities:

It depends on how I structure (the class/lesson), but if you say I have got a 2 or 4 hour class, I usually could have 45 minutes theory. So this is the theory, that’s what we are going to talk about. So if you talk about Freud, who was he, where he came from, what were his main ideas, let’s have a look and clarify that, often then I give them a task … so if they have an activity, a case study or I give them a topic, and I say, within your group, look at these 5 questions and discuss it. (P06-T2)
In this context, the students’ role shifts towards more active participation in practical activities, in contrast to the previous two approaches where students are perceived to be in a more passive role of receiving information. Therefore, students are seen as having dual roles, that is, listen to teachers when they explain the main ideas and then actively engaged in opportunities created by teachers for participation in certain activities:

*Sometimes, as a teacher, I am the source of all information and I use a didactic method…. In this particular course, my role is partially facilitative in the sense that I assist them in understanding the project and accessing information that they need, so it’s somewhat advisory. I help them with the technology, but I also will have little brief periods of straight instruction to give them enough information so that they can deal with the technology.* (P15-T2)

Approach C includes and extends the strategy component of previous approaches. The difference among these approaches is reflected in their respective intent. For Approaches A and B, intention is attached to effective delivery of content. This is expanded in Approach C with the inclusion and linking of basic theoretical and practical knowledge. For example, the participants from the mechanical engineering department shared how they incorporate theoretical and practical knowledge in teaching:

*So we start with the basic principles. We spend about an hour to explain the basic principles. Once we finish explaining the principles and standards that go along with that, then we start with the basic drawings, simple drawings.* (P17-T1)
In this approach, an additional point of importance is found in relation to student engagement with practice. However, this engagement is limited because students are not independent in their learning. They depend on teacher instruction and participate in practical activities. In this context, student-teacher interaction is broader in type than in previous approaches.

5.3.4 Approach D: A student-focused, facilitation-oriented strategy with the intention of providing active learning for developing students’ understanding

Approach D represents a qualitative shift in strategy from teacher-focused to student-focused teaching (Figure 5.4).

![Figure 5.4 Structural and referential components of Approach D](image)

The intention is to provide students with an environment that is conducive to active learning. The main focus is on student development where ICT is used as a medium in which to engage students to take responsibility in developing their own
I think that the students need to take responsibility for their own learning as well. It’s an adult learning environment. Nobody else is going to be able to do it for them. My job is to facilitate that learning. (P12-T2)

In Approach D, teachers are facilitators who create a learning environment where students are engaged through the use of ICT tools. The students are responsible for their own learning in many ways and they interact with teachers and other students, engage in problem solving activities, respond to opportunities to work on different projects, and actively participate in group discussions using learning management systems. All of these activities focus primarily on student active participation in learning:

It’s coming back to that facilitative model, it’s not just about “you [students] sit there and listen, and we will talk”. But it’s about students engaging with the technology, interacting with it, using the resources around them, the online things and learning from it. (P13-T2)

Sharing knowledge between and among students is another important aspect of Approach D. Students not only take their responsibility to learn but also work in teams and collaborate in groups. ICT is perceived as offering a supportive space in which to engage students and to provide them with a platform in which they can work together to learn as well as to promote shared interaction among teachers and other students. For example, students upload their activities through learning management system to share their knowledge, which helps to improve their learning:

They [students] upload it [activities], and somebody else makes a comment on
how good it is, or maybe point out areas that they could find to improve on, then that’s part of the satisfaction. To me, that’s part of the engagement, that’s to me part of maintaining the drive to want to learn more. And not only are they potentially making themselves more vulnerable, but they’re also sharing their knowledge with other people. (P05-T2)

This approach is found in both face-to-face and online learning contexts. It can also involve flexible learning, where students are provided with a wider scope of opportunities to engage and encourage them to learn across classroom boundaries. For example, the participants stated that students used ICT-supported tools that helped them to engage with their learning, even when they were outside institutions. It also helped them to acquire an in-depth understanding of subjects’ content:

They can engage from their iPhones, their iPad or whatever. So, they can do it anyway. Get involved, spare a few minutes, jump in and do it. So it makes it more accessible, and it spreads it out and breaks down the barriers … and in a subject like critical thinking, you need that sort of engagement. It allows you [students] to be immersed in the subject. So, all the time, they’ve got access to these sorts of things. They can be thinking about it all the time. (P02-T3)

In addition, ICT, in some cases, is used for collaboration and communication between students and teachers. Vocational teachers perceived that students create asynchronous and synchronous communication and interactions using various communication media such as email, learning management systems, and mobile apps (software applications):
Students are able to post their comments and post their requests and sometimes they like, on the Wiki, they can actually post some of their own viewpoints, creating a small page of their own. Adding that to the Wiki that I have already got there. So they become authors over there. So in that process it becomes a collaborative, collaborative [sic] piece at the end of semester, so at the end of the semester they scroll up, they can see what the discussion has been through the whole semester. And that content has been provided not only by the teachers but by the students as well. So that is how they [students and teachers] became collaborative. It is collaborative in a structured way, it is not loosely collaborative, that is, nobody can just keep posting. There is posting to a particular topic or ask a question is being answered but this question has been answered in this open space where people can see each other’s responses.

(P19-T2)

Approach D differs from the previous approaches as it adopts student-focused, facilitation-oriented strategies that are manifested in student engagement in the teaching-learning process. In this context, teachers aim to provide a supportive framework as well as to create a space for student engagement through active learning, shared activities, and mutual support.

One question worth considering is: How does approach D differ from Approach C? Students’ activities are visible in both approaches but there is a clear distinction between them. In Approach C, students’ activities are guided and managed by teachers. Theoretical knowledge is provided by the teachers before the execution of practical activities. In contrast, in Approach D, students are responsible for
developing their own understanding and for taking the initiative for learning, where teachers are facilitative in nature towards students learning. Moreover, this approach places a strong emphasis on discussions with peer groups and interaction and engagement with technology. It also focuses on peer-to-peer exchanges of ideas and feedback in the online as well as in face-to-face context, which is rarely found in the previous approaches.

You [Teachers] get them working in groups, for example, get them shouting out answers and get them arguing back and forth. When they have their own individual computers, as I said before, you can send them away to find information and bring it back and share it all. It just changes the dynamic of the classroom, so instead of a one-way type of situation, it becomes much more interactive. So I suppose that’s why makes it more fun, makes it more interesting to learn. (P02-T3)

5.3.5 Approach E: A student-focused, industry-oriented strategy with the intention of developing students’ knowledge and skills to meet industry needs

Teachers, in Approach E, adopt a student-focused, industry-oriented strategy (Figure 5.5).

Approach E primarily aims to develop student knowledge and skills related to industry needs. In a manner similar to Approach D, Approach E focuses on student active learning, which indicates that the same student-focused strategy is followed to that of Approach D. In Approach E, however, the nature of student engagement is mainly workplace focused. This approach emphasises the provision of an extended space (different than in Approach D) for student discussion, collaboration and
interaction. For instance, active learning opportunities are further expanded to maintain online discussion forums with industry practitioners, and other teacher and student groups. Students are encouraged to conduct research to upgrade their knowledge and skills to meet future employment. The participants highlighted similar aspects:

*They [students] do research on what is happening [in the industry], for example, in the latest cabling structure, information, or in wireless technology or fibre optic, although it depends on the topic, or how to configure a router or how to do problem solving. So the skills that they are developing, I think, are much broader than the actual requirement of the unit.* (P05-T2)

*The ICT is again the tools they need, it’s the heart of the course, the technology they need to learn, it is the skills which is [sic] required for the industry, and the technology that are needed for employment.* (P13-T2)

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**Approach E: A student-focused, industry-oriented strategy with the intention of developing students’ knowledge and skills to meet industry’s needs**

- **Intention:** Developing students’ knowledge and skills to meet industry’s needs
- **Strategy:** Student-focused, industry-oriented

*Figure 5.5 Structural and referential components of Approach E*
ICT is also seen as a supportive framework for collaborative learning or networking with others by using different social media. This way, students are able to build networks with professionals or experts in the relevant field, the academic community and other peer groups. The intention of using social media is to keep students and professionals up to date on latest and emerging trends in the industry. For example, in some cases, teachers encouraged students to take initiative to connect and to communicate through Facebook and LinkedIn:

* I wanted the students to be involved, create up [sic] some opportunities, so when we started talking about social media in classes and marketing and advertising, I got the students to create their own Facebook page, and then we actually had to create it to see how many people got likes. (P12-T2)

It is important to note that in Approach E, students are encouraged to participate in relevant professional practices. This approach provides scope to work with related professionals. Vocational teachers perceived that in some cases, apprentices have opportunities to take part in work placement and to gain work experience. In addition, experts from relevant industries visit the institutions to share their latest trends and standards, and to give students an overview of what is currently happening in their industry. For example, representatives from different industries introduce the latest technologies to students through trade exhibitions where they meet students, but relationships with students can be built up online:

* We recognise that online learning is really important from a commercial perspective. Being able to get our target market, which is the event industry…. We work many hours in the event industry, that is, we need to be able to make what our target market requires. (P12-T2)
Consequently, as a teaching community, we have to be aware of that fact. We have to be aware what the other companies [are up to] Always we have a meeting with the companies, we invite them to give lectures to our students to give them an idea about the current technology and what they think about future technology, and we have a very good communication with the industry to see their implementation of such things. (P10-T3)

This approach has an added focus on guiding students towards new knowledge and developing skills related to technology. Vocational teachers noted that technology is changing and evolving very quickly. Therefore, technology-related knowledge and skills need to be fast tracked and well prepared for students to respond. Teachers therefore need to direct their students towards an awareness of this constant ongoing change:

*I use ICT not just to engage but to challenge them. I always try and find new technologies that they have not heard of, so I can prove to them that there is always something new out there…. So I challenge to them also into finding out about technology. Challenge them to find out what’s new in the industry.* (P05-T2)

In some cases, Approach E is similar to Approach D, the teachers act as facilitators who provide a space for student engagement in the learning process. However, Approach E differs from Approach D, in terms of teachers’ tasks and extends to an additional role, that is, to provide an environment for industry exposure. In addition, students have a wider range of opportunities for collaboration, research and working with related professional groups to achieve competencies that meet
current workplace needs. These aspects were not seen in Approach D.

5.4 Summary and relationships among the categories

From the above findings, it is concluded that five approaches to ICT-enhanced teaching emerged, based on the intention and strategy frameworks presented in this section.

Approach A: a teacher-focused, information-oriented strategy with the intention of effectively delivering subject content;

Approach B: a teacher-focused, feedback-oriented strategy with the intention of achieving intended course outcomes;

Approach C: a teacher-focused, practice-oriented strategy with the intention of linking theoretical and practical knowledge;

Approach D: a student-focused, facilitation-oriented strategy with the intention of providing active learning for developing students’ understanding; and

Approach E: a student-focused, industry-oriented strategy with the intention of developing students’ knowledge and skills to meet the industry’s needs.

A relationship was found among the five approaches. Particularly each ICT-enhanced teaching approach is qualitatively distinct in nature and includes dominant aspects. The relationships were developed based on these dominant aspects. For example, who is playing the central role in each teaching approach was considered the focus point to construct the relationship among the identified approaches. Approach A is seen as a teacher-focused approach where teachers play the important role of conveying the contents of a subject and managing teaching. In
contrast, students are seen as receivers of the information. Therefore, Approach A is classified as a teacher-focused approach. Similarly, Approaches B and C also fall into teacher-focused approaches. Approach D is viewed as a student-focused approach where teachers are seen as facilitators of student learning, and students are seen as taking responsibility for their own learning. In Approach E, students’ involvement is greater than in the other approaches and teachers are facilitators. Thus, Approaches D and E fall under the student-focused approach (Table: 5.1).

Table 5.1 Outcome space: *intention and strategy components*

<table>
<thead>
<tr>
<th>Intention (referential)</th>
<th>Strategy (structural)</th>
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<tbody>
<tr>
<td></td>
<td>Teacher-focused</td>
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<tr>
<td></td>
<td>Information oriented</td>
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<tr>
<td></td>
<td>Feedback oriented</td>
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<td></td>
<td>Practice oriented</td>
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| Effectively delivering subject content | A               |
| Achieving intended course outcomes    | B               |
| Linking theoretical and practical knowledge | C               |
| Providing active learning for developing students’ understanding | D               |
| Developing students’ knowledge and skills to meet industry’s needs | E               |

Table 5.1 (the *outcome space* of the phenomenographic study) summarises the referential (intention) and structural (strategy) components of each approach. The five structural components of ICT used in teaching approaches were categorised in this study as follows: ‘teacher-focused, information-oriented’; ‘teacher-focused, feedback-oriented’; ‘teacher-focused, practice-oriented’; ‘student-focused, facilitation-oriented’, and ‘student-focused, industry-oriented’. These five structures were broadly placed
into two main orientations, which were a ‘teacher-focused: information-oriented, feedback-oriented, practice-oriented’ and a ‘student-focused: facilitation-oriented, industry-oriented’. The former broad orientation had the main emphasis on conveying information to the students, providing feedback and managing teaching activities by using ICT. Teachers played an active role in teaching while students were generally seen as recipients of lectures (information, subject content, feedback and theory for practice). Most importantly, students were not generally seen to be independent in their knowledge and skill acquisition. In contrast, the orientation - ‘student-focused: facilitation-oriented, industry-oriented’ - was considered as a student-focused teaching approach where ICT was viewed as means of engaging students in active learning, such as to provide space for students to participate in online discussions, information-gathering activities, or to maintain online discussion forums with industry practitioners, and to build networks with professionals or experts in the relevant field, the academic community and other peer groups. In this orientation, the primary role of teachers is to facilitate the teaching and learning process, as well as to create a space for engaging students in active learning, thus, students were generally involved in learning to gain and to construct their own knowledge and skills.
CHAPTER 6 – VOCATIONAL TEACHERS’
CONCEPTIONS OF ICT IN PROFESSIONAL WORK

6.1 Introduction

The aims of this study were to explore vocational teachers’ conceptions of ICT in professional work. Therefore, the present study focuses on the following research question: What does ICT mean to TAFE teachers when it is used in professional activities?

This chapter reports the results of the analysis of vocational teachers’ understanding of ICT in professional work. With the same structure as the previous two chapters, the presentation of results is organised into three sections. The first section contains an introduction of the categories of description and a detailed explanation of each category. The second section describes the relationships among these categories and the last section concludes with a summary of the findings including referential and structural components.

6.2 Overview of teachers’ conceptions of ICT in professional practices

Three qualitatively distinct categories of description emerged that represent a variety of ways of seeing ICT in professional practices.
Three categories:

Category A: ICT could be used for various work-related tasks;

Category B: ICT helps to accomplish a job more effectively; and

Category C: ICT is an essential tool in professional activities.

The following sub-sections describe each category that emerged from the detailed phenomenographic analysis (Chapter 3).

6.2.1 Category A: ICT could be used for various work-related tasks

In Category A, ICT is viewed as a complementary medium for performing professional tasks. The aim of using technology, in Category A, is to provide support in the workplace and enables professionals to perform various tasks\(^8\). For instance, vocational teachers perceived that different professions use technology to process or to produce their desired output. Therefore, ICT can be used to provide a supplementary service that is not limited to a particular profession, rather, it can be used in different professional activities. For example, ICT-supported tools, both software and hardware, are used to store records in small and large businesses, to check details of patients at hospitals, to accomplish a range of tasks in banks, to document or to keep records in engineering profession, as well as in many others. Some participants discussed these:

* ICT just provides a service to other industries, like my friend, she is working in [a] hospital. There they have records for all the patients. Not only that, I have

\(^8\) Here and throughout the chapter, the discussion is based on second-order perspective, which means that explanation and discussion are derived from the participants’ views and their ways of seeing the phenomenon.
got a student who set up the radio for a hospital, but still [the] radio is a network as well. There are a lot of things [going on through ICT]. It is not just people working [in] IT. IT provides a service to other industries, like the bank - online banking. They use the service from IT. (P23-T3)

What I have seen in my last job was in the air conditioning industry. They were using software in their designing, Processing, design software like solid works, solid air, and CAD software, et cetera. (P07-T2)

Category A demonstrates a view in which ICT allows professionals to execute many of their activities. For instance, it is found that participants working in the profession used technology when performing their professional activities every day. It was found also that they used different types of software and hardware such as computers, faxes, and printers, in order to support their regular tasks. For example, participants from the finance department discussed that they used different software to support professional practice:

I use it sometimes for investigating financial decisions, so I use two computer software packages from my investments. One is called Scaffold, the other one is called John Price. And, I spend, I don’t know, fifteen minutes every day looking and assessing different shares and analysing them using these program packages. (P15-T2)

Category A provides an additional emphasis on the use of ICT in relation to communication. Vocational teachers perceived that participants used different tools such as email, social media and industry-related software to communicate within and outside the profession:
When I was back at working industry, there were only two things, if you ask what I was using for communication: [one is] emailing and [another is] using industry software. They are the only two things I can think of from the top of my head. (P22-T2)

Thus, the imperative to use ICT in workplace is less related to the effectiveness of performing professional tasks, but more to its complementary use in professions. ICT use in this category is seen in many forms, which mainly focus on complementary purpose. Professions may use ICT for their regular activities but these practices are not considered as an effective or a vital part for their professions. For instance, professionals perform many of their tasks using different software and other forms of ICT, because it is available. Few professions did not identify the need to use ICT. For example, one participant from the community service department initially did not see any major reasons for using ICT at work. However, she perceived that ICT is relevant in meeting the basic purpose of the community service profession, particularly in record keeping tasks:

To see the use of it [use of computers for community work or social work], and [to] keep even basic things like having case files on the Internet. They do case studies on the computer rather than writing it on paper. So I see that it’s still a big challenge - the use of ICT in our profession as it is mostly face-to-face conversation with clients – and ... it will change because the system has been changed and therefore we need to move with it. (P06-T2)

In summary, ICT, in this category, could be used to accomplish different professional activities and sometimes to perform quite important professional tasks such as the use of CAD for designing, or the use of software to access financial
updates. However, ICT is not seen as a critical professional tool in this category, rather it is used because the tools are out there. Therefore, in Category A, participants primarily considered ICT as a supportive or complementary tool rather than as a necessary means to effective functioning in various professions.

6.3.2 Category B: ICT helps to accomplish a job more effectively

In Category B, the emphasis is on using ICT to accomplish professional tasks more effectively than without ICT. The effectiveness is assessed through four commonly used criteria: time, cost, degree of accuracy, and productivity.

ICT, in Category B, is perceived as a time saving feature. It allows for faster performance of tasks and when the appropriate kind of ICT is used, it assists industries to plan for and to complete their work on time. Work is accomplished more quickly with the use of technology compared to the time taken with the use of other conventional methods. Participants explained that industries can make necessary decisions more quickly, therefore products can be delivered with greater speed. Consumers can then make purchases more rapidly. Designers can design and produce multiple copies within a short period. It is much faster to use drawing software to redesign, to reshape, and to create multiple copies of a particular image compared to the tedious process of manual drawing:

You can change numbers on Excel spreadsheet and decide what you need to produce this week, how many people you need, what materials you need. When you run the software, you get all the information in a second. So, it’s the speed of processing…. So, it’s speeding up. The speed, I think, is the key from a
customer point of view, and also from my manufacturers’ point of view. (P07-T2)

I had an issue with a website in America. I jumped onto the chat sites, talking with somebody at 11am, in my time. Previously, we had never been able to do that. Because we are so globalised now, we need to be connected at the little [sic] times and build those relationships with people. (P12-T2)

The use of ICT in the workplace is seen as a contributor to cost effective operation. Although the initial cost to set up technology seems to be high in most of cases because of expensive ICT hardware, but long term, operators and systems evolve into cost-effective systems and procedures. Therefore, the use of ICT brings with it low production and operation cost. The initial and long term costs depends on many other factors associated with the specific workplace. For example, participants mentioned that ICT helps to reduce manpower in the industry, because technology-supported control systems require fewer personnel than do manually controlled systems. ICT-supported security systems can also reduce the cost, and production volume is increased due to the integration of technology into professional activities. Therefore, ICT can yield a reduction of overall costs in industry:

I think it [ICT] is a key driver, like, environmental protection, it is [a] financial reality. I think we live in a market-driven society, and that ultimately, it is more productive, it is less expensive. (P15-T2)

The company I used to work for specialised in people gathering information about the sales per supermarket outlet right across the whole country, so they know exactly who is buying what and when and could analyse that in great detail [find out the best deal] and try to figure out ... to see the impact of sales
and so on. [It] Cost a huge amount of money, millions of dollars to install the systems, but gave them a really [long service] great age [sic]. (P14-T1)

ICT is understood as a device to complete a task with greater accuracy. Different kinds of technology are used in order to offer more precise ways of accomplishing professional tasks. ICT can minimise the chance of human error in performing required activities.

*I think it [ICT] is all positive. The main thing [is] it tends to do save energy.*

*That seems to be the main point, it also saves time, and it saves mistake.* (P01-T2)

The use of ICT is seen as a means of increasing productivity to industry, either directly or indirectly based on the impact of ICT on production time, cost, and degree of accuracy (Figure 6.1). Productivity also has a relation to the overall profit of an industry as it is influenced by the use of technology. For instance, with the use of ICT, a job can be completed faster than when traditional methods are used. Thus, the amount of work done within the same time can be increased, that is, enhanced industrial productivity. For example, participants mentioned that when technology was used accurately in production, it results in higher quality outputs:

*If you put [in] all the numbers correctly, you are going to get good output, too.*

*Otherwise, it is garbage in and garbage out. So, if the inputs are good, then you get a reasonably good output.* (P07-T2)
Within Category B, a further focus of using ICT in professions is that profit increases. Industries make investments in the form of purchasing, installing, maintaining, and operating technological instruments and gadgets to accomplish actions effectively. The primary target of efficiency and effectiveness in the workplace is to increase profit. For example, participants mentioned that industry uses technology to provide effective operations and in return, they expect profit:

*Well, basically, industry wants to use technologies so that they can maintain business need so they can produce profit. The bottom line is profit. So whatever industry spends on technology is always an expense. So they need to see return on investment. So if there is no return on investment, there is no place for the technology. That’s the basic formula.* (P05-T2)

This category shifts the focus from the complementary use of ICT in Category A to a focus on the fostering effective use of ICT in order to maximise overall profit in Category B. Category B is qualitatively advanced than Category A, because it not
only focuses on supporting various activities within a profession, it also concentrates on efficiency and effectiveness in terms of greater speed, accuracy, productivity and quality control that can all lead to increased overall profit.

6.3.3 Category C: ICT is an essential tool in professional activities

In Category C, ICT is viewed as an inevitable condition for the continuity of professional activities. This is based on the reality that some technology-driven industries are totally reliant on the use of ICT.

In Category C, using ICT is primarily perceived as an essential tool for the existence of many industries. Some participants from the ICT department mentioned that in many cases, professions would not exist without ICT:

*It is just like asking a fish to describe what it is like to breathe water. That’s what it [ICT] does. If you took it away, it [ICT industry] wouldn’t exist… So if you are talking about accounting or something like this, then if you are taking the technology away, they would still exist because they had an existence beforehand. But without ICT, there was nothing before in the industry [ICT industry].* (P02-T3)

According to this category of the use of ICT, participants acknowledged that a wide range of activities, in a range of industries, rely on technology. For instance, drawing industries, electronic industries, production industries, ICT industries in all sectors, considered technology as a vital instrument for everyday business.
The significant impact of ICT is not limited to industry, but is also evident in its integration into many services that are used daily by individuals and society. This is evidenced by the large dependence of all sectors of industry, particularly those engaged in public service such as communication, transportation, treatment, education, and entertainment:

*My whole industry is ICT, so anything that goes, anything electronic, and anything that buzzes, anything that has a PowerPoint attached to it is my industry. People might say that TVs might belong to the AV experts. But TVs nowadays are computers as well, you know, video recorders are all digital, all electronics, all computerised, and a lot of what we do, as we move forward in society, is more about technology talking to technology. Around the house you can have network cables; all wired up to different parts of the room, you can pump content from one room to another room in your house. You can set up a media house from one part of the house and stream movies to any TV in the home. It’s all about ICT technology, for me it is possesses [sic] every boundary of our everyday life.* (P13-T2)

When compared with previous categories, a qualitative shift of focus emerged, that is, from the effective use of ICT to the indispensable use of ICT in workplace. The previous categories focused on using ICT “for complementary purposes” (Category A) where ICT was perceived as a simple professional tool and “for effectiveness” (Category B) where ICT was construed as an effective tool for accomplishing different professional activities. In contrast, Category C presents technology as an “essential condition” to the continued existence of professions:
My profession is marketing and computers are an enormous part of that. For starters, there is a huge amount of data. You are communicating with people, and you are doing that electronically. Without computers, and you could not manage the profession. (P14-T1)

For example, participants from a marketing department mentioned that technology is a crucial tool for managing their profession, as illustrated in the previous quotation. In summary, ICT is perceived as a crucial professional tool in this category. Category C not only emphasises effective task performance but also describes the crucial nature of the use of ICT to the existence of many professions in a technology-driven society.

6.3 Relationship between categories of description

The three qualitatively different ways of experiencing the use of ICT in professions are explained by variations along these four inter-related dimensions. These four dimensions were identified based on the central awareness of each category. Identifying each dimension further required empirical evidence which was ensured by the interviews data (Åkerlind, 2005b). For example, accessing and receiving information was considered as a central element by which three categories of description could be deviated from each other. Similarly other three dimensions were identified.

This section presents a discussion about the identified relationships among the categories of description. In order to understand the relationships mentioned,
vocational teachers’ understanding of ICT in the workplace was further explored as *internal* and *external horizons*. The external horizon was defined as the way the phenomenon was connected to its context (Barnard & Gerber, 1999). In this study, the external horizon involved how the role of ICT was related to professional context. Therefore, the external horizon noted the use of a myriad of ICT supported tools, machinery and equipment in the workplace. The internal horizon was denoted by the focused awareness of the participants, that is, the central awareness by which each category was unique and deviated from each other. In this study, four dimensions of variation were included as the internal horizon (Cope, 2004). For instance, accessing and receiving information, performing a professional job, communication and professional development were the main central focus points through which each category was distinct and deviated from the others.

### 6.3.1 Dimension 1: Accessing and receiving information

Dimension 1 represents the theme depicting the expanding focus on the use of ICT in professional activities from accessing information for complementary use to considering access to information as an essential part of profession (Table 6.1).

<table>
<thead>
<tr>
<th>Category</th>
<th>Role of ICT in accessing and receiving information</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Supporting a variety of work-related tasks</td>
<td>A complementary use for accessing information</td>
</tr>
<tr>
<td>B. Accomplish a job more effectively</td>
<td>Increased speed, efficiency, and accuracy in accessing and sending information</td>
</tr>
<tr>
<td>C. Essential tools in professional activities</td>
<td>An essential tool for accessing and sending information</td>
</tr>
</tbody>
</table>
In Category A, ICT is seen as a complementary tool for accessing information in professional activities. ICT could be used to provide a wide range of digital tools used to locate information individually; for instance, individuals can access information for their personal interest. It could also be used collectively, as in the case of some industries, which use ICT for accessing and receiving information collectively. The participants from an event management department mentioned that customers prefer to use technology in order to avoid printed materials such as magazines or books. ICT, in this category, is mainly reflected as a tool for locating information:

*From my perspective, because we work within the wedding industry, a lot of the brides are quite Internet savvy, so they are avoiding picking up a magazine or a book. They jump straight online, using social media, going onto portal websites and finding out the information themselves.* (P12-T2)

In Category B, the emphasis is expanded to the distinctive role of ICT usage for accessing information with greater speed. In this context, technology is not only used as a basic tool for information access and retrieval, but also for enhancing its efficiency and accuracy in order to meet professional needs. Vocational teachers in this category viewed that similar work (accessing and receiving information) becomes easier and more convenient when technology is used:

*We can go online to another company and get information and those are the major things I can get from technology. It makes your life easier and quicker… if you could be online, you type it in, it will come straight [up].* (P17-T1)
Within Category C, ICT is viewed as an essential part of professions for accessing and sending information. Technology is not only considered as an effective tool to access information but also as a *vital* part of industry. ICT enables professionals to collect vast amounts of information as well as to send a large volume of data, files, and other information. Without the use of technology in some professions, it would not be possible to perform many tasks related to accessing and sending information. The focus, in this category, shifts from the supportive and effective role of ICT of Categories A and B, to an essential condition in the workplace of Category C. For example, participants from electrical engineering and ICT departments mentioned:

*I think it is getting very vital [sic] with this industry. Even just keeping in touch with things, there is more on the computer at the moment called Voltimum [online portal for the electrical industry], which has a lot of suppliers that send information on the website, and they might be talking about a particular new light fitting that they have and they are allowing a whole lot of people to access the information about that.* (P01-T2)

*It [ICT] is embedded into our everyday lifestyle, it is a part, the way we operated and the way we moved forward. Microsoft is moving technology into cars, I think Google is trying to do the same, Google has ‘Google Goggles’ where the glasses themselves are a computer and you can see your emails and whatever on it. ICT is the world; it is in everything.* (P13-T2)

234
6.3.2 Dimension 2: Performing professional tasks

Dimension 2 represents an expanding focus from the view that ICT plays a supporting role as in Category A, to the view that ICT has become a vital element in the accomplishment of professional tasks (Table 6.2).

Table 6.2 Variation in the role of ICT in performing professional tasks

<table>
<thead>
<tr>
<th>Category</th>
<th>Role of ICT in performing professional job</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Supporting various work-related tasks</td>
<td>Complementary tools for accomplishing various professional tasks</td>
</tr>
<tr>
<td>B. Accomplish a task more effectively</td>
<td>Perform various professional tasks efficiently</td>
</tr>
<tr>
<td>C. Essential tools in professional activities</td>
<td>Rely on technology to execute many activities in a profession</td>
</tr>
</tbody>
</table>

As Category A, ICT is perceived as a simple instrument to execute professional tasks. It focuses mainly on performing industrial and personal tasks within a profession. For instance, industries use software and hardware - computers, other devices - for controlling manufacturing processes and for performing many other activities. Individual staff perform many of their professional tasks using different software and other forms of ICT. It is important to acknowledge that in Category A, this is a complementary view of using ICT in professions. ICT is used because it is available:

*For me, being an electrical engineer was in fact, using computing to control engineering projects. And I worked at a power station on a hydro-electric dam, and I did computer control of that from another city [by using ICT].* (P03-T2)
Category B perceived a similar view of performing professional tasks with an extended focus on greater speed and overall profit. This view shows that technology helps professionals to complete their work efficiently. For instance, it is faster to complete jobs, and it is easier to accomplish tasks on time or even before deadlines. This category suggests an additional focus on overall final output of industry as captured by the four elements: benefit gained from the use of ICT tools, customer feedback, legal compliance, and the quality of the end products due to the use of ICT in the workplace:

*My industry is basically a mechanical engineering related industry. So if you want to buy an industrial product, you can use your software to select it. So the speed at which you can make a decision, as a customer, you can make decisions with greater speed. Also with the manufacturer’s point of view, they can also make decisions faster.* (P07-T2)

*Because they are looking for gross opportunities [total profit], they are looking to expand, they are looking for profitability, customer satisfaction, quality assurances, and sometimes they are looking for meeting legislative requirements, so collectively, industry uses technology to meet one, if not all those areas that I’ve mentioned.* (P05-T2)

Finally, in Category C, the role of ICT shifts from being perceived as effective tools to being perceived as providing an essential condition to accomplish professional activities. In this category, ICT focuses on the central purpose of performing specific tasks for different professions. Industries use different hardware and software for managing their activities and industry reliance on ICT indicates that many industries would not continue to operate without this technology. For example,
participants viewed that some industries use software for performing specific professional work, and for analysing various complex problems, for example using Auto-Cad, 3D-CAD, the Internet, or other related ICT-supported tools:

Without those technologies, the industry would not survive. It would die. So, it is those sorts of things we have talked about. Auto-CAD, 3D-CAD, finite element analysis, Internet searches - they are all the same and are used to be able to survive engineering today, using technology in profession. (P04-T1)

I rely on reporting using tools like Excel, Access. I rely on Word in order to send completion reports. I rely on MS Project for keeping my timeline. I rely on Excel for budgeting. I rely on the TPD that we use internally to keep track of my assessor’s times that they are on a project. (P05-T2)

It is important to clarify that some ICT tools may be used in more than one category but the understandings are different depending on the category involved. For example, CAD could be used in Category A in which it is viewed in a simple manner – as a supporting tool. In Category C, CAD is construed as an essential tool for accomplishing specific professional tasks.

6.3.3 Dimension 3: Communication

The focus of Dimension 3 is to expand Categories A to C from perceiving ICT as a supportive means for communication, to considering ICT as a core component of communication tasks within professional work.
Table 6.3 Variation of the role of ICT for communication purposes within professional practices

<table>
<thead>
<tr>
<th>Category</th>
<th>Communication</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Supporting various work-related tasks</td>
<td>Communicating with other staff</td>
</tr>
<tr>
<td>B. Accomplish a job more effectively</td>
<td>A simple, straightforward and effective tool for communication</td>
</tr>
<tr>
<td>C. Essential tools in professional activities</td>
<td>An essential media for communication</td>
</tr>
</tbody>
</table>

In Category A, ICT is viewed as a communication tool. It is mainly used for networking or connecting with colleagues in the same profession or in other professions. The main reasons for using ICT in this category are: to reach out to co-workers for personal or professional reasons, to continue discussions with people who are not available in the office, to send messages to specific staff, and to circulate notices or agendas of meeting to concerned professionals on either an individual or a group basis. In this context, email, text messages, skype, tele- and video conferencing, and some cases, audio chat are the means of communication:

*If I want to have a discussion with my boss or another person, with different companies, we can have a teleconference. We used telepresence from Cisco to assist us in communication with different companies and so on.* (P10-T3)

The focus of using ICT in relation to communication shifts from Category A to Category B. The nature of communication using ICT is the same as it is for Category A (see previous theme), but the perceived focus has been expanded. In Category B, sending emails and building networks for communication are important features, similar to the Category A. However, there is an additional focus on its effectiveness for conveying messages to recipients in professional practices as well as in personal
lives:

*ICT is a tool, not a target. We use it to facilitate life for you. For example, communication, using email - it’s far better than using a phone or even walking to the other building* [for such communication]. (P10-T3)

In Category B, the use of ICT for communication in the workplace is considered as a convenient tool when compared to the use of conventional means such as meeting face-to-face, sending letters, and the like. Participants mentioned that technology provides an easy and simple way to communicate with others, and does not require in-person contact. This category also indicates that professionals use software or programs for uninterrupted communication tasks:

*Easy communication. You do not need any human being. So it is very simple, straightforward. As a human, each person is unique. He or she will be sensitive to what you say, which might not be the same for another person. We do not worry about those things in technology. There is a program, it does the job. That is it. It is one of the big achievements by technology.* (P17-T1)

In Category C, ICT is viewed as a *vital* medium for communication. The nature of the use of ICT is similar to the previous dimensions. The difference rests on the importance of using technology in both personal and professional practices, thus shifting the emphasis from ICT being an effective tool to it being an essential tool in relation to communication. Professionals depend on various ICT tools for communication-related tasks in workplace.
Its [company] all communication was electronically, email electronically. We didn’t do anything on paper, it was all electronic…. So, I mean, it’s an integral part of the business. (P14-T1)

In Category C, communication media such as email, text, audio and video conferencing, software (used for networking), Internet, is used extensively for continual back-and-forth communication. For instance, social media such as Facebook and LinkedIn are cited as holding “an extremely important role” for networking. In these contexts, technology, both hardware and software, is used to design networking systems that are viewed as critical professional means for building necessary communication portals. Therefore, vocational teachers perceived that without technology in the professional field, it would be impossible to maintain communication between and among colleagues:

One of the biggest things that our industry is seeing is that the word of mouth is the biggest jump, so they’re jumping on Facebook, posing them questions, and getting responses from their friends who they trust more than what advertising is telling them. So it’s time to recognise that social media is playing an extremely important role in our field. (P12-T2)

All the work, all the communications, all the documentation, everything is done on the computer. (P03-T2)
6.3.4 Dimension 4: Professional development

Dimension 4 is represented by an expanding focus from Categories A to C, from considering ICT as a tool for enhancing knowledge and skills to being viewed as a means to facilitate engagement in professional development programs.

Table 6.4 Variation of the role of ICT in professional development activities

<table>
<thead>
<tr>
<th>Category</th>
<th>Role of ICT in professional development</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Supporting professional tasks</td>
<td>Individual development or upgrade individual knowledge and skills</td>
</tr>
<tr>
<td>B. Accomplish a job more effectively</td>
<td>Provide a wider range of options to conduct professional development programs</td>
</tr>
<tr>
<td>C. Essential tools in professional activities</td>
<td>Provide continual engagement and collaboration in professional development activities</td>
</tr>
</tbody>
</table>

In Category A, ICT is viewed as a medium through which personnel can upgrade their professional knowledge and skills. The role of ICT, in this category, is to place emphasis on individual use of ICT for personal and professional development and less focus on collective professional development programs. For example, individual staff use smartphones, tablets or desktop computers to take part in short courses or to access information for professional improvement and updating knowledge and skills to meet current or future professional requirements. Individual professional development via ICT is therefore seen as a substitution for attending vocational courses:

*I can jump onto my iPhone now and do a short course or read a blog, or do some sorts of certain skills we [personnel] need to refresh our knowledge and skills that is in an app. So, do I need to come to TAFE anymore? I can read*
through the course, answer question, and have a certificate emailed to me.

(P12-T2)

The above-mentioned roles of ICT in professional development are also found in Category B, but in expanded form in terms of providing a wider range of options to update professional knowledge as well as to gain further mastery of professional skills. For instance, Category B not only emphasises individual effort to update knowledge and skills similar to Category A, but also focuses on collective efforts. These collective aspects could involve workshops, short courses, or seminars, which are organised by different professional bodies. Within this category, ICT is viewed as a valuable and versatile tool for professional development activities, particularly in the area of updating practical knowledge:

I think for our own professional development there are lots and lots of options by using technology because you can access seminars from overseas and learn more about particular topics that you are interested in. So that is great as a professional development tool. (P06-T2)

In Category C, ICT is perceived as an essential element for continual engagement in professional development activities. Within this category, the focus shifts to engagement and collaboration. The personnel rely on various sorts of technology for engaging and collaborating with clients and team members:

I rely on my ability to use my mobile for continual engagement with my clients, I rely on communicator as a tool to engage with my internal team. (P05-T2)

ICT tools such as WebEx, and teleconferences, are widely used for engaging, meeting, giving feedback, and the like:
So we use WebEx as well as teleconferences in order to meet with them [participants from different projects], in order to answer their questions and engage with them. I rely on the assessors getting continual feedback from the assessors on their engagement strategies with the participants. (P05-T2)

6.4 Summary and relationships among the categories

In summary, the emerging findings indicate that ICT-supported work in professions can be understood in three qualitatively different ways by teachers:

Category A: ICT could be used for various work-related tasks;

Category B: ICT helps to accomplish a job more effectively; and

Category C: ICT is an essential tool in professional activities.

Relationships were also found among these three categories. They deviate internally along four dimensions: accessing and receiving information; performing a task; communication; and professional development. These relationships appear in Table 6.5 and show the role ICT in workplace. For example, the theme ‘accessing and receiving information’ represents an expanding focus in using ICT from a complementary use to essential use, for managing information in the workplace. In the case of ‘professional development’ theme, the expansion is from individual development to collective development. Similar expansion of the participants’ awareness was also found in the remaining two themes: ‘performing professional job’ and ‘communication’ (Table 6.5).

Conceptions, in phenomenographic studies, have structural and referential
components, as Marton and Booth (1997) note, “the ‘how’ and ‘what’ are component parts of the entire conception” (p. 112). In this study, the ‘what aspect’ of the role of ICT in professional activities deals with what the vocational teachers conceived and the ‘how aspect’ is connected with the explanation (structure) of ICT usage in the workplace in relation to the identified conceptions.

Table 6.5 Relationships between categories of description (ICT in workplace)

<table>
<thead>
<tr>
<th>Category</th>
<th>Supporting a variety of work-related tasks</th>
<th>Accomplishing a job more effectively</th>
<th>Essential tools in professional activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dimensions of variation (Internal horizon)</td>
<td>Expansion</td>
<td></td>
<td></td>
</tr>
<tr>
<td>accessing and receiving information</td>
<td>a complementary use for accessing information</td>
<td>increased speed, efficiency, and accuracy in accessing and sending information</td>
<td>an essential tool for accessing and sending information</td>
</tr>
<tr>
<td>performing professional job</td>
<td>complementary tools for accomplishing various professional tasks</td>
<td>perform various professional tasks efficiently</td>
<td>rely on technology to execute many activities in a profession</td>
</tr>
<tr>
<td>communication</td>
<td>communicating with other staff</td>
<td>a simple, straightforward and effective tool for communication</td>
<td>an essential media for communication</td>
</tr>
<tr>
<td>professional development</td>
<td>individual development or upgrade individual knowledge and skills</td>
<td>provide a wider range of options to conduct professional development programs</td>
<td>provide continual engagement and collaboration in professional development activities</td>
</tr>
</tbody>
</table>

Table 6.6 (the outcome space of the phenomenographic study) summarises the referential and structural components and their relationships to the use of ICT in the workplace. The study identified three broader structural components: ‘individual focused’, ‘tool focused’, and ‘community focused’. The three categories of description ranged from an ‘individual focused’ to ‘community focused’ regarding understanding of ICT usage in the workplace. Category A was considered as
indicating simple or less complete conceptions because the main emphasis was on using ICT concentrating on individuals, whereas collective focus for using ICT in the workplace was given very little attention. Conversely, the last two Categories B and C were considered to be more complete conceptions than Category A because the main focus of using ICT in the workplace shifted towards collectiveness. Therefore, Category C is the most inclusive in nature, that is, the participants, who had elements that includes from Category C, also hold views that may belong to Category A and B. For example, one participant from an ICT department held views that included features from Category C in which ICT use was directed to collective engagement in the workplace.

So we use WebEx as well as teleconferences in order to meet with them [participants from different projects], in order to answer their questions and engage with them. I rely on the assessors getting continual feedback from the assessors on their engagement strategies with the participants. (P05-T2)

Table 6.6 Outcome space: referential and structural components of using ICT in the workplace

<table>
<thead>
<tr>
<th>Referential component ('what' of the conceptions)</th>
<th>Structural component ('how' of the conceptions)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Supporting a variety of work-related tasks</td>
<td>Individual focused</td>
</tr>
<tr>
<td>Accomplish a job more effectively</td>
<td>Tool focused</td>
</tr>
<tr>
<td>Essential tools in professional activities</td>
<td>Community focused</td>
</tr>
</tbody>
</table>

The same participant also discussed views that belonged to Category B where ICT use was seen as a tool (tool focused) for industrial benefit.

Industry wants to use technologies so that they can maintain business need so they can produce profit. The bottom line is profit. (P05-T2)

In brief, vocational teachers’ conceptions of the role of ICT in the workplace
represent three different ways of seeing the same phenomena and these conceptions represent three structural components. Moreover, their relationships showed that the categories of description deviated from each other due to their central features. However, each category is qualitatively distinct or has its own unique features. A detailed discussion appears in Section 6.2.
CHAPTER 7 – DISCUSSION AND CONCLUSIONS

7.1 Discussion of findings

The aim of this study was to explore vocational teachers’ conceptions of ICT-enhanced teaching, different ways of using ICT in teaching approaches, and teachers’ ways of apprehending the role of ICT in professional work. The results of the study were reported in Chapters 4-6. This chapter contains detailed discussion of the findings and the conclusions. The chapter consists of seven sections, starting with a discussion of the findings in relation to the three research questions that the study sought to answer. The second section discusses the integration of three research questions. The third section focuses on the possible implications of this research on teachers’ professional development, curriculum development and vocational teachers’ benefits. It further discusses the contributions to current practice (teaching and workplace), methodology and theory. The fourth and fifth sections present limitations and future research possibilities that emerged from this study. The last two sections present the researcher’s experience as a phenomenographic researcher and make some concluding statements.

7.1.1 What does ICT-enhanced teaching mean to TAFE teachers?

The research revealed five teacher conceptions of ICT-enhanced teaching in vocational education. These were, Category A: “meet external expectations”; Category B: “gain access to information and resources”; Category C: “delivery tool”;
Category D: “media for active learning”; and Category E: “preparing students for future profession”. In a phenomenographic study, conceptions are discerned from people’s understanding, thereby constructing a set of categories of description from interviews. Thus, categories of description represent the characteristics of conceptions. The five conceptions ranged from a teacher-centred/content-oriented to a student-centred/industry-oriented understanding of ICT-enhanced teaching. The first three conceptions were considered simple or less complete conceptions because the main focus was on the teachers’ task of conveying necessary information, whereas students’ conceptual development (by their active involvement in teaching-learning) was given very little attention. Conversely, the last two conceptions were considered more complete conceptions, when compared to the first three, because the main focus of the teachers’ tasks expanded to students’ development by engaging them in active learning.

Conceptions of teaching in a face-to-face context: Vocational teacher conceptions of ICT-enhanced teaching described in this study tend to be related to teachers’ conceptions of face-to-face teaching, that is, the identified categories consistent with those of other phenomenographic studies that investigated face-to-face teaching contexts in tertiary education (Table 7.1). The table compares the present study with prior research on face-to-face teaching. Vocational teachers’ conceptions of ICT-enhanced teaching broadly support Kember’s (1997) “teacher-centred/student-centred” frameworks. The five conceptions contain elements from teacher-centred and student-centred orientations. However, this study did not find any intermediate orientation between teacher-centred and student-centred. More specifically, in the lower level conceptions (Categories A, B and C), teachers are seen
as presenting teaching materials (class notes, lectures, other resources) while students are seen as acting as recipients. Therefore, these three conceptions fall into a teacher-centred orientation. In contrast, the more complete conceptions (Categories D and E) focus on student active participation, where students are actively engaged with their own learning while teachers primarily act as facilitators. These two conceptions fall into a student-centred orientation. Together, the five conceptions revealed in this study can be split either into teacher-centred or student-centred orientations. No intermediate orientation was found through the study and this is inconsistent with Kember’s (1997) argument. Instead, the findings were in line with the arguments of Samuelowicz and Bain (2001), who claimed that there is no need to identify any intermediate orientation. The study provides further supporting evidence for the teacher-centred/student-centred frameworks in face-to-face teaching contexts.
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</tr>
</thead>
<tbody>
<tr>
<td>A. Imparting information</td>
<td>A. Transmitting information</td>
<td>A. Imparting information</td>
<td>A. Transmitting the basic information of the discipline</td>
<td>A. ICT is used to meet external expectations</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>B. Transmitting structured knowledge</td>
<td>B. Transmitting structured knowledge</td>
<td>B. Transmitting structured knowledge</td>
<td>B. Transmitting lecturers’ understanding</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>C. Providing and facilitating understanding</td>
<td>C. Providing and facilitating understanding</td>
<td>C. Providing and facilitating understanding</td>
<td>C. ICT is used to gain access to information and resources</td>
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<tr>
<td>D. Helping students acquire teacher knowledge</td>
<td>D. Helping students acquire teacher knowledge</td>
<td>D. Helping students acquire teacher knowledge</td>
<td>D. ICT is used as a delivery tool</td>
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<tr>
<td>Intermediate</td>
<td>C. An interaction between the teacher and the student</td>
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<tr>
<td>Learner-centred</td>
<td>E. Helping students develop conception</td>
<td>D. Facilitating understanding on the part of the student</td>
<td>D. Helping students develop expertise</td>
<td>C. Developing students’ understanding</td>
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<tr>
<td></td>
<td>F. Helping students change conceptions</td>
<td>E. Preventing misunderstandings</td>
<td>E. Preventing misunderstandings</td>
<td>D. Changing students’ understanding</td>
<td></td>
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<tr>
<td></td>
<td></td>
<td>F. Negotiating meaning</td>
<td>F. Negotiating meaning</td>
<td>D. Developing students’ understanding- developing critical thinking</td>
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<tr>
<td></td>
<td></td>
<td>G. Encouraging knowledge creation</td>
<td>G. Encouraging knowledge creation</td>
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<td>D. ICT is used as media for active learning</td>
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<td></td>
<td></td>
<td></td>
<td>E. ICT is used for preparing students for their future profession</td>
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</table>
In order to reveal relationships among the five conceptions, this study further explored four dimensions of variation to present how the conceptions were related internally. The dimensions of variation were: (i) the role of teachers; (ii) the role of students; (iii) the impact of technology on student and teacher knowledge; and (iv) who benefits from the use of ICT in teaching. These were similar to the previous studies conducted in face-to-face teaching contexts (Åkerlind, 2004; Kember, 1997). For instance, the dimensions on the role of teachers and the role of students are similar to most of the studies on face-to-face teaching, while the dimension, who benefits from the use of ICT in teaching, is consistent with Åkerlind’s (2004) dimension, breadth of benefit, where the main benefits were directed to students, teachers and society. However, the present study identifies institutions and industries as additional beneficiaries in this context.

Conceptions of teaching in blended contexts: Table 7.2 compares the present study with prior research in blended teaching contexts. The conceptions revealed in this study support previous research findings on teachers’ conceptions of various kinds of technology-enhanced teaching, such as blended learning (Bliuc et al., 2012), e-learning (González, 2010; Stein et al., 2011), web learning (Roberts, 2003) and online learning (González, 2009). In particular, Category B: “gain access to information and resources”, is in line with the findings of Roberts (2003) and González (2009), who found that some teachers conceived of the web as a source of information. The current study also supported the findings of Ellis et al. (2009), who found that technology was considered as a tool for access. Likewise, Category C: “delivery tool”, was similar to the findings of Ellis et al. (2009), Stein et al. (2011) and Bliuc et al. (2012), whose findings were that some teachers perceived learning
technologies as tools for information delivery. In addition, there are comparable conceptions to Category D: “media for active learning”, found in the studies of Roberts (2003), Ellis et al. (2009), González (2010), and Bliuc et al. (2012). These studies identified similar conceptions that emphasised students’ engagement in their development.

This study, however, identified some distinctive aspects in the conceptions of ICT-enhanced teaching in vocational education. More specifically, Category A: ICT is used to meet external expectations, has its emphasis on meeting demands created externally. This was not found in previous phenomenographic studies. Category E, which reflects the view that ICT prepares students for their future profession, was also not clearly identified in previous studies. The most obvious reason is that the Australian vocational context is strongly oriented towards the needs of immediate employment (Rosalind Carter & Ellis-Gulli, 2014). Therefore, teachers’ understanding of the use of ICT in Category E is likely align with achieving future employment; distinguishing it from some broader or longer-term aims associated with other categories identified in university education (Åkerlind, 2004; González, 2011; Kember, 1997). In university education, the focus generally appears directed more on the development or expansion of theoretical knowledge through research, rather than on gaining immediate skills to enter the workplace.
Table 7.2 The findings of the study in relation to prior research on conceptions of teaching in blended contexts

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</thead>
<tbody>
<tr>
<td>Technology Focused / Technology - Centred</td>
<td>Less Complete, fragmented</td>
<td>A. The web as a source of information</td>
<td>A. The web for individual access to learning materials and information, and for individual assessment</td>
<td>A. Learning technology as tools for access</td>
<td>A. eLearning as a medium for providing information</td>
<td>A. Blended learning as the use of technological teaching tools</td>
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<td>B. Learning technologies as tools for information delivery</td>
<td>B. eLearning as a medium for occasional communication</td>
<td>B. Blended learning as an aggregation of face-to-face, online and other types of technologically driven delivery</td>
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<td></td>
<td>C. ICT is used as a delivery tool</td>
</tr>
<tr>
<td>Student Learning Focused / Student Learning-Centred</td>
<td>More Complete, cohesive</td>
<td>B. The web used for individual and independent self-paced learning</td>
<td>B. The web for learning-related communication (asynchronous/synchronous)</td>
<td>C. Learning technologies as ways of providing active learning opportunities</td>
<td>C. eLearning as a medium for engaging in online discussions</td>
<td>D. Blended learning for students’ needs and learning goals</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td>C. The web as a medium for networked learning</td>
<td>D. eLearning as a medium for supporting knowledge building tasks</td>
<td>E. Blended learning to empower students for lifelong learning</td>
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<tr>
<td></td>
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<td></td>
<td></td>
<td></td>
<td>E. ICT is used for preparing students for their future profession</td>
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9 The table is made based on Gonzalez’s, 2010.
Category E shares some similarities with conceptions of blended learning such as, *empower students for lifelong learning*, which were also identified by Bliuc et al. (2012) on vocational teachers’ conceptions of blended teaching. The present study, and that of Bliuc et al. (2012), placed Category E (Table 7.2) at the highest level of conception. Both the studies found: (i) an emphasis on students’ learning experiences beyond the classroom, (ii) a similar focus on lifelong learning. However, the features of Category E: “preparing students for future profession”, differ from the category identified by Bliuc et al. (2012), in which “blended learning empowers students for lifelong learning”. For example, the present study not only focuses on the students’ lifelong learning, similar to the study of Bliuc et al., but also emphasises students’ immediate employment opportunities.

On some aspects, there were differences between the categories presented in this study and the equivalent categories in previous studies. For example, the use of ICT as a delivery tool in the present study explored three main elements of vocational teaching: it aimed to provide face-to-face instruction, it was an integrated course delivery platform, and it was an alternative delivery system. In contrast, Ellis et al. (2009) identified “learning technologies as tools for information delivery”, therefore their category was such that the primary focus was on conveying information. It is important to acknowledge that both studies (Ellis et al., 2009 and present study) were conducted in face-to-face and online teaching contexts. However, the present study identifies a more detailed view of the use of technology, by presenting three separate areas of ICT use as a delivery tool. Extended elements may have emerged in the present conception (ICT is used as a delivery tool), due to the fact that this study was conducted in a vocational context, where some of the participating teachers mentioned
that professional skills could be better taught through different delivery tools.

The present study identified dimensions of variation among the developed categories similar to those found in the study of Lameras et al. (2012), and of González (2010), on the blended teaching contexts. In contrast, the other studies shown in Table 7.2 did not identify them. The present study identified two dimensions (role of teacher and role of students) similar to those recognised by Lameras et al. (2012), and González (2010). The current study also revealed one dimension: the impact of technology on student and teacher knowledge, which is not found in any other phenomenographic studies on both face-to-face and blended teaching contexts.

7.1.2 How do TAFE teachers approach teaching with ICT?

With the second research question, the study identified five approaches to ICT-enhanced teaching in vocational education. Approach A is referred to as a teacher-focused information-oriented strategy with the intention of effectively delivering subject content. Approach B pertains to a teacher-focused feedback-oriented strategy with the intention of achieving intended course outcomes. Approach C is about a teacher-focused practice-oriented strategy with the intention of linking theoretical and practical knowledge. Approach D is described as a student-focused facilitation-oriented strategy with the intention of providing active learning for developing students’ understanding. Approach E is referred to as a student-focused industry-oriented strategy with the intention of developing students’ knowledge and skills to meet industry’s needs. The analysis of the features of these
five approaches demonstrated two broad approaches to ICT-enhanced teaching: teacher-focused (A, B, C) and student-focused (D, E).

Table 7.3 compares the key findings of the present study with prior research. The findings of the current study support the results of the prior research, which was conducted in both face-to-face (Trigwell et al., 1994) and blended teaching (González, 2012). In particular, the present study is consistent with the broader approaches reported in the majority of previous studies of face-to-face teaching approaches in tertiary education, which fall into teacher-focused to student-focused teaching approaches (Kember & Kwan, 2000; Samuelowicz & Bain, 2001; Trigwell et al., 1994).
Table 7.3 **Comparative analysis between present study and the outcomes of prior research on approaches to teaching based on intention and strategy frameworks**

<table>
<thead>
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<tbody>
<tr>
<td><strong>Strategy</strong></td>
<td>1. Teacher-focused</td>
<td>1. Information-focused strategy</td>
<td>This study did not identify</td>
<td>1. Teacher-focused information-oriented</td>
</tr>
<tr>
<td></td>
<td>2. Student/teacher interaction</td>
<td>2. Communication-focused strategy</td>
<td></td>
<td>2. Teacher-focused feedback-oriented</td>
</tr>
<tr>
<td><strong>Intention</strong></td>
<td>1. Information transmission</td>
<td>1. Provide easy access to course materials and administrative information</td>
<td>1. Provide detailed and accurate materials</td>
<td>1. Effectively delivering subject content</td>
</tr>
<tr>
<td></td>
<td>2. Concept acquisition</td>
<td>2. Provide access to up-to-date/quality materials</td>
<td>2. Make students’ practical needs easier and more convenient</td>
<td>2. Achieving intended course outcomes</td>
</tr>
<tr>
<td></td>
<td>3. Conceptual development</td>
<td>3. Provide a space for asking questions, making announcements, keeping in touch</td>
<td>3. Ensure appropriate levels of computer literacy to enhance contact between students and the teacher and promote the psychological wellbeing</td>
<td>3. Linking theoretical and practical knowledge</td>
</tr>
<tr>
<td></td>
<td>4. Conceptual change</td>
<td>4. Engage students in deep thinking, and</td>
<td>4. Use affordances of the blended context to better meet learning needs, and</td>
<td>4. Providing active learning for developing students’ understanding, and</td>
</tr>
<tr>
<td></td>
<td></td>
<td>5. Provide a space for building knowledge</td>
<td>5. Improve the quality of student learning and develop complex skill</td>
<td>5. Developing students’ knowledge and skills to meet industry’s needs</td>
</tr>
</tbody>
</table>
In relation to blended teaching, the present study identified some distinctive features in the approaches to ICT-enhanced teaching in vocational contexts. These are discussed below, in relation to three main components of approaches to ICT-enhanced teaching: (i) focus of strategy; (ii) orientation of strategy; and (iii) intention.

This study has identified approaches to ICT-enhanced teaching in vocational education, ranging from using ICT with a focus on conveying information with an emphasis on students’ active learning in order to develop their knowledge and skills to meet industry’s needs. Parts of the findings of the present study are in line with previous studies. For example, vocational teachers’ approaches to ICT-enhanced teaching in relation to conveying information are consistent with transmitting information, identified by Ellis et al. (2009), and González (2012), in university teaching. With regard to the active learning aspect, the study found mostly similar results to prior research in tertiary education. In particular, this study identified Approach D: a student-focused, facilitation-oriented strategy with the intention of providing active learning for developing students’ understanding, which primarily focused on students’ development by creating a space for active learning. This was also found in other studies, such as that of González (2012), which identified an approach with a communication-focused strategy aimed at providing a space to engage students in deep thinking.

Some differences were observed between the approaches identified in the present study and the equivalent approaches of other studies. These differences arise from the way those approaches are constituted, and depend on the approaches having the same internal construction, the same intentions or strategies. For example, Ellis et
al. (2009) identified Approach D: encouraging students’ autonomy in learning, which encouraged students to take the initiative in their learning. This is in line with the present study in terms of the broader view on students’ engagements in their learning in Approaches D and E. However, the study of Ellis et al. (2009) did not clearly elaborate on a specific intention of this view or on a strategy to achieve it. González (2012) identified specific strategies to develop students’ engagement in their learning, and more specifically he identified a “communication-focused strategy” and a “collaborative-focused strategy” to describe students’ active learning in e-learning teaching contexts in the university. Again, the present study, in contrast with the study of González (2012), found one specific strategy, “student-focused facilitation-oriented”, instead of two strategies emphasising students’ active learning in vocational teaching. This difference might be because González (2012) conducted his study focusing on e-learning in university teaching, while the present study investigated ICT-enhanced teaching in vocational education contexts.

The current study revealed two strategies with five main orientations to teaching with ICT along a continuum, namely: teacher-focused, comprising information-oriented, feedback-oriented and practice-oriented; and student-focused, consisting of activity-oriented and industry-oriented teaching. This continuum is an extension of the frameworks revealed in previous phenomenographic research, namely: the “information transmission/teacher-focused” and “conceptual change/student-focused”.

In this study, the teacher-focused broad approach included feedback-oriented and practice-oriented strategies, which not only focused on transmitting information
but also put emphasis on providing feedback, and integrating theoretical as well as practical knowledge, to distinguish it from an “information transmission/teacher-focused” orientation. A student-focused, industry-oriented strategy concentrated on students’ development, with a particular emphasis on industrial needs. The above extended three elements: feedback-oriented, practice-oriented and industry-oriented strategies are novel, or not found in other phenomenographic studies. There are two possible reasons for identifying new elements in the existing strategy. The first reason might be the change of research context, from university to vocational. Teaching in a vocational context can require different strategies to those in university teaching. For instance, prior studies mentioned that teaching at vocational institutions is different from teaching in the university sector, based on aims, focus and general practice (Rosalind Carter & Ellis-Gulli, 2014; Kloppenborg, 2010). The second reason could relate to the teaching of particular subjects. For example, it was found (from vocational teachers’ perspectives) that participating teachers from specific departments, such as ICT and IT, used a feedback-oriented strategy component in their teaching, whereas teachers from electrical and even management departments used an industry-oriented strategy.

In contrast, an exception can be found in prior research addressing industry-related components in blended teaching approaches such as that of the Bliuc et al. (2012) study that identified: *teaching as an opportunity to enrich the learning experience and to provide innovative ways to learn through the blended context*, to focus on students’ development towards the demands of the workplace. Bliuc et al. (2012) did not identify a specific intention and strategy to arrive at this approach. Conversely, the present study identified both an intention and a strategy to reach the
industry-related approach: A student-focused, industry-oriented strategy with the intention of developing students’ knowledge and skills to meet industry’s needs.

In addition, this study identified five intentions. They are: (i) effectively delivering subject content; (ii) achieving intended course outcomes; (iii) linking theoretical and practical knowledge; (iv) providing active learning for developing students’ understanding; and (v) developing students’ knowledge and skills to meet industry needs. Parts of the intentions of the present study are in line with previous studies. Specifically, the main focus of intentions (i), (ii) and (iv) is found in previous studies by Trigwell et al. (1994), González (2012), and Bliuc et al. (2012), in different teaching contexts (Table 7.3). For example, the main focus of intention (iv) is developing students’ understanding, which is in line with the third intention of Trigwell et al. (1994): conceptual development, and the fourth intention of González (2012): engage students in deep thinking. However, the current study identified two new intentions, (iii) and (v), which are not found in prior phenomenographic research. Although the present study claims that intention (v) is new, it should be admitted that the intention described by Bliuc et al. (2012), to improve the quality of student learning and develop complex skills, gives a similar perspective.

7.1.3 What does ICT mean to TAFE teachers when it is used in professional activities?

Vocational teachers’ conceptions of ICT in professional practice is a new area of investigation but the findings of this study can be interpreted in a wider context. The findings are in line with broader phenomenographic perspectives, which have established that people express their conceptions of a certain phenomenon
encountered in the workplace or profession through a limited range of categories (Marton, 1981). Three qualitatively distinct categories were identified in the current study: Category A: *ICT could be used for various work-related tasks*; Category B: *ICT helps to accomplish a job more effectively*; and Category C: *ICT is an essential tool in professional activities*.

Conceptions of technology in professional activities are presented in Table 7.4. Although there has been very little research found in this particular area, mainly investigating people’s conceptions of technology, Information Literacy (IL), and medical technology, the conceptions of ICT identified in this study support that research.\(^\text{10}\)

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\(^{10}\) The operational definition is presented in Section 1.5
Table 7.4 The findings of the study on conceptions of ICT in professional work in relation to prior research

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<tbody>
<tr>
<td>Context</td>
<td>contemporary surgical nursing</td>
<td>engineering students</td>
<td>district nurses</td>
<td>vocational teachers</td>
</tr>
<tr>
<td>Conceptions</td>
<td>Technology as:</td>
<td>Technology:</td>
<td>Medical technology:</td>
<td>A. ICT could be used for various work-related tasks</td>
</tr>
<tr>
<td></td>
<td>A. machinery and equipment</td>
<td>A. artefacts with certain characteristics</td>
<td>A. leads to vulnerability</td>
<td>B. ICT helps to accomplish a job more effectively, and</td>
</tr>
<tr>
<td></td>
<td>B. changes to skills</td>
<td>B. artefacts with a purpose to satisfy certain needs</td>
<td>B. demands collaboration</td>
<td>C. ICT is an essential tool in professional activities</td>
</tr>
<tr>
<td></td>
<td>C. increasing knowledge</td>
<td>C. how artefacts work and are constructed</td>
<td>C. demands self-reliance</td>
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<tr>
<td></td>
<td>D. respect and autonomy</td>
<td>D. an independent discipline</td>
<td>D. requires awareness, and</td>
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<tr>
<td></td>
<td>E. control of clinical practice</td>
<td>E. applied science, and</td>
<td>E. provides freedom for patients</td>
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<td></td>
<td>F. clinical resources of the practice environment to meet the needs of technology</td>
<td>F. reciprocal to science</td>
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<td></td>
<td>G. including the patients’ experience and clinical presentation, and</td>
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<td>H. alteration to the free will of nurses</td>
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<tr>
<td>Dimensions of</td>
<td>This study identified logical relationship among the categories. The dimensions of variation were not investigated</td>
<td></td>
<td>Did not investigate</td>
<td>1. accessing and receiving information</td>
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<tr>
<td>variation</td>
<td></td>
<td></td>
<td></td>
<td>2. performing the job</td>
</tr>
<tr>
<td></td>
<td>1. machinery and equipment</td>
<td></td>
<td></td>
<td>3. communication, and</td>
</tr>
<tr>
<td></td>
<td>2. readiness for clinical practice</td>
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<td></td>
<td>4. professional development</td>
</tr>
<tr>
<td></td>
<td>3. the outcome of technology use in clinical practice, and</td>
<td></td>
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<td></td>
</tr>
<tr>
<td></td>
<td>4. volition and nursing practice</td>
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In particular, Category A: *ICT could be used for various work-related tasks* appears as a novel category, but its features broadly support previous phenomenographic studies such as Kabo and Adawi (2011), and Munck et al. (2011). For example, the use of ICT is perceived in Category A as a supportive instrument in professional practices. ICT is seen as being used to organise and manage activities in both industry and individual professional practice. These understandings are in line with the study of Kabo and Adawi (2011), where they identified engineering students’ conceptions of the nature of technology. They viewed that the purpose of using technology was to “accomplish a specific task or to solve a particular problem” (p. 288).

Another aspect relating to Category A is that vocational teachers, in the current study, viewed ICT as a supportive tool for communication and information access, which agrees with the findings of previous phenomenographic studies such as Bruce (1999), or Engström et al. (2009). For instance, Bruce (1999) identified that professionals viewed IL as a way to improve information awareness and to help professionals to communicate with others. Engström et al. (2009) identified a comparable conclusion about ICT in dementia care. For example, ICT, such as email, is described as a complementary tool that improves information and communication between co-workers and relatives of the patient. In addition, in Category A, it is perceived that staff update their professional knowledge and skills by attending short courses and accessing information by using ICT. This aspect is also found in the study of Munck et al. (2011). In order to operate medical devices, nurses are seen to upgrade their knowledge and skills by searching for information on the Internet and by taking part in various training courses. However, the nurses claimed that it is not
an easy task to keep updated in medical technology while performing their regular professional work. In contrast, the present study did not reveal a similar level of difficulty in relation to updating knowledge and skills, which is likely due to the research setting. This study was conducted in an educational context where the vocational teachers expressed their understanding of the role of ICT in a wider industrial context. They expected to upgrade their knowledge and skills for the sake of their teaching, and did not see this as an issue in the workplace. The former study, however, was focused on a very particular profession, palliative homecare, in which district nurses may not have had time to update their knowledge and skills within their work routines.

In Category B, ICT is used in professional practice to complete work effectively and accurately. This conception is consistent with the results of Barnard and Gerber’s (1999) phenomenographic study, where contemporary surgical nurses perceived technology as a device that makes clinical practice simpler, easier and in some cases more accurate. An additional element in Category B, was that ICT is viewed as an efficient instrument in professional work or as a help to perform work with greater speed, is consistent with the results of Engström et al. (2009). They identified a similar element in their first revealed theme: “moving from fear of losing control to perceived increase in control” showing that the staff perceived that using ICT increased their overall performance in dementia care. The phenomenographic study of Munck et al. (2011) revealed similar findings, notably that medical technology is viewed as a device in palliative homecare. It provides increased opportunities for patients, such as greater freedom to choose the place for their care and treatment. The above understandings are also supported by the phenomenological study of Almerud
et al. (2008), where they mentioned their views that technology-supported machines provide safety, control, and efficiency in organisational operation. Overall, in Category B, vocational teachers considered ICT as an effective tool to perform professional work with greater speed, accuracy, productivity and quality control.

In Category C, the use of ICT was described as an essential condition to the existence of many industries. According to this understanding, ICT is viewed as being at the heart of professorial practice. This view supports previous studies. For example, Poulis et al. (2013) identified the views of ship owners on the innovative use of ICT in the ship industry. The ship owners who used modern technology reported that the use of technology is crucial for their industry, which is a view similar to that of Category C. Likewise, in the phenomenological study, Almerud et al. (2008) identified that caregivers perceived technology as a master that could have control of life and death. In addition, Barnard and Gerber (1999) identified contemporary surgical nurses’ Category E: control of clinical practice, where they found that nurses rely on technology to control clinical practices, such as monitoring and assessing patients, or fostering relationships with patients. Nurses also depend on technology to provide care for patients and involve healthcare activities in a busy and challenging working environment. However, the authors identified views about the potential dangers of relying excessively on technology in the contemporary surgical nursing profession. For example, the authors described the nurses’ understanding of using technology to make unnecessary excessive diagnostic tests, relying more on technology than on the patients, tending to the technology rather than looking after the patients. In contrast, the present study did not identify any potential dangers in overusing ICT in workplaces. However, in Category A, this study identified that ICT
is not equally important or accessible in all sectors of professional work. For example, participants teaching in the community service profession did not find any significant use of ICT in this sector. Therefore, vocational teachers recognised that the use of ICT is not equally important in different types of industries and workplaces.

Vocational teachers perceived that employees rely on ICT for continual collaboration and engagement, which is another important aspect in Category C. This supports the findings of Munck et al. (2011), where the identified Category B: “medical technology demands collaboration” presents similar elements to the current study. However, the present study, which viewed ICT in Category C as a medium for collaboration, showed that the mentioned engagement and collaborations were limited to co-workers and clients, and related to professionals involved in similar work. Whereas, Munck et al. (2011) revealed that collaboration is not restricted to work personnel. It extends to personnel, patients and relatives, who are involved directly and indirectly in palliative homecare.

In addition, comparable elements are found in the studies of Barnard and Gerber (1999), Bruce (1999), Engström et al. (2009), Munck et al. (2011) and Forster (2013). These studies identified similar features in their revealed categories in relation to professional development and competence. These studies emphasised that the workforce needs to constantly update knowledge and skills when working with technology (IL, medical technology). The reason for similar findings in different studies is the changing nature of technology in the workplace. Technology is ever changing, and therefore personnel need to cope with the changes by updating their knowledge and skills.
This study, however, identified some distinctive aspects in the conceptions of ICT in the workplace. For example, the essence of using technology in Category A, is that *technology is out there*. In contrast, other phenomenographic studies did not reveal this. Vocational teachers in Category C viewed that both the industry and society depend on technology. This was not identified in other similar phenomenographic studies. In Category B, the view was expressed that one of the main reasons for using technology in the workplace was to increase overall profit. Again this has not been highlighted in other similar phenomenographic studies. Moreover, the present study identified vocational teachers’ conceptions of the role of ICT in professional activities in a wider context, not limited to any particular profession. Thus, their views could be summarised in three key terms: (i) a supporting role, (ii) an effective role (*accomplish a task more effectively*), and (iii) an essential role. In contrast, the other reviewed studies cited in this section were related to a specific sector, particularly the nursing profession and engineering students’ understanding of nature of technology.

In this study, the relationship between three conceptions was also investigated through the dimensions of variation across the categories, along four internally related themes: accessing and receiving information, performing the job, communication, and professional development. Most studies mentioned in the review (Section 2.5) did not identify the dimensions of variation with one exception, in Barnard and Gerber’s (1999) study. They identified four levels of dimensions of variation (Table 7.4) to draw relationships between their eight identified categories. Therefore, in terms of identifying dimensions of variation among the categories, the current study presents the above four new aspects (or dimensions), which offer a richer understanding of the
three conceptions. It also demonstrates how the conceptions deviated and are qualitatively different from each other.

7.2 Associations between conceptions of, and approaches to ICT-enhanced teaching and conceptions of ICT in the workplace

Vocational teachers in this study expressed their views and experiences regarding ICT-enhanced teaching. Table 7.5 shows the associations between conceptions of, and approaches to, ICT-enhanced vocational teaching.

The associations indicate that both conceptions and approaches are related. The table presents three groups of associated areas where 21 teachers are located. The first group, which is highlighted as group one (G1), perceives ICT-enhanced teaching as a ‘teacher-centred/content-oriented’ and this is linked with a ‘teacher-focused’ teaching approach. In group one (G1), vocational teachers who viewed ICT-enhanced teaching as a ‘teacher-centred/content-oriented’, tended to adopt a ‘teacher-focused’ approach to ICT-enhanced teaching.

The second group, which is highlighted as group two (G2), conceives of ICT-enhanced teaching as a ‘student-centred/activity-oriented’ and this conception is connected with a ‘student-focused’ teaching approach, that is, vocational teachers who hold ICT-enhanced teaching as a ‘student-centred/activity-oriented’, tended to adopt a ‘student-focused’, teaching approach and more particularly showed a student-focused, facilitation-oriented strategy (G2 in Table 7.5).
### Table 7.5 Associations between conceptions of, approaches to ICT-enhanced teaching

<table>
<thead>
<tr>
<th>Conceptions of ICT-enhanced teaching</th>
<th>Approaches to ICT-enhanced teaching</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Teacher-focused</td>
</tr>
<tr>
<td></td>
<td>A</td>
</tr>
<tr>
<td>Teacher-centred/ content-oriented</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>B</td>
</tr>
<tr>
<td></td>
<td>C</td>
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<td></td>
</tr>
<tr>
<td></td>
<td>P01, P07</td>
</tr>
<tr>
<td>Student-centred/ activity-oriented</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>P11</td>
</tr>
<tr>
<td>Student-centred/ industry-oriented</td>
<td>E</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Conceptions of ICT-enhanced teaching, ICT is used:</td>
<td>Approaches to ICT-enhanced teaching:</td>
</tr>
<tr>
<td>(A) to meet external expectations;</td>
<td>(A) a teacher-focused, information-oriented strategy with the intention of effectively delivering subject content;</td>
</tr>
<tr>
<td>(B) to gain access to information and resources;</td>
<td>(B) a teacher-focused, feedback-oriented strategy with the intention of achieving intended course outcomes;</td>
</tr>
<tr>
<td>(C) as a delivery tool;</td>
<td>(C) a teacher-focused, practice-oriented strategy with the intention of linking theoretical and practical knowledge;</td>
</tr>
<tr>
<td>(D) as a medium for active learning; and</td>
<td>(D) a student-focused, facilitation-oriented strategy with the intention of providing active learning for developing students’ understanding; and</td>
</tr>
<tr>
<td>(E) for preparing students for their future profession.</td>
<td>(E) a student-focused, industry-oriented strategy with the intention of developing students’ knowledge and skills to meet the industry’s needs.</td>
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</table>

The third group, which is marked as group three (G3), perceives ICT-enhanced teaching as a ‘student-centred/industry-oriented’ that is associated with a ‘student-
focused’ teaching approach. Primarily, in group three (G3), vocational teachers who viewed ICT-enhanced teaching as a ‘student-centred/industry-oriented’, tended to adopt a ‘student-focused’, teaching approach and showed a ‘student-focused, industry-oriented strategy’. Only one exception is found, in the description of teacher P06. While P06 described a ‘student-centred/industry-oriented’ conception, her teaching approach however, was not consistent with a ‘student-focused, industry-oriented strategy’. The approach of P06 to ICT-enhanced teaching was broadly consistent with a ‘student-focused’ approach.

Two teachers in this study had inconsistent conceptions of, and approaches to, ICT-enhanced teaching. Firstly, P10 viewed ICT-enhanced teaching as a ‘teacher-centred/content-oriented’ but tended to express a ‘student-focused’ teaching approach. Secondly, P11 perceived ICT-enhanced teaching as a ‘student-centred/activity-oriented’ but was inclined towards a ‘teacher-focused’ teaching approach (Table 7.5). However, these inconsistencies (P10, P11) may have been due to the participants’ dominant conceptions and approaches. For instance, P11’s dominant conception was Category D, but occasionally showed understanding from Categories A to C.

Thus, this study found that most teachers who hold a particular conception of ICT-enhanced teaching tend to follow a consistent approach to ICT-enhanced teaching in a vocational context. That is, vocational teachers who hold a ‘teacher-centred/content-oriented’ conception of ICT-enhanced teaching are more likely to adopt a ‘teacher-focused’ approach. Likewise, vocational teachers who hold ‘student-centred/activity-oriented’ and ‘student-centred/industry-oriented’ conceptions of ICT-enhanced teaching are more likely to adopt a ‘student-focused’ approach to ICT-
enhanced teaching. These associations support previous studies claiming that conceptions of teaching in higher education have a relationship with approaches to teaching (Donche & Van Petegem, 2011; Kember, 1997, 2009; Prosser & Trigwell, 1999; Trigwell & Prosser, 1996a).

Table 7.6 Associations between conceptions of ICT-enhanced teaching and conceptions of ICT in workplace

<table>
<thead>
<tr>
<th>Conceptions of ICT-enhanced teaching</th>
<th>Conceptions of ICT in workplace</th>
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<tbody>
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<td>A</td>
</tr>
<tr>
<td>Teacher-centred/content-oriented</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>B</td>
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<td></td>
<td>C</td>
</tr>
<tr>
<td>Student-centred/activity-oriented</td>
<td>D</td>
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<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Student-centred/industry-oriented</td>
<td>E</td>
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</table>

Conceptions of ICT-enhanced teaching, ICT is used:
(A) to meet external expectations;
(B) to gain access to information and resources;
(C) as a delivery tool;
(D) as a medium for active learning; and
(E) for preparing students for their future profession.

Conceptions of ICT in workplace, ICT:
(A) could be used for various work-related tasks (supplementary);
(B) helps to accomplish a job more effectively (effective); and
(C) is an essential tool in professional activities (obligatory).

Table 7.6 shows associations between conceptions of ICT-enhanced teaching and conceptions of ICT in the workplace for which students are prepared. The associations indicate that the two conceptions are related.

The table presents two areas of association for 21 teachers. The first area, area one (1), conceives of ICT-enhanced teaching as a ‘teacher-centred/content-oriented’
and this is linked with Categories A and B in the workplace. In this area, vocational teachers who hold ICT-enhanced teaching as a ‘teacher-centred/content-oriented’, tended to understand the role of ICT in the workplace from supplementary to effective. The second area, area two (2), perceives ICT-enhanced teaching as ‘student-centred/activity-oriented’ and ‘student-centred/industry-oriented’ conceptions and these conceptions are connected with Categories B and C in the workplace. In this area (2), vocational teachers who viewed ICT-enhanced teaching as ‘student-centred/activity-oriented and / or industry-oriented’, tended to understand the role of ICT in the workplace from effective to obligatory in nature.

However, two teachers in this study did not express conceptions that followed the stated associations. Therefore, they were not placed within the two marked areas. For example, P01 viewed ICT-enhanced teaching as a ‘teacher-centred/content-oriented’ but was inclined to express Category C (obligatory) as an understanding about the usage of ICT in the workplace. Likewise, P08 perceived ICT-enhanced teaching as a ‘student-centred/industry-oriented’ but was inclined towards Category B (effective) as his understanding about the usage of ICT in the workplace (Table 7.6). These inconsistencies could have been due to the participants’ dominant nature of conceptions. For example, P01 whose dominant conception was Category C in the workplace, occasionally showed understandings from Categories A and B.
The associations indicate that both approaches to ICT-enhanced teaching and conceptions of ICT in the workplace are related (Table 7.7). The table presents two groups of associated areas for 21 teachers. The first group, highlighted as place one (P1), conceives of approaches to ICT-enhanced teaching as a ‘teacher-focused approaches’ and this is linked with Categories A and B in the workplace. In this area, vocational teachers who hold ICT-enhanced teaching as a ‘teacher-focused’ teaching approach tended to understand the role of ICT in the workplace from supplementary...
to effective. The second area, marked as place two (P2), is included under a ‘student-focused approaches’ and these approaches are connected with Categories B and C in the workplace. In P2, vocational teachers who viewed ICT-enhanced teaching as a ‘student-focused’ teaching approach, tended to understand the role of ICT in the workplace from effective to obligatory in nature. However, two teachers did not expressing approaches to teaching that followed the above stated associations; therefore, they were not placed within the two marked areas (Table 7.7).

This study found that teachers’ conceptions of, and approaches to, ICT-enhanced teaching and conceptions of ICT in the workplace are linked (Table 7.5, 7.6, & 7.7). Vocational teachers who hold a particular conception of ICT-enhanced teaching tended to follow consistent approaches to ICT-enhanced teaching that are further linked with conceptions of ICT in the workplace. For example, vocational teachers’ who viewed a ‘teacher-centred/content-oriented’ conception of ICT-enhanced teaching are more likely to adopt a ‘teacher-focused’ approach to ICT-enhanced teaching. The teachers within this group are more likely to hold an understanding about the role of ICT in the workplace that ranges from supplementary to effective. Likewise, vocational teachers who viewed ‘student-centred/activity-oriented and / or industry-oriented’ conceptions of ICT-enhanced teaching are more likely to adopt a ‘student-focused’ approach to ICT-enhanced teaching. The teachers within this group are more likely to hold an understanding about the role of ICT in the workplace that ranges from effective to obligatory.
7.3 Implications

This section summarises the implications of the study in the areas of teachers’ professional development, vocational curriculum especially ICT-enhanced teaching and learning, and its contribution to practice, research, and methodology (theory).

7.3.1 Implications for professional development, curriculum development and teacher benefit

Introducing new and innovative ICT-supported teaching tools in the classroom is not enough to meet teachers’ teaching goals and students’ learning objectives, and these tools alone cannot not meet these teaching and learning challenges (Hodgson, 1997; Koehler & Mishra, 2005). Teachers can potentially make changes by effectively using ICT in their teaching. Effective use of ICT depends on teachers’ pedagogical knowledge of teaching and learning (Guzey & Roehrig, 2009; Koehler & Mishra, 2005; Law, 2008). Therefore, there is an increasing demand for the inclusion of ICT in professional development programs for teachers. Phenomenographic research findings were previously incorporated into professional development programs in university teaching to enhance teachers’ pedagogical competency (Åkerlind, 2008; Prosser & Trigwell, 1997). The findings of the current study provide knowledge about vocational teaching and therefore seeks to be a source of information for the improvement of vocational teachers’ pedagogical practice. (Implications for pedagogical practice are discussed in Section 7.3.2). The findings provide knowledge in terms of vocational teachers’ understanding of ICT-enhanced teaching, and information about how they approach it.
Previous research claimed that changes in teachers’ conceptions have influenced their professional development (see Ho et al., 2001; Ramsden, 1991). If teachers refuse to accept a student-focused approach to teaching (e.g., student-focused teaching approach) due to a lack of congruence with their conceptions of teaching and learning, then higher quality teaching is unlikely to emerge (see Trigwell & Prosser, 1996a). The findings of the study can serve as evidence to program designers of professional development programs, which aim to change or enhance teacher conceptions and approaches to ICT-enhanced teaching. For example, teachers who are emphasise teacher-centred conceptions of ICT-enhanced teaching may be offered academic training or professional development activity to expand their conceptions to accommodate more student-centred conceptions. This suggestion is anchored on the premise that changing vocational teachers’ conceptions has an impact on changing their teaching approaches, which then could lead to better learning outcomes for vocational students (Trigwell et al., 1999).

Understanding the way in which vocational teachers experience ICT-enhanced teaching is a valuable reminder to academic program designers of vocational education. They could benefit by remembering that teachers may hold a number of different conceptions of ICT-enhanced teaching, which otherwise may or may not align with planned activities for academic development. Programs need to foster vocational teacher conceptions in line with teaching that is more student-focused.

Teachers in vocational education could also benefit from the findings of this study. This knowledge could prompt vocational teachers to reflect on their teaching practice in the context of ICT-enhanced teaching. Consequently, vocational teachers
may develop an awareness and understanding of possible ways of experiencing ICT would contribute to improving teaching practices, thereby expecting influence on student achievement and on learning outcomes.

The present study provides empirical support for curriculum improvement initiatives. Balaba (2010) stated that a vocational curriculum should meet the demand of both industry and apprentices, courses should have connections between theory and practice that provide necessary knowledge and skills to face challenges and changes in future. The findings of this study reflect Balaba’s (2010) statement. Explicitly, two of the most relevant findings of this study are: Category E - ICT is used for preparing students for future profession, and Approach E - A student-focused, industry-oriented strategy with the intention of developing students’ knowledge and skills to meet industry needs. The former can inform vocational teachers’ thinking about ICT-enhanced teaching, giving an indication that vocational courses should emphasise the significance of what they teach to immediate employment opportunity. The latter indicates the importance of vocational education teachers practising professional and industry-oriented teaching approaches to meet the needs and demands of the industry. Thus, these two findings provide useful knowledge for curriculum development.

This study provides empirical evidence (based on the third research question) related to vocational teachers’ understanding and experience in the use of technology in the workplace. For example, vocational teachers’ understanding of ICT showed different structural components of uptake of ICT in professional practice. It provides useful knowledge in terms of the use of technology in different professions, ranging from the simple support level to the obligatory or crucial level of use in the workplace.
It is expected that teachers’ conceptions of ICT in teaching and their associated conceptions of ICT in the workplace may bring useful insights. This illustrates the importance of incorporating ICT into any vocational curriculum.

The findings of the study are also important for industry. Teachers’ conceptions and approaches (ICT-enhanced teaching and ICT in the workplace) revealed in this study reinforce improvement of teaching practice and curriculum development, thereby, providing competent graduates who will work in industry as an ICT-skilled workforce. This claim aligns with previous research that reported that teachers’ conceptions influence their teaching practice and student learning outcomes (Kember, 2009; Prosser & Trigwell, 1999). This study also revealed that teachers created a space for their students to collaborate with industry in ways that prepared them for future industrial requirements. Therefore in order to produce a ICT-skilled workforce, this study provides empirical data concerning: (i) teacher awareness towards different ways of using ICT in teaching and the workplace; and in relation to (ii) teaching practice and curriculum development.

7.3.2 Implication to practice, research and methodology (theory)

The contributions of the study for professional practice and research can be reflected in two questions: how does this study contribute to practice?; and, how does this research contribute to educational research?

Firstly, the outcomes contribute to our understanding of vocational teachers’ different ways of conceptualising and using ICT in their teaching practice. It reveals
new ways of experiencing ICT in vocational teaching that are not commonly found in university teaching. This study presents important differences that provide new aspects and features in both university and vocational teaching practice. For example, this study identified two novel conceptions of ICT-enhanced teaching. These were that ICT is being used to meet external expectations and, that ICT is being used to prepare students for their future profession. Additionally there were three novel orientations - feedback, practice and industry focused - in the teaching approach in vocational education. These emerging conceptions and approaches could be important across other forms of higher education including within the university sector.

Secondly, these findings are related to pedagogical practice in vocational education. Previous studies reported that pedagogical practice between university and vocational education is not quite same (Section 2.2.2). The findings of this study also support this argument. The study revealed through empirical data, that vocational teachers teaching practices have a connection to their theoretical knowledge and practices. For example, strong evidence links theory and practice as seen in Approach C (a teacher-focused, practice-oriented strategy with the intention of linking theoretical and practical knowledge); and evidence of independent learning is seen in Category D (ICT is used as a medium for active learning). Life-long learning and industrial involvement are important features in both Category E and Approach E where teachers use facilitative pedagogical practice. This could therefore assist students to realise their professional potential and is not explicitly limited to vocational institutions; rather it could link to a future career. In addition, the identified categories of first and second research questions revealed that ICT-enhanced teaching in vocational contexts includes a teaching technique (pedagogical practice) that is a fusion of teacher lead instruction, independent learning, collaboration, group work,
social interaction and links with theory and practice. These pedagogical principles are similarly important in other higher educational institutions such as in the university sector.

Thirdly, in relation to the third research question, vocational teachers’ conceptions of ICT in the workplace could improve pedagogical practice. Previous research found that teachers’ conceptions have a direct influence on students’ learning outcome (Prosser & Trigwell, 1999). Thus, teachers’ three ways of understanding and the four dimensions of variation about the role of ICT in the workplace have an impact on their teaching views (conceptions) and teaching approach (Tables 7.6 & Table 7.7). This links with teachers’ pedagogical practices. For instance, teachers who conceived of ICT as obligatory and effective instruments in the workplace are more likely to introduce knowledge and skills related to ICT. This means that the students will be acquainted with using different forms of ICT in the workplace. (See associations: Section 7.2) A similar possibility was mentioned by Poortman et al. (2014) in their statement that vocational teachers should help students develop their academic skills that they later apply in industry (p. 186). These associations are not only beneficial for TAFE NSW, but also important for other vocational institutions and in higher education in general.

Fourthly, the findings of the study provide new insights and knowledge for both university and vocational contexts. The study has extended prior research by investigating: (i) ICT-enhanced teaching in face-to-face and blended contexts together; (ii) a problem space related to the role of ICT in the workplace for which teachers prepare their students (Barnard & Gerber, 1999; Bliuc et al., 2012; González,
The current investigation revealed emerging research findings that contribute to bridging the gap between teaching and professional practice. It provides further insights that could promote additional initiatives to address the existing gap between teaching in higher educational institutes and current practices in the workplace where there is a particular focus on ICT.

Lastly, the study contributes in two ways in relation to research methods: (i) it was the first (to the researcher’s knowledge) phenomenographic study following a semi-structured interview protocol for investigating problems in a vocational teaching context. (ii) To investigate the third research question, phenomenography was the specific theoretical and methodological approach that has provided value to understandings of vocational teaching and to professional practices in particular and higher education in general in the form of identifying new knowledge, extending the existing methodological framework as well as making connections between teaching and practice.

7.4 Limitations

Previous research reported that teaching in tertiary education is related to education level and teaching context (Lindblom-Ylänne, Trigwell, Nevgi, & Ashwin, 2006; Lueddeke, 2003; Prosser & Trigwell, 1999; Samuelowicz & Bain, 2001). Teaching practices may vary depending on different teaching contexts, such as face-to-face, blended, and online. This study solely investigated ICT-enhanced teaching in TAFE NSW. Therefore, it is difficult to generalise the outcome space identified in this study to other vocational institutions, where the teaching context is
different, such as teaching in a face-to-face context, teaching in a vocational school or in other TAFE institution.

Some studies reported that contextual factors, such as teaching level, and teaching contexts influence teaching approaches (Kember & Kwan, 2000; Lueddeke, 2003; Prosser & Trigwell, 1997). Although demographic information such as gender, age, study area, working experience, teaching mode, industrial experience was collected for each teacher in the current study, these features were not analysed. The aim was to investigate collective variations among the participants who had prior experience about the investigated phenomena. A follow-up study focusing on how and why any of the demographic characteristics influence teachers’ conceptions and approaches is planned later.

It is important to acknowledge that the findings of this study were based on the participants’ interview data. A substantial number of previous studies also relied only on interview-based data (Åkerlind, 2004; Dall’Alba, 1991; González, 2010; Prosser et al., 1994; Trigwell et al., 1994). However, Kane, Sandretto and Heath (2002) have argued that what teachers say about teaching and what they do in the classrooms are not necessarily the same, and teachers’ reported experiences might not necessarily equate with their actual teaching practices. This limitation was addressed in part by this study through collection and analysis of the teaching material. At the end of each interview, the researcher made a request for teacher-participants to show their teaching materials related to their explanation of how they use ICT in their teaching. These materials could provide a glimpse into actual teaching practices. During the data analysis stage, the teaching materials were used as an additional data source for
interpreting the underpinning meaning of how individual participants described ICT-enhanced teaching and their way of using it.

The major limitation of phenomenography as a research approach is often described as its perceived lack of validity, data analysis procedure and its denial of consideration towards individual voice for constructing categories of description (Åkerlind, 2012; Bowden, 2000). The detailed discussion is listed as bellow:

(i). The phenomenographic outcome space has been the subject of criticism because it is an interpretive process where interview data are classified by researchers in the interpreted context, that is, in terms of how phenomena are experienced by the participants (Åkerlind, 2012). In relation to ensuring validity in this study, the communicative and the pragmatic validity check were applied. Validity in this context does not mean a measurable reality; rather it means the appropriate categorisation of experiences of people in a given context. Thereby, ensuring validity was one of the concerns in this research approach. The details appear in Section 3.5.1.

(ii). The analysis of phenomenographic data could be improved by investigating with a group of researchers working in a team. Being a single researcher in this research, I accepted every opportunity to consult with peer groups and supervisory teams while the analysis process was carried out. A detailed discussion appears in Section 3.4.4. However, analysis by an individual researcher is an accepted practice (Åkerlind, 2012).

(iii). Another limitation of using phenomenography as a research approach is not to focus on individual participants’ experiences to construct categories of description (Åkerlind, 2012). That is, the outcome space in phenomenographic research is
identified through a collective analysis. It examines the understanding and experiences of a group of people rather than what an individual participant could comprehend. Therefore, this study combined the experiences of individual participants regarding ICT-enhanced teaching and the role of ICT in the workplace. This means that the overarching experience of the group is of primary importance, however, this then becomes a limitation too – the focus on the collective experience tends to discount a detailed description of individual differences.

It is also acknowledged that the researcher was aware of the limitations associated with phenomenographic research and these limitations were carefully considered in order to minimise their effect on the final outcome. However, phenomenographic research methods provided a powerful way of investigating and describing how vocational teachers in a specific context experience the chosen phenomena (Roisko, 2007).

7.5 Suggestions for future research

The research problems investigated and their corresponding findings revealed the need for further research. In particular, the participants were recruited from three TAFE institutes in NSW. The experience of ICT-enhanced teaching in other institutes or other states may result in an expansion of the meanings discovered. These could depend on different factors: (i) different levels of ICT integration in classrooms; (ii) changing contexts from state to state; and (iii) the inclusion of participants from a wider range of disciplines, such as building and construction, early childhood education and care, counselling, and mental health. Therefore, it would be useful to
conduct a similar study on a wider scale, recruiting participants nationwide, from TAFE institutions and other similar vocational education providers, and therefore covering a larger sample.

As noted, previous research showed that what teachers said during interviews may or may not be congruent with their actual teaching practices (Kane et al., 2002). Though class observations were not conducted in the present study, further research may focus on the congruence of teachers’ interview statements with their practice in the classroom. It would be valuable to conduct further studies where both the interviews and the observations are conducted with the same participants.

Previous research reported that teachers’ approaches have a relationship with the discipline taught (see Becher, 1994; Lindblom-Ylänne et al., 2006; Lueddeke, 2003; Neumann, 2001; Neumann & Becher, 2002). Further research could investigate teachers’ conceptions of, and approaches to, teaching in specific disciplines. For example, teachers who teach in business, IT, engineering or social science may perceive and use ICT differently. However, participants, in this study, were recruited from a range of disciplines and outcome spaces were revealed based on participants’ collective awareness. Therefore, a separate study could investigate focusing on a particular discipline, and the main aim of the proposed future research would be to investigate how teachers approach their teaching in those disciplines.

Research on student conceptions of, and approaches to, ICT-enhanced learning in vocational education is a new area of investigation. For that reason, future research is proposed to investigate the relationship between teachers’ conceptions of, and
approaches to, ICT-enhanced teaching and students’ conceptions of, and approaches to, ICT-enhanced learning in vocational education. The main aim of conducting such research is to determine how vocational teaching and learning are related and how those practices have an impact on students’ learning outcomes.

7.6 The researcher experience

The researcher faced many challenges while conducting this research across three broad stages:

*Before commencing the research:* The researcher’s intention was to investigate vocational teachers’ experiences of ICT-enhanced teaching and finding out any reason for any disconnection between teaching practice and workplace practice. There were three underlying reasons for choosing this phenomenon for the PhD research: The researcher had expertise in technical and vocational education (TVE) and his research area was ICT integration in a TVE context. The researcher was interested in investigating why vocational teachers follow different teaching styles even though they are associated with the same teaching context. Thirdly, the researcher was aware of the disconnection between teaching practice in TVE and current workplace practice. In order to incorporate the researcher’s interest, phenomenography was chosen as the theoretical and methodological framework. The challenge was to combine the three stated reasons into a problem area that could cover both vocational teaching and workplace practice using a phenomenographic approach. During this stage, the researcher assessed many related articles to understand the problem areas and to
understand the existing literature. This was a necessary process to improve his expertise to conduct the research.

*During the research:* As a novice researcher, I needed to know and learn the required techniques to conduct the phenomenographic research effectively. During this stage, special focus was dedicated to the methods of conducting phenomenographic interviews, and later on the generation of verbatim transcripts from interview data, analysing the phenomenographic data, discerning outcome spaces and building relationships among the outcome spaces. A number of books such as *Learning and Awareness* (Marton & Booth, 1997), and *Doing Developmental Phenomenography* (Bowden & Green, 2005) as well as related articles were the resource materials for learning about the phenomenographic approach. Numerous confusions and ambiguities that arose whilst conducting the research were explained by consulting with a peer group (colleagues: current PhD students, post-doc researchers and PhD alumni) who had previous experiences in phenomenography as well as the supervisory team.

In order to conduct phenomenographic interviews skilfully as a non-native English speaker, the researcher followed Bowden’s (2005) recommendations: “pilot interviews are important to enable the interviewers to perfect their phenomenographic interviewing skills” (p. 19). Thus, the pilot study was not only crucial for gaining necessary interview skills but also in building the researcher’s confidence. During the analysis process (interpretation of meaning from interview data), context is an important aspect to unveil the meaning in a phenomenographic approach (Bowden, 2000). By accepting this notion, the researcher transcribed 23 interviews in order to
better understand the content and the associated context of the data. During this stage, I learned the usage of the NVivo software to manage the vast amount of qualitative data. The last challenge was to confirm the final ‘outcome spaces’ and to build relationships between the identified categories. This process mainly involved reading the transcripts several times that is, a read and re-read strategy. In this stage, the researcher learned how to negotiate with the supervisory team to finalise the categories of description, thereby confirming the final outcome spaces. It was an opportunity to critique through an interpretative process and to find verifiable ways in which the categories were developed.

After finalising the outcome spaces: The challenge was to discover relevant research communities for presenting the outcome spaces. The initial results were presented and discussed with scholars of the Higher Education Research and Development Society of Australia (HERDSA) and the Australian Society for Computers in Learning in Tertiary Education (ASCILITE). The researcher received feedback from one conference run by each organisation and incorporated the feedback into the thesis. This step also helped to ensure the validity and reliability of this study.

In summary, the following experiences listed may assist others when conducting a phenomenographic study:

- In order to acquire deeper knowledge and understanding about a phenomenographic research approach, it was necessary to read a large number of related books and articles.

- A pilot study was helpful to achieve the necessary skills for conducting phenomenographic interviews. Conducting all interviews by a single
researcher were beneficial to reduce researcher bias, to complete interviews in an identical fashion.

- Transcribing all audio files without assistance from others allowed for a much deeper understanding about interview data and interview contexts. These provided additional benefits during data analysis and finding stages.
- Consulting with scholars (peer groups, colleagues, supervisory team and others) with phenomenographic experience was an effective way to learn about appropriate ways to conduct phenomenographic research.

7.7 Conclusions

This study aimed to investigate vocational education teachers’ ways of understanding ICT-enhanced teaching, and their views on the use of ICT in the workplace. Three research questions were investigated.

1. What does ICT-enhanced teaching mean to TAFE teachers?
2. How do TAFE teachers approach teaching with ICT?
3. What does ICT mean to TAFE teachers when it is used in professional activities?

This study involved phenomenographic interview-based qualitative inquiry. The over-arching features of the findings that emerged from the first two research questions were consistent with previous phenomenographic studies. For example, ICT is viewed as a way to “gain access to information and resource”, as a “delivery tool”, and as “a medium for active learning”; and the meanings of these categories are found in other phenomenographic studies. The main findings of this study were consistent with “teacher-centred” and “student-centred” teaching frameworks.
The study also identified new understandings of teaching in tertiary education. Specifically, this study revealed two novel conceptions of ICT-enhanced teaching in professional education: ICT is used to “meet external expectations”, and it is used to “prepare students for their future profession”. In relation to approaches to ICT-enhanced teaching, this study supports the “teacher-focused” and “student-focused” approaches to teaching frameworks. However, this study identified three new elements in the existing strategy frameworks: feedback-oriented, practice-oriented and industry-oriented. This study contributes to existing literature in terms of providing extended knowledge in relation to ICT-enhanced teaching in tertiary education in general, and vocational education in particular. This study discussed rich accounts of vocational teaching that build on previous phenomenographic studies (Bliuc et al., 2012; Ellis et al., 2009) and included the dimensions of variation among the identified categories of conceptions. It also investigated approaches to ICT-enhanced teaching by following intention and strategy frameworks.

In relation to third research question, this research contributes to the literature of professional education by providing new knowledge in relation to the use of technology in the workplace. It builds relationship between vocational teachers’ ICT-enhanced teaching practices and the role of ICT in the workplace which may further provide empirical evidence reducing the gap between instructional approaches and workplace practices. Additionally, vocational teachers’ ways of conceptualising the role of ICT in professional activities are an addition to the existing literature.
The outcomes presented in this thesis are expected to have implications for current practice in vocational education and for future research. In relation to their implications for practice, the results of this study contribute in several ways: (i) they provide important knowledge about the impact ICT has on vocational teachers’ teaching – it could be used in academic development programs; (ii) curriculum developers and course designers may incorporate the findings in their work processes such as in curriculum and course design; (iii) industries and other relevant professions will benefit by knowing more about vocational teachers’ understandings of ICT in the workplace; and (iv) vocational teachers could be influenced directly and indirectly by this study which might be a means for improving their pedagogical practice in relation to ICT-enhanced teaching.

In relation to future research, this study suggests that it would be beneficial to investigate vocational students’ conceptions of, and approaches to, ICT-enhanced learning. Further, it would also be beneficial to explore the relationships with teachers’ conceptions of, and approaches to, ICT-enhanced teaching. Additional exploratory research could address these aspects within specific disciplinary areas, by recruiting participants nationwide and by identifying the relationship between teachers’ conceptions of ICT-enhanced teaching and associated conceptions of ICT in the workplace. Certainly, more studies could explore new facets of this subfield in vocational education research.

To conclude, relatively little research has focused on vocational teachers’ conceptions of, and approaches to, ICT-enhanced teaching, or on variations in their understanding of the use of ICT in the profession. None has investigated those aspects
within the context of NSW TAFE. The present study has addressed some important gaps in our understanding of these issues. The results can be used to inform a number of areas of planning, related to the enhancement of vocational education, as well as to identify some promising points of departure for further research.
References


Bowden, J. (2000). The nature of phenomenographic research In J. Bowden & E. Walsh (Eds.), *Phenomenography* (pp. 1-18). Melbourne: RMIT University Press.


Law, N. (2008). Teacher learning beyond knowledge for pedagogical innovations with ICT. In J. Voogt & G. Knezek (Eds.), *International Handbook of Information Technology in Primary and Secondary Education* (pp. 425-434): Springer US.


Parry, O., & Mauthner, N. S. (2004). Whose data are they anyway?: practical, legal and ethical issues in archiving qualitative research data. *Sociology*, 38(1), 139-152.


Appendices

Appendix 1. Participant Information Statement (PIS)

PARTICIPANT INFORMATION STATEMENT

(1) What is the study about?

This study seeks to determine the conceptions of TAFE teachers on the use of ICT in their teaching and in the professional field. It also seeks to investigate their approaches to teaching when using ICT and whether disciplines have any influence on teachers’ conceptions and teaching practices.

(2) Who is carrying out the study?

This study is being conducted by a PhD student Shahadat Khan, studying at the Centre for Research for Computer Supported Learning and Cognition (CoCo) at the University of Sydney’s Faculty of Education and Social Work under the supervision of Dr. Lina Markauskaite, Senior Lecturer eResearch and Professor Peter Goodyear, Co-director, Centre for Research on Computer Supported Learning and Cognition.

(3) What does the study involve?

This study involves interviews and you will be invited to be interviewed at a time suitable for you. The interview will take place in your office or other place convenient to you. The interview will focus on your experience and understanding regarding ICT while you are using it in your teaching and profession.

(4) How much time will the study take?

The interview will take 40-60 minutes.

(5) Can I withdraw from the study?

Yes. Being in this study is completely voluntary - you are not under any obligation to consent and - if you do consent - you can withdraw at any time without affecting your relationship with the University of Sydney, or your TAFE institution and without having to give a reason. If you decide to withdraw from the study, please inform Dr. Lina Markauskaite (telephone: +61 2 9036 5320, email: lina.markauskaite@sydney.edu.au) or Shahadat Khan (telephone: +61423709814, email: skha8285@uni.sydney.edu.au).
(6) Will anyone else know the results?

All aspects of the study, including results, will be strictly confidential and only the researchers will have access to information about participants. A report of the study will be prepared in the form of a doctoral thesis and may be submitted for a conference or journal publication. Individual participants will not be identifiable in such reports.

(7) Will the study benefit me?

While there are no direct benefits to the participants, as there is no reward or reimbursement for participation in this study, but there may be indirect benefits in terms of the findings of this study contributing to the better integration of ICT into TAFE curriculum and teachers’ professional development.

(8) Can I tell other people about the study?

Yes.

(9) What if I require further information about the study or my involvement in it?

When you have read this information, the researchers will discuss it with you further and answer any questions you may have. If you would like to know more at any stage, please feel free to contact Dr. Lina Markauskaite (telephone: +61 2 90365320, email: lina.markauskaite@sydney.edu.au) or Shahadat Khan (telephone: +61413357675, email: skha8285@uni.sydney.edu.au).

(10) What if I have a complaint or any concerns?

Any person with concerns or complaints about the conduct of a research study can contact The Manager, Human Ethics Administration, University of Sydney on +61 2 8627 8176 (Telephone); +61 2 8627 8177 (Facsimile) or ro.humanethics@sydney.edu.au (Email).

This information sheet is for you to keep
Appendix 2. Participant Consent Form

PARTICIPANT CONSENT FORM

I, ......................................................................................................................[PRINT NAME], give consent to my participation in the research project

TITLE: Technical and Vocational Education (TVE) teachers’ conceptions of and approaches to ICT in professional education

In giving my consent I acknowledge that:

1. The procedures required for the project and the time involved have been explained to me and any questions I have about the project have been answered to my satisfaction.

2. I have read the Participant Information Statement and have been given the opportunity to discuss the information and my involvement in the project with the researcher/s.

3. I understand that being in this study is completely voluntary – I am not under any obligation to consent.

4. I understand that my involvement is strictly confidential. I understand that any research data gathered from the results of the study may be published however no information about me will be used in any way that is identifiable.

5. I understand that I can withdraw from the study at any time, without affecting my relationship with the researcher(s) or the University of Sydney or TAFE institution now or in the future.

6. I understand that I can stop the interview at any time if I do not wish to continue, the audio recording will be erased and the information provided will not be included in the study.

7. I consent to:

- Audio-recording  YES ☐ NO ☐
- Receiving Feedback YES ☐ NO ☐

If you answered YES to the “Receiving Feedback” question, please provide your details i.e. mailing address, email address.
Appendix 3. The interview schedule

This interview schedule is semi-structured and designed to be used flexibly during interviewing teaching staff. The interviewer will concentrate on the enlisted questions.

1. Commencing with the purpose of the project

I would like to introduce the project briefly: The project focuses on TAFE teachers’ perceived understanding or how you conceptualised about ICT-enhanced teaching. It also focuses on teaching style while you use ICT in your teaching in different disciplines and how you think about ICT when it is used in profession.

- ICT is the acronym for Information and Communication Technology.
- Profession refers to any occupation that requires knowledge and skill from any recognised technical and vocational institution, for example TAFE institutions, such as: Sydney Institute of TAFE, Western Sydney Institute of TAFE.

As aforementioned, I would like to request for your permission to record the interview because it will be transcribed along with others and the collected data
from this study will use pseudonyms and your identity will be kept confidential. Is it ok if the interview is recorded?

Beginning of the interview: the total interview has been designed in three phases:

1. **Introduction and background of the interviewee (10 minutes)**

   1. First, could you tell me what is your current role of teaching at your institution?
   2. What is your teaching experience as a teaching staff in TAFE?
   3. Do you teach face-to-face only or do you conduct any online courses?
   4. What do you teach with ICT (briefly)?

   **Probes:**
   i. What kind of ICT tools do you use for your teaching in the course?
   ii. How long have you been teaching with ICT?

2. **Conceptions of ICT-enhanced teaching (Approx. 15 minutes)**

   1. What does ICT in teaching mean to you?
   (If they ask for further clarification, I will ask them in another way: What do you understand by ICT in teaching)

   **Probes:**
   i. Why do you think [this]?
   ii. Could you explain more about [this]?

   2. Why do you use ICT in your teaching?

   **Probes:**
   i. Could you provide more reasons?

3. **Approaches to ICT-enhanced teaching (Approx. 15 minutes)**

   1. What do you teach with ICT?
   2. Which disciplines (courses) do you teach? Describe all courses that you teach with ICT?

   **Probes:**
   i. Do you always teach in one course? If yes, go for question 3
   ii. If no, I would like to request you to pick up one specific course (then go for question 3)

   3. How do you teach by using ICT? (If they ask for further clarification, I will ask them in another way: How do you use ICT in your teaching?)
Probes:
   i. Could you explain more [about this]?
   ii. How often do you use ICT in your teaching?
   iii. For what purposes do you use ICT?

4. In what ways do you think students are involved while using ICT in teaching?

Probes:
   i. What do students do with ICT?

I would like to request you to show me your teaching materials after the interview.

4. Teaching disciplines (Approx. 5-10 minutes)

You have informed me before that you have been teaching in different disciplines. Do you use ICT differently? (Could you explain in more details how you go differently)
Probes:
   • Why do you teach it that way?

5. Conceptions of ICT in profession (Approx. 15 minutes)

1. Based on your experiences, what does ICT mean to you when ICT is used in profession? (If they ask for further explanation or are unsure: I will ask it another way: How could ICT be used in professions?)

Probes:
   i. What are the purposes of using ICT in profession?
   ii. What kinds of jobs are performed using ICT? Can you give some examples?
   iii. What are the possible benefits and limitations of using ICT in professions?

Show Me: I would like to request you to show me your teaching materials, any specific software or website that you use during your teaching with ICT.

Probes:
   i. Do you use them frequently? I mean, do you always use the same teaching materials, software, website?

Closing of the interview

Before we finish, is there anything else you would like to include or explain that you have not already mentioned?
Appendix 4. Individual participant’s information

Participant No: P03
Participant Institute: T2
Participant ID: P03-T2

Important Note

- How to communicate with students: Module, forum and website (no email)
- Use CLAMS software for student record and attendance. Records students’ activities to help with necessary steps for administrative decisions. This software is a part of TAFE intranet. He also used TAFE internal software for students’ assessment and attendance
- He used online discussion and wiki space
- How to communicate with staff: Face to face preferred

<table>
<thead>
<tr>
<th>Teacher ID</th>
<th>Institution ID</th>
<th>Gender</th>
<th>Discipline</th>
<th>Employment level</th>
<th>Teaching with ICT mode</th>
<th>Experience of teaching with ICT</th>
</tr>
</thead>
<tbody>
<tr>
<td>P03</td>
<td>T2</td>
<td>Male</td>
<td>Electrical</td>
<td>Full time</td>
<td>Face-to-face, blended, online</td>
<td>16 - 20 years</td>
</tr>
</tbody>
</table>
Appendix 5. Letter of invitation to participants

Email to the Head Teacher

Dear Sir/Madam

I am a PhD student at the Centre for Research on Computer Supported Learning and Cognition (CoCo), at the University of Sydney. Currently I am doing research in the area of TAFE education and the research is titled:

“Technical and Vocational Education (TVE) teachers’ conceptions of, and approaches to Information and Communication Technologies (ICT) in professional education”.

As a part of my research project I am conducting interviews with TAFE teachers who use ICT in their teaching, and looking for teachers who might volunteer to participate in my study. I would appreciate it if you forwarded the attached invitation to participate in my study to all teachers in your department.

I have also attached the Participant Information Statement that provides more information about the research project. This study been approved by Human Ethics Research Committee (HERC) of the University of Sydney and your institution. If you have any questions or would like to get more information about the study, please feel free to contact me (email: skha8285@uni.sydney.edu.au; phone: 0413 357 675) or my supervisor Dr. Lina Markauskaite (lina.markauskaite@sydney.edu.au).

With thanks for your assistance.

With best wishes,

Shahadat Hossain Khan
Ph. D Candidate
Centre for Research on Computer Supported Learning and Cognition (CoCo)
Faculty of Education and Social Work
The University of Sydney,
Dear Teacher

I am a PhD student at the Centre for Research on Computer Supported Learning and Cognition (CoCo), at the University of Sydney. I am doing research in the area of Information and Communication Technologies (ICT) in TAFE. In particular, I am interested in TAFE teachers’ views about the role of ICT in the discipline or profession that they teach and how they use ICT in their teaching.

If you have been using ICT in your teaching for at least one year, I would appreciate it if you agreed to participate in my study. This will involve your participation in one interview, expected to last approximately 1 hour, that will be arranged at time and place convenient for you. More information about the study is provided in the attached Participant Information Statement. If you are interested in participating in the study, please contact me by email (skha8285@uni.sydney.edu.au) or phone (0413 357 675). If you have any questions or would like further information about the study, please feel free to contact me by email or phone, or my supervisor Dr. Lina Markauskaite (lina.markauskaite@sydney.edu.au).

With best wishes,

Shahadat Hossain Khan
Ph. D Candidate
Centre for Research on Computer Supported Learning and Cognition (CoCo)
Faculty of Education and Social Work
The University of Sydney,
NSW, Australia
Appendix 6. The development of the categories of description across time

Appendix 6.1 The development of the categories of description over time: conceptions of ICT-enhanced teaching

The aim of this section is to examine the progress of developing categories of descriptions based on the completion of analysis cycle from the beginning to the end. The final five categories of descriptions emerged through an iterative process over many months. These categories have been developed from three distinct stages:

1. Initial stage;
2. Peer group stage; and
3. Supervisory team stage

Five versions were revealed throughout the analysis process and are presented in the following table.

*Initial stage:* The initial stage consisted of an independent analysis process in which the researcher worked solo. It started with the first iteration of transcripts and ended after the fifth iteration. Version 1 was derived from this stage.
Table A.1: Showing the process of developing the final outcome space (Conceptions of ICT-enhanced teaching)

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<tbody>
<tr>
<td>A</td>
<td>Fulfilling academic requirement</td>
<td>Academic requirement</td>
<td>Academic requirement</td>
<td>Social challenge Or External expectations</td>
<td>External expectations</td>
</tr>
<tr>
<td>B</td>
<td>Digital tool for getting and transmitting info</td>
<td>Access and Transmit info</td>
<td>Access information</td>
<td>Access information</td>
<td>Access to info and resources</td>
</tr>
<tr>
<td>C</td>
<td>Accelerate teaching</td>
<td>Accelerate teaching</td>
<td>Delivery tool</td>
<td>Delivery tool</td>
<td>Delivery tool</td>
</tr>
<tr>
<td>D</td>
<td>Communication</td>
<td>Communication</td>
<td>Engaging students</td>
<td>Active learning</td>
<td>Active learning</td>
</tr>
<tr>
<td>E</td>
<td>Engaging students</td>
<td>Engaging students</td>
<td>Prepared students for desired profession</td>
<td>Preparing for future profession</td>
<td>Preparing for future profession</td>
</tr>
<tr>
<td>F</td>
<td>Prepar students for desired profession</td>
<td>Prepared students for desired profession</td>
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</table>
**Peer group stage:** The peer group stage evolved from the scope of work accompanying the consultation conducted with peer groups who had phenomenographic experience. The intention of the peer group discussion was to make sure that the categories of descriptions had valid meaning and covered the full range of perspectives and themes. After discussing with a peer group, Version 2 emerged. At this point, the researcher read the transcripts again attempting to keep an open mind and checked the categories of descriptions that developed during Version 2. At the end of this review, the researcher derived Version 3 with slight modifications to Version 2 (Table A.1).

**Supervisory team stage:** The supervisory team stage was the final version of categories of descriptions, through back and forth discussions with the supervisory teams. Initially, Version 4 was revealed after a meeting with the supervisory team. The discussion with the researcher’s supervisor was based on Version 3 in terms of the related definition and explanation set for each category as well as verbatim quotations from transcripts. After the first meeting, the researchers inserted all 23 transcripts into NVIVO software and re-read them to keep an open mind and checked with Version 4. At the end of this stage, Version 5 was developed with very little modification from the former version. Finally, the five categories of descriptions were confirmed by the supervisory teams.

Appendix 6.2 The development of the categories of description over time: approaches to ICT-enhanced teaching

This section is primarily focused on the development process of the categories of
descriptions that took place throughout the analysis. The final five (5) approaches were drawn from an iterative process that was conducted over many months. These are the five versions that progressed over the analysis phase of the study as shown in table A.2. This section describes the evolvement process of these versions through an analysis timeline comprising of three stages: (i) initial stage; (ii) peer group stage; and (iii) supervisory team stage.

**Initial stage:** The initial stage was basically an independent stage that consisted of no group discussions. It began with the first iteration of the transcripts and ended at the sixth. ‘Version 1’ was initially revealed after the fifth iteration. Then all twenty-three transcripts were inserted into the NVIVO software. ‘Version 2’ was founded after the researcher started to re-read the transcripts, which finally checked and matched with the former version.

**Peer group stage:** At this stage the analysis process was anchored on inputs from group discussions. This represents the consultation(s) with peer groups who had previously experienced phenomenography and similar research methods. The main purpose of these group discussions was to make sure that the categories of descriptions identified were authentic and genuine in order to add more insights into the analysis process. During this stage, the researcher shared his experience of discovering the categories of descriptions with peer groups and consequently bringing out ‘Version 3.’ At this point, the researcher also began re-reading the transcripts several times with an open mind and also checked on the categories of descriptions that emerged during ‘Version 2’. This stage was completed on the 7th iteration.
Table A.2: Showing the process of developing the final outcome space (Approaches to ICT-enhanced teaching)

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</thead>
<tbody>
<tr>
<td>A</td>
<td>An information-focused strategy with the intention of providing instruction to draw student’s attention and cover the topic in time</td>
<td>An information-focused strategy with the intention of providing instruction to draw student’s attention and cover the topic in time</td>
<td>An information-focused strategy with the intention of providing information to draw the students’ attention and cover the topic on time</td>
<td>An information-focused strategy with the intention of providing information to draw the students’ attention and cover the topic on time</td>
<td>An information-focused strategy with the intention of providing information to achieve the goal of effective delivery of content</td>
</tr>
<tr>
<td>B</td>
<td>An information-focused strategy with the intention of completing instruction with a scope for providing immediate feedback</td>
<td>An information-focused strategy with the intention of completing instructions with a scope for providing immediate feedback</td>
<td>An information-focused strategy with the intention of providing immediate feedback to make sure that students’ achieve the subject’s objective or concept of the subject</td>
<td>An information-focused strategy with the intention of providing immediate feedback to make sure that students achieve the subject’s objective</td>
<td>An information-focused strategy with the intention of providing immediate feedback to make sure that students achieve the subject’s objective</td>
</tr>
<tr>
<td>C</td>
<td>An information-focused strategy with the intention of providing structural subject materials (structured course contents) with a little scope for student engagement</td>
<td>An information-focused strategy with the intention of providing latest materials with a little scope for student engagement</td>
<td>An information-focused strategy with the intention of providing latest materials to achieve the subject’s objectives or concept of the subject</td>
<td>An information-focused strategy with the intention of providing practical tasks to students in order to achieve subject’s basic principles and standards</td>
<td>An information-focused strategy with the intention of incorporating theoretical and practical knowledge</td>
</tr>
<tr>
<td>D</td>
<td>A student-learning focused strategy with the intention of providing flexible learning to achieve the subject’s objective.</td>
<td>A student-learning focused strategy with the intention of engaging students in their own learning to achieve the subject’s objective (engaging or active learning)</td>
<td>A student-learning focused strategy with the intention of providing students with the opportunity for self-paced learning</td>
<td>A student-learning focused strategy with the intention of providing a space for active learning in order to develop students understanding</td>
<td>A student-learning focused strategy with the intention of providing a space for active learning in order to develop students understanding</td>
</tr>
<tr>
<td>E</td>
<td>A student-learning focused strategy with the intention of engaging students to their own projects to maintain industrial requirement.</td>
<td>A student-learning focused strategy with the intention of engaging students in their own projects to maintain industrial requirement</td>
<td>An industry-need focused strategy with the intention of a space for the students’ collaboration to satisfy industry requirements and standards</td>
<td>An industry-need focused strategy with the intention of developing students knowledge and skills to satisfy industry requirements and standards</td>
<td>An industry-need focused strategy with the intention of developing students knowledge and skills to satisfy industry requirements and standards</td>
</tr>
<tr>
<td>F</td>
<td>A student-learning focused strategy with the intention of having a space for students collaboration for developing their knowledge and skills for their profession</td>
<td>A student-learning focused strategy with the intention of having a space for students collaboration for developing their knowledge and skills for their profession</td>
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<tr>
<td>Approaches</td>
<td>Version 6 (After third meeting with supervisor)</td>
<td>Version 7 (After fourth meeting with supervisor)</td>
<td>Version 8 (After fifth meeting with supervisor)</td>
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<td>---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------</td>
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</tr>
<tr>
<td>A</td>
<td>An information-focused strategy with the intention of providing information towards the goal of effective delivery of content</td>
<td>A teacher-focused information oriented strategy with the intention of effectively delivering subject content</td>
<td>A teacher-focused information oriented strategy with the intention of effectively delivering subject content</td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>An information-focused strategy with the intention of providing immediate feedback to make sure that students achieve their learning objective</td>
<td>A teacher-focused feedback oriented strategy with the intention of achieving intended course outcomes</td>
<td>A teacher-focused feedback oriented strategy with the intention of achieving intended course outcomes</td>
<td></td>
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</tr>
<tr>
<td>C</td>
<td>An information-focused strategy with the intention of incorporating theoretical and practical knowledge</td>
<td>A teacher-focused practice oriented strategy with the intention of linking theoretical and practical knowledge</td>
<td>A teacher-focused practice oriented strategy with the intention of linking theoretical and practical knowledge</td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td>A student-focused learning strategy with the intention of providing a space for active learning in order to develop students’ understanding</td>
<td>A learning-focused activity oriented strategy with the intention of creating a space for active learning</td>
<td>A student-focused facilitation-oriented strategy with the intention of providing active learning for developing students’ understanding</td>
<td></td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>An industry-need focused strategy with the intention of developing students’ knowledge and skills to satisfy the requirements and standards of industry practice</td>
<td>A learning-focused industry need oriented strategy with the intention of developing students’ knowledge and skills to meet industry’s needs</td>
<td>A student-focused industry need oriented strategy with the intention of developing students’ knowledge and skills to meet industry’s needs</td>
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</table>
**Supervisory team stage:** The final categories of descriptions were revealed by the back and forth discussions with the supervisory teams. A meeting with the supervisory teams on ‘Version 3’ led to the development of ‘Version 4’. The discussion was based on the former version (Version 3) and related definitions and explanations set for each category and the associated verbatim citations from the transcripts. The first meeting had been concluded with a few suggestions, such as adding more verbatim citations from transcripts in order to elucidate each category of descriptions. At the end of this stage, ‘Version 5’ was developed with very little modification from Version 4. Later, the five categories of descriptions were confirmed by the supervisory teams. In addition, the final outcome spaces (‘Version 5’) were presented to the relevant research community in order to check if the findings in terms of themes or conjectures were inferred properly.

Appendix 6.3 The development of the categories of description over time: conceptions of ICT in workplace

This section mainly focuses on the overview of developing progress of the category descriptions throughout the analysis phase of the study. The final three categories of descriptions were developed through an iterative process over many months. There are five versions (Table A.3) that were revealed over the analysis process. The whole development process, however, was divided into three separate stages through which these categories had been discovered. Three stages are as below:
Table A. 3: Showing the way of getting final version (shifting the categories) (Conceptions of ICT in workplace)

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</thead>
<tbody>
<tr>
<td>A</td>
<td>Keep people informed</td>
<td>Accessing information</td>
<td>Information access</td>
<td>Accessing and receiving information</td>
<td>Basic Use</td>
</tr>
<tr>
<td>B</td>
<td>Tools for performing job</td>
<td>Tools for performing job</td>
<td>Performing job</td>
<td>Performing Job</td>
<td>Work efficiency</td>
</tr>
<tr>
<td>C</td>
<td>Efficient tools</td>
<td>Efficient tools</td>
<td>Work efficiency</td>
<td>Work efficiency</td>
<td>Necessity</td>
</tr>
<tr>
<td>D</td>
<td>Basic tools for accomplishing work</td>
<td>Basic tools for accomplishing work</td>
<td>Necessities</td>
<td>Necessity</td>
<td></td>
</tr>
<tr>
<td>E</td>
<td>Communication</td>
<td>Communication</td>
<td>Networking</td>
<td>Networking/communication</td>
<td></td>
</tr>
<tr>
<td>F</td>
<td>Professional development</td>
<td>Professional development</td>
<td>Professional development</td>
<td>Professional development</td>
<td></td>
</tr>
<tr>
<td>Category</td>
<td>Version 6 (After third meeting with supervisor)</td>
<td>Version 7 (After fourth meeting with supervisor)</td>
<td>Version 8</td>
<td>Version 9</td>
<td></td>
</tr>
<tr>
<td>----------</td>
<td>-----------------------------------------------</td>
<td>-----------------------------------------------</td>
<td>-----------</td>
<td>-----------</td>
<td></td>
</tr>
<tr>
<td>A</td>
<td>used to support professional tasks</td>
<td>Used for various work related tasks</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>B</td>
<td>accomplish a job effectively</td>
<td>accomplish a job more effectively</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>C</td>
<td>unavoidable tools for continuing the present professional activities</td>
<td>an essential tool in professional activities</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>E</td>
<td></td>
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<tr>
<td>F</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Initial stage: In this phase, the researcher worked independently, starting with the first iteration of the transcripts and ending after the 7th iteration. Initially, ‘Version 1’ was derived after the 6th iteration. Likewise, at such point, the researcher inserted all transcripts into the NVIVO software to re-read with a free mind. At the end of this stage, ‘Version 2’ emerged with a little shift from ‘Version 1’.

Peer group stage: This stage was conducted to ensure the categories of descriptions were original and to expand these to the fullest range of possible perspectives. It occurred through peer group discussion from which ‘Version 3’ was produced. At this stage, the researcher started to re-read the transcripts again with an open mind and checked the categories of description which were finalized during peer group discussion. Ultimately this stage ended up with the eighth iteration.

Supervisory team stage: This stage constituted the evolvement of the final version of the categories of descriptions through back and forth discussions with the supervisory teams. Initially, ‘Version 4’ was revealed from the first meeting with the supervisory team. The meeting-discussion centered on ‘Version 3’ that yielded the associated definitions and explanations for each category and with relevant citations. This first meeting concluded with a few suggestions and new directions for reflection towards the construction of categories of descriptions. At the end of this stage, ‘Version 5’ was revealed from a large amount of modifications of Version 4. These final outcome spaces were embedded based on the results of previous meetings with the supervisory teams and from careful analyses of representative verbatim transcriptions. ‘Version 5’ as the final outcome was also confirmed during a meeting of the supervisory team.
Appendix 7. Works published from this thesis


Appendix 8. Detailed review of studies focusing on ICT in vocational education context

Recently, Armatas and Papadopoulos (2005) conducted a mixed-method study that focused on evaluating vocational ICT courses in Australia. The participants consisted of 17 program staff, 18 students and 2 industry partners who were engaged in interviews while another set of 42 students participated in an online survey. This study reported significant benefits for both students and educators with regard to industrial engagement and developing collaborative networks. For example, students could understand the relationship between theory and practice, and how their knowledge and skills connected with work. As a result, students could transfer the knowledge and skills they learned in the classroom to the workplace. The staff members also benefitted when they shared their experiences and witnessed the success of the programs. However, this study mentioned that finding an accommodating industry as a potential partner is the main challenge to integrate ICT courses with industrial involvement.

Similarly, Jansen and Adams (2013) identified benefits from the use of ICT-supported flexible delivery. Their case study investigated flexible delivery and self-paced learning strategies within a complex electronics trades training environment. Several benefits accrued to the participants. They could: (i) get their preferred space for learning; (ii) assess their learning at their convenience to determine readiness for final assessment; (iii) achieve a higher level of knowledge and skills by focusing on their practical tasks; and (iv) share their knowledge and skills. Despite these advantages, the authors identified several constraints when introducing flexible
delivery, namely, that students were upset when they could not adapt to the flexible
delivery, that the success of the delivery depends mostly on the students’ self-directed
participations, and in some cases, that it was time consuming. For instance,
preparation of an online database for learning and assessment requires a significant
amount of time.

Recently, McKenry (2008) identified several benefits resulting from using a
blended approach in Kangan institutes. These included blended learning providing
students with flexibility, meaning that students can learn from any place; students
having opportunities to engage in self-paced learning; and students taking the
opportunity to undergo a digital development program. The author, however, did not
mention any disadvantages in the use of blended learning in her institute.

L. Collins and Eagle (2013) conducted an interview-based study with two
Australian and two international training providers who were offering vocational
courses. The aim of their study was to find out the impact of m-learning (mobile
learning which is offered via smartphone and tablet devices) in vocational training
organisations. The study identified mobile learning as an effective platform when
incorporated with face-to-face delivery, particularly regarding sharing and
collaboration. Both students and teachers can build their confidence and improve their
knowledge and skills in the vocational courses. The findings, however, acknowledged
that teachers and students become frustrated when m-learning is solely used for
delivery.
Automotive sectors

Spöttl and Becker (2013) conducted a project in the automotive sectors and revealed that ICT (hardware and software) was used extensively in all sectors and sub-sectors as summarised in Table 2.3. They reported that more than 90% of the workforce employed in the automotive sector, directly and indirectly, relies on ICT during their work in professional practices. It follows that a large number of professionals need both knowledge of ICT application and other (non-ICT) knowledge related to automobile production and repairs.

Table A Application of ICT in the automotive production industry, from Spöttl and Becker, 2004, p. 30

<table>
<thead>
<tr>
<th>Automotive production (Fields of work)</th>
<th>Specific tasks</th>
<th>Role of ICT</th>
<th>Users (Workers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design</td>
<td>Design of products, Use of CAD/CAM software (CATIA, PRO-E, AutoCAD, Inventor, etc.), 3D-CAD; 2D-CAD</td>
<td>Modification and efficient use of CAD/CAM software, PPS-systems, databases</td>
<td>Professional engineers, Highly qualified technicians</td>
</tr>
<tr>
<td>Production</td>
<td>Production of plants/work on projects, Use of PC hardware and software, PLC programming, 3D measuring instruments</td>
<td>Use of: hotlines, PPS systems, CNC/HSC –systems, 3D-quality control, databases, software spreadsheets.</td>
<td>Highly qualified technicians, Skilled workers</td>
</tr>
<tr>
<td>Assembly</td>
<td>Assembly preparation, Use of programming and measuring devices, Use of PLC tools</td>
<td>Use and re-programming of: PLC, plants.</td>
<td>Skilled workers, Highly skilled workers</td>
</tr>
<tr>
<td>Service</td>
<td>Assembly preparation, Use of software</td>
<td>Use of manifold software, Re-programming of plants/tools etc.</td>
<td>Highly qualified technicians, Skilled workers</td>
</tr>
<tr>
<td>Quality control and check</td>
<td>Function checks, Coordination of measuring, Control technology, Adaptation of quality control systems</td>
<td>Use and modification of 3D-equipment, PLC programming, Use of databases</td>
<td>Professional engineers, Highly qualified technicians</td>
</tr>
</tbody>
</table>
Appendix 9. Detailed review of studies focusing on ICT in professional practices

Southern and Tilley (2004) conducted a qualitative study to find the relationship between small firms and ICT use. They categorised small firms into three types based on their ways of using ICT in the workplace: low user, medium user and high user. Table 2.14 presents their findings. They reported that small industries, such as telecommunication companies, a newly arrived cable company, a commercial photographer, an industrial fittings company, a clothing designer, furniture manufacturers and a soft drinks manufacturer increasingly depend on ICT.

In another study, Stare et al. (2000) reported that use of ICT is not limited to small industry, but is embraced by most industries. They found the benefits of using ICT were crucial in the service and manufacturing industries. ICT has positive influence on automating production processes, on introducing new ways of organising and managing professional work, and on building networks with suppliers and customers. It had a stronger impact on the service industry than on the manufacturing industry. Stare et al. (2006) noted that these findings were only preliminary, so further research is needed to confirm their findings.

The above reviews particularly highlighted the studies which focused on the use of ICT in different industries, such as: small, medium, technology-driven and non-technology-driven industries. Additionally, this review cited two more examples from two different professional workplaces that can illustrate the use of ICT: one from an applied engineering discipline (the automotive industry), and another from an applied
arts discipline (the graphic arts and media sector).

Spöttl and Becker (2006) conducted a project as part of a four-series study launched by the European Centre for the Development of Vocational Training (Cedefop). Their main goal was to analyse significant progress in automotive industries, particularly in automotive production and in motor vehicle repairs and sales. This project focused on ICT skills to determine its needs in the relevant industry. Another focus was to identify the training needs of ICT practitioners\(^1\) in vocational occupations. The project initially divided the automotive sectors into three segments: (i) development, research and engineering; (ii) production (manufacturing and assembly); and (iii) repair and sales. The study revealed that ICT (hardware and software) was used extensively in all sectors and sub-sectors as summarised in Table 2.15, justifying the authors’ statement that “almost 93% of all persons engaged in the automotive sector encounter ICT during their work in a professional sense, beyond pure application” (Spöttl & Becker, 2004, p. 95). It follows that a large number of professionals need both knowledge of ICT application and other (non-ICT) knowledge related to automobile production and repairs.

There are three main types of workers in the automotive industry engaged with ICT: professional engineers, highly qualified technicians, and skilled workers. The professional engineers are usually graduates or degree holders from university programs, while the other two types of workers are recipients of diploma and training certificates from the VE sector.

\(^1\) ICT practitioner means all those staff members primarily working with ICT, either generic ICT skills or occupationally specific ICT skills within their work/industry
The recent advances in technology and consumers’ demands have significantly influenced the graphic arts and media sector. During the last decade, this sector has been moving towards full digital workflows (the total working process) and digital printing, demonstrating a strong uptake of technology (2004). This trend demands a switch in the industry from production-focused to customer-focused services as depicted by Danielson and Politis (Danielson & Politis, 2004). This study examined the relationships and interactions among ICT job profiles and skills relevant to graphic arts and the media. It highlighted the need for an ICT-skilled workforce in this industry, and the impact of ICT in the same industry. This impact varied due to the nature of the job needing to be done. However, the project showed that when using ICT in print and graphic communications there was a demand on workers to perform their activities accurately. This brings to the fore the need to continually upgrade and broaden workers’ skills. The Danielson and Politis (2004) study also identified many job positions that require ICT knowledge in the graphic arts and media industry – graphic designer, scanner operator, pre-press operator, pre-press network administrator, website designer, multi-media application designer, plate maker for offset and flexographic printing, as well as pre-press operator for specific applications for packaging design flexo, finisher, binder, and packaging operator. It subsequently identified many ICT usages in the graphic arts and media industry:

- applications for hardware specific software (FrontPage, Dreamweaver, etc.)
- network administration and support
- file formats and connectivity
- connection of devices and workstations
- database processing
- storage and retrieval of assets (images) from data banks
• use of machines connected to computers and application of vendors’ specific interfaces

• knowledge of data input in production planning systems and the like.
Appendix 10. Human Research Ethics Committee (HREC) approval latter

Ref: [MF/KFG]

18 September 2012

Dr Lina Markauskaite
CoCo Research Centre
Faculty of Education & Social Work
The University of Sydney
Email: lina.markauskaite@sydney.edu.au

Dear Dr Markauskaite

Thank you for your correspondence dated 10 September 2012 addressing comments made to you by the Human Research Ethics Committee (HREC).

I am pleased to inform you that with the matters now addressed your protocol entitled “Technical and Vocational Education (TVE) teachers’ conceptions of, and approaches to, ICT in professional education” has been approved.

Details of the approval are as follows:

Protocol No.: 15220
Approval Date: 17 September 2012
First Annual Report Due: 30 September 2013
Authorised Personnel: Dr Lina Markauskaite
Prof Peter Goodyear
Mr Shahadat Hossain Khan

Documents Approved:

<table>
<thead>
<tr>
<th>Document</th>
<th>Version Number</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Participant Information Statement</td>
<td>Version 1</td>
<td>June 25, 2012</td>
</tr>
<tr>
<td>Participant Consent Form</td>
<td>Version 1</td>
<td>June 25, 2012</td>
</tr>
<tr>
<td>Email invitation to individual teachers</td>
<td>Version 1</td>
<td>undated</td>
</tr>
<tr>
<td>Email to the head teacher</td>
<td>Version 1</td>
<td>undated</td>
</tr>
<tr>
<td>Interview Schedule</td>
<td>Version 1</td>
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</tbody>
</table>

HREC approval is valid for four (4) years from the approval date stated in this letter and is granted pending the following conditions being met:

**Conditions of Approval**

- Continuing compliance with the National Statement on Ethical Conduct in Research Involving Humans.

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CRICOS 00026A

340
• Provision of an annual report on this research to the Human Research Ethics Committee from the approval date and at the completion of the study. Failure to submit reports will result in withdrawal of ethics approval for the project.

• All serious and unexpected adverse events should be reported to the HREC within 72 hours.

• All unforeseen events that might affect continued ethical acceptability of the project should be reported to the HREC as soon as possible.

• Any changes to the protocol including changes to research personnel must be approved by the HREC by submitting a Modification Form before the research project can proceed.

Chief Investigator / Supervisor’s responsibilities:

1. You must retain copies of all signed Consent Forms (if applicable) and provide these to the HREC on request.

2. It is your responsibility to provide a copy of this letter to any internal/external granting agencies if requested.

Please do not hesitate to contact Research Integrity (Human Ethics) should you require further information or clarification.

Yours sincerely

Dr Margaret Faedo
Manager, Human Ethics
On behalf of the HREC

cc: Shahadat Khan
skha8285@unl.sydney.edu.au

This HREC is constituted and operates in accordance with the National Health and Medical Research Council’s (NHMRC) National Statement on Ethical Conduct in Human Research (2007), NHMRC and Universities Australia Australian Code for the Responsible Conduct of Research (2007) and the CPMP/ICH Note for Guidance on Good Clinical Practice.