



Pipe dreams or digital dreams: Technology, pedagogy and content knowledge in the vocational educational and training sector

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Regional Australia provides fertile ground for the integration of online technologies to support the vocational education and training (VET) sector. This paper examines teachers' beliefs about teaching with technology in a regional VET institute. VET teachers must demonstrate teaching expertise (pedagogical knowledge) and industry expertise (content knowledge) for diverse learners and contexts; however, the emergence of new digital technologies illustrates an increasing need for teachers to embrace 'technology' knowledge commensurate with industry practice. Recent surveys have revealed that teachers' use of online digital technology within the VET sector is not effectively incorporated nor has it been embraced in pedagogically defensible ways. This paper adopts a mixed methods approach to understand how the epistemic beliefs of VET teachers influence their teaching and how the TPACK is applied in practice. Finally, this paper illuminates the need for professional development programmes to focus on developing teacher knowledge across all TPACK domains.

Key words: VET sector, TPACK, epistemic beliefs

Introduction

Over the last few decades, there has been increasing pressure on teachers to integrate digital technology tools into their practice. This presents a significant paradigm shift within the vocational education and training (VET) sector. The potential for effective teaching with technology can be a powerful means of effecting change in people's lives, reducing the tyranny of distance, which has previously blocked access to education for marginalised and minority groups, many of whom reside in regional areas (Dhanarajan, 2001). The potential for effective online teaching and learning for regional Australians can achieve this goal; however, the success of these experiences is reliant on the teachers' skills in using technology effectively, their beliefs about being able to do so and their knowledge about teaching. The research aims were to explore the reasons for low integration of online technology by VET teachers in regional Australia. To achieve this, a framework was identified which would provide a lens through which to examine the role of technology in teachers' knowledge alongside their beliefs that influence the decision to integrate technology.

VET sector

Within the VET sector it is possible that technologies for education are being used in traditional epistemological ways to guide VET programs and pedagogic practice (Robertson, 2007). The rapid growth of the knowledge society challenges these traditional epistemologies and their means to prepare students for the workplace (Tsai, Chai, Wong, Hong & Tan, 2013). VET products, 'training packages', contain the curriculum that industries require, stipulate the standards for competent performance, dictate the knowledge and skills required as well as the critical aspects for gathering evidence for assessment. Assumptions about the nature of knowledge and how it is acquired and used are reflected in the curricula, delivery and assessment strategies (Pratt, 1992). In the VET

sector, the teacher implements these programs thus influencing what counts as knowledge and how that knowledge is acquired (Hofer & Pintrich, 1997; Pajares, 1992). It is commonplace for teachers to begin teaching with a rich content knowledge of a particular trade or vocation. This is based on an assumption that they bring with them knowledge of the tools and the technology of that industry as well. Recent criticism of the minimum requirement (the Certificate IV in Training and Assessment) to become a VET teacher has indicated that many graduates of this qualification may not have developed sufficient pedagogical knowledge to inform their teaching practice (Wheelahan, 2010), let alone the technological knowledge required to integrate that technology. Yet, they must demonstrate teaching expertise and industry expertise across diverse contexts and learners. The emergence of new global digital technologies illustrates an increasing need for teachers to develop an additional set of knowledge, particularly in light of industrial change. Therefore the pressure on VET teachers to integrate online technology effectively has never been more compelling. For that reason, this research aims to explore the current situation of VET teachers in relation to their technology, pedagogy and content knowledge and in particular explore their belief systems about teaching with technology. The questions which have guided the research are:

1. What is the relationship between VET teachers' technology, pedagogy and content knowledge?
2. How do teachers' epistemic beliefs influence the integration of technology in a regional VET context?

Theoretical framework

Teacher preparation programs are often held accountable for failing to adequately prepare teachers to establish pedagogical connections between the pedagogy and the technology. The framework at the centre of this research is grounded in an understanding that quality teaching does not occur when the three knowledge bases of technology, pedagogy and content exist separately. The specific type of knowledge required is technology, pedagogy and content knowledge (TPACK), a unique body of knowledge constructed from the intersection of the three knowledge bases with the centre indicating maximum technology integration (Mishra & Koehler, 2006). It has its origins in Shulman's (1987) seminal work where it is argued that the most central area of knowledge is the construct Pedagogical Content Knowledge (PCK), that which differentiates the teacher from the expert (Shulman, 1987). TPACK has emerged as the amalgam of PCK and technology (Angeli & Valanides, 2009). The TPACK framework has practical appeal in that it offers an analytical lens through which to structure professional development programmes, in particular a structure for researching what teachers know and should be able to do. It has the potential to examine how technology is expressed within a teacher's belief system (Bates & Maor 2010; Jimoyiannis, Tsiotakis, Roussinos & Siorenta, 2013). The way in which this research applies TPACK is to examine the relationship between VET teachers' technology, pedagogy and content knowledge through a survey, the purpose of which is to identify teachers' skills in using technology effectively, their beliefs about being able to do so and their knowledge about teaching specific content in order to understand better their pedagogical and personal beliefs relating to successful technology integration (Ertmer, 2005).

Epistemic beliefs

Epistemic beliefs are core beliefs about the nature of knowledge and knowing, how one comes to know things (Hofer & Pintrich, 1997; Harteis, Gruber & Hertramph, 2010). While the TPACK framework does not necessarily acknowledge teachers' epistemic beliefs (Angeli & Valanides, 2009) it is proposed that such beliefs significantly influence technology integration and have a major bearing on whether the technology is used in constructivist or traditionalist ways. Epistemologically, it is contended that the more elaborate a person's set of epistemic beliefs, the better the learning and teaching performance. Thus, the epistemic beliefs held by teachers and trainers may have a significant influence on what students come to believe about the nature of knowledge and what it means to learn. This assertion implies that where knowledge that is believed to be fixed is reflected in teacher centred approaches whereas beliefs that knowledge is not fixed and evolving tends to be more student centred (Buehl & Fives, 2009). Research suggests that teachers with traditional pedagogical beliefs apply a didactic approach to technology integration whereas teachers with more constructivist beliefs and pedagogical practices use technology more meaningfully and more often (Tondeur, Hermans, van Braak & Valcke, 2008; Park & Ertmer, 2008). Epistemic beliefs therefore are important to this research in that they are identified as having significant influence over a teacher's belief system suggesting that the way one teaches is directly connected to one's personal beliefs about knowing and knowledge, teaching and learning.

Methodology

This research adopted a mixed method design using both a survey and a semi structured interview to explore how the epistemic beliefs of regional VET teachers influence their teaching and how their TPACK is applied in

practice. VET teachers represented the primary data source. The survey was based on an existing instrument (Archambault and Crippen, 2009) and was modified to reflect a VET context. Twenty five teachers who volunteered to participate in the research completed the TPACK survey. From the survey results, 14 teachers were selected for an interview based on the criteria of the highest, mid-range and lowest scores. In total, five of the highest scores, five of the mid-range and four of the lowest scores were selected for interview. Interviews took place at the teacher's workstation which provided the interviewer access to the teaching materials, software, resources and technologies that the teacher was using. The semi-structured questions were designed to explore teacher's beliefs about technology, the content they teach and how they teach it as well as their beliefs about the nature of knowledge and learning.

Data analysis

Quantitative data obtained from the TPACK survey was analysed using both descriptive and inferential statistics. The seven subscales are presented in Table 1: Pedagogical Knowledge (PK), Content Knowledge (CK), Technological Knowledge (TK), Technological Content Knowledge (TCK), Technological Pedagogical (TPK), Pedagogical Content Knowledge (PCK) and Technological Pedagogical Content Knowledge (TPACK). The measures included the mean and standard deviation for items (a) through to (x) to answer the question, "Please rate your ability to undertake the following tasks associated with teaching in a VET context?" Qualitative data was obtained from the semi-structured interviews. Each interview was recorded and transcribed verbatim. TPACK related themes and categories emerged and were used as a basis upon which to identify teacher beliefs. Each interview took 40 minutes, however, for the purpose of this paper a small selection of excerpts is presented to complement the quantitative data.

Results

In order to answer the first research question about the relationship between VET teachers' technology, pedagogy and content knowledge, a summary of survey responses are illustrated in Table 1. Teachers rated their knowledge highest for the scales of pedagogy (3.53), content (3.46) and pedagogical content (3.41). Technology knowledge was reported significantly lower (2.64) than both pedagogical and content knowledge but rates even lower in the intersection of technological pedagogical knowledge (2.25) thereby suggesting that while technology knowledge was low, knowledge of how to use technology to teach in an online learning environment was even lower. What is also apparent is that these teachers do not feel they have the knowledge or the skills to troubleshoot hardware and software technological issues for both themselves and their students. These results indicate that VET teachers report to be most uncomfortable and unconfident with aspects of technologies in their learning environments with which they are unfamiliar.

Table 1: Summary of descriptive statistic for the TPACK results

Descriptive Statistics						
Domain	N	Range	Minimum	Maximum	Mean	SD
PK	25	2	2	5	3.53	0.62
TK	25	3	1	4	2.64	0.85
CK	25	2	2	5	3.47	0.57
PCK	25	3	2	5	3.41	0.61
TPK	25	3	1	4	2.25	1.05
TCK	25	3	1	4	2.69	0.94
TPACK	25	3	1	4	2.61	0.81

In order to answer the second research question of how teachers' epistemic beliefs influence the integration of technology in a regional VET context, interview data were transcribed and analysed. Interview analyses are organised and presented as TPACK themes. A snapshot of the VET teachers' belief system is presented below.

Technology: Teachers generally believe that the role of technology is to support traditional teaching practice: as an administrative aid; *I think technology has made it easier and we haven't spent much time using the photocopier*, as a mechanism to enable file dissemination; *It is an Excel spreadsheet and it has coloured links to his students and his course materials so when his apprentices come onto Block Release and they need an assignment or a file, he sends it electronically*, and as a conduit for the delivery of content; *We have a folder on the LMS and it contains the course information and the assessments they will need to pass.*

Pedagogy: Teachers' pedagogical beliefs were firmly grounded in instructional pedagogy with a focus on delivery of content (*Content is provided to the student by the teacher and the student's role is to access that content from the LMS*). Other responses related to perceptions that teaching is a process whereby knowledge is

imparted by the teacher to the student: *To teach means to impart knowledge into a person so they can understand what it is they are going to be doing, and We give advice as to where to go and what to do and walk them through their assignments and what we will assess.* However, there was evidence that teachers had few tools for thinking about how to make the shift to constructivist pedagogies and therefore plans to use technology were couched in language of the future as demonstrated in the following excerpt: *I hope to do an online course next year.. and use technology differently, and I want to make Blackboard a bit more interactive when I have the skills.*

Content: Teachers described the importance of covering the content, believing that the content of what they teach is prescribed, contained in training packages, and can only be delivered in certain ways. This was evident in the following quotes: *The LMS is just a platform for our information because the content is from the Education Department and our students need to know about the legislation and policies and so we send them to their website to see their policies, and I am using this LMS because the learner guide we have access to is from two training packages ago..*

Knowledge: Teachers' epistemological conceptions, for the most part expressed knowledge as being external to the learner, existing in texts and learning guides, not able to be challenged and contested as demonstrated in the following quotes: *Students still have to read their textbook and that's where their learning is done, and We take them through the assessment plan with the information they need to pass and we say that their assessments will guide them through their studies.*

Discussion

While the interview analyses suggest that VET teachers express and espouse traditional beliefs and views regarding pedagogy and content knowledge, constructivist orientations to the affordances of digital technologies in online environments will remain a pipe dream. The survey results show that teachers tend to rate the pedagogy and content knowledge higher than what is reflected in their teaching practice suggesting that teachers report being most comfortable and confident with aspects and perspectives of traditional teaching environments, using their experiences and skills associated with face to face environments. While teachers integrate online technology in varying degrees, their use of technology reflects traditional approaches to teaching. Technology use is shaped by the teachers' belief systems: beliefs about technology, pedagogy and content and beliefs about knowledge. The implications are of particular importance for teaching in the VET sector where an important role of the teacher is to prepare students to undertake high level and complex tasks in the workplace. Based on the data presented in this paper a contradiction exists between teachers' TPACK and their expression of beliefs relating to knowledge and teaching which might help to understand why technology is not being integrated as well as it could be within the VET sector. The learner-centred, constructivist approach to teaching with technology is in conflict with the teacher centred, traditional approach to teaching using technology. Clearly, other contextual factors are at play. The self-reporting nature of the survey asked teachers to rate themselves and their ability to operate in an online environment; therefore the teachers' responses are limited only to what they believe about their ability. If teachers adopt practices that are consistent with these belief systems (Tondeur et al., 2008) this in itself is insufficient to bring about a paradigm shift towards constructivist teaching within the VET sector. This research has exposed a contradiction between teachers' self-report about their teaching, their epistemic beliefs about knowledge and the influence of these beliefs on the integration of digital technology in regional education. Our next stage is to consider what to suggest in terms of professional development that will merge the TPACK domains and therefore make teaching in regional Australia more of an electric dream than a pipe dream.

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