Exploring teachers Technological Pedagogical Reasoning through digital portfolios

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Abstract: This paper is a progress report on the findings of a research project currently being undertaken with fifteen teachers. The project is using a triangulated approach to understand the pedagogical reasoning to use Information Communication and Technology (ICT) in the classroom. Data is collected from video stimulated interviews, concept maps and access to a teacher's *SMART Classrooms Professional Development Framework - Digital Pedagogical License* (DPL). This paper reports the first stage of analysis completed on four teachers' DPL's. These DPL's provide rich descriptions of a teacher's professional values, relationships, knowledge and practice with using ICT. The aim of this study is to understand how teachers reason with ICT. These DPL's were reviewed using Shulman's Model of Pedagogical Reasoning and Action (1986, 1987b) as a lens. Findings indicate there is evidence of pedagogical reasoning with ICT embedded in the portfolios of these four experienced teachers.

Keywords: pedagogical reasoning, technological pedagogical reasoning, digital portfolios, e-portfolios

Introduction

In Australia and throughout the world there has been an increasing push for teachers, through the teaching professional standards (Australian Institute for Teaching and School Leadership (AITSL), 2011) and policy initiatives (Department of Education Employment and Workplace Relations, 2011), to use Information Communication and Technology (ICT) in the classroom. The *Digital Education Revolution* (DER) Roadmap (Australian Information and Communications Technology in Education Committee's (AICTEC), 2009) asserts that "educators require the pedagogical knowledge, confidence, skills, resources and support to creatively and effectively use online tools and systems to engage students" (p.6). In deciding to use ICT in the classroom, teachers have enhanced their pedagogical reasoning abilities in deciding to use ICT. It is suggested that pedagogical reasoning with ICT should be termed *Technological Pedagogical Reasoning* (TPR).

This research project will look into the pedagogical reasoning of ICT using teachers at differing career stages (Graduate, Proficient, Highly Accomplished and Lead) as defined in the Australian National Professional Standards (Australian Institute for Teaching and School Leadership, 2011). The aim of this research project is *To investigate how teachers reason with ICT and what influences their development of technological pedagogical reasoning*. Looking at teachers across career stages will help define TPR and determine what influences its development. This research project has collected data from video, interviews and digital portfolios of teachers located in Queensland Australia.

Teachers participating in this research were employed by the state, one of three employment authorities in Queensland (workforce of 41,000 plus teachers). To facilitate teachers using ICT, the state has developed a *SMART Classrooms Professional Development Framework* (SCPDF)(Department of Education and Training, 2012), a three level digital accreditation process (ICT Certificate, Digital Pedagogical Licence and Digital Pedagogical Licence Advanced). As part of the framework, teachers prepare a Digital Pedagogical Licence (DPL) to provide evidence of their professional values, relationships, knowledge and practice in line with a series of predetermined indicators. An 'Accredited Facilitator' then assesses the portfolios before an accreditation and certificate are awarded. Teachers have used various tools to prepare their DPLs including webpages, virtual classrooms (BlackBoard) and wikis (EdStudio). To 2010,

2,021 teachers had completed their DPL and 54 had completed Digital Pedagogical License-Advanced (O'Hagan, 2010). To December 2012 the number had grown to 3800+ teachers achieved their DPL and 22,000 achieved their ICT Certificate (Department of Education Training and Employment, 2012a).

Theoretical Frameworks/Perspectives

The theoretical framework to support this research is built from two domains of research. Firstly a discussion of pedagogical reasoning is presented from Shulman's original work to more recent ideas presented on pedagogical reasoning with ICT. From this literature the origins of ideas about Technological Pedagogical Reasoning are discussed. The second major domain is research is on teacher use of digital portfolios.

Pedagogical reasoning

Using Shulman's Model of Pedagogical Reasoning and Action this study seeks to extend this model with the use of ICT. Pedagogical Reasoning was first suggested by Shulman (1987a) in his justification for the existence of Pedagogical Content Knowledge (PCK) where he introduced pedagogical reasoning as "Pedagogical content knowledge is not simply a repertoire of multiple representations of the subject matter. It is characterized by the way of thinking that facilitates the generation of these transformations, the development of pedagogical reasoning" (p.115).

Shulman (1987) suggests that this special kind of 'teacher thinking' is developed "through the process of planning, teaching, adapting the instruction, and reflecting on the classroom experiences, (teachers) acquire new types of knowledge" (p. 117). Shulman went further to define pedagogical reasoning in the Model of Pedagogical Reasoning and Action. This model is described in six processes: Comprehension; Transformation; Instruction; Evaluation; Reflection; and New Comprehension. Comprehension is achieved when teachers understand what they are going to teach. Transformation is about transforming the content into a format that will motivate the learner. Shulman suggests the following processes for Transformation: Preparation; Representation; Selection; and Adaptation. Instruction is the act of teaching including the many aspects of pedagogy including "organizing and managing the classroom; presenting clear explanations and vivid descriptions; assigning and checking work; and interacting effectively with students through questions and probes, answers and reactions, praise and criticism" (Shulman, 1987a, p. 117). Evaluation is completed as teachers check for student understanding. Reflection is what teachers do when they "look back at the teaching and learning that has occurred, and reconstructs, re-enacts, and/or recaptures the events, the emotions, and the accomplishments" (1987, p. 117). New comprehensions are gained when the teacher identifies improvements in the teaching and learning processes; that is, their new understanding of what works and what doesn't. For this study Shulman's processes are used as a basis for understanding a teachers pedagogical reasoning in deciding to use ICT in their teaching.

Pedagogical reasoning with ICT

As previously reported in recent papers by the authors (Smart, Sim, & Finger, 2012, 2013) a brief discussion of Webb's (2002) work on Model of Pedagogical Reasoning with ICT with further work with Cox (Webb & Cox, 2004) and then extended by Webb (2011) are discussed. More recently in Webb's (2011) revised version, Technological Pedagogical Content Knowledge (TPACK) is mentioned and shows its influence on pedagogical reasoning. Webb suggests that teachers' professional knowledge including TPACK is required for the process of pedagogical reasoning, teachers need to know what resources are available to them for the process of teaching, teachers need to consider what assessment is required to check for student understanding, teachers' behaviors influence their pedagogical reasoning, as it is their belief, values and ideas about ICT and education that will enable them to use ICT in teaching. Finally Webb suggests that teachers' pedagogical reasoning is stored in lesson plans.

Starkey (Starkey, 2010a, 2010b, 2011) has proposed another Model of Teacher Pedagogical Reasoning and Action for the Digital Age. This is another attempt to show the influences of ICT on Shulman's PRA model (Starkey, 2010a, 2010b, 2011). This model is founded on Shulman's (1987) Model of PRA but modified for action in the digital age. In a previous article by the authors (Smart et al., 2012) the differences in this model to Shulmans original works are discussed. "Comprehension is demonstrated using substantive and syntactic knowledge to influence what set of ideas should be taught. Enabling Connections replaces Transformation and its sub-processes but elements of the five sub-processes remain

although not named specifically. Teaching and Learning replaces Instruction and incorporates the elements of Evaluation and finally Reflection remains the same" (p.5-6). They go further to say that Starkey includes the New Comprehensions along with Wilson et al (1987) but Webb et al (Webb, 2002, 2011; Webb & Cox, 2004) has not presented this as a separate process.

To date, little research has been found to confirm the models discussed above. It is hoped that this study may be able to elaborate and extend on these models to gain a view to the elements of pedagogical reasoning with ICT and determine if this can be termed - Technological Pedagogical Reasoning.

Digital portfolios

Research suggests that teachers have been using digital portfolios from pre-service education programs as part of assessment (Çimer S. Odabaşı, 2011; Davies & Willis, 2001; Napper & Smith, 2006; Ryan & Kuhs, 1993; Willis & Davies, 2002) as well as in licensing with a teacher registration bodies (Napper & Smith, 2006). Portfolios can be used to aid in obtaining jobs where the portfolio "aims to showcase a candidate's competencies for the position" (Nodoye, Ritzhaupt, & Parker, 2012, p. 1). The teacher registration body in Queensland suggests that portfolios can be used to: plan an educational program; documenting knowledge, skills, abilities and learning; track development; job seeking; evaluating a course and monitoring and evaluating performance (Queensland College of Teachers, 2009).

Portfolios "can increase reflection, develop content and pedagogy skills and facilitate communication between teachers and administrators" (Napper & Smith, 2006, p. 31). Skrabut (2011) posit that "research on e-portfolio retention suggests that teachers quickly abandon practices following career milestones" (p.32). Rolheiser and Schwartz (2011) found that there eleven first year teachers had maintained their portfolios in their first year of teaching and Grant and Huebner (2001) found in earlier research that teachers three years after graduation were still maintaining their portfolios. Research suggests that portfolios are used extensively in pre-service teacher education programs to prepare students for jobs and licensure but there is limited evidence that teachers continue to use them after graduation.

Digital Pedagogical Licenses

The digital portfolios used in this research were prepared as part of a professional development program run by their employer. A three level accreditation scheme was implemented from 2006 as a way to acknowledge teachers using ICT in the classroom. Teachers could begin the program with an *ICT Certificate* to show understanding of using ICT purposefully, then complete a *Digital Pedagogical Licence* (DPL) to demonstrate and reflect on using ICT and then progress to a *Digital Pedagogical Licence Advanced* as teachers who lead the transformation of learning through ICT (Department of Education Training and Employment, 2012d). Each level of the accreditation asked teachers to provide evidence of their Professional Values, Professional Relationships, Professional Knowledge and Professional Practice as appropriate for that level. Teachers were asked to prepare their DPL in a structured template format as shown in Table 1.

Digital Pedagogical Licence Layout
1. Context Statement (500 words)
2. Reflective Statement (500 words)
3. Items (Explanation to support evidence – format in Table 2)
4. Evidence (eg: student work, unit plans, criteria sheets, photographs, lesson outlines, screen captures, websites, audio or video files)
5. Statement of Support (principal or delegate)

Table 1 - Digital Pedagogical Licence Layout

For each item included, teachers were asked to provide responses to a series of headings. These headings are shown in Table 2.

Evidence Item Headings
1. Title
2. Date of implementation
3. Evidence
4. Year level and student context
5. Item overview
6. Reason for inclusion
7. Development and planning
8. Curriculum links
9. Central focus of the student learning (curriculum intent)
10. Sequence of learning
11. Teaching and learning approach
12. My learnings
13. Further reflections and information

Table 2 - Evidence Item Headings

For all information provided in the DPL the teacher was required to demonstrate that their pedagogy aligned with the Digital Pedagogical Licence indicators. Table 3 includes an excerpt from Teacher-K's DPL and how they have mapped to the Professional Value Indicator 1 (PV1).

Criteria	Professional Values
Indicator	PV1
Indicator description	I am committed to developing my digital pedagogy through reflection on my practice to inform professional learning goals.
Teacher	Teacher - K
Found in DPL	Belief Statement
Teacher response example	"I therefore seek to facilitate students' learning through contextualized, stimulating and relevant experiences which they share with others, drawing, where possible, on prior knowledge and experience. PV1"

Table 3 - Example mapping to DPL Indicator

The teachers participating in this research project, have constructed their digital portfolios after graduation, they are not required for licensure, do not guarantee career advancement and are not completed with the professional standards as a template.

Methods

This research has been designed with a qualitative frame to obtain the voice of practicing teachers. The teachers purposely selected have diverse teaching contexts, at differing points in their teaching careers and age variations. The methodology that has been used for this study required interviews, observations and the collection of data in the form of video stimulated interviews, think aloud concept mapping and the digital portfolios of teachers. Fifteen teachers agreed to participate in the research project and ten had completed DPL's. A summary of the first four teachers analyzed is reported in this paper.

Ethics

Ethical clearance was requested and approved by the university prior to the study commencing. The university granted human ethics approval after the submission and review of consent forms for schools principals, teachers and parents of students in the classes that were video recorded.

Results and Expectations

This paper provides a snapshot in time of the data analysis to date. Four digital portfolios have been mapped to Shulman's MPRA to find evidence of pedagogical reasoning.

The teachers

The teachers (n=4) included in this paper (shown in Table 4) were purposively sampled by being known to the researcher. All have over ten years of teaching experience. Three of the four teachers were teaching in early childhood and last was teaching in a secondary environment. All would be considered digital pedagogy leaders in their schools. Three teachers were working in two P-12 schools and the other teacher was working in a P-7 school with all located in South East Queensland.

Teacher	Teacher - A	Teacher - C	Teacher - M	Teacher - K
Teaching area	Prep	Prep	Prep	Secondary
Teaching experience	10 years	Over 20 years	10 years	20 years
Career stage	Lead	Lead	Lead	Highly Accomplished
Date portfolio prepared	2007	2006	2008	2011
School	Primary	P-12	P-12	P-12

Table 4 - A summary of the teachers

The DPL's

The DPL's for these teachers were located in a secure BlackBoard environment only accessible by approved users. The DPL's contained a variety of items as shown in Table 5.

DPL Contents
• Context statement (details about the school); • Teachers belief statement for using ICT; • Items with complete descriptions in a structure template format; • Evidence for each item including: unit overviews; assessment tasks; virtual classrooms; webquests evidence; links to learning objects; lesson plans; photographs; blogs; student work; recorded lessons; national testing data; resources; and grading; and • Individual support statement from school administration (principal or nominee).

Table 5 - DPL Contents

The objective of the DPL was to "acknowledge teachers who demonstrate and reflect on how learners use ICT purposefully" (Department of Education Training and Employment, 2012d). "It is a collection of carefully selected or composed professional experience, thought and goals that are threaded with reflection, evidence and self assessment" (Department of Education Training and Employment, 2012b).

All four DPL's followed the suggested layout as shown in Table 2. The SCPDF allowed for renewal of DPLs every three years. Three of the four had evidence of their renewal process (Teacher A, C and M). The fourth (Teacher K) had submitted her DPL in 2011 and was also recommended for an award for her submission. As part of the SCPDF there was an annual award process for teachers who had used ICT to do outstanding work in the classroom (Department of Education Training and Employment, 2012c).

Evidence of pedagogical reasoning

The DPL's were analysed using Shulman's Model of Pedagogical Reasoning and Action as a frame and has been previous reported by the authors (Smart et al., 2013). This paper provides further details of the mapping of Shulman's model to the DPL headings (as shown Table 6).

Shulman's Model of Pedagogical Reasoning and Action		**DPL Heading (as shown in Table 2)**
Comprehension - Understand what is to be taught		5. Item Overview 6. Reason for inclusion 7. Development and planning 8. Curriculum links 9. Central focus of the student learning (curriculum intent) 10. Sequence of learning
Transformation - taking subject matter and understanding student minds and motivations	Preparation - examining and critically interpreting the materials	5. Item Overview 6. Reason for inclusion 7. Development and planning - How this task was developed 9. Central focus of the student learning 11. Teaching and learning approach used and why
	Representation - thinking alternative ways of teaching	6. Reason for inclusion - Why this is in my portfolio 3. Evidence - provided for this item 11. Teaching and learning approach used and why
	Instructional Selection - teaching strategy	5. Item overview 10. Sequence of learning 11. Teaching and learning approach used and why
	Adaption - fitting material to students	2. Date of implementation - When this item was implemented 4. Year level and student context
	Tailoring - To suit individual students	
Instruction - the act of teaching		3. Evidence - provided for this item 9. Central focus of the student learning (curriculum intent) 10. Sequence of learning
Evaluation - checking for understanding		6. Development and planning - How as this item assessed 10. Sequence of learning
Reflection - looking back at teaching and learning		12. My learnings Why was this item worth doing: a. what worked b. what didn't work c. what I would change 13. Further reflection or other information
New Comprehensions - learning from experience		12. My learning - Skills I developed by doing this item

Table 6 – Mapping of Shulman's Model of Pedagogical Reasoning and Action to the DPL Evidence Item Headings

From this table is can be seen that the DPL's contained aspects of pedagogical reasoning. All aspects except Tailoring showed evidence of the pedagogical reasoning of these four teachers. There was little evidence of how teaching to individual students was catered for in the classroom but this would depend on the teachers and the focus of the DPL. Some teachers could include details of how they are tailoring material to suit individual learners but as this is not a requirement of the DPL it was more likely to not be included. Further details of the mapping and discussion of the aspects is included in a previous paper by the authors (Smart et al., 2013).

Is this Technological Pedagogical Reasoning (TPR)?

Each element of the model was evident in all four DPL's. Because the focus of the DPL was on teachers using ICT and this could be mapped to the MPRA, could this be termed Technological Pedagogical

Reasoning? Or could MPRA with technology be redefined as TPR? In Shulman's original work there were many references and examples to teachers' work that do not reflect the current use of ICT. Shulman's work was published over twenty-five years ago when ICT did not have a great impact on the practice of teachers. The DPL's do not provide a 'full' picture of the process of TPR, as some aspects of *Transformation* could not be captured in DPL's as it was not the purpose to capture those details in these portfolios. There was also little evidence of *Instruction* unless the teacher was able to capture a recording of the lesson but this is difficult to achieve for the purpose of the DPL (practicalities of recording yourself while teaching and the permission from parents).

Conclusions

To finalize the data analysis, themes will be allowed to emerge from the data (Rudolph, 2006). Each teacher will form a case and teachers will be compared and contrasted within and across cases until no new categories arise. The data will be thoroughly analyzed to determine the elements of TPR with the hope that an understanding of what constitutes TPR and what influences the development of TPR will be found. First level analysis of four experienced teachers digital portfolios has provided evidence of Shulman's model of pedagogical reasoning (Smart et al., 2013). Shulman's original work is over 25 years old and does not reflect the current use of ICT in teaching practices. These teachers' digital portfolios contained evidence of pedagogical reasoning highlighting there may be support for TPR. As this analysis is currently being undertaken it is anticipated that the final thesis will be completed in time for the next ISTE conference and a paper will be submitted with the final results.

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