PROPOSING A MODEL OF PEDAGOGICAL REASONING WITH TECHNOLOGY

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Abstract

This paper proposes a lens to view a teacher’s Technological Pedagogical Reasoning through a digital portfolio. There is much evidence of pre-service teachers preparing a digital portfolio but there is limited evidence of successful programs where in-service teachers have prepared a digital portfolio. This research provides confirmation of a Queensland based program where teachers have completed a digital portfolio as part of the Smart Classrooms Professional Development Framework. This digital portfolio provides rich descriptions of a teacher’s professional values, relationships, knowledge and practice. This type of portfolio encompasses sumptuous discussions and evidence of using technology in the classroom. Inherent in this digital portfolio are elements of their pedagogical reasoning with technology (PRT) or Technological Pedagogical Reasoning. This paper reports on one teacher’s digital portfolio as part of the wider research project investigating the development of PRT. Findings indicate there is evidence of pedagogical reasoning within this digital portfolio, which suggest that PRT is present. Therefore, this paper proposes that it is time for a Model of Pedagogical Reasoning with Technology in order to capture the interrelationship of teaching and technology in the 21st century.

Introduction

This paper presents research from a doctoral thesis that has been designed to understand teacher’s pedagogical reasoning when deciding to use technology. This acknowledges and builds upon Shulman’s earlier theorising about pedagogical reasoning. The paper presents the case that while Shulman’s Model of Pedagogical Reasoning and Action (PRA) is a critical model to explain effective pedagogy; it needs now to be re-examined to explain and accommodate teachers and technologies, and proposes a Model of Pedagogical Reasoning with Technology (PRT). To begin, the SMART Classrooms Professional Development Framework is described to provide the context in which teachers, participating in this research project, have prepared digital portfolios. To understand the process, the digital portfolio is explained with the example from one teacher ‘C1’ or Carmelina (not her real name).

The Smart Classrooms Professional Development Framework (SCPDF)

The Framework, launched in Queensland 2005, adopted tri-level accreditation for teachers to provide evidence of the use of technology in their teaching practices. The three levels were: ICT Certificate, the Digital Pedagogical License, and the Digital Pedagogical License Advanced (Department of Education Training and Employment, 2012a; 2012b). It is important to note that these were conceptualised to reflect pedagogy and digital technologies, as reflected in their naming.

For the ICT Certificate level teachers were expected to show understandings of using technology purposefully. The Digital Pedagogical License was used to demonstrate and reflect on using technology. Finally, the highest level - Digital Pedagogical License Advanced, was designed to show evidence of teachers who lead the transformation of learning through technology (Department of Education Training and Employment, 2012c). Embedded in their digital portfolios, teachers provided evidence of their values, relationships, knowledge and practice.

This SCPDF was successful, as shown in Table 1 by 2010 over 13,500 teachers had completed and
submitted a digital portfolio (O’Hagan, 2010). Within two years, over 25000 teachers had completed and submitted a digital portfolio (Department of Education Training and Employment, 2012a). With a teaching workforce of more than 40000 teachers in Queensland’s state schooling system, this represents a significant growth in their capability with over half of the teaching population providing evidence that they were using technology in their teaching.

Table 1 - Smart Classrooms Professional Development Framework Growth in Capability

<table>
<thead>
<tr>
<th>Smart Classrooms Professional Development Framework</th>
<th>2006</th>
<th>2010</th>
<th>2012</th>
</tr>
</thead>
<tbody>
<tr>
<td>ICT Certificate</td>
<td>549</td>
<td>11714</td>
<td>22000</td>
</tr>
<tr>
<td>Digital Pedagogy License</td>
<td>525</td>
<td>2021</td>
<td>3800</td>
</tr>
<tr>
<td>Digital Pedagogy License Advanced</td>
<td>0</td>
<td>54</td>
<td>54</td>
</tr>
</tbody>
</table>

For this research project the Digital Pedagogical License was used as a lens to view how these teachers pedagogically reasoned with technology.

The Digital Pedagogical License (DPL)

The format of the evidence required for the DPL was published as part of the framework. The DPL required the development of a digital portfolio consisting of a variety of items including:

- context statement;
- belief statement;
- evidence (items including unit overviews, assessment tasks, virtual classrooms screen shots, webquest evidence, links to learning objects, lesson plans, photographs, blogs details, student work, recorded lessons, audio recordings, national testing data, resources and grading examples); and
- a support statement from their principal or delegate.

The objective of the DPL was to acknowledge teachers who demonstrated and reflected on how learners use technology purposefully (Department of Education Training and Employment, 2012c) as a collection of “carefully selected or composed professional experience, thoughts and goals that are threaded with reflection, evidence and self assessment” (Department of Education Training and Employment, 2012b). Each candidate for the DPL was required to discuss and present two or three items of evidence depending on the coverage of the indicators.

There were thirteen indicators covering: values; relationships; knowledge; and practice. Teachers were required to map their evidence against these indicators and show that mapping in their evidence. The indicators were embedded to ensure that they were all addressed in order for the certification to be issued. After completion of the DPL, an ‘Accredited Facilitator’ was assigned to access the portfolio before a certificate was awarded. In compiling their digital portfolio, teachers could use various tools including webpages, virtual classrooms (BlackBoard) and wikis.

A Model of Pedagogical Reasoning and Action

This section presents a brief discussion of Shulman’s Model of Pedagogical Reasoning and Action, referred to as PRA (Shulman, 1987b). It is briefly discussed because it provides the framework upon which to consider the need for renewal linked to pedagogical reasoning with technology.

Shulman’s seminal work (1987b) was his conceptualisation of knowledge base of teaching proposed the Model of Pedagogical Reasoning and Action (PRA). His “view of pedagogical reasoning is from the point of view of the teacher, who is presented with the challenge of taking what he or she already understands and making it ready for effective instruction” (Shulman, 1987, p.14). This thinking is developed “through the process of planning, teaching, adapting the instruction, and reflecting on the
classroom experiences, (teachers) acquire new types of knowledge” (Shulman, 1987, p. 17). The PRA is described in six processes: Comprehension; Transformation; Instruction; Evaluation; Reflection; and New Comprehension. As previously reported in Smart, Sim, and Finger (2013a):

- **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 re-enacts, and/or recaptures the events, the emotions, and the accomplishments” (Shulman, 1987a, p. 117). New comprehension 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. (p. 2)

For this study, we emphasise that Shulman’s PRA was developed well before the emergence of the digital technologies, including the Internet enabled connectivity and its associated possibilities for learning and teaching. Therefore, while PRA is used as a basis for understanding teacher pedagogical reasoning in making decisions about using technology in the complex process of teaching, we also draw upon the work by the authors (Smart, Sim, & Finger, 2012; Smart et al., 2013a; Smart, Sim, & Finger, 2013b) and Finger and Finger (2013) in suggesting that PRA is no longer sufficient, and that teachers engage in pedagogical reasoning with technology.

**Summary of the research design of this study**

This research presented in this paper is part of a wider doctoral research project that has been designed to answer the following research questions:

- how do teachers pedagogical reason with technology? and
- what influences their development of technological pedagogical reasoning?

The teachers selected for this study were considered to be technology-using teachers who had developed a digital portfolio. They reflected diverse teaching contexts, and were at differing points in their teaching careers. Project data have been collected from video-stimulated recall interviews, think-aloud interviews and concept maps. In accordance with university policy, prior to the study commencing, ethical clearance (EDN/89/11/HREC) was obtained.

Findings from the wider study will be presented as a multiple case study design whereby each teacher will represent one case. Each case will include the teacher’s digital portfolio. Case studies “are strong in reality…because case studies are down to earth and attention holding, in harmony with the reader’s own experience, and thus provide a natural basis for generalisation” (Cohen, Manion, & Morrison, 2011, p. 292). While conclusions drawn from this small qualitative study may lack statistical significance, the insights gained from the number of case studies will add to the growing body of literature on teachers’ pedagogical reasoning with technology.

The digital portfolios were analysed using Shulman’s PRA as a theoretical frame and has been reported by the authors (Smart et al., 2013a, 2013b). This paper provides a detailed description of the mapping of one individual teacher’s digital portfolio. As previously published in an International Society for Technology in Education (ISTE) conference paper (Smart et al., 2013a), Table 2 contains a revised example of the mapping of Shulman’s PRA to the DPL headings for a new teacher - Carmelina. A portion of the table has been reproduced below to show an example of this mapping.

**Table 2 – Revised Example of the mapping of Shulman’s Model of Pedagogical Reasoning and Action to the DPL Evidence Item Headings**

![Page 432 of 487](image-url)
Evidence from one teacher - Carmelina

Carmelina has been selected for review and discussion in this paper. Carmelina has been teaching for over 20 years in a primary school setting. She would be described as a highly accomplished teacher and is recognised in her school as such. She has previously held technology leadership responsibilities in her school, and she is informally responsible for mentoring teachers to use technology. She had first prepared her digital portfolio in 2009 and significantly updated it, when renewing it in 2011. Carmelina has provided two pieces of evidence in her digital portfolio, and this has been mapped to the PRA as shown in Table 3. The text in italics is taken directly from her digital portfolio.

As shown in Table 3, there is evidence across all aspects of the PRA. This supports and extends what has been previously reported by the authors (Smart et al., 2013b) and provides evidence that the PRA is valid. However, as Shulman’s original work was published over twenty-five years ago and before technology becoming so prevalent, the evidence shown incorporates digital technologies and pedagogy. Consequently, the key question is whether or not PRA is still valid. We suggest that PRA is now insufficient, and along with the expanding TPACK (Mishra & Koehler, 2006) literature research which builds upon Shulman’s Pedagogical Content Knowledge, we agree here with Finger and Finger (2013), and to build upon the work of Starkey (2010) outlined in her paper Teachers’ pedagogical reasoning and action in the digital age, and Smart et al. (2013) in proposing a Model of Pedagogical Reasoning with Technology.

For teachers, the use of technology can be add on to existing practices, or it can transform existing practices (Finger, Russell, Jamieson-Proctor, & Russell, 2007). The evidence shown in Carmelina’s digital portfolio highlights this teacher’s transformational use of technology by incorporating Learning Contract (Item 1) and Science Unit (Item 2). Carmelina’s key argument for this approach is to provide differentiation for her mixed ability students plus the class being a 1:1 laptop class where all students used their own school defined but individually purchased laptop. Both items of evidence show a redesign of the teaching approach from instruction through to evaluation with the use of technology. This is supported by Teacher-Carmelina’s discussion of her beliefs of using technology in her teaching.

Transformational learning occurs when there is a fundamental shift in learner’s worldview, which leads to profound changes in the learner themselves, not just their thinking. ... I advocate purposeful digital pedagogy to teachers and students and support others in this endeavour. (Carmelina – Digital Portfolio - Belief Statement)

Conclusion

Proposing a Model of Pedagogical Reasoning with Technology (PRT)?

This paper has presented a sample of evidence to show support for Shulman’s PRA as found in this teacher’s digital portfolio. The digital portfolio was created to show the knowledge, values, relationships and practices of using technology and, in particular, the opportunities this teacher has taken to transform her teaching with technology. However, it is clearly evident that digital technologies have
implications for the way in which teachers undertake their pedagogical reasoning, which builds upon PCK /TPACK and PRA/PRT. Therefore, is the PRA still appropriate or do we need a new model incorporating technology as Pedagogical Reasoning with Technology? The contribution that this paper makes is to raise this question and to propose that further research needs to be undertaken to explore the proposal here for a Model of Pedagogical Reasoning with Technology.

Digital portfolios

This research upon which this paper is based has demonstrated how practising teachers are using digital portfolios for provide evidence for professional purposes, such as the SCPDF accreditation and career development. These digital portfolios were not based on professional standards but a consistent framework based on items of evidence to enable them to be peer reviewed. In examining the nature of the evidence included and the ways in which teachers explain the purpose of the evidence, the study is identifying specific factors that align with a model for pedagogical reasoning but include of course, a focus on the use of digital technologies.

It is suggested that digital portfolios should be viewed as a career-long and lifelong investment from graduation, registration, and career promotional advancement in developmental and leadership career stages, and not as separate digital portfolios, but conceptualised and supported as a continuous process of reflection and renewal. While the technology platform might change, such as the use of social media such as LinkedIn, the teacher has a sense of agency to update, review and improve their digital presence and portfolio.

The format for this type of digital portfolio has no linkage to the professional standards. We suggest that in Australia, the format and approach for preparing any digital portfolio could also be conceptualised according to the Australian Professional Standards for Teachers (AITSL, 2011). This would facilitate a digital portfolio development that not only responds to a nationally recognised representation of the work of those teachers, but can develop evidence to contribute to a clearer understanding of what constitutes the career stages of the 21st century teaching profession. In this way, the digital portfolios that include reference to the professional standards would provide comprehensive evidence of what is important to become a quality teacher. Teachers could map the standards to their digital portfolio responses. This would also provide them with a means to identify opportunities to expand their knowledge and experiences and for others to easily see that they have addressed all focus areas.

In Queensland, the system established to support the Smart Classrooms PD Framework was effective in promoting teacher engagement with many teachers across the state preparing a digital portfolio and a network of people to mentor and assess those digital portfolios. Disappointingly, due to a change in Government and subsequent budget cost cutting, this program was no longer funded to continue in the established format. Though some schools and regions have decided to encourage teachers to continue, in general, in 2014, it has lost momentum across the system and the references to the DPL on the SCPD website have been removed. There is now the assumption is that technology is embedded in their teaching, because of the new Australian Curriculum (which is now also being reviewed). This assumption is problematic, and considerable work is suggesting that TPACK capabilities require significant development in an era where PCK and PRA are insufficient. As this paper concludes, it is proposed that TPACK might be enhanced through the development of Pedagogical Reasoning with Technology.
<table>
<thead>
<tr>
<th>DPL Evidence Item</th>
<th>Teacher – Carmelina Item 1</th>
<th>Teacher – Carmelina Item 2</th>
<th>PRA</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Title</td>
<td>Integrated learning contract using Microsoft OneNote</td>
<td>Its electrifying - A science unit</td>
<td>Comprehension</td>
</tr>
<tr>
<td>2 Date of implementation</td>
<td>2011</td>
<td>2011</td>
<td>Instruction</td>
</tr>
<tr>
<td>3 Evidence</td>
<td>OneNote/Photo/Screen shots/Work samples/Curriculum documents</td>
<td>Unit Plan/Photostory/Childs work sample Virtual classroom/Class blog</td>
<td>Instruction Evaluation</td>
</tr>
<tr>
<td>4 Year level and student context</td>
<td>Y5 -eLearning class/Gifted and talented focus school where differentiation is school policy</td>
<td>Y5 -eLearning class/Gifted and talented focus school where differentiation is school policy</td>
<td>Comprehension Adaptation</td>
</tr>
<tr>
<td>5 Item overview</td>
<td>Learning contract covering learning for one month</td>
<td>Science unit – concept of electricity and simple circuits.</td>
<td>Comprehension</td>
</tr>
</tbody>
</table>
| 6 Reason for inclusion | • Use of digital technology allows for differentiation very effectively with the use of open ended software.  
• Students were able to work independently.  
• Assist with support staff as task was set up with clear instructions. | Example of work that has used online community for collaboration and sharing. | Comprehension Preparation Representation Instructional Selection Adaptation Tailoring Comprehension Preparation Representation Instructional Selection Adaptation Tailoring Evaluation |
| 7 Development and planning | • Having a master of the work proved invaluable as I could spend the majority of my teaching time supporting the children and not on sending, saving distributing or creating resources for the class.  
• Used agreed learning materials for year level.  
• as a 1-1 eLearning class we had the ability to provide a wider range of resources and response tools. | | |
| 8 Curriculum links | • School is a gifted and talented focus, school differentiation and productive pedagogy is a planning consideration | • State based essential learning for Science and ICT. | |
9 Central focus of the student learning (curriculum intent)

- Differentiation
- Science
- ICT tools for collaboration and learning

10 Sequence of learning

- Detailed lesson sequence
- Embedded in learning

11 Teaching and learning approach

- The learning contract is a purposeful way to scaffold differentiated learning.
- This item clearly shows my belief in teaching and learning for a purpose and that digital devices are to be used as tools to drive and support learning.
- Whole class instruction
- Group work
- The virtual classroom community became a place where learning could occur at school and at home. The class could use the learning objects and blog entries to contribute to their homework log and even involve family in the learning experiences.

12 My learnings

- …effective tool to structure the content and learning experiences.
- Children requiring support found the flexibility a challenge at the start of the contract as they tried to complete activities they considered “fun” to the exclusion of learning they found challenging.
- OneNote itself proved to be a very successful tool to differentiate the learning tasks, however on reflection I would have introduced the OneNote contract as a smaller learning experience initially as a maths investigation.
- OneNote has been so successful…I have already planned next terms maths investigation…
- The unit was very successful as it engaged the children and allowed them to collaborate in a safe environment.
- Some student literacy issues when contributing to a blog …I would buddy them with another learner for support
- Overall the unit is interactive, interesting and the students rate it as one of their favourites in the year.

13 Further reflections and information

- I have been asked to share my experience with OneNote in a web conference to eLearning Facilitators on transformational learning in term 3 this year.
- Looking forward to using new ICT learning tools.
- The unit could be negotiated with higher-level learners …They could have a journal of their learning possibly in OneNote and contribute to a blog as proof of their learning.

- Reflection
- New Comprehensions
References


