The alignment of digital pedagogy to current teacher beliefs

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The alignment of digital pedagogy to current teacher beliefs

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Abstract

This paper explores teacher beliefs that influence the ways Information and Communications Technologies (ICT) are used in learning contexts. Much has been written about the impact of teachers' beliefs and attitudes to ICT as 'barriers' to ICT integration (Ertmer, Ottenbreit-Leftwich & York, 2007; Higgins & Mosley, 2001; Loveless, 2003). This paper takes a closer look at the types of beliefs that influence ICT practices in classrooms and the alignment of these beliefs to current pedagogical reform. The paper reports on the initial phase of data collection for a Griffith University Industry Collaborative project. The Industry Partners are four Catholic primary schools and their communities in the Brisbane Archdiocese. A teacher survey was implemented across the four schools. Questions asked participants about their ICT beliefs, practices and competency, as well as future ICT directions. The survey data was analysed using a factor analysis with correlations made to data sets. The results present specific links between ICT beliefs that are informing teachers' practices. ICT beliefs and practices are aligned to reform agenda for digital pedagogies. The findings of this research inform teacher ICT practice and requirements for ICT professional development.

Introduction

It can be simply stated that teachers' pedagogical beliefs affect their teaching behaviours in the classroom (Bandura, 1986; Clark & Peterson, 1986). With the advent of Information and Communications Technologies (ICT) in education, teachers form their own beliefs about the role of ICT as a teaching tool, the value of ICT for student learning outcomes and their own personal confidence and competency. These beliefs intersect with teachers' established pedagogical beliefs. This intersection can be a 'collision' or 'collusion', both having implications on how ICT is used in the classroom, as an add-on to established curriculum practices or as a tool that effects change in their practice (Prestridge, 2007). Teachers are likely to plan and implement practices with technologies that reflect their beliefs about teaching and learning (Drenoyianni & Selwood, 1998).

Teacher beliefs have been identified as a 'second-order' barrier to the integration of ICT in teaching and learning (Ertmer, 2005). First-order barriers are extrinsic to the teacher and include lack of resources, time, access and technical support. As part of current educational reforms, such as The Digital Education Revolution 2008-2011 in Australia (Department of Education, Employment and Workplace Relations (DEEWR), 2009), The National Education Technology Plan in America (U.S. Department of Education, 2006) and the Every Child Matters programme of change in the United Kingdom (Department of Children Schools and Families (DCSF), 2009) technological infrastructure such as broadband internet, as well as new ICT equipment, online curriculum resources and ICT training for teachers is being delivered. Regardless of place, sentiment such as this is leading these reforms:

> *'Australia will have technology enriched learning environments that enable students to achieve high quality learning outcomes and productively contribute to our society and economy' (DEEWR, 2008, p.4).*

First-order barriers, consequently, are being overcome. Teachers are gaining access to ICT, professional development is available, and digital curriculum resources are accessible and are continually being developed- the digital classroom is a reality. However, teachers' ability to use these digital tools in their classrooms, that is, the digital pedagogies required for the effective implementation of ICT, have not been adopted by the majority of teachers (Scrimshaw, 2004) and there still exists a division between the input of the early adopters and the reality of a more widespread implementation of ICT (Watson, 2006). Tondeur, van Braak and Valcke's (2006) research on the impact of a national curriculum on the use of ICT in primary schools found that Flemish primary school teachers still stress, to a large extent, technical ICT skills. Smeets (2005) also argues that current ICT integration in Dutch primary schools reflects traditional pedagogical approaches that emphasise skill-oriented instructional use of ICT. Similarly, evident in Prestridge's (2007) examination of curriculum reform in Australian primary schools, the majority of teachers were expected to reach targets aimed at augmenting the existing curriculum, in other words, adding-on ICT or assimilating ICT as traditional teaching that has been technologised (Lankshear & Bigum, 1998). The Digital Education Revolution in Australia is a response to the finding that even though most teachers and students benefit from access to computers and online resources 'only a minority are reaping the benefits of the information technology revolution' (DEEWR, 2008, p. 3) by using digital pedagogies.

Current reform agenda suggests a 'meaningful change to teaching and learning' described as 'student centric programs of learning' that 'employ contemporary learning resources and activities' (DEEWR, 2008, p.4). Student-centred activities that utilise digital resources can be described as 'Digital pedagogies'- teaching and learning practices that engage with digital technologies. Exemplary teachers who embed ICT in a seamless fashion have been defined as those who use ICT in learner-centred constructivist environments as opposed to traditional teacher-directed environments (Ertmer et al., 2007). This does not imply that direct instruction is not appropriate, as Gibson (2001) points out that the most effective learning environment is 'that in which the teacher, the facilitator, the guide, the instructor is capable of selecting the most appropriate strategy', knowledge instruction or knowledge construction, and that ICT must be 'transparent to the learner and allow for ubiquitous learning opportunities' (p. 56). Consequently, if teachers are required to implement the kind of pedagogical change indicated in current educational reform agendas, professional development programs must look beyond first-order barriers to the intrinsic, more complex second-order barriers of teacher beliefs and how they influence ICT implementation in the classroom. This paper provides an examination of teachers' pedagogical beliefs about ICT that inform their classroom practices in the context of current reform agenda.

Theoretical Framework: Teacher beliefs and the link with ICT practices

Teacher beliefs about learning and teaching are critical factors in how ICT is actualised in the classroom (Becker, 2000; Cox et al., 2004; Orlando, 2009; Wozney, Venkatesh, & Abrami, 2006). The relationship between teachers' beliefs and the integration of ICT has been explored in the literature. Loveless (2003, p. 323) in her research of primary teachers' perceptions of ICT and their pedagogy, found that teachers' perceptions of ICT are fashioned by their 'identity and participation in wider cultural and social spheres which influence the professional arenas and settings in which they practice'. She grouped teachers' perceptions of ICT into three categories: ICT in society: teachers talked about the 'Information Society' and its impact on children's future working lives; ICT capability: teachers talked about the ICT skills or 'information literacies' children require as a subject and as a cross curricular tool; and ICT in schools: teachers talked about 'new' technology in schools and how the lack of resources influenced its integration. Loveless suggests that these perceptions reflect ongoing negotiations of the meanings of ICT in teachers' work and that seeing them as sources of tension rather than as sources of anxiety is more constructive for continued meaning-making.

Veen (1993) found that teachers' beliefs about the nature of a given subject, such as History or Science, and the associated pedagogical practices greatly influenced their use of ICT. This aligns with the concept of Technological Pedagogical Content Knowledge (TPCK) provided by Mishra and Koehler (2006), who highlight the way ICT applications change content knowledge. Jacobs and

Clements (1999) found two distinct epistemologies that were either conducive or obstructive to the implementation of ICT. A constructivist epistemology 'believing that students learn best when they are given projects and guidance to help them construct mathematical concepts for themselves' (p.243) was found to be conducive, whereas a reductionist epistemology, 'where concepts are viewed to be passed along one at a time to students' (p. 244) was found to be obstructive. Howard, McGee, Schwartz, and Purcell (2000) developed a scheme to represent the underlying beliefs of objectivist/constructivist learning models, indicating that a sophisticated epistemology engenders principles of constructivism. The relationship between constructivist approaches and the use of ICT is presented as highly effective in the literature (Becker, 2000; Ertmer et al., 2007; Gibson 2001; Jonassen, 2006; Scrimshaw, 2004).

Cox et al (2004) moved away from the instructionist/constructivist framework to analyse ICT practices shaped by pedagogical beliefs. They did this by focusing on teachers' perception of ICT in the teaching process, that is, as a 'servant' to reinforce existing practices or as a 'partner' to change the way the teacher and the children interact with one another and the given task. In this way, trying new approaches to a task is perceived as necessary to utilise the ICT. Loveless, Burton, and Turvey (2006, p. 10) captured student teachers' reflections on their conceptualization of their teaching practices that supported development of children's creativity through the integration of ICT. Student teachers' pedagogical beliefs were described as 'play as a starting point', 'giv[ing] permission to try things out', 'compromise and improvisation in responding to the children's ideas' and 'not wish[ing] to provide too much guidance which might 'stifle''. These student teachers were learning *with* the children in their groups, as facilitators of creative thinking, rather than as instructors of ICT functions.

Evident in this literature are the influences on teacher beliefs about ICT. Influences include technology in society and working life, teacher competency, access in classrooms, the nature of the subject or task and associated pedagogies, how children learn, and the learning outcomes to be achieved. There is a link between teacher beliefs associated with constructivist approaches and using ICT as a partner to facilitate creative thinking and learner-centred activities. These beliefs align with what has been described previously in this paper as digital pedagogies. Teacher beliefs that expose digital pedagogies will be explored further in this paper.

Research Context

This paper reports on one aspect of a research project concerned with ICT professional development that enables teachers to engage with digital pedagogies. The project aims to extend the conceptual boundaries of Teacher ICT Professional Development through multiple layers: layering of 2 Dimensional (2D) and 3 Dimensional (3D) communities of practice of classroom teachers, with an extension to the layering of school community as participants in teacher ICT professional development. The project is supported by funding from Griffith University, Queensland, Australia and four Catholic Schools in the Brisbane Archdiocese.

The four Catholic schools and their communities provide the research context. The schools are within the greater metropolitan region and are all Prep to year 7 (Primary schools), and educate from 200 to 520 children. All teachers and community members were informed of the research directions and ethical clearance.

Methodology

This paper is concerned with examining teacher beliefs and practices to gain conceptual understanding of the requirements for implementation of virtual ICT professional development. To ascertain teachers existing pedagogical beliefs and practices with ICT a survey was distributed to all teachers within the four catholic schools (n=48). Questions asked participants for background and demographic information, ICT beliefs, ICT practices in general, current ICT usage and ICT competency as well as future ICT directions. The survey also included questions regarding the types of professional development that teachers had attended, and teachers' perceptions of effective elements of ICT professional development. Participant teachers responded on a 7-point Likert scale (Agree to

Disagree). Three items in the scale were recoded to ensure all items were reporting a positive orientation to the integration of ICT.

Survey data was analysed using the Statistical Package for the Social Sciences (SPSS). An initial assessment of the reliability of the scale was undertaken. A Factor Analysis was used to identify dimensions underlying the set of questions – using an Oblimin Rotation, with Principal Components Extraction with Factors identified where eigenvalues were greater than 1. Factor scores were calculated from identified questions and these were recoded to a 3-point scale to allow an assessment between these Factors and teacher beliefs.

For the purpose of this paper, data relating to teacher beliefs and teacher practices was analysed. No data on professional development has been included in the analysis. The 'teacher practices' data set was analysed for Factors. Cross tabulation with 'teacher beliefs' data set followed.

Results

The data set in the survey comprised of Agree/Disagree scaled responses to 11 questions regarding teachers' current ICT practices.

The scale (Items 1-11) had a moderate reliability, given the relatively small sample size, with a Cronbach's $\alpha = .678$. Analysis of the scale indicated that Question 3 was poorly correlated to the overall scale, with an $\alpha = .727$ for the 10 remaining items.

The Factor Analysis was undertaken on all 11questions. The Factor loadings (from the Pattern Matrix) are presented in Table 1 along with the level of variance explained by the identified factors. No significant correlations were found between the four Factors.

Table 1 Identified factors with weightings reported in Pattern Matrix (% explained variance)

Item	Factor1 (28.579%)	Factor 2 (16.215%)	Factor 3 (11.608%)	Factor 3 (10.139%)
Question 1	.773	.248	-.184	.222
Question 2	.371	.145	.263	.307
Question 3	.063	.264	.872	-.047
Question 4	-.108	.649	-.440	-.116
Question 5	.181	.846	.128	.043
Question 6	-.077	.706	.217	-.096
Question 7	.824	-.239	.228	-.136
Question 8	.501	.104	-.353	-.219
Question 9	.099	.207	.212	-.721
Question 10	.366	-.108	.057	-.680
Question 11	-.237	.014	-.137	-.811

This analysis suggests that teachers were responding to four Factors, as defined by associated questions in Table 2. While Question 3 was included in the Factor Analysis it was identified as a distinct Factor, consistent with the assessment from the reliability analysis. Question 2 (on Factor 1) did not load strongly on any factor, but has been included under Factor 1 – its strongest loading.

Table 2 Factors and associated questions

Factor 1	**Factor 2**	**Factor 3**	**Factor 4**
Qb1rec: I do know how to use ICT to enhance children's learning in my classroom	Q8b4: Teaching critical analysis is an important part of ICT activities	Q8b3: Students need to be competent at basic computing skills before they engage in a broader range of higher level ICT activities	Q8b9: ICT activities should enable students to draw on and engage with problems encountered in real-life
Q8b2: As I plan the next unit of work I think about how I will integrate ICT	Q8b5: ICT activities should relate to student's everyday out-of-school experiences		Q8b11: Students are more self directed during ICT activities which changes my role as a teacher
Qb7rec: ICT shouldn't be taught as a separate subject area	Q8b6: ICT lessons should focus on skill development		Q8b10: ICT activities are part of larger on-going tasks than explicit ICT focused lessons
Qb8rec: An ICT specialist shouldn't be employed to teach ICT to all students			

Drawing upon the Literature for Digital Pedagogies the Factors are presenting different ICT practices:

Factor 1–teachers practices are represented in this Factor as Foundational ICT Practices. The statements expressed in Factor 1 are in the affirmative and indicate that teachers were responding to foundational ICT practices such as thinking about ICT in the planning phase, understanding that ICT should be integrated into all Key Learning Areas and is the responsibility of the classroom teacher. ICT was also identified as a tool to enhance children's learning. These practices could be considered as 'general' or 'basic' in this form as there is no development of 'how' ICT enhances learning and the statements depict general understandings represented in curriculum documentation for the use of ICT in learning (see for example Queensland Studies Authority -Essential Learnings).

Factor 2- teachers practices are represented in this Factor as Developing ICT Practices. The statements expressed in Factor 2 indicate that teachers are thinking about curriculum implications of ICT such as ICT activities encompassing critical thinking, skill components and relevancy to life experiences. These elements demonstrate a development towards what has been described as digital pedagogies.

Factor 3- teachers practices are represented in this Factor as Skill-based ICT Practices. One statement was expressed in this Factor indicating the focus on ICT skills. The idea represented in this statement, that basic ICT skills precede student engagement in complex ICT tasks, aligns with the aggregation of skills similar to an ICT skills continuum, which reduces ICT to a competency approach rather than a tool for thinking and creating. In other words, it suggests that students must do Word processing before Web design or Robotics and that ICT skills are in focus rather than an enhancement of learning. The skills directive aligns with traditional knowledge competency, sometimes called an 'Industrial' narrative (Whitby, 2006), whereas utilising ICT as a thinking or mindtool (Jonassen, 2006) enabling complex ICT applications at any given point, orientates with constructivist approaches that are more likely to be associated with digital pedagogies.

Factor 4- teachers practices are represented in this Factor as Digital Pedagogical Practices. The statements expressed in Factor 4 indicate that teachers are identifying characteristics of ICT application that represent digital approaches such as enabling students to engage with authentic problem-oriented activities, the beliefs that ICT is a tool within the task, not a focus of the lesson, and the beliefs that the teacher's role is changing to facilitate self-directed learning.

The Factor scores for each factor were used to link teachers to the Factor with which they were most strongly identified – these are presented in Table 3. The teachers are represented by the whole number given to them on their survey. The greater the factor score the greater the teacher's affiliation with that Factor.

Table 3 Teachers and their Factor score

F1: Foundational		F2: Developing		F3: Skill based		F4: Digital	
4	2.2018	42	2.50905	17	2.34457	11	1.41201
25	1.73344	26	2.22911	44	1.93888	16	1.11574
18	1.53039	22	2.09439	3	1.78852	20	1.10814
2	1.36374	31	1.12016	15	1.74653	12	0.78007
1	1.35452	34	1.10696	5	1.41288	48	0.73697
49	1.34115	29	1.0974	45	1.30856	46	0.69815
35	1.33282	6	1.07809	30	1.18596	41	0.61472
47	1.29458	32	1.03018	33	0.96685	27	0.31932
38	1.18229	9	0.32983	43	0.5842	28	0.30368
37	1.12293						
13	1.06253						
23	0.89081						
40	0.79959						

Most teachers identified with Foundational ICT practices (Factor 1). Of the 49 teachers surveyed 9 teachers did not have a marked preference on any of these Factors. These teachers are not represented in Table 3. There is stronger alignment for teachers with Developing ICT practices (Factor 2) where scores are greater than 2 compared with teachers indicating Digital Pedagogies scoring in the range of 0.3- 1.4, identifying it as the weakest Factor.

To further explore current teacher practices the relationship between the scale, identified Factors and the teacher beliefs data set (Table 4) was assessed. The 11 questions in the data set for teacher beliefs (agreement scale was 1 Agree to 7 Disagree) are displayed in Table 4.

Table 4 Teacher beliefs survey questions

Question 1	I believe ICT is a valuable learning tool in my classroom
Question 2	ICT enhances the learning of subject content
Question 3	ICT can make learning relevant and current
Question 4	Students need to use ICT because it relates to their future employability
Question 5	Students need to use ICT because of the expansive use of technologies in society
Question 6	Children are motivated to use ICT
Question 7	Using ICT helps children think about the concept under study more deeply
Question 8	I use ICT because it is required by school policy
Question 9	ICT disrupts learning
Question 10	Because of technical issues ICT is often a waste of time
Question 11	ICT changes how children learn

Cross tabulations were undertaken to identify the views of the teachers against beliefs by their Factor group. While the numbers were too low to be able to test statistical significance various patterns were observed, as discussed below, that contribute to our understanding of the link between teacher ICT practices and beliefs.

There was a high level of agreement by all teachers to Question 1- 'ICT as a valuable tool' with this strongest in Factor 3 and 4 (100% strongly agreeing) compared to Factor 1 and 2 where fewer than half the teachers responded this strongly with 1 member of both groups uncertain as to the value. When identifying the relationship between ICT and subject content, (Q2) those in Factors 3 and 4 again expressed the strongest agreement, contrasting to Factor 1 and 2 where opinion ranged from strongest agreement to uncertainty. Beliefs statements 3 to 6 affirm the use of ICT to the curriculum for relevancy and motivation and to future employment needs. Teachers responding to Factor 4 consistently showed the strongest agreement to these items while those responding to Factor 1 were least positive with disagreement expressed on question 4 to 6 (2, 1, and 2 persons respectively).

Belief statements 8, 9, and 10 cast negative beliefs associated with ICT- it is required, it disrupts, and it is a waste of time. In regard to policy driving ICT use, teachers responding to Factor 1 and 2 oppose this statement consistently by responding in the negative 5-7 disagree range. Teachers in Factor 3 strongly disagree while teachers in Factor 4 had responses from agree to disagree with this statement. Interpreting this belief statement, teachers could acknowledge the policy requirements in either a positive or negative way. All teachers disagreed that ICT disrupts learning, with teachers in Factor 1 disagreeing the least.

Finally, in regard to technical issues making ICT a waste of time, the majority of teachers strongly disagreed, with strongest disagreement by teachers in Factor 4 (44.4%). However, there was a lot of variation across the agreement scale from teachers in all Factors. This suggests that technical issues impede the use of ICT and frustrates the teacher.

Beliefs 7 and 11 were included in the survey to differentiate teacher beliefs associated with digital pedagogies. Statement 7 links the role of ICT to conceptual development while statement 11 indicates the changes to how students learn with ICT. In regard to conceptual development over half (55.6%) of teachers in Factor 4 strongly agreed with this statement. All other teachers responded by mainly agreeing at the 3 on the scale (teachers in Factor 1 and 3) while teachers in Factor 2 were uncertain (4 on the scale). In regard to changes in how students learn, all teachers in Factor 4 agreed, while 75% of teachers from the other three Factors also agreed.

The responses to these belief statements align with the interpretation of the Factor groupings. Teachers are responding in ways that connect their ICT beliefs with their practices. For example, teachers responding to Factor 4 Digital Pedagogies have strong agreement values for ICT beliefs that relate to their ICT practices. This is also the case for teachers responding to Factor 1 and 2 as they are developing their understanding of the role of ICT in learning. Interestingly the teachers responding to Factor 3 who are ICT Skill-orientated in their practice are also more aligned to digital pedagogies in their belief statements- though not as strongly as those teachers responding to Factor 4. The only beliefs to which these teachers did not respond strongly to were the beliefs addressed in question 7 - 'conceptual development and ICT', which focuses ICT use on learning rather than skilling, and the beliefs addressed in question 8, which linked ICT to school policy. All of Factor 3 disagreed with this statement.

It is suggested here that further more indepth investigation is needed into how the belief statements are being interpreted by the teachers.

Conclusion

In this paper teachers' beliefs about ICT and their practices in the classroom have been presented based on survey data. Reflecting on the current educational reform agenda in Australia, teachers are being asked to employ contemporary learning resources and activities that will ensure a digitised curriculum through digital pedagogies. Enabling this meaningful change to teaching and learning

suggests that teachers would be better positioned to engage with this if they possessed ICT beliefs and practices representative of those teachers who were responding to Factor 4 Digital Pedagogies. As evident in both the ICT beliefs and ICT practices, these teachers are acknowledging the role of ICT as a tool to learn with, the relevancy of ICT to society and future employability, and the orientation towards authentic problem-based approaches to teaching and learning.

The other three Factors to which the teachers were responding to suggest the various approaches to ICT in schools currently. Foundational and Developing ICT practices represent those teachers who are beginning to engage with ICT in teaching and learning and are moving towards what could be considered as Digital Pedagogies. These teachers responded to the ICT beliefs statements in ways that suggested their uncertainty or lack of engagement with ICT. Teachers who were responding to Factor 3, Skill-based ICT practices, could be considered those teachers who are operating within a traditional teacher-centred approach where developing ICT skills are in focus. Interestingly, these teachers were agreeing with ICT beliefs align with Digital Pedagogies, however, not with the same conviction.

Further research is therefore needed to examine the actualised practices that stem from these stated beliefs. As Albion & Ertmer (2002) found that teachers' beliefs about ICT do not always match their classroom practices.

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