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How does pre-service teacher preparedness to use ICTs for learning and teaching develop during the first two years of teacher training?

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Pre-service teacher development in the use of ICT's in the classroom was one of three aspects investigated over a period of two years in a qualitative study. Data collection was performed using three semi-structured interviews (3 phases), this was analysed and the developmental positioning of the pre-service teachers determined using a model developed by Taylor (2004). The results illustrate the diversity in students' initial capabilities, and indicate that the students' development over time was impacted in the main by attitudes and beliefs formed in class and on teaching placements, hands–on experience, and modelling of ICT use. Due to the acknowledged need for graduate teachers to effectively integrate technology into their teaching, the results are likely to be of interest to teacher educators involved in early childhood, primary and secondary pre-service teacher education courses. The paper is also likely to be of interest to higher educators in other professional disciplines, particularly those in which changes to course structures and content have been proposed on the basis of assumptions about the capabilities of 'Digital Native' students.

Keywords: ICT education; pre-service teacher attitudes; teacher education

Introduction

The development of skills and knowledge in the use of ICTs is increasingly deemed to be an important aspect of preparation for participation in an information society, as is the use of ICTs to enhance the quality of learning and teaching in classrooms. Despite significant political will and expenditure on equipment and training, levels of ICT integration in classrooms for learning and teaching are often low. This paper reports on a project which investigated the preparedness of Primary Education students' to use ICTs in the classroom. The aspect in focus for this paper is the development of pre-service teachers to use ICTs for learning and teaching which was traced and positioned using a model developed by Taylor (2004).

The project employed a qualitative approach, gathering data through a series of three semi-structured interviews held over a period of two years. The sample comprised eight volunteer participants drawn from a population of 118 first year Bachelor of Education (Primary) students, though not all students participated in each interview phase.

In the first phase of the study (interviews May 2007), the first year Primary Education students'

perspectives on their preparedness to use ICTs for learning and teaching was examined by investigating their attitude towards ICTs, experience and confidence with ICT's, as well as their intent to use ICTs in the classroom. The second phase (interviews June 2008) aimed to establish in what ways ICT use, and the experience of their first teaching placements may have altered their perspectives and intent. The final stage for this project investigated whether and/or how their experience, confidence, and intent translated into practice i.e. using ICTs in the classroom during their second placement (Sept/October 2008). The study also examined the developing understandings of teaching using ICTs, positioning these pre-service teachers at various stages of their learning using a model developed by Taylor (2004).

The study suggests that potential exists to maximise teacher preparedness to use ICTs through teacher modelling of ICT use in tandem with technical and pedagogical skill and knowledge development, and by providing opportunities for pre-service teachers to observe, think about, experience, and reflect on how they might use ICTs for learning and teaching.

Background

A key part of the Rudd government's election platform was a set of school education policies incorporating a 'Digital Education Revolution', which aimed to "contribute sustainable and meaningful change to teaching and learning in Australian schools that will prepare students … to live and work in a digital world" (DEEWR, 2009). However, this is only the latest in a long series of political initiatives in Australia and internationally which, despite significant spending on technical equipment and training, have continued to see very low levels of ICT integration in schools. A number of commentators who have reviewed the history of ICT integration internationally have questioned the impact on schools of large scale investment in technology. For example Cuban, Kirkpatrick and Peck (2001) argue that studies have repeatedly shown infrequent use of computers in classrooms, and lack of widespread change to teaching approach even when technologies have been made widely available. Somekh (2004, p.163) characterises the situation of one in which policy makers have "unrealistic visions for information and communication technologies", and argues against the "superficial addition" of ICTs to current systems. Both commentators list teacher preparedness to use ICTs as a barrier to widespread and effective adoption. Clearly, the question of how best to prepare teachers for the effective use of technologies in their classrooms is of pressing concern for teacher educators.

The drivers behind government and organisational policy relating to ICT integration are many and varied. Reasons cited for encouraging ICT integration include the need to equip students with the skills to participate and thrive in an information society, and the need to create highly skilled and flexible workforces (Baskin & Williams, 2006; Ottesen, 2006). The potential for enhancement of the "quality of the learning experience" and the transformation of pedagogy are other factors driving ICT integration in classrooms (McNair & Galanouli, 2002, p. 182).

Providing some insight into the issue of teacher preparedness to use ICTs for learning and teaching, Granger, Morbey, Owston & Wideman (2002, p. 487), explain that the "relationship between teachers' ICT skills and successful implementation is complex." The results of their study of schools suggests that there are a range of contributing issues including teacher "attitudes, philosophies, communication, and access to skills training", in addition to having the necessary equipment, support, and education (p. 487). Baskin and Williams (2006, p. 10) posit that human factors are "… the most critical in nurturing the ICT culture and growing the critical mass of teachers able to sustain the use of ICTs effectively in their teaching".

Wang (2002, p.152) concurs and asserts that "pre-service teachers' beliefs and perceptions play a crucial role in shaping their future teaching behaviors." Brownlee, Purdie, and Boulton-Lewis (2001, pp. 247-248) with a view to increasing the preparedness of pre-service teachers to use ICTs, suggest that "teacher educators need to focus on teacher thinking and teacher beliefs to facilitate changes in the teaching-learning process." From these findings it would seem clear that human factors such as attitudes and beliefs have a significant influence on teacher behaviours, and consequently their preparedness to use ICTs for learning and teaching. The complexity of the process by which teachers become prepared for the integration of ICTs into their teaching, and in particular the fact that there is a whole range of factors aside from personal usage and basic computer skills that come into play has been the subject of research for some time, with Downes (1993) one of the earliest to identify this as an important issue. More recently, the importance of professional experience placements in the preparation of teachers for the effective use of ICTs in their teaching has been recognised by a number

of researchers (see, for example, Duran, Fossum & Luera, 2006; Steketee, 2005), and was one of the key conclusions from a large DEST funded study led by Downes et al. (2001).

At Charles Sturt University (CSU), all of the early childhood, primary and secondary teacher education degrees have recently undergone major reviews and in each case there was a move from requiring students to complete ICT subjects to a model whereby ICT skills and pedagogical knowledge are taught in an integrated way within discipline and curriculum method subjects. Implicit in this move was an assumption that students were 'digital natives' (see Prensky, 2001) and would consequently enter their courses with substantial ICT skills, an assumption which has been brought into question by the results of a large Australian Learning and Teaching Council funded project (see Kennedy, Dalgarno et al., 2007, 2008).

Mishra and Kohler (2006) present a model illustrating the range of knowledge and skills required for effective use of technology for teaching and learning. Their model makes an important distinction between general 'technological knowledge', discipline specific 'technological-content knowledge', skills in the use of technology in teaching which they term 'technological-pedagogical knowledge' and discipline specific 'technological-pedagogical-content knowledge'. The move at CSU and in many other teacher education degrees to the integrated teaching of ICT skills and pedagogical knowledge throughout the course (rather than in discrete ICT subjects), as well as implicitly assuming that students already have substantial ICT skills (i.e. Mishra and Kohler's 'technological knowledge') also assumes that pedagogical knowledge associated with the use of ICT in the classroom is best learnt in the context of discipline specific curriculum method subjects (i.e. an emphasis on Mishra and Kohler's 'technological-pedagogical-content knowledge' rather than more general 'technological-pedagogical knowledge').

By intensively studying student preparedness to use ICTs in their classrooms as they progress through their course, this study has begun to explore the validity of the assumptions underlying these important shifts in teacher education course design and more broadly the degree to which the new course structures adequately prepare students for the 'Digital Education Revolution'.

The first stage of this study (see Gill & Dalgarno, 2008) found that beliefs, attitudes, confidence with ICTs, teacher modelling of ICT use, as well as experience in-class and on placements affected preparedness to use ICTs for learning and teaching, as well as the participants' developmental progress that would enable them to do so. In this paper, the second stage of the study, the students' development is analysed in the light Taylor's (2004) three stage model.

As well as being a common scenario within pre-service teacher education courses at universities within Australia, the move away from requiring students to undertake Information and Communication Technology (ICT) subjects, to a model where ICT skills are taught in an integrated way throughout the degree is also occurring in courses within a number of other (non Education) disciplines. The degree to which this adequately prepares students for a technology rich professional world is an issue of ongoing interest in many professional disciplines and consequently the findings from this study should be of wide interest. Additionally, the issues faced by pre-service teachers as they develop skills in the effective use of technology in their teaching, replicate the issues faced by University lecturers as they shift to technology facilitated flexible and blended models of learning. Consequently, the findings from this study are also likely to be of interest to academic staff developers.

Method

This project employed a qualitative approach, and consistent with a phenomenological perspective the intention was to gain knowledge "by understanding the direct experience of others" (McMillan & Wergin, 2006, pp. 5-6). The study did this through "engagement with the participants" via interview, summarisation and analysis of the data (McMillan & Wergin, 2006, p. 6). Although the findings of this study could be considered specific to this case, it is hoped that by providing a description of the context of this study that the results could be considered transferable to other situations which may be similar.

Data Collection

The data for this project was gathered using a series of three semi-structured interviews. There are a number of reasons why this approach was well suited to this project. As the core purpose of the project

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was to gain knowledge of the participants experience with ICTs, their attitudes toward ICTs, and intent to use ICTs in their teaching, the interview, with its ability to "yield rich insights into people's … experiences, values, aspirations, attitudes and feelings" would seem a particularly appropriate method to employ (May, 2001, p. 120). Byrne (2004) cited in Silverman (2006, p. 114) concurs, positing that "qualitative interviewing is a particularly useful research method for accessing individuals attitudes and values."

The semi-structured format provided a desired balance between consistency and flexibility in the investigation, and enabled the collection of specific information as well as deeper exploration of each participant's experience (Merriam, 1998). Given the attention to the human factors impacting upon preparedness to use ICTs for learning and teaching, this method is deemed most appropriate because the interview as a data gathering technique can be most effective, particularly "where human motivation is revealed through actions, feelings and attitudes" (Best & Kahn, 1998, p. 322).

Consistent with a description of such from May (2003, p. 123), the interview questions were pre-specified, however there was probing beyond the answers given to obtain clarification and/or to provide opportunity for elaboration of such. All interviews were digitally recorded and professionally transcribed. Intending to maximise the content validity of the study, the interviews were "based on a carefully designed structure" with the intent of "ensuring that significant information is elicited" (Best & Khan, p. 322).

The participants

The sample comprised eight participants who were recruited from amongst the target population of 118 first year BEd Primary students, though, as mentioned above, not all were involved in each of the three phases of the study. Volunteers were sought as unwilling or disenfranchised participants may not have been ideal subjects.

There were six females and two males interviewed in Phase 1, three were in the 18-21 age bracket, two aged 26-30, two 31-35, and one in the 36-40 age range. This sample was representative of the gender balance and proportional age representation in the course population.

The same group were invited to continue with the project approximately 12 months later when the second phase of the project began. At this point, as indicated in Table 1, only five of the participants were interviewed as one of the sample changed degree programs, one declined an invitation to continue with the project, and another became unavailable during this phase of the project. The size of the population had also decreased by this time from 118 to 85 students, which minimised the alteration to the sample to population ratio (6.8% - 5.9%). The Phase 2 group comprised two males (Jack, Jason) and three females (Jenny, Judy, Jess), and coincidentally one participant in each age group. For Phase 3 both Jenny and Jess were unavailable to be interviewed, however, Joan became available resulting in a sample of four participants (2 male, 2 female). The age groups consisted of one participant in the 18-21 range, one in the 31–35 group, and two between 36 and 40 years of age.

Table 1: Sample participation

Pseudonym	Participation
Jenny	Phase 1 & 2
Jack	Phase 1, 2, & 3
Jason	Phase 1, 2, & 3
Joan	Phase 1 & 3
Judy	Phase 1, 2, & 3
Jess	Phase 1 & 2
Jacinta	Phase1
Jacqui	Phase1

Interview questions

The interview questions were designed to investigate the following research questions:

- What are the Primary Education student's perspectives on their preparedness to use ICTs for learning and teaching?
- What influences pre-service teacher preparedness to use ICTs for learning and teaching?
- How does pre-service teacher preparedness to use ICTs for learning and teaching develop during teacher training?

Analysis

Informed by guidelines presented by Merriam (1998) in particular, the approach to the analysis of this case was multi-level, engaging in three types of analysis:

1. descriptive account;
2. category construction; and
3. theory development.

Although it is considered a most basic level of analysis, the "descriptive account" is seen to be important as it enables the report to "convey a holistic understanding of the case" (Merriam, 1998, pp. 178, 194). Given the volume of data generated in a qualitative study, even one this size, the decisions about what to leave out of, and what to include in the description were challenging. In this case, the decisions were largely based on the relevance to the research questions, and the recurrence of the concepts revealed in the data through the process of identifying categories/themes. This approach is consistent with a description of phenomenological data analysis from Creswell (1998, p. 55) where data are "transformed into clusters of meaning", and "tied together to make a general description of the experience". In practical and broad terms the categorisation process as described by Merriam (1998), Dey (1993) and Bell (2005) involves the sorting of data into categories or groups with identifiable commonalities/recurring themes, each of these "reflect[ing] the purpose of the research" (Merriam, 1998, p. 183).

Results

The results of this study indicate that the students did progress over time. In some cases progress was within an identified stage rather than beyond it. Upon evaluation this development seemed to be impacted to the greatest degree according to the ways in which the participants had observed and/or used ICTs for learning and teaching while on prac placements. A summary of this development through each phase including interview data follows the below matrix (Table 2) which provides an overall picture of their progress mapped against Taylor's (2004) model. The numbers in the matrix indicate at which phase there was evidence in relation to a given aspect of the criteria for positioning a student at a particular stage.

As shown in the table, Taylor's (2004) model predicts that pre-service teachers will progress through the following three stages as they develop their understandings of teaching using ICTs:
- Stage 1. Uncritical and accepting where most students appear to have a "good understanding of the possibilities for the use of ICT, and may receive others' assertions about the value of ICT without questioning them" (Taylor, 2004, p. 48).
- Stage 2. Beginning to problematise; characterised by increasing awareness and analysis of their own and others practice; and
- Stage 3. Reflection and theorisation. represented by "reasonably sophisticated reflection and theorisation for at least some strands in their thinking" (Taylor, 2004, p. 48).

Table 2: Taylor (2004) Trainee teacher development matrix

Stages	Characteristics	Jenny	Jack	Jason	Joan	Judy	Jess	Jacinta	Jacqui
Stage 1: Uncritical and accepting	Good knowledge of possible uses of ICTs in teaching				1, 3	3	1, 2	1	
	Unsubstantiated generalisations about ICT use, language definite	1, 2	1, 2	1	1	2		1	1
	Uncritical, unselective about own/others practice	1	1, 2, 3	1	1, 3	1, 2			1
	Straight transfer and/or acceptance others' ideas	1, 2	2, 3	1, 2,	1, 3	2		1	1
	Awareness of issues only at a generalised level	1, 2	1, 2, 3	1, 2,	1	1, 2	1, 2		1
Stage 2: Beginning to problematise	Increasing focus on specifics of own experience			3		3	2		
	Reflecting on and questioning own and others work			3		3	2		
	Starting to anticipate issues and develop pedagogical sensitivity			3	3	1	2	1	
	Suggests simple and context specific solutions			2, 3					
	Acknowledges complexity, language more tentative, but doesn't follow through the strands of causation					3			
Stage 3: Reflection and theorisation	Starting to group ideas from various sources and insights from experience, able to suggest own set of principles/practical theory					3			
	Critical engagement with own previous ideas and experiences of others								
	Conditional understanding: Able to identify and explore some contingent circumstances								
	Suggesting solutions and explanations to issues based on deeper analysis and understanding of the complex nature of teaching and learning								
Key: 1 = Positioning at Phase 1; 2 = Positioning at Phase 2; 3 = Positioning at Phase 3									

Phase 1: first semester, first year

At this early point in their course, the students had experienced preparation to use ICTs for learning and teaching in a way that most closely resembled the "ICT pedagogy approach" described by Steketee (2005, p. 104), where ICT skills and pedagogy are taught together though here, being a first year and

first semester subject, the majority of time was allocated to learning about and how to use ICTs, with little time being assigned to lesson design using ICTs. Within this environment the pre-service teachers developed new technical skills with ICTs, and towards the end of the session were expressing a predominantly positive attitude towards ICTs, and intent to use them in the classroom.

The participants' descriptions of expected use of ICTs for learning and teaching were consistent with Stage 1 of the model describing developing understandings created by Taylor (2004, p. 49), where ICT use is largely uncritical and accepting and is characterised by behaviour such as the "straight transfer and/or acceptance of others ideas". Examples of evidence aligned with this criteria included statements about expected ICT use offered by Jacqui, "like using, for example, how in our lectures they use PowerPoint presentations", and Jason, "in seeing the way the lecturers teach us …, using the PowerPoint displays…going to be a great tool." These statements also qualified as examples of unselective practice, and could be, it is suggested, responses to unintended modelling.

The Stage 1 criteria "good knowledge of possible uses of ICTs in teaching" is considered somewhat subjective and as such a little difficult to decide upon, however, half of the participants were nominated as having achieved this by relaying a multi point list of plausible options. The remainder of the Stage 1 section of the table was largely filled by 1s indicating most participants' achievement of the various criteria by the time of the Phase 1 interview with the exception of Jess who didn't present any evidence of the three middle criteria.

Phase 2: end of first semester, second year

While the participants' understandings about teaching with ICTs had developed since the Phase 1 interviews, based on their responses, four of the five for the most part appeared to still be positioned within Stage 1 of the Taylor (2004) model where ICT use is predominantly uncritical and accepting. Jess was the exception, showing clear signs that she had largely transitioned to Stage 2. The key difference here seemed to be that Jess had really embraced ICTs and made the most of opportunities in class and on prac, and given this was able to focus and reflect on her own experience, as well as to consider others practice. An example of this was using her own mp3 recorder while she was on prac to capture and play back her kindergarten pupils storytelling for an "English lesson…so that they could hear themselves… [which incidentally] they thought …was great". When asked about where the ideas came from Jess responded "I tend to look at the syllabus…the recording idea I sort of thought up myself…I wanted to do different things…you have to be inventive if you're going to be a teacher…you have to keep changing it (practice), mixing it up a bit".

The "awareness of issues only at a generalised level" was a common identifier of positioning (Taylor 2004, p. 49). Potential issues raised by Judy when asked about using ICTs on her next prac included: competition with existing routines, "time constraints with computer access" and the "potential for anything to not be working." Jason also raised concerns about class organisational issues such as when there was a need to share resources (e.g. computers) between a number of students, and working out "who does what", though he suggested that "there's probably a way of getting around that".

Responses in keeping with the "straight transfer and/or acceptance of others' ideas", and being uncritical about their own or others' practice were other key Stage 1 indicators (Taylor, 2004, p. 49). Similar to her own learning experience at university, Jenny suggested that she might "be able to get the students to use them (ICTs) for any of their presentations… or you can do things where you make a video or something and use that as a way to get students thinking about something". Providing an example of how he might use ICTs in the classrooms, Jack related to an on campus child development lesson that used video: "I reckon to be able to show the kids some vision… and certainly the web gives you the opportunity to look at … such a huge range of resources… that's what probably what I'd use".

Phase 3: post-prac second semester, second year

As the numbers in the matrix indicate, at the point of the Phase 3 interview, only two of the participants presented evidence of progressing into the second stage of the Taylor (2004) developmental model. In the case of Judy much of this advancement appeared to be due to thought and action in response to observations and experience of ICT use for learning and teaching during her five week placement. An example of her reflecting on the work of others was a recount of experience on prac where she described a classroom teacher led lesson in the computer labs using Kid Pics, suggesting that it "was

kind of a bit minimal the way they used it…they seemed to just base it around the computer topic…I kind of got a bit disappointed that they weren't doing more". Following this up Judy suggested "using the computers for other subjects, a bit more integration…they might do a response in English and type it up, so that's part of involving it in other subjects".

As for Jason who made little use of ICTs in class during his placement, but did observe some use, the progression seemed to have been generated primarily by considered reflection on ICT use for learning and teaching. Having observed lessons in the library where little seemed to be achieved, Jason too indicated that "the thing that I'd probably do different is integrate the ICTs…integrating ICT into [an]…English lesson…, doing both together". Indicating developing pedagogical sensitivity and the ability to anticipate issues, Jason when asked how he felt about ICTs, included in his response some specific ideas "there's definitely an area for it…it's more applicable for engagement…I'm yet to see anything that's not too basic…like word and picture identification…linking the picture to the word…which is good, but by the time you've got one Smart Board and 20 kids, and if you've got 20 worksheets you can do that in five minutes…helps the visual learners…time management for me is a big issue with the Smart Boards".

Although he saw potential for ICTs to be used for learning and teaching, Jack made minimal progress in his development based on the criteria in the Taylor model. Having self identified as being one who could do with more ICT skill development, and stated that he still had "a fair way to go until…[he'd] be pretty comfortable" to use ICTs for learning and teaching, this could be considered a predictable outcome. It is suggested that having very little ICT use to observe and no experience using ICTs for learning and teaching on prac, that Jack was not ideally placed to become critical about his own or others practice, or to be aware of issues and use beyond those of a general nature, and in so doing, progress beyond Stage 1. His own words sum this up well, "you just need more experience".

While Joan was a willing user of ICTs, her activity with ICTs for learning and teaching at this point largely mirrored the method of use modelled by the in-service teacher, a pattern of use best described by items in Stage 1. Describing her ICT use on prac Joan stated "This is what she (the teacher) [did] before I arrived on prac, and we just continued it and I got to learn and observe." Having said this, through prac and in class experience Joan had gained some confidence and insight which allowed her to develop some pedagogical sensitivity. For example, she stated that she would be fine in the classroom "doing a program with the children or trying to download something or Googleing or finding information", each of these being activities undertaken on prac. Indicating some consideration of pedagogy, and in regard to Smart Board use she suggested that she wasn't keen to use it for the students to "write what I'm writing as I'm writing it, as she felt it was awkward to write with and that the text was messy, but that "it's great to hold information, just click a button and it's there". It would seem based on these results that experience with ICTs on practicum and in class is of great value, having had the preparation to do so as a part of coursework.

Discussion and conclusions

The results indicate that the students did progress over time, and upon evaluation, this development seemed to be impacted by whether or not or how the participants had observed and/or used ICTs for learning and teaching while on prac placements. In short, the development of preparedness is in most cases slow or minimal where there is no observed or actual use of ICTs for learning and teaching while on prac.

The specific findings around the participants' development were that:

1. Developmental progression can be facilitated by considered reflection on observed use of ICTs for learning and teaching; Taylor (2004, p. 54) ascribes the development of the more sophisticated level of understanding and philosophy to the required "reflection on practice and integration with reading" in the latter part of the course;
2. Experience in the classroom can increase confidence to use ICTs for learning and teaching; Highlighting the importance of being able to apply what had been learned during the practicum, Taylor (2004, p. 54) reported that "classroom experience seemed to be central" to increasing this understanding;
3. Observing or experiencing ICT use for learning and teaching provided opportunity to become critical about the work of others or themselves; The study suggests that potential exists to

maximise teacher preparedness to use ICTs through teacher modelling of ICT use in tandem with technical and pedagogical skill and knowledge development, and by providing opportunities for pre-service teachers to observe, think about, experience, and reflect on how they might use ICTs for learning and teaching;

4. Through prac and in-class experience confidence to use, and insight into ICT use for learning and teaching can be gained; Affirming the espoused value of having multiple strategies expressed above by Smarkola (2007), Taylor (2004) found that students believed that a range of experiences enabled their "understandings to grow, notably university-based teaching, undertaking assignments which related practice to research literature and experience of teaching using ICT with their classes"(p. 54); and

5. Experience in the classroom can enable and hasten the development of the awareness of issues and pedagogical sensitivity in regard to ICT use for learning and teaching.

To conclude, it would seem that there is evidence to suggest that the aspects of curriculum identified by the study are all important contributors to developing teachers that are capable, confident, and willing users of ICTs for learning and teaching. It would also seem that the potential exists to maximise teacher preparedness to use ICTs through modelling of ICT use (at university and on prac) in tandem with technical and pedagogical skill and knowledge development, and by providing opportunities for pre-service teachers to think about and experience ICT use for learning and teaching, and to reflect on this use and consider future use.

Although it is beyond the scope of this study, it might be expected that similar findings would emerge if the development of ICT capabilities of students from other professional disciplines was studied. That is, one would expect that these students would also progress through early skill development and uncritical acceptance of modelled practices before, through reflection on authentic experience, potentially progressing to a deeper level of understanding of the role of ICT within their professional practice. Another possible extension of the study described in this paper would be to explore the ways in which University lecturers' progress in their adoption of educational technologies in their teaching. It could be expected that similar to pre-service teachers, lecturers would initially engage at a surface level with the ways in which technologies can enhance learning, before eventually problematising the practices of others and developing their own approaches consistent with the expected learning outcomes and the accepted pedagogical approaches in their own discipline area.

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