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Abstract: The current expectation of teachers in Australia is that they are able to collect, interpret, and use data related to teaching and learning. Digital technologies in schools, such as electronic methods of record-keeping, offer enhanced opportunities for teachers to perform this skill, and its application has been growing steadily in education. The aim of this exploratory study was to examine fourth-year pre-service teachers' behaviour in record-keeping whilst on their final professional experience placement. Using Ajzen's (1992) theory of planned behavior, this study found that most pre-service teachers exhibited positive attitudes toward the behaviour of recording, using, and analysing classroom data. Despite this positive attitude, many pre-service teachers were unable to maintain any system of record-keeping whilst on placement. For many, this was due to a number of external influences or perceived external influences, which acted as a constraint to their behaviour.

Background

Using the theory of planned behaviour (Ajzen, 1991) as a framework, a survey on the attitudes toward behaviour and another on perceived behavioural control were used to gather data about the use of information communication technology (ICT) from 34 pre-service students in their final year of a Bachelor of Human Movement. More specifically, this study investigated how pre-service teachers used ICT to collect, record, interpret and use classroom data on their students during professional experience.

Introduction

The release of the National Professional Teaching Standards (NPTS) framework highlights current expectation of teachers in Australia that they are able to collect, interpret and use data related to teaching and learning (Australian Institute of Teaching and Learning (AITSL), 2011a; 2011b). Due to be implemented in full in 2013, this framework consists of three domains: professional knowledge, professional practice and professional engagement. Each of these domains contains a number of standards such as

demonstrating a capacity to "Assess, provide feedback and report on student learning" (AITSL Standard 5) , which belongs to the professional practice domain. Furthermore, contained within these standards are a number of focus areas which serve as an indicator of competency within that standard. Within the aforementioned standard, teachers are expected to be able to focus on their ability to: "Assess student learning" (Focus area 5.1); "Provide feedback to students on their learning" (5.2); "Make consistent and comparable judgements" (5.3); "Interpret student data" (5.4) and; "Report on student achievement" (5.5). It is difficult to envisage a teacher meeting these focus areas effectively (as well as many other standards and focus areas not listed above), if they were not able to collect, interpret and use data related to assessments and other aspects of learning and teaching.

These domains, standards and focus areas require teachers to have detailed knowledge and understanding of their students. One way of achieving this level of understanding is through analysis of assessment data using a detailed and systematic method of record-keeping. Gardner (2009) described most of the evidence teachers collect as that which is based on "judgement and interpretation" of the "myriad of evaluations happening by the minute in the classroom" (p. 2). Therefore, record-keeping systems need to include a range of evidence to support decisions made by the teacher which could include, but not be limited to, observations, inventories, checklists, work samples and photographs. Additionally, Gardner stated that the collected evidence could extend to more objective measures such as evidence concerning school-based test scores, state-wide or national standardised tests, skills tests data, and/or attendance data.

In the current data-driven educational climate, where schools find themselves awash with data, teachers need to be proficient in the collection, interpretation and application of evidence concerning student achievement (Earl & Katz, 2008; Guskey & Bailey, 2001; Hattie, 2005). Systems developed to enable this proficiency need to be efficient and manageable (Earl & Katz, 2006), a challenge for teachers given that there is a wide array of existing needs which varies greatly from school to school, and even from teacher to teacher within the same school (Vecchioli, 1999).

The accuracy and quality of classroom-generated data will determine the accuracy and quality of decision-making and feedback provided by teachers and pre-service teachers to the relevant stakeholders (Brady & Kennedy, 2012). Unlike large-scale assessment data reports, which are often lacking in detail and returned too late for the teacher to effect any change (Barton, 2002; Kifer, 2001; Young, 2006), classroom-generated data has the potential to provide immediate and formative feedback on teaching and learning.

The analysis of data may be limited by the method through which the records are kept. Data stored using electronic methods (i.e., spreadsheet or database) may have some advantages for some teachers and pre-service teachers when compared to more traditional methods such as the ubiquitous spiral-bound teacher notebook. Digital technologies in schools, such as electronic methods of record-keeping (EMRK), offer enhanced opportunities for teaching and learning and its application has been growing steadily in education. EMRK, for example, could allow for sophisticated analysis of data and provide frequent and timely feedback to relevant stakeholders (Csapo, et al., 2012). Teachers and pre-service teachers competent in the use of EMRK can track the performance of groups of students, evaluate different approaches to curriculum organisation and teaching and use that information to evaluate future teaching and learning (Arthur, Beecher, Death, Dockett, & Farmer, 2007; Brady & Kennedy, 2009;

Churchill et al., 2011; Earl & LeMahieu, 1997; Killen, 2005). Large-scale implementation of digital technologies to improve assessment practices still "requires further developmental work" (Csapo, et al., 2012, p. 144).

The drive for technology-driven modernisation of education may be limited by the method of implementation. One way of understanding this limitation is by examining the behaviour through Ajzen's (1991) theory of planned behaviour (TPB). The TPB model (see Figure 1), postulates that behavioural intentions can be influenced by three factors: the individual's attitude toward the behavior (AB), the individual's subjective norms (SN) such as cultural influences and social pressure, and the individual's perceived behavioural controls (PBC) which is the degree of perceived ease or difficulty in performing the behaviour.

TPB has been used previously to better understand the dissonance between intentions and behaviour in teachers' application of technology in the classroom (for example, see Cox, Preston, & Cox, 1999; Pierce & Ball, 2009; Salleh & Albion, 2004; Stuart, Mills, & Remus, 2009). However, these studies have tended to focus on the implementation of technology as a tool for teaching (e.g. software packages, graphic calculators, use of websites, etc) rather than EMRK. Furthermore, previous studies have tended to focus on practicing teachers' implementation and use of technology and tend not to focus on pre-service teachers who are the teachers of tomorrow and therefore "must be prepared for the near and distant futures" (Michaels & Johnson, 2004, p. 648).

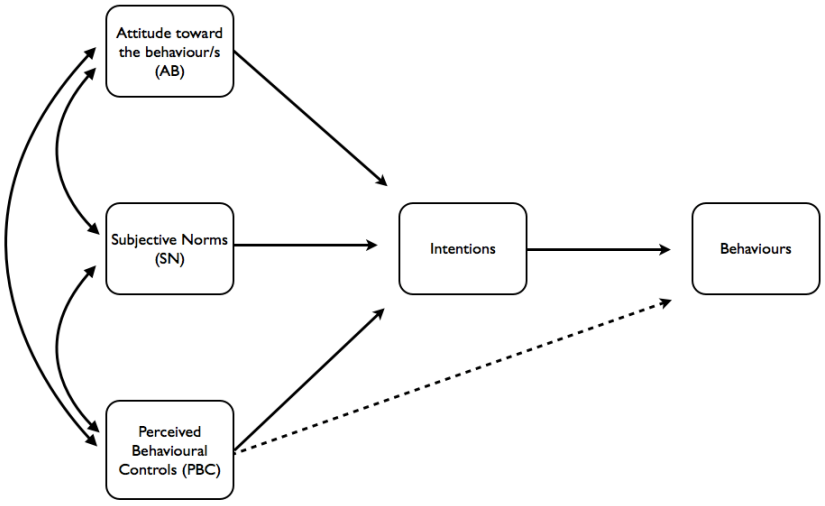

Figure 1. The Theory of Planned Behaviour (Ajzen, 1991, p.182).

The aim of this study was to examine pre-service teachers' behaviour in keeping classroom data on their students whilst on professional experience through the lens of the TPB. Furthermore, in light of the potential advantages of EMRK this study investigated the affordances (items that act to enable and promote its use) and constraints (those items that act as barriers to its use whether they are real or perceived, actual or potential) influencing their PBC when implementing or attempting to implement this method. This study therefore focused solely on the AB and PBC elements of the TPB model. The cultural factors (SN) influencing intentions are unique to each pre-service teacher and could include such situational variables as existing

school protocols concerning record-keeping and/or quality of mentorship. Hence, because of this diversity, SN were not included in this study. The outcomes of this study were achieved through two surveys asking participants Likert scale and open-ended questions concerning AB and PBC in relation to their actual behaviour whilst on professional experience.

Method

Participants

Participants were 34 pre-service teachers (n=19 males, n=15 female) in their fourth and final year of a Bachelor of Human Movement, which is a teacher education degree at a regional campus of The University of Tasmania. The age of participants ranged from 20–27 years. Participants were selected because they were about to commence their final four-week professional experience placement (also known as school experience or school placement in other tertiary institutions). Although they were still supervised by a school mentor (usually a class teacher), they have already demonstrated competency in three previous school placements where their role and responsibilities were gradually increased. A university research ethics committee granted ethical approval for this study. Pre-service teachers were not coerced into being participants in this study; their participation or non-participation in this research had no influence on their course of study or any individual items of assessment. Informed consent was provided before any data collection took place. Names of participants have been replaced with pseudonyms.

Instruments

Data were collected using two surveys created and paneled by the researchers using the TPB as a framework for the construction of questions. An instrument required development because there was no existing instrument that measured ABs and PBCs for pre-service teacher's collection and use of classroom data.

Survey 1 only consisted of two demographic questions (age, gender), and one Likert-scale question asking participants to rate their attitude (AB) on the importance of keeping and maintaining records as a tool for teaching. This question, "How do you rate the importance of keeping and maintaining records as a tool for teaching", was measured on an ordinal scale with anchors set at 1 (unimportant) and 10 (highly important), with a score of 5 indicating 'neither important nor unimportant'.

Survey 2 was an online questionnaire consisting of three sections. The first section replicated the Likert-scale question from Survey 1 with the added intention of gaining an understanding of participants' actual behaviour during their professional experience. To accomplish this participants provided an estimate, in the form of a percentage, of how often they kept records in their classes when they had the opportunity to do so.

The second section of Survey 2, designed to gain an understanding of items which may or may not influence participant's PBC, began with a logic statement related to pre-service teachers' use of EMRK to collect and analyse evidence of student learning. For example, participants were asked to respond to the stem "Which statement

best depicts your use of the electronic spreadsheet?". Participants could select from four different choices; I found the records I collected to be (1) highly informative, (2) somewhat informative when teaching this class, (3) I seldom used the records I collected using the electronic spreadsheet to inform my teaching, or (4) as I did not collect any records using the electronic spreadsheet, it did not inform my teaching. Follow-up questions were logically dependent on the response to this statement. For example, participants who stated they found the EMRK to be highly informative or somewhat informative were asked "In what way did it inform your teaching?". Following this response, all participants were asked to elaborate on their responses by answering the open-ended question: "Drawing from your experiences, what are the advantages/disadvantages of the electronic form of record-keeping".

Section three of Survey 2 was an exact replica of section two except the wording of the logic statements referred to traditional methods of data collection (i.e., hand-written) instead of EMRK.

Procedures

In the weeks leading up to Survey 1, participants completed a record-keeping module within a unit on classroom assessment strategies. The purpose of the module was to examine principles of data collection and analysis in education to improve teaching and learning. As a workshop activity within this module, participants created their own EMRK system to collate and analyse classroom data such as assessment items, behaviour, attendance, and effort. Participants modeled their EMRK system based on working examples provided by current teachers in schools. Such examples were created using commercially available software such as FileMaker Pro, Microsoft Excel and Apple Numbers. Following the demonstration of the working examples, all participants selected Microsoft Excel as the software to create their EMRK system, although they had the freedom to choose other software to create their EMRK if they desired. Participants completed Survey 1 at the conclusion of this module. On average, participants took less than five minutes to complete this survey.

Upon completion of Survey 1, participants trialed their EMRK system while on a four-week professional experience placement. Assuming that the pre-service teachers satisfactorily met the requirements set by the University, this placement would be their last before graduation. Accordingly, their responsibility for teaching, learning, and assessment of students was typically greater than it had been in previous school placements. All school placements took place in a Tasmanian secondary school or college (years 7-12). Participants agreed that they would trial their EMRK system on at least one of their classes in which they had teaching responsibilities, but had the freedom to use it for more than one class if they wished.

One week after the conclusion of participants' four-week professional experience placement, Survey 2 was sent to each participant via electronic mail. This latency allowed participants to reflect on their professional practice which included the collection and use of data whilst on placement. It took approximately 25 minutes for participants to complete Survey 2.

Data Analysis

Descriptive statistics (frequency, mean, standard deviation, range) were calculated for all Likert-scale questions in both surveys to report participants' AB in record-keeping before and after professional experience, and their actual behaviour of record-keeping (EMRK and traditional) whilst on professional experience. These data were used to help determine if participants exhibited favourable or unfavourable attitudes and behaviours toward record keeping.

To address issues concerning PBCs, responses to open-ended questions in the second and third parts of Survey 2 were thematically coded using emergent themes within the categories of *constraints* and *affordances* (Cohen, Manion, & Morrison, 2011). In terms of verification, categorisation of emergent themes was guided by (a) rational considerations in which categories have face validity and the appearance of logical connectedness, and (b) referential considerations in which established research findings were used to justify the category generation. Within the constraints category emergent themes included accessibility, prioritisation, duplication, and relationships. Within the category of affordances, emergent themes included teaching and learning, organisation and sharing. These terms will be explained and further examined in the results and discussion section of this paper.

Results and Discussion

Pre-service teachers sampled in this study exhibited an inconsistent and often contradictory pattern concerning their intention and behaviour in keeping evidence of student learning. Success was defined as being able to record classroom data concerning achievement, improvement or any other information concerning the process by which their students conducted themselves during the class (e.g., attendance, behaviour, effort). Participants were asked to provide a percentage of their success in recording classroom data in relation to the number of opportunities they had to record these data whilst on placement, and this was converted to a scale from 0-100 for the purposes of data analysis. In terms of their success in EMRK, pre-service teachers used just over half of their opportunities to collect their records electronically ($M = 52.74$, $SD = 36.29$, $R = 100$). Furthermore, the range of responses suggested there was a broad degree of variability in success. Some pre-service teachers used all opportunities to use EMRK, whereas others did not use any of their opportunities.

These descriptive statistics indicated that participants were neither highly successful nor consistent with each other in using EMRK to record classroom data. Notwithstanding that quantity does not necessarily mean quality, pre-service teachers' inability to make the most of their opportunities to record evidence was surprising considering they had just completed a module on its importance in terms of teaching and learning. It could be argued that the reason for the low use of EMRK by pre-service teachers in this study was the fact that the technology itself may have been a barrier to its use. In a review of previous studies on why people are anxious in their adoption of new technologies, Selwyn (1997) indicated that there may be psychological, sociological or operational factors behind an individual's reticence in using ICT. Interestingly however, when pre-service teachers were asked to report on their success rate for recording classroom data using traditional methods that did not involve the use of

technology (e.g. pen and paper), there was a similar degree of variability and only a marginally better success rate (M = 64.26, SD = 32.16, R = 100). Taken collectively, it would appear that the record-keeping habits of pre-service teachers sampled in this study were highly variable regardless of the method.

Acting upon the assumption outlined in the TPB model that behaviour is a manifest of intention, it could be argued that the pre-service teachers involved in this study did not have a favourable AB when it comes to keeping and maintaining student records. However, asked how they rated the importance of keeping and maintaining records as a tool for teaching on a scale of 1-10 (1 = unimportant, 10 = highly important), participants involved in this study had a very favourable AB to keeping such records. These data were consistently high in phase one of data collection (M = 8.79, SD = 1.30, R = 5.00), and even higher with a narrower response range after the pre-service teachers' professional experience in the second phase of data collection (M = 9.35, SD = 0.77, R = 2.00).

On average the pre-service teachers' AB of record-keeping was highly favourable, yet this did not align with their actual behaviour as described earlier. Furthermore, when asked whether or not the pre-service teacher would consider using EMRK to collect, interpret and use classroom data, only one participant indicated they wouldn't, three remained uncommitted and the remaining 30 indicated they would. This further suggests that pre-service teachers in this study had a very positive AB in terms of using EMRK. This finding presented a curious paradox where AB and the actual behaviour were not aligned. This may have been attribute to the participants' perceived behavioural control (PBC), that is, the extent to which pre-service teachers felt the task was easy or difficult.

To help identify which factors influenced participant PBC, the sample (n=34) was separated into two groups based on their response to the logic statement in Table 1. Participants that indicated EMRK was highly informative or somewhat informative were placed in Group A, if the selected seldom used the information they collected or had not collected any information to use they were assigned to Group B for further analysis. In effect, Group A was the "successful" group whereas Group B had no success or only very limited success. Thus, these two groups provided a logical way of examining PBC in relation to the use of EMRK.

	Frequency	
	Total	Group
Response 1: I found the records (data) I collected using the electronic spreadsheet to be highly informative when teaching of this class.	6	A (n=21)
Response 2: I found the records (data) I collected using the electronic spreadsheet to be somewhat informative when teaching of this class.	15	
Response 3: I seldom used the records (data) I collected using the electronic spreadsheet to inform my teaching.	6	B (n=13)
Response 4: As I did not collect any records (data) using the electronic spreadsheet, it did not inform my teaching	7	
Total	34	

Table 1: Responses from Survey 2 to Questions Concerning Whether Pre-service Teachers Found Recording Student Information Informative

It appears that the two groups had different responses in regards to electronic methods to keep and maintain student records (see Table 2). On a scale of 1-100, the mean rating for Group A to keep records on students using EMRK when they had an opportunity was 74.81 (SD = 19.44), whereas Group B's mean rating was 17.08 (SD = 27.60), Interestingly, Group B students improved when they recorded information using traditional methods, perhaps suggesting that the method of record keeping was an influence in their PBC.

	Method: Electronic			Method: Traditional		
	Mean	SD	Range	Mean	SD	Range
Group A (n=21)	74.81	19.44	50.00	68.76	25.29	69.00
Group B (n=a13)	17.08	27.60	90.00	57.00	40.74	100.00
Total (N=34)	52.74	36.29	100.00	64.26	32.16	100.00

Table 2: Pre-Service Teachers Ability to Keep Student Records on Teaching and Learning (By Success Groups)

In applying the TPB model to better understand pre-service teacher behaviour in terms of using EMRK, the constraints and affordances data provided in the open-ended responses provided insight into this practice that influenced the participants' PBC whist on professional experience.

Constraints

When discussing the use of EMRK, a range of common themes and categories emerged regarding constraints that prevented, hampered or limited the ability of the pre-service teachers to behave in a way that aligned with their intentions. In other words, these themes had a negative impact on the pre-service teachers' PBC. These themes included accessibility, prioritisation, duplication, and relationships (see Table 3).

	Group A (n=21)		Group B (n=13)		Total (n=34)	
Constraints	□	%	□	%	□	%
1. Accessibility:	21	100	13	100	34	100
a) Portability and other practical issues	12	57.14	9	69.23	21	61.76
b) Technical issues	6	28.57	6	46.15	12	35.29
c) Issues with Trust	7	33.33	2	15.38	9	26.47
d) Inconvenience	12	57.14	10	76.92	22	64.71
2. Prioritisation	11	52.38	10	76.92	21	61.76
3. Duplication	18	85.71	7	53.85	25	73.53
4. Relationships	7	33.33	3	23.08	10	29.41
Affordances						
1.Teaching & Learning	21	100	8	61.54	29	85.29
2. Organisation	21	100	11	84.62	32	94.12
3. Sharing	8	38.10	3	23.08	11	32.35

Table 3: Constraints and Affordances to Using Electronic Methods of Record-Keeping (EMRK)

Accessibility

Every participant in the study commented at least once that they experienced some kind of difficulty related to access. For the purposes of this study, an accessibility issue was defined as any event where pre-service teachers were frustrated by a technical or physical issue which prevented, hampered or limited their use of EMRK. As accessibility had a variety of possible interpretations, this theme has been sub-categorised to allow for greater description and more concise analysis. These sub-categories for accessibility were: portability and other practical issues, technical issues, issues with trust and inconvenience.

Portability and Other Practical Issues

A common response from pre-service teachers when discussing the limitations of digital technologies to record classroom data was portability, with 57% of participants from Group A and 69% of participants from Group B reporting an issue of this kind. Examples included David (Group A) reporting that "this form of record keeping was impossible to use when teaching practical lessons" and Ivan (A) stating that the act of using a laptop computer was "highly impractical". Quentin (B) simply stated "carrying around a laptop…. not a good idea". Some responded that their teaching included classes that had some type of out-of-classroom teaching including sport and recreation classes or outdoor education. It is not unreasonable to expect that these pre-service teachers would be reluctant to bring this valuable piece of equipment outside where the weather or a wayward ball could result in its damage, yet there were similar responses from participants who had indoor classes as well. For example, Michael (B) did not use the electronic method of data collection, as he "didn't want to bother with bringing the charger", even though he accepted that it "sounded silly". Kieran (B) stated "…my laptop computer is somewhat large and heavy to carry around".

These responses question the usage of the term 'portable'. Whilst many would consider a laptop computer to be a portable device, it clearly presented a constraint on pre-service teachers' PBC. Some participants specifically mentioned their desire to capture information on devices that were more portable than a laptop computer such as smart phone or a tablet device. For example, Kieran (B) stated that he would prefer to use "…a more suitable device such as an iPad or similar [which] would be much easier to carry around and faster to use". Gordon (A) stated that "…if there was an easier way/tool that the electronic method could be used in a practical setting (application for iPhone, etc), I would most certainly look at using this method in all aspects of my teaching".

Technical Issues

For a variety of reasons nearly half of the students in Group B (46%) reported some kind of a technical difficulty, compared to a little over a quarter (28%) of participants in Group A. These attributions most commonly replicated those statements from the accessibility theme. For example, Harry (A) reported that "I share my computer with another prac student" which limited the way he could complete the task. Larry (B) stated that he "wasn't allocated a school laptop or connected to the wireless system". Phil (B), who did not have access to a computer throughout his placement conceded that "I need to buy myself a laptop so I can get this sort of thing done". Difficulties with using the software was not a common theme to emerge from the participants, however Olivia (B) reported that it took her some "initial time to work out how to use software" despite it being the focus of several classes prior to the commencement of professional experience. These responses highlight the need for universities and schools to be aware that there are a range of skills and abilities in relation to technical proficiencies. This finding reaffirms the position of Bennett, Maton and Kervin (2008) that the 'digital natives' debate is not theoretically or empirically informed and people's use and skills involving technology are not uniform.

Issues with Trust

Some participants expressed an opinion that they were concerned with the potential for digital information to be lost, deleted or corrupted. Participants in Group A were stronger in expressing this concern (33%) compared to Group B (15%). This is perhaps unsurprising as participants in Group A had more data to lose than those in Group B. Beatrice (A) feared that she could go to all this effort only "to have the file corrupt or computer die". Ivan (A) worried that his computer "can crash resulting in loss of ALL data with no way at all of recovering it". Frances (A) stated that technology is "not reliable", whereas Olivia (B) simply stated that computers are "unpredictable". Only one pre-service teacher, Helen (A), actually reported any data loss during the professional experience placement. The pre-service teachers reporting this concern appeared either have a general lack of awareness of methods to ensure digital information is backed-up, or they knew how to back up their data but, for reasons not investigated in this study, chose not to. These results suggest that some pre-service teachers require further support in taking required action to ensure their data is backed up appropriately.

Inconvenience

Ten of the thirteen participants in Group B (77%) expressed feelings of inconvenience when asked to reflect upon the use of EMRK. Many compared their use, or lack thereof, to more convenient alternatives such as hand-written tables or checklists. Comments such "…as I just preferred a manual approach" (Larry), "…it is much easier to record hand written" (Nelly), and "…it was a lot easier to have a simple note pad or class list" (Steven) were typical responses from Group B. This may explain why participants in Group B were able to demonstrate greater success in collecting and using traditional methods when compared to their use of EMRK (see Table 2). However, whilst Group B reported greater success in keeping records using traditional methods in comparison to EMRK, the rating of 57.00 on a scale of 1-100 is still low compared to Group A's reported rating for electronic (74.81) and traditional (68.76) methods of record-keeping.

Twelve of the twenty-one participants (57%) in Group A also reported some level of inconvenience when they were using EMRK although there was a difference in the nature of the comments they made. Jenny, for example, stated that she preferred "to write things. But I do see the increased need to do things electronically". She went on to state that "once I found what worked best for me I would find electronic records handy and more beneficial to my teaching". In another example of pre-service teachers finding the use of EMRK somewhat inconvenient, Carolyn stated that she liked the use of EMRK as her method for record-keeping but found "that setting up electronic records can be a hassle and tedious. I do see that electronic records are probably the best way for keeping records in the future as they are faster and more accurate". Carolyn reflected a sentiment amongst many in Group A that could see that there were advantages to this method, which outweighed the inconveniences. Further to this, Group A comments relating to the amount of time it takes to keep records were not necessarily restricted to EMRK, and was more of a reflection of the pre-service teachers who were facing a realisation that that keeping, maintaining and reviewing records was a time consuming

reality of professional practice regardless of the method through which this information was kept.

Prioritisation

Results from Table 3 demonstrate that despite a clear appreciation of the need to keep student records, pre-service teachers were prioritising other events in the classroom over the record-keeping. Prioritisation of tasks and duties is a necessary skill of being a teacher. Students require and deserve the undivided attention of their teacher, but this in itself does not negate the need for teachers to be able to keep records and other evidence on students. It is expected that pre-service teachers would feel pressure to perform from a number of sources whilst on professional experience. This pressure may come from their supporting teachers, the school hierarchy, the university, their peers or even family and friends, but it is still expected that these pre-service teachers would be performing at graduate standard by the time they are completing their final placement.

This issue was more prevalent in Group B (76%) than it was in Group A (52%) suggesting that this may be one of the main differences between the two groups. The nature of qualitative responses also differed between the two groups. For example, Alan (A) stated that "I tried to gather data to enter electronically every lesson, however due to time constraints … recording results was difficult", and Isabella (A) stated "keeping records are vital for a teacher. However, on this prac it has been a challenge to keep records with everything else that's going on and needs to be done". These pre-service teachers clearly had been able to devise successful strategies to overcome this issue of prioritisation. In comparison, Group B contained responses such as "…it wasn't one of the things high on my priority list" (Mary), "I was more preoccupied with teaching and running my lessons" (Nick), and "I was not able to keep records as I am constantly busy" (Quentin). There was a district language shift from responses where participants found ways to complete these essential tasks despite time pressures to participants who decided that this was a task that they felt needed to be delayed or ignored altogether for the sake of other tasks.

Duplication

Perhaps the key reason for pre-service teachers in Group A being more successful in keeping electronic records is the strategy they adopted to input data. It was frequently reported (18 of 21 respondents in Group A) that the pre-service teacher made hand-written notes and then, at a convenient time, would duplicate this information in to the electronic form to allow for data analysis. For example, Carolyn wrote "I kept a handwritten record first and then transferred it to the electronic spreadsheet after class". In doing this, she found that "as long as I did it straight away after the class (or as close to it as possible) it was easy to keep records 100% of the time". Likewise, Cameron "took handwritten notes and/or attendance and then just slotted them onto the computer which took 2 minutes. So the only limitation was easily managed". Carolyn and Cameron's responses were typical strategies discussed by pre-service teachers in Group A. This strategy could be seen as both a help and a hindrance. Whilst it is admirable that pre-service teachers are diligent enough to hand-write the student records and then re-

enter this data in to electronic form, this duplication of information is often time-consuming and, for many, an unsustainable practice.

In this study, nearly three out of four participants (73%) used this strategy of duplication, suggesting that there were some usability issues with EMRK, which meant that the inputting of data was not as fast or as convenient as they would have liked.

Relationships

There were a number of participants who specifically mentioned that it was difficult to keep records on their students before a relationship with the students was established. “I'm not good enough yet to remember student’s names and abilities” (Olivia (B)), “I hardly knew all the names in the first week. In the fourth week I still had trouble with a couple of the student’s names.” (Lisa (B)) or “It was very difficult for me remembering student’s names, let alone recording information on each student.” (Gemma (A)) were indicative of the struggles that pre-service teachers had when recording information. However, many pre-service teachers noted that the task became easier the further into the professional experience, and the need to keep information on students actually provided the impetus to accelerate the relationship-building process.

The constraints noted by study participants provide insight into many of the features of technology which may influence PBC and potentially limit its levels of adoption. If a record-keeping digital system were to gain widespread adoption, it would need to be able to reduce these constraints, which have a negative impact on PBC; and maximize the influences of the affordances, which have a positive influence on PBC. On the basis of the evidence collected in this study, an EMRK needs to be highly portable and quick to access. This would eliminate the need for duplication of information as entering data on this system could be just as quick or even quicker than alternative (traditional) methods. The speed at which data is entered may reduce the need for pre-service teachers to make the choice of prioritising other duties over the keeping of records. It would be technically reliable and data would be automatically and securely backed-up.

Affordances

Affordances are the key items or attributes related to the task that act as enablers for completion of the task. They serve as the incentives to use electronic methods of record-keeping over other methods as previously discussed. Three themes emerged from data analysis when the open-ended responses were thematically coded: teaching and learning, organisation, and sharing. Emerging from these data were some possible evidence of pre-service teachers’ development as educators in accordance with the NPTS. Where appropriate, this evidence of pre-service teachers working towards a graduate career stage is indicated by the standard enclosed in square parentheses. For example, Beatrice (A) remarking that she used EMRK to “assist with the planning of future lessons and enable you to assess your teaching” is followed with (2.3, 3.2, 3.6, 4.5, 5.4) indicating this comment provides some evidence of her working towards these standards. Table 4 provides a summary of domains, standards and focus areas mentioned in the following pages.

Domain	Standard	Focus Area
Professional Knowledge	2. Know the content and how to teach it	2.3 Curriculum, assessment and reporting
Professional Practice	3. Plan for and implement effective teaching and learning	3.2 Plan, structure and sequence learning programs
		3.6 Evaluate and improve teaching programs
	4. Create and maintain supportive and safe learning environments	4.5 Use ICT safely, responsibly and ethically
	5. Assess, provide feedback and report on student learning	5.1 Assess student learning
		5.2 Provide feedback to students on their learning
		5.3 Make consistent and comparable judgements
		5.4 Interpret student data
		5.5 Report on student achievement
Professional Engagement	6. Engage in professional learning	6.3 Engage with colleagues and improve practice
	7. Engage professionally with colleagues, parents/carers and the community	7.3 Engage with the parents/carers

Table 4: National Professional Standards for Teachers (NPTS) (Australian Institute of Teaching and School Leadership, 2011a)

Teaching and Learning

Every participant in Group A had mentioned in the open-ended responses that the records they collected had positively influenced teaching and learning. For example, Beatrice (A) stated that record-keeping using the electronic method will "assist with the planning of future lessons and enable you to assess your teaching" (Focus areas 2.3, 3.2, 3.6, 4.5, 5.4), and Brad remarked that "It allows [me] to study trends, record hard evidence and reminders about students behaviour" (4.5, 5.4). David (A) believed that "record-keeping is important for maintaining records on students' progress, but more important[ly] for informing the teaching of beginning teachers." (3.6, 5.2, 5.3, 5.4)

These comments are important as they provide evidence that some pre-service teachers were shifting from a mindset of keeping records for the purpose of accountability to keeping records for the purpose of improvement.

Organisation

One of the most consistent enablers for pre-service teachers using EMRK concerned and improvement or perceived improvement in their level of organisation. Across the sample, 32 of 34 participants noted that one of the enablers of EMRK was that they like the information to be organised and centrally located. Examples of comments included Quentin (B) stating "It can be quick and easy to review and compare results." (4.5, 5.3, 5.4), Phil (B) remarked "You don't have to shuffle through heaps of papers to find what your looking for" (4.5) and Nick (B) commented "It makes it so much easier to view the information that you require" and that EMRK is "far less messy than keeping a terms of years [sic] worth of handwritten notes ... It is also more easy to see trends and areas of improvement." (3.6, 4.5, 5.3, 5.4).

Sharing

Pre-service teachers from both Group A and Group B specifically commented that one of the enablers of using EMRK was the ability for them to easily share information with their colleagues. Harry (A) liked the electronic method as "it [is] quick and easy to show these results to anyone who wants to see them" (3.7, 4.5, 5.5, 6.3, 7.3). Following a similar theme, Edward (A) stated that "It is also easy to pass on to colleagues when they require info on students." (4.5, 6.3). Denise (A) commented that EMRK is "particularly useful when writing reports and dealing with parents." (4.5, 5.5, 7.3).

In their responses, only five participants across both groups discussed sharing the evidence they had collected with parents, which as previously discussed, is one of the primary reasons for keeping records. It could be inferred here that these pre-service teachers did not have to deal with the consequences of not keeping information on their students. That is, their placement did not include responsibilities that include report writing or parent-teacher interviews. Despite all three domains of the NPTS necessitating the collection and interpretation of data on teaching and learning, this is a skill, which was directly or indirectly assessed whilst on professional experience. Whether the behaviour of pre-service teachers would better match intentions if they had greater responsibility for providing feedback to parents through report-writing or parent-teacher meetings is a relationship which requires further investigation.

Conclusion

The purpose of this study was to examine pre-service teachers' behaviour in keeping classroom data on their students whilst on professional experience through the lens of the TPB. Although pre-service teachers exhibited a positive attitude (AB) towards the behaviour of recording, using and analysing classroom data through systematic record-keeping in our first survey, many of them had trouble performing this fundamental skill in the final school placement of a four-year teaching degree. This difficulty was attributed to a number of external influences or perceived external influences, which acted as a constraint to their PBC. These data suggested that the difference between pre-service teachers who were successful in record-keeping, and

those who were not was their ability to problem-solve and work around the constraints which were having a negative impact on their PBC. Whilst this was evident in traditional methods of record-keeping, it was highly evident when considering EMRK. Whilst participants found that these constraints hampered their ability to perform the task, those who were successful were the ones who were able to adapt to the technology.

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