2018

The factors influencing nurse graduates use of mobile technology in clinical settings in Perth Western Australia: A mixed method study

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Chapter Three

Methodology

Introduction
This chapter details the methodology, including the mixed method explanatory sequential design used in the study. It will also provide a brief discussion on the philosophy underpinning mixed method approach to research. The remainder of the chapter concerns the development and testing of the draft survey.

Mixed methods research
The focus of the design for this study was to combine statistical trends from quantitative data, with participant’s personal experiences from the qualitative data, to better understand the research problem and to answer the research questions (Creswell & Plano Clark, 2011; Creswell, 2015). It has been suggested that using this approach provides a balance between the limitations and strengths of one approach with the other (Creswell & Plano Clark, 2011).

Mixed method research is typically associated with a pragmatist worldview from a philosophical perspective. The core of the philosophy is that truth is ‘verified and confirmed by testing ideas and theories in practice’ (Patton, 2015, p.151). Pragmatists emphasise the nature of experiences and focus on the outcomes of action. It is argued that pragmatic decisions can be made based on constraints and limitations that emerge, rather than adherence to a pure paradigm. It also fosters the mixing of methods and adapting data collection as the study unfolds (Patton, 2015). Nursing is a practice-based discipline thus, the use of mixed method was deemed appropriate to answer the research questions.

Study design
The explanatory sequential approach to the research design involved the collection and analysis of both quantitative and qualitative data. The analysis of the first phase
(quantitative) connected and informed the second phase (qualitative). Using this design, each data set was dependent on the results of the previous phase and built on what was learnt (Creswell & Plano Clark, 2011). The study was composed of six stages (see Figure 2). The framework for the study provided an overview of the links between the quantitative and qualitative phases of the study. Stages one, two and three formed the quantitative phase of the study whilst stages four, five and six formed the qualitative phase.

Figure 2. A diagrammatic representation of the study design
As can be seen in the design of the study it consisted of six sequential stages. Each stage was predicated on the previous stage since the findings from each influenced the transmission of the next. The following research questions were addressed within stages three to six.

**Research questions**

1. What factors influence nurse graduates use of mobile technology in the clinical setting?

2. To what extent and in what ways do nurse graduates currently use mobile technology in the clinical setting?

3. What are the perceptions of nurse coordinators, educators and managers of graduate programs, regarding mobile technology use in the clinical setting?

Stage three describes the quantitative phase of the study. It details the process involved in the promotion and administration of the online survey, the data collection methods, and the subsequent analysis and presentation of the results. It provides an overview of the findings that require more explanation and exploration. The findings were subsequently used to develop the open-ended questions for the online text-based focus group interviews. Research questions one and two were addressed from a quantitative perspective.

Stages four to six describes the qualitative phase of the study. It details the sequence of methods, analysis of data and the findings. Research questions one and two were addressed from a qualitative perspective from text-based focus group interviews with graduates who undertook the quantitative survey in stage three. Research question three was addressed in stage six, which referred specifically to the perceptions of nurse coordinators, educators and managers of graduate programs, regarding mobile technology use in the clinical settings.

The final chapter of the thesis provides an important synthesis of the findings from both the quantitative and qualitative phases of the study, juxtaposing them with the research questions.
Stage one: Confirm permission for policy/guideline review

The aim of stage one was to explore in greater detail, policy and guidelines concerning mobile technology available across Fiona Stanley Hospital (FSH); Royal Perth Hospital (RPH); Sir Charles Gairdner Hospital (SCGH); and St. John of God Hospitals (SJOGH)-Murdoch and Subiaco. An email request with a formal letter to gain access these hospitals for information on policy/guidelines was forwarded to the Directors of Nursing of the designated hospitals that offered graduate programs (see Appendix 1). Most people indicated there were no policy or guidelines. At the FSH however, there was a Bring Your Own Device (BYOD) policy. The graduate program coordinator advised that anecdotally this was not well known by the graduates or other staff in the hospital.

Ethical considerations

Stage one also involved seeking the final ethical and governance approval through the sites within the study. The study utilised low risk ethical principles and followed the guidelines outlined by the National Statement on Ethical Conduct in Human Research (NHMRC, 2007). The Human Research Ethics Committee reference number from University of Notre Dame Australia included 015163F. The study adhered to the ethical principles of beneficence, non-maleficence, justice, and confidentiality. The study was considered low risk in affecting aspects of non-maleficence, and the researcher acknowledged the ethical rights of the participants during the conduct of this study.

The Human Research Ethics Committee (HREC) and Research Governance Office provided the HREC number as 2016-037 for the public hospital sites of SCGH, FSH, and RPH. For the site at FSH, a further reference number was 2016-159, and for RPH, 16-159. For the sites at SJOGH, the HREC reference numbers included 1024.
Informed consent was gained from each participant in the study. It adhered to the issues relating to the principle of respect of the individual right to full disclosure and encompassed the right to self-determination. The participant information sheet specific to each site outlined the rights and responsibilities of the participants and the researcher. Participants were informed that they were under no obligation to participate in the study, and that they could withdraw from the study at any time.

It is acknowledged that there may have been a power differential between the researcher and nursing students used in the test-retest, since the researcher is a Senior Lecturer in the School of Nursing and Midwifery at UNDA, Fremantle Campus and also works within the healthcare workforce. It was essential to assure the participants were comfortable in their participation and that the study took place outside the researcher’s academic position.

Participants were assured that taking part in the study and that information gathered, did not prejudice employment prospects. This process assisted in achieving a balanced relationship with the participants and increased the trustworthiness of the study. Gaining consent from participants and using clear communication skills helped to build trust. Developing a partnership with the participants, asking permission, and using clear communication skills to build trust, resolved possible bias. Consent to participate in the study demonstrated a lack of coercion.

The principle of justice and right to fair treatment was considered in the design of the survey and during the collection of other data. Questions for the focus groups and interviews were aimed at developing rapport and encouraging participants to share their thoughts. The interviews took place at times mutually convenient to both researcher and participant with the participant playing the lead role in determining these arrangements. All participants were provided with the opportunity to review their transcripts, to add comments, make corrections or withdraw from any statement.

Confidentiality and privacy are important aspects of ethical research. Some of the data and themes may be sensitive to individual clinical sites and to participants thus, removal of any identifying information will be maintained during the study. A numeric code was entered and kept in the researchers journal and cross-coded with the participant with contact details. Data collected electronically, including transcript
recordings, were stored securely in accordance with the University’s policy in a password-protected file and loose printed data was stored separately in a locked filing cabinet in the School for a period of five years. To ensure confidentiality, the researcher and his supervisor were the only people permitted access to the data.

*Figure 4. Stage two of the quantitative phase*

**Stage two: Development and design of the survey**

In order to answer the research questions it was decided that a survey would be appropriate. Since the potential participants would be employed as graduate registered nurses working across shifts both day and night, it was more flexible to design the survey for online use. Typically, the online survey obtained quantitative information about the prevalence, distribution and interrelations of variables within the sample (Polit & Beck, 2014). It was developed using the key concepts identified in the literature review including TAM2 theoretical framework. The next step was to test the draft survey for validity and reliability. This step is outlined in Figure 5.
Figure 5. Online survey development process
Step one: Literature review

The first step in the process of developing the draft survey was to examine the literature to identify themes that could provide an evidence-based approach to the design. These themes constituted the first section of the survey.

As previously identified, the TAM2 model had been used across a number of areas in assessing technology use. The questions used in the model have been previously well validated (Venkatesh & Davis, 2000). In order to apply the TAM2 to this study, it was necessary that TAM2 underwent very slight modifications to apply to the research setting. Such changes included the term ‘mobile technology’ in place of the term ‘system’ by the original authors. Additionally, the term ‘supervisors/managers’ was added to two of the TAM2 questions when referring to ‘people of importance’. The remaining questions were not changed so that it maintained consistency with the original questionnaire (Venkatesh & Davis, 2000).

The original TAM2 included moderating variables such as experience and voluntariness (Venkatesh & Davis, 2000). Voluntariness was defined as the extent to which potential adopters of the technology or system perceived the adoption decision to be non-mandatory (Hartwick and Barki 1994). As the use of mobile technology by graduates in the clinical setting was deemed to be a voluntary choice the terms ‘Voluntariness’ and ‘Experience’ were not included in the draft survey.
Step 2: Design of the survey

Whilst online surveys are economical, flexible and provide a broad scope, they can tend to yield low response rates, and can be relatively superficial rarely probing deep into human behaviour (Polit & Beck, 2014). For this study, the draft survey consisted of a self-report questionnaire using closed-ended questions for most items. Participants also had the opportunity in selected sections, however, to include written comments.

In the development the survey, careful consideration was given to the order of the questions; the clarity of the information sought; the grammar; and that each item was value free (Schneider, Whitehead, Elliott, LoBiondo-Wood & Haber, 2012). It was important to maintain consistency among the items, including the testing and scoring systems (Schneider, Whitehead, Elliot, LoBiondo-Wood & Haber, 2012). To confirm these issues, the questionnaire underwent validity and reliability testing.

It was deemed important for consistency and clarity of the responses to include a working definition of the term mobile technology. This was highlighted at the top of each new page of questions. The survey included instructions for completion and an invitation to participate in the text-based focus group following completion of the survey.

The survey was structured into two main sections with a five item Likert scale for each question. Participants indicated for each question whether they: strongly agreed, agreed, unsure, disagreed, or strongly disagreed. An ‘unsure’ option was included since it was deemed important the context of participants being unsure if a policy or guideline was present in the hospital. Although inclusion of the unsure
choice in a Likert scale can be considered controversial, as it allows the participant to avoid making a clear choice or a positive or negative statement (Burns & Grove, 2001). Nevertheless, it was important in the descriptive analysis of the data to explore and explain the findings.

Section one referred to the literature review key topics, and section two referred to the modified TAM2. The themes included in the sections are outlined below.

**Section One**
- Nursing graduates use of mobile technology in the clinical setting
- Mobile technology in learning and teaching relating to the clinical setting
- Mobile technology in learning and teaching relating to the University setting.
- Mobile technology use by nurses and other health professionals
- Policies and guidelines associated with mobile technology in the clinical setting

**Section Two**
- Factors influencing the use of mobile technology in healthcare (TAM 2 Model)

*Figure 8. Step three: Expert panel review*

**Step three: Expert panel**
Methods for measuring validity, is based on judgement particularly from an expert panel of experienced people. Three aspects of validity have been identified: content validity; criterion-related validity; and construct validity. It was argued about the
usefulness of using the three terms, since they are all related with an overlap of approaches (American Education Research Association, American Psychological Association & National Council on Measurement in Education, 1999). Construct validity was seen as a unifying umbrella term under which all types of validity were situated (Beckstead, 2009; Schneider, Whitehead, Elliott, LoBiondo-Wood and Haber, 2012). The content expert approach, however, is useful in the early phase of the instrument development for clarity of content (Schneider, Whitehead, Elliot, Lobiondo-Wood, & Haber, 2012).

Six academics and experienced researchers within the School of Nursing and Midwifery were recruited for this purpose. All survey reviewers were selected based on their experience with constructing online surveys and their extensive research backgrounds. Two expert reviewers were topic experts on mobile technology and elearning, and had conducted research on mobile technology in teaching and learning. This number of people was deemed acceptable (Lynn, 1986; Streiner & Norman, 2005). The panel members were invited via email and personal communication to evaluate the draft survey (see Appendix 2). An email with instructions within the survey (see Appendix 3) was provided to the reviewers, along with a rating scale and a response section.

The clarity of each item was determined by a rating scale of “clear”, or “unclear” (Mastaglia, Toye & Kristjanson, 2003). Content validity clarified the adequacy of items for participants to understand the meaning of the conceptual domains and to evaluate redundancy among the items (Imle & Atwood, 1988). Reviewers were asked to indicate a closed ended response in assessing content validity to specific items, and then as part of a set of questions. The panel were provided with specific guidelines for judging the content of the questions (relationship to the construct); the order they were presented; one question for each item; be grammatically correct, free of jargon; and not open to alternative interpretations (Polit & Beck, 2014). These measures were to determine the clarity, content validity and apparent internal consistency of the draft survey (Lynn, 1986). Reviewers were able to provide feedback comments in a textbox under each subsection.
Internal consistency is applied where there were a number of items that purported to measure the same multidimensional construct (Nagy, Mills, Waters & Birks, 2010). In addition, it refers to whether these items are grouped or linked together appropriately as a particular subset of the conceptual domain (Mastaglia, Toye & Kristjanson, 2003). This process was important to apply the TAM2 framework to the survey.

Expert panel review results
Five out of the six (83%) panel members agreed that the item was consistent (Lynn, 1986). The researcher and supervisor revised items that did not achieve a minimum agreement (DeVon, et al., 2007). A textbox at the end of each section provided comments to further refine and provide clarity for the questions. Suggestions for rewording particular questions were useful and provided the researcher and supervisor with creative alternatives prior to the test-retest of the draft survey. Face validity was strong for most questions with only slight rewording required for a small number of questions. All results from the expert panel are provided in Appendix 4.

It was considered whether rewording section two would be viable, since changing the original TAM2 structure may alter its validity and thus affect the results. A decision was made to keep the questions in their current form and review the test/retest results in regards to its reliability.

As part of the survey design, a comment check box was included as 1 of 3 options to select. These options included: ‘Yes, No, and Comments’. Four reviewers indicated ‘Yes’, with one indicating ‘No, and one checking the comments box. In a redesign of the survey draft to the expert panel, the option to choose “comments” would be removed as it seemed to confuse the panel members.
Step four: test-retest

Reliability refers to consistency of a test calculating what it is supposed to measure and focuses on three elements (Fain, 2015). These three elements include test-retest reliability (stability), internal consistency (homogeneity), and interrater reliability (equivalence) (Fain, 2015). Test-retesting was required to compare data from both test one (T1) and test two (T2) for reliability of the draft survey (Creswell & Plano Clark, 2011). The draft survey needed to consistently measure the same results over time. Achieving stability of an instrument is when similar results are obtained on separate occasions (Nagy, Mills, Waters & Birks, 2010; Polit & Beck, 2014; Schneider, Whitehead, Elliot, Lobiondo-Wood & Haber, 2012).

In order to undertake the test-retest, permission was granted from the Dean of the School of Nursing and Midwifery at the University of Notre Dame to invite third year, semester five students to test the draft survey. Third year students would have spent nearly 1120 hours in clinical settings in healthcare agencies across WA and were best placed to evaluate the draft survey for reliability. An email invitation with a hyperlink and information sheet (see Appendix 5) was forwarded to the potential participants. The researcher and semester five lecturers promoted the study on PowerPoint slides (see Appendix 6).

Accordingly, the draft survey was administered twice to a convenience sample of students. A two-week interval between the T1 and T2 was applied. Timing of the tests was important, as the participants may have remembered their scores from T1 when completing T2, which could have affected the co-efficient (Nagy, Mills, Waters & Birks, 2010). Participants were encouraged to complete T1 within a one-week timeframe, before attempting T2. Students were then encouraged to
complete T2 due by the end of the second week. Test 1 was completed by 36 students (31.2%) of the cohort.

To avoid the possibility of response set bias, the researcher aimed to balance positively and negatively worded items to reduce the tendency for participants to agree or disagree in a uniform way (Fain, 2015). In order to prevent participants identifying potential themes in the TAM2 section the software SurveyMonkey™ was programmed to randomise each of the questions in the second section of the draft survey. This also meant that no TAM2 subheadings were used in any of the surveys.

The measurement of the extent that the raters assign the same score to the same variable/s is termed interrater reliability (McHugh, 2012). Measurement of interrater reliability can be applied through percentage agreement calculated as the number of agreement scores divided by the number of scores (McHugh, 2012). Cohens Kappa is a statistical measure that quantifies the degree of consistency among raters (Fain, 2015). It is a measure of agreement that adjusts for chance agreement (Cohen, 1960).

Kappa was designed for nominal random variables. Surveys with Likert scales are considered to be ordinal data measurement. This discrepancy creates concerns where in ordinal data, the seriousness of a disagreement is dependent on the differences between the ratings (Wilcox, 2012). Influences to the Kappa score, include prevalence, bias and non-independence of ratings (Sim & Wright, 2005). Kappa can also fail to capture all the information in ordinal data, as it does not allow partial credit for ratings that are similar but not exactly the same. Collapsing similar categories together can often improve the kappa score (Newman & Kohn, 2009). In order to avoid some of these influences in this study, the Likert scales were collapsed from five to three categories for analysis using Kappa and percentage agreement. The survey was reviewed and critiqued by the University’s Biostatistician and the researcher’s supervisor during this phase.
Analysis and results

The results from the test-retest were transferred from the SurveyMonkey™ software into SPSS™ Ver.24 (IBM SPSS, 2016). It was noted some participants had not completed both T1 and T2; the subsequent incomplete tests were, therefore, deleted from the final set of data. Removing these participants’ responses resulted in 23/113 (20.3%) cohort. The data were manually compared then adjusted within SPSS™ Ver.24 (IBM SPSS, 2016).

Section one of the draft survey

In order to measure the internal consistency of both sections of the draft survey, Cronbach’s alpha was calculated. This statistical procedure measures the extent to which all items in the survey measure the same concept. It has been suggested that the test-retest of 0.80 would be considered a good reflection of reliability for a survey (Polit & Beck, 2012). For newly developed instruments, however, a reliability coefficient of 0.70 was considered acceptable (Burns & Grove, 2001). Cronbach’s alpha scores demonstrated in section one of the survey were considered reliable and consistent (see Table 1).
Table 1

Cronbach Alpha Scores for Test-Retest: Section One

<table>
<thead>
<tr>
<th>Section One Subheading Questions</th>
<th>Cronbach Alpha Scores for Test1 and Test2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q8 Nursing graduates use of mobile technology in the clinical setting: Questions 1-10</td>
<td>Ranged from .789 (T1) - .724 (T2)</td>
</tr>
<tr>
<td>Q9 Mobile technology in learning and teaching relating to the clinical setting: Questions 1-5</td>
<td>Ranged from .641 (T1) - .585 (T2)</td>
</tr>
<tr>
<td>Q10 Mobile technology in learning and teaching relating to the University setting and clinical practice rotations: Questions 1-5</td>
<td>Ranged from .700 (T1) - .747 (T2)</td>
</tr>
<tr>
<td>Q11 Mobile technology use by nurses, other health professionals and patients: Questions 1-9</td>
<td>Ranged from .357 (T1) - .719 (T2)</td>
</tr>
<tr>
<td>Q12 Policies and guidelines associated with mobile technology in the clinical setting: Questions 1-7</td>
<td>Ranged from .834 (T1) - .787 (T2)</td>
</tr>
</tbody>
</table>

Both Kappa scores and percentage agreements were calculated for each question in both sections of the draft survey. A percentage agreement of 80% was considered as acceptable in the early testing (McHugh, 2012) (see Appendix 7).

Kappa scores for section one of the draft survey mostly ranged from fair to excellent based on Fleiss’s evaluation criteria which suggested: poor < 0.40, fair = 0.40–0.599, Good = 0.60–0.749, excellent 0.75 (Fleiss, 1981). Results were colour coded for improved visual representation (see Appendix 7). Nine questions which scored poorly still indicated reasonable to high percentage agreements. The poor range questions were reviewed along with the qualitative responses, to gain greater understanding of why the consistency among raters may have been low. The results were then reviewed and a decision was made to keep the questions, as the vast majority of scores were positive with high percentage agreements.
Section two of the draft survey

This section of the draft survey concerned the TAM2. It contained subheadings that reflected the original study (Venkatesh & Davis, 2000). Cronbach’s alpha was calculated according to each coded subheading including: Intention To Use (ITU); Perceived Usefulness (PU); Perceived Ease Of Use (PEAU); subjective norm (SN); Image; Job Relevance (JR); Output Quality (OQ); and, Results Demonstrability (RD).

Table 2

Cronbach Alpha scores for Test-Retest: Section Two (TAM2)

<table>
<thead>
<tr>
<th>Section Two Subheading Questions</th>
<th>Cronbach Alpha Scores for Test1 and Test2</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intention To Use (ITU)</td>
<td>Ranged from ( \alpha = .724 ) (T1) - .713 (T2)</td>
</tr>
<tr>
<td>Perceived Usefulness (PU)</td>
<td>Ranged from ( \alpha = .896 ) (T1) - .864 (T2)</td>
</tr>
<tr>
<td>Perceived Ease Of Use (PEOU)</td>
<td>Ranged from ( \alpha = .827 ) (T1) - .800 (T2)</td>
</tr>
<tr>
<td>Subjective Norm (SN)</td>
<td>Ranged from ( \alpha = .862 ) (T1) - .770 (T2)</td>
</tr>
<tr>
<td>Image</td>
<td>Ranged from ( \alpha = .799 ) (T1) - .864 (T2)</td>
</tr>
<tr>
<td>Job Relevance (JR)</td>
<td>Ranged from ( \alpha = .841 ) (T1) - .888 (T2)</td>
</tr>
<tr>
<td>Output Quality (OQ)</td>
<td>Ranged from ( \alpha = .679 ) (T1) - .896 (T2)</td>
</tr>
<tr>
<td>Result Demonstrability (RD)</td>
<td>*Ranged from ( \alpha = -.600 ) (T1) - .443 (T2)</td>
</tr>
</tbody>
</table>

*For the Result Demonstrability (RD) subsection (4 questions), the last question was reverse scored to fit the calculation of the statistic.

Although the original instrument had been considered reliable, it was pertinent to use Kappa since the draft survey had modified a few items. The Kappa scores for this section were similar to those in section one. Thus it was decided not to change or remove any questions from the original TAM2 model.

In reviewing the text-based comments on the draft survey it was noticed that students indicated they were not permitted to use mobile technology as directed in their clinical practice handbook. This finding may have influenced the students’ unwillingness to answers questions positively. Additionally, students may have been
unaware of hospital based library resources. These findings from the test-retest may have influenced the statistics.

**Conclusion**

This chapter outlined stage one and two within the study. The aim of stage one was to explore in greater detail, policy and guidelines available across the sites within the study. Potential inconsistencies and discrepancies between the sites was noted, where most did not have a specific policy or guideline directing acceptable use of mobile technology for staff. Stage two involved a systematic process of testing the online survey for reliability and validity, prior to administering to the graduates. Chapter four discusses the data collection, analysis and results of the online survey.