Data collection techniques and analysis

The previous chapter has evaluated the secondary research available for the key topics discussed in this study; the focus will now be on primary research. This chapter aims to describe the research methodology and design used for this research, and includes an explanation of the data collection techniques and analysis (Polit & Beck 2010). The study is being undertaken to contribute to the body of knowledge within the area of nursing drug calculation errors, and barriers and facilitators to confidence with numeracy in a sample of undergraduate nursing and midwifery students which is currently limited (references). The study was undertaken at the University of Hertfordshire, UK, in the academic year 2012/2013 semester A.

Research Design

This author decided to use a mixed methods (Tashakkori & Teddlie, 2003) design, which can be defined as ‘ research in which the researcher uses the qualitative research paradigm for one phase of a research study and the quantitative research paradigm for another phase of the study’ (Johnson & Christensen, 2000a). This involved two separate phases of research, to collect, analyse and “ mix” both quantitative and qualitative primary data to understand the problem of nursing students drug calculations more completely (Creswell, 2002). Johnson & Christensen (2000) state that, importantly, mixed research will promote the conduct of excellent research. Advantages of mixed research are:

When different approaches are used to focus on the same phenomenon and they provide the same result, you have “ corroboration” (superior evidence) for the result;

You can complement one set of results with another;

To expand a set of results; or

To discover something that would have been missed if only a quantitative or a qualitative approach had been used (Johnson & Christensen, 2000).

The major characteristics of mixed research are shown in Table X (below).

Source: Johnson & Christensen (2000a)

Stage 1: Online Survey – The primary purpose of this stage was to find possible associations between categorical independent variables such as demographics, maths qualifications, calculation skills, instrumental support, learning strategies, inhibitors of drug calculations, and the dependent variable (outcome) of numeracy confidence, in order to predict barriers and facilitators that may affect numeracy amongst nursing and midwifery students. Stage 1 gathered data via a “ one-shot” self-report online questionnaire design, i. e., one group of participants is studied only one time (Vanderstoep & Johnston, 2009, p. 60), as it is inexpensive, less time consuming and has the ability to gather data from a large research sample fast (Cornford and Smithson, 1997; Vanderstoep & Johnston, 2009, p. 61). The survey was conducted from the start of November 2012 until mid-December 2012.

Stage 2: Focus Groups – This stage of the research focused on exploring nurses and midwifery students’ perceptions and ideas on numeracy and its teaching. A group setting was selected as the best methodology as it enabled the researcher to hear multiple experiences in a detailed and

unhurried manner. Participants were encouraged to remember and discuss their own numeracy training and drug calculations experiences. Two groups were conducted in December 2012.

Rationale for mixed methods approach

The rationale for mixing is that neither quantitative nor qualitative methods are sufficient by themselves to capture the complexity of the issue. When used together, both methods complement each other and allow for more complete analysis (Greene & Caracelli, 1997; Green, Caracelli, & Graham, 1989, Tashakkori & Teddlie, 1998). The author felt it was beneficial to balance the primary survey data with richer, more contextualised perspectives of nurses to build a full picture of teaching practices and numeracy skills in the context of the nursing drug calculations issue. Therefore, the current research employed a mixed-method deductive-inductive approach, and considered the two research philosophies of positivism and interpretivism (Blumberg, Cooper, and Schindler, 2008).

Bowling (2002) states the importance of choosing the appropriate research method. There are two approaches used in research, qualitative and quantitative research.

Quantitative Approach: Deductive Positivist

Quantitative research can be defined as “ explaining phenomena by collecting numerical data that are analysed using mathematically based methods (in particular statistics)” (Aliaga and Gunderson, 2000, cited in Muijs, 2011, p. 1; Charles & Mertler, 2002). It uses a positivist paradigm for developing objective knowledge, such as causal models, analysis of

variables, hypotheses, quantitative measurement and observation, and uses highly structured, large samples for deductive testing of theories, (theory â†’ observations/finding). Typically, a researcher identifies explanatory variables and causally relates them to determine the frequency and the magnitude of relationships.

Qualitative Approach: Inductive Interpretivist

Alternatively, qualitative “ inquiry” is a subjective, exploratory, constructivist (Guba & Lincoln, 1982) process of understanding where the researcher develops a “ complex, holistic picture, analyses words, reports detailed views of informants, and conducts the study in a natural setting” (Creswell, 1998, p. 15). Qualitative research uses small samples and an in-depth investigation and commonly inductive theory-development, (observations â†’ finding/theory). Ultimately, qualitative research “ produces an understanding of the problem based on multiple contextual factors” (Miller, 2000).

Whilst the wealth of drug calculations literature, the need to explain causal relationships between selected variables and numeracy confidence are elements of deduction in the current research; inductive elements included the individual nursing students’ perspectives of instructional support (at school and university), through collection of qualitative data with less concern to generalise. Tashakkori and Teddlie (2003, p. 768) state that such a mixed methods approach is useful as it provides a better opportunity for research questions to be answered and better evaluation and inferences from the research findings. Additionally, because all methods of data collection have limitations, the use of multiple methods can neutralize or cancel out some of the disadvantages of certain methods (e. g., the detail of

qualitative data can provide insights not available through general quantitative surveys) (Jick, 1979; cited in Creswell, Clark, Gutmann & Hanson, 2003, p. 164). Thus, there is wide consensus that mixing different types of methods can strengthen a study (Greene & Caracelli, 1997, cited in Creswell, Clark, Gutmann & Hanson, 2003, p. 164).

Survey – Sampling and Participants:

The participants for the survey were self-selected. Every nursing and midwifery student at UH was given the opportunity to complete the questionnaire. In this study all of the cohorts were included, year 1, 2 , 3 (undergraduates) and year 4 (postgraduates). On successful completion of the three year bachelor program the students then join the NMC to practice as registered nurses. The target population was the entire undergraduate nursing and midwifery student population registered at the University of Hertfordshire, UK in the 2012/2013 academic year (N= 1000). A participant invitation information letter was sent to all nursing and midwifery undergraduate students using The University of Hertfordshire's online learning platform, StudyNet (see Appendix X), as the sampling frame, i. e., list from which we sample from (Statistics Canada, 2010, p. 34).

A final sample of 225 surveys were completed (22. 5% response rate), of which the demographic background is as follows: 94% were females while 6% were males. The majority of respondents (57%) were found in the younger age group (25 years or less), followed by the older age group (25+ years) comprising 43% of the survey sample. In terms of math qualifications, the majority of respondents (90%) hold GCSE/O-level math qualifications, 32% hold another basic math qualification and 9% hold A-level math

qualifications. In terms of educational backgrounds, 79% were educated in UK secondary schools and 21% were non-UK secondary school students. In terms of undergraduate study, the majority of respondents (72%) were nursing students, and 28% were midwifery. As far as year of study, the majority of respondents (80%) were in year 1, 1% were in year 2, 17% were in year 3, and 2% were in year 4. Additionally, in terms of disability, the majority of respondents (97%) do not have a disability that may affect their numeracy skills and 3% do. See Table X (below).

Focus group – sampling and participants:

For the focus groups, the chosen sampling method was nonprobability (non-random) purposive sampling, in which the researcher decides what needs to be known and sets out to find people who can and are willing to provide the information by virtue of knowledge or experience (Bernard 2002). Purposive sampling may involve studying the entire population of some limited group or a subset of a population. According to Rubin and Rubin (1995), selected informants should be ‘ knowledgeable about the experience or situation, willing to talk, and representative of a range of points of view’ (p. 66). ‘ Purposive sampling does not produce a sample that represents some population, but can be exactly what is needed in a case study of an organization, community, or some other clearly defined and relatively limited group’ (Schutt, 2012). The informants of the focus group discussion did not know each other. Each FGD consisted of four informants, of whom 100% were female nursing and midwifery students at UH.

Materials:

Questionnaire Construction:

‘ A survey is any activity that collects information in an organised and methodical manner. It is usually motivated by the need to study the characteristics of a population, build a database for analytical purposes or test a hypothesis’ (Statistics Canada, 2010, p. 20).

Self-report methods require a very well-structured, easy to follow questionnaire with clear instructions for the respondent (Statistics Canada, 2010, p. 50). Questions were compiled from nursing drug calculation literature to represent potential explanatory factors. The four-page questionnaire contained 13 close-ended questions in English which were divided into three sections: the demographic data section, the confidence with numeracy section, the learning strategies section, and the inhibitors of drug calculations section (See Appendix X). Demographic questions included: gender, age group, type of student, year of study, secondary school education, maths qualifications, and disability that may affect numeracy skills. Individual responses to multiple choice answers, were limited to, for example, ranking using Likert scale (4-point scale) and ‘ yes’ or ‘ no’ answers (Yin, 2008; Field, 2005). Jarvis (2006, p. 59) states that “ Likert (1932) developed the simplest and what has become the most common way of measuring attitudes.” A Likert scale measures how much a respondent “ agrees or disagrees with a statement or series of statements, usually in a four, five, six or seven point rating scale” (Saunders et al., 2009, p. 378). This enabled the information to be grouped and analysed statistically using categorical data analysis (Leung, 2001). Since the answers can be influenced

by respondents' understanding of the study, a carefully crafted introduction explained who the researcher represents, purpose of the study and how and why the respondents were selected for the research, and the importance of their answers to the research.

Procedure – Data Collection Methods:

The researcher conducted a research strategy with more than one data collection method, which is known as Methods Triangulation (i. e., using multiple methods, such as interviews, questionnaires, and observations in investigating an issue) (Johnson & Christensen, 2000b). One advantage of triangulation is that it can enhance the credibility of a study. One disadvantage is that it can be time consuming, expensive and sometimes provide conflicting data" (Hastings, 2010).

Compared with the task of managing focus groups, a self-report survey is relatively easy to administer (Statistics Canada, 2010, p. 50). Limitation of self-report are that response rates are usually lower than for interviewer-assisted methods as there is no pressure for the respondent to complete the questionnaire (Statistics Canada, 2010, p. 50). However, benefits are that anonymity of a web survey allows respondents to answer quite personal or sensitive questions without fear of embarrassment.

The protocol followed for data collection was as follows:

Online survey questionnaire:

The first phase of primary data collection was carried out using an online survey, after reviewing the available information (the cost and time of set-up and administration, the likelihood of changing the questionnaire after pilot-

testing, etc.), as it is easy to manage at minimal cost, and can collect a large volume of data fast. Evans and Mathur (2005) cite benefits of online surveys as: the flexibility, the speed that data can be collected, that respondents can answer the survey at a convenient time, low administration and preparation costs and that a large sample is easy to obtain. (Evans and Mathur, 2005). Additionally, Schonlau, Fricker and Elliott (2001) state that " further into the future, some experts expect that the majority of all survey research will be done online" cited in Evans and Mathur, (2005: 196), justifying that further supported an online survey is an appropriate and credible data collection method.

Pilot study:

A pilot study was undertaken to assess the adequacy of the questionnaire, suitability of the survey frame, operational procedures, etc. (Statistics Canada, 2010, p. 19), ensure the questions were understood and clear to respondents, and to observe the time taken to complete the questionnaire. Modifications to question working were made to increase clarity (based on pilot feedback). Such amendments were rechecked and approved by the ethics committee.

The final version of the questionnaire was launched during a cross-sectional time period from the start of November 2012 until mid-December 2012. Bristol Online Survey (BOS) website was used to build, deploy, receive and collate surveys via the Web. Clicking on the link at the end of the participation information letter launched the online questionnaire. The BOS questionnaire collected the required information from the respondents and stored it. A paper version of the questionnaire was provided for those

participants who requested this method. The completed paper version questionnaire was later transferred onto the BOS manually by the researcher [explain]. Section 1 of the questionnaire used objective closed questions to obtain data on year of study, demographics, maths qualifications and disability. Section 2 asked subjective questions to measure numeracy confidence, preferred learning strategies and potential inhibitors to drug calculations. Section 2 asked participants to provide answers on a 4 point scale, for example, where 1 meant (strongly disagree), 2 (disagree), 3 (agree), 4 (strongly agree). A copy of the questionnaire is attached in the appendix.

Focus group interviews:

Students who responded to the request to participate in a focus group discussion (FGD) were contacted via their provided email. A convenience sample of 4 nursing students participated in each FGD. Two FGDs were held in interview rooms at the UH university. This second phase of data collection involved a semi-structured focus group discussion with follow-up probes used to explore participants' current math skills, confidence with numeracy, instrumental support, and memories and perceptions about drug calculations in practice at different stages of their training. This methodology enables participants to provide in-depth accounts of their experiences while also allowing the researcher considerable flexibility in probing interesting areas which emerge (Smith, 1995). First more general questions were asked to involve all participants and elicit any potential topics from informants. Then more specific open questions relating to particular topics were asked. According to student responses during the interview probing questions were

asked to help elaborate on details. Each FGD was conducted within a relaxed, quiet, informal environment at UH university, facilitated by the moderator (researcher). The moderator guided the interviewees and encouraged all participants to put their ideas and thoughts forward to ensure no dominant speakers. When participants formed a concensus, the moderator then tried to break such dominant ideas to prevent conflict (groupthink), so that participants would say what they really think. Participants were given opportunities to question each other to clarify answers or ideas which helped the researcher to get a better understanding of the ideas being proposed.

Focus groups lasted between 45 and 60 minutes and were audio-recorded and transcribed verbatim.

Data were analysed using data-driven thematic analysis (reference). This process of qualitative data analysis involved the open and axial coding stages proposed by grounded theory (Strauss & Corbin, 1990). Thematic analysis offers a straightforward, pragmatic method for identifying codes, categories and themes (reference), with or without the application of preconceived themes, allowing researchers to identify themes in the data (reference). FGD transcripts were read and reread and initial codes were identified and marked in the text, to reduce and summarise the data, after which codes were organised into categories, in order to develop a deeper description and interpretation and interconnection of themes. Codes were altered and adjusted as new themes emerged during data coding.

Ethical considerations:

The researcher read all university guidelines relating to conduct of research with humans, after which both phases of the study were reviewed and approved by the University of Hertfordshire Faculty of Health and Human Sciences Research Ethics Committee prior to data collection.

Survey Consent :

In November 2012, at the onset of investigation, potential participants were thoroughly briefed on all aspects of the survey research via a participant information letter circulated to all nursing and midwifery students using The University of Hertfordshire's online learning platform, StudyNet (see Appendix X). This briefing explained:

The nature, purpose and duration of the survey

That the study did not employ any deceptive data collection techniques

Participants may withdraw from the study at any time, without penalty

No foreseeable threat to researcher/participant safety or wellbeing

All information/contribution participants provided was voluntary, anonymous and confidential. All data collected was stored securely and processed anonymously in accordance with the Data Protection Act. Only the principal researcher and supervisor would see the results, the findings from the study would be used for ethical purposes, accurately reported, and final outcomes might be shared with nursing tutors to help future students

Completing and submitting the questionnaire implied consent to take part in the survey.

Additionally, the researcher’s contact details were provided so that potential respondents could contact the researcher for further information or to verify the survey (Bulmer et al., 2010). None of the survey participants were known to the researcher or the supervisor.

Focus Group Consent

Willing participants for the focus group discussion (FGD) were asked to provide their email addresses which implied consent for contact to be made for focus group recruitment. A reminder email was circulated in December 2012 to increase participation in the FGD.

Debriefing: When all data had been collected, the researcher provided participants with any necessary information to complete their understanding of the nature of the research.

Data Analysis

Quantitative analysis of survey data

The data analysis for the survey was carried out using IBM SPSS (Statistical Package for the Social Sciences) version 19. 0. A variety of statistical analyses were performed on the data to enable the researcher to make valid inferences from the data, at univariate, bivariate, and multivariate levels, in order to determine the association between demographic characteristics, maths qualifications, instructional support, learning strategies, inhibitors and numeracy confidence. To check the responses of the survey questions, the

first stage of the data analysis consisted of checking for missing data and tagging respondents with a unique number. Categorical variables were next recoded into binary variables (i. e., agree/disagree, and helpful/unhelpful) to reduce the data and produce 2 x 2 contingency tables. Univariate frequency tables were generated to summarise demographic information such as the age group, gender, student type, year of study, and maths qualifications achieved for respondents. Descriptive data analysis provide an appreciation of the actual numbers and values, and hence the scale of the issue that we are dealing with (Dwivedi and Weerakkody, 2007). Next, the researcher generated bivariate Pearson Chi-Square (Ï‡2) statistics to examine associations among major variables. All bivariate associations that were statistically significant (p <. 05) following bivariate analysis were included for the multivariate analysis. A multiple logistic regression model was applied to determine statistically significant explanatory variables for numeracy confidence. Statistical significance was based on 2-sided tests set at Î±= 0. 05 (5%, p <. 05). The results of the model were reported as odds ratios (ORs) with 95% confidence intervals (CIs).

Qualitative thematic analysis of focus group interviews

Analysis of data from focus group discussions followed steps described by Warden and Wong (2007). The researcher transcribed the recorded discussions verbatim, then read and reread through the transcripts to become familiar with the data. Coding of the data was done line-by-line as the researcher read through the transcripts. This was done by placing words or phrases that summarised key words, statements, paragraphs on the right-hand side. Codes were then organised and aggregated into categories and

themes and interpreted. Relevant quotations were then extracted verbatim from the transcripts to illuminate each theme and subtheme.