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Sample Size Calculations in Nursing Student Mobile Application Research: A Systematic Review

Muhamad Andika Sasmita Saputra[1]*, Tukimin bin Sansuwito[2], Faridah Mohd Said[2]

[1]STIKes 'Aisyiyah Palembang, Sumatera Selatan 30961, Indonesia
[2]Faculty of Nursing,Lincoln University College, Wisma Lincoln, No. 12-18, Jalan SS 6/12, 47301 Petaling Jaya, Selangor Darul Ehsan, Malaysia

Corresponding Author's Email: andika.phdscholar@lincoln.edu.my

ABSTRACT

Background: Research must certainly have subjects or samples that will be used in the research, including research on mobile phone applications. Research using mobile applications has begun to be widely carried out, so this phenomenon needs to be analysed as to what is ideal among researchers in determining the number of samples used in the research. **Objective:** This systematic review aims to analyse the sample size and calculation technique used by previous researchers to research mobile phone applications involving nursing students as research samples. **Methods:** This systematic review took electronic database sources through journal search engines, such as Google Scholar, Pro-Quest, PUBMED, and Science Direct. The criteria for the journals taken were open-access journals published within the last five years (2018–2023). The journal search used the keywords "mobile phone application" and "nursing students." **Results:** A total of six journals had eligibility out of the 18 journals assessed, showing that the largest number of samples used by previous researchers was 256, while the minimum was 25. **Conclusion:** Whether large or small, the number of samples used in implementing mobile applications among nursing students does not follow existing trends but must be calculated according to a representative portion of the subject population to be studied.

Keyword: Sample Size Calculations; Mobile Applications; Nursing Students

INTRODUCTION

Technological advances are developing so rapidly that they have entered the era of digital technology. These technological developments also impact style, lifestyle, habits, and daily activities (Cardoso-Andrade *et al.*, 2022; Nor *et al.*, 2021; Weisberger, Grinshtan, & Blau, 2021). It does not stop there; technological developments have spread to all fields, including the field of education (Weisberger, Grinshtan, & Blau, 2021; Yuen *et al.*, 2023). It also changes academic patterns and systems, starting from the learning process, assignments, etcetera, which are related to academic activities (Cantabella *et al.*, 2019; Wang *et al.*, 2022; Weisberger, Grinshtan, & Blau, 2021). It indicates many benefits to be gained from this technological development, especially in education.

The development of technology is nothing new. Technological development has been carried out since pre-historic times and will continue to undergo evolution based on times, needs, and human thinking (Pacey & Bray, 2021; Van De Poel & Royakkers, 2023; Wahyuni, 2020). According to Van De Poel & Royakkers (2023), technology helps humans in their activities and all kinds of things. However, the use of technology must, of course, receive attention because, in the hands of the right people, technology will be helpful. However, in the hands of the wrong people, technology will become a means of crime and disaster (Chesney & Citron, 2018; Kunjukunju, Yusof, & Ahmad, 2020). In other words, technology will continue to progress, but its use is in the hands of humans themselves, whether it is good or not.

Advances in digital technology used in nursing academic activities are also beneficial. Many academic nursing activities currently use technology (Campbell *et al.*, 2020; Kurt *et al.*, 2020; Mweshi & Sakyi, 2020). For example, chatting applications usage, which can facilitate communication between lecturers and students,

to the use of student web portals, which provide integrated facilities for managing grades, payments, registration, and many others (Mthimunye & Daniels, 2019; O'Connor *et al.*, 2023; Sumpter *et al.*, 2022). Other examples include mobile applications that help nursing students' study, laboratory practice that leads to skill improvement, assignments, and quizzes (Fresta *et al.*, 2023; Meum *et al.*, 2021). Of course, it cannot be separated from the role of researchers who conduct research that directs their research towards technological development (Borah, Massini, & Malik, 2023; Malik *et al.*, 2023; Stundner *et al.*, 2023). It means that the development of digital technology, which is changing the styles and patterns of human life today, including academic nursing activities, cannot be separated from the role of researchers.

Researchers have a huge role in advancing digital technology today, especially in developing mobile applications that provide convenience for lecturers, academic supervisors, clinical instructors, and nursing students. According to Stundner *et al.* (2023), researchers play the role of solving problems, answering questions in the field under their control, and providing new knowledge or knowledge based on findings that can be used to solve existing problems. Apart from that, research is also very closely related to the development of science and technology because the development of science and technology requires processes that require supporting data or facts (Ardito *et al.*, 2019; Fresta *et al.*, 2023; Malik *et al.*, 2023). The development of science and technology will always follow the results of the latest research, and this can be seen in the emergence of new sciences, which are developments of previously existing sciences (Grove & Gray, 2019; Park *et al.*, 2021). It means that researchers and the development of science and technology are related to one another, and because of the research, there will be the development of science and technology. However, in a study, subjects or samples are certainly needed.

The subject, or sample, is an essential component of research. Creswell & Creswell (2017) said that the research sample is a small part of the population taken according to specific procedures that can represent the population. Samples are used if the population studied is large and the researcher cannot possibly study the entire population. These obstacles can occur due to the limited costs, energy, and time available to researchers (Creswell & Clark, 2017; Mills & Jordan, 2022). The sample from the population must truly represent the population studied so that the expected results will be correct (Flick, 2022; Reichardt, 2019). It means that in determining the research sample, the researcher must accurately calculate how many samples will be taken so that they can answer the expected research objectives.

Research on technology development will undoubtedly involve many samples. According to Flick (2022), the more general the sample, the greater the number of requirements, while the more specific it is, the fewer there will usually be. Meanwhile, according to Creswell & Clark (2017), the number of samples has calculations and conditions according to the research design and methods. Meanwhile, according to Memon *et al.* (2020), a good sample size is 30 to 500. From the sentences above, the question naturally arises: "What is the ideal sample size used by researchers in conducting mobile application research if the research scope is made specifically for nursing students, and what is the technique for calculating it?"

It is necessary to analyse the form of a systematic review of the results of published reports or journals to answer this question. The analysis results are expected to provide guidance and knowledge for researchers or readers who will conduct research so that there is no doubt in determining the number of samples to be taken.

METHODOLOGY

This systematic review study aims to analyse the size of the sample used and the calculation technique used by previous researchers to conduct research on mobile phone applications involving nursing students as research samples. Apart from providing information, this systematic review will also be a primary consideration for researchers to determine the number of samples to be taken during the research. The systematic review process is carried out by taking sources from several electronic open databases using journal search engines, such as Google Scholar, Pro-Quest, PUBMED, and ScienceDirect. The journals were selected within the last five years (2018–2023). The keywords used to obtain systematic review sources are made more specific, namely "mobile application usage to improve the quality of clinical practice evaluation among nursing students" OR "mobile phone application" AND "nursing students." The aim of using specific keywords is so that researchers can immediately find journals that are genuinely related to the topic being discussed, making it more effective and efficient. Journal analysis was carried out using the Preferred

Reporting Items for Systematic Review and Meta-Analysis (PRISMA) method. The data extraction process uses the following methods: (1) looking at the database starting from the author, title, date, year, journal type, keywords, topic, and primary source of references used; (2) the content or subject matter provided contains topics according to keywords.

Table 1 : Inclusion and Exclusion Criteria for Assessing Identified Papers

No	Assessment Level	Criteria	Assessing Identified Papers Criteria
1	Year of Publication	Inclusion	2018 until 2023
		Exclusion	Longer than 2018
2	Title and abstract (Screening)	Inclusion	• At least one operational research, mobile application, and nursing student with name or general in the article title, journal title, or keywords **AND/OR** • At least one mobile application and nursing student are mentioned in the article title, journal title, keywords, or abstract. **AND** • Discuss the sample size of nursing students in the abstract or method.
		Exclusion	E1: The title or journal of publication had no relevance to operational research: mobile application and nursing student. E2: Abstract not indicated to the mobile application and nursing student. E3: Paper not focused on mobile applications and nursing students.
3	Full Text (Eligibility)	Inclusion	• Discussion of the mobile application and nursing students in the abstract and body of the paper. • Discussion of the sample size of nursing students in the abstract and body of the paper and the quantitative research method.
		Exclusion	E4: All the articles that do not meet the inclusion criteria

RESULTS

The results of journal searches that have been carried out are displayed in the PRISMA Flow Chart as follows:
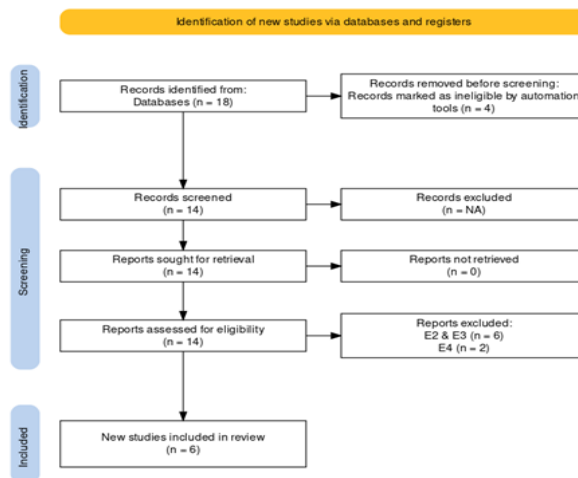

Figure 1: Flowchart of the Systematic Review Selection Stage

The flow chart above shows the process and assessment results of the journal being analysed. This flow chart was created using the PRISMA flow diagram generator application (Haddaway *et al.*, 2022). From the assessment results, it was found that 18 journals were downloaded and analysed. Four journals were automatically eliminated because the title was a website-based application journal; six were eliminated because the topic and discussion fell into the exclusion criteria E2 and E3, and two were eliminated again because the subject matter was out of topic (E4). The results of the assessment and analysis left six eligible journals. The journal is as follows:

Table 2 : Result of Systematic Review Assessment

No	Year & Source	Author	Research Design	Application	Sample and Size	Calculation Technique
1	2018 ProQuest	Wu *et al.*, 2018	Experiment	Mobile E-Book Application	Two classes were taken from four nursing schools, each divided into experimental and control groups. Each group had 32 nursing students, a total of 256 samples.	Not mentioned
2	2018 Science Direct	Kim & Suh, 2018	Experiment, using randomized control group pre-test and post-test design	Interactive Nursing Skills Mobile Application	A school of nursing in Seoul, Korea. The initial sample of 72 was divided into two groups: 36 experimental and 36 controls. Several samples were withdrawn, so the final sample only consisted of 66, 34 experimental, and 32 controls.	G*Power software program (Version 3.1.9.2)
3	2021 Google Scholar	Singh *et al.*, 2021	Cross-sectional	Educational Application	UWI, The University of the West Indies. The initial sample was based on a count of 166. The sample that participated in the research until the end was only 112 people	Not mentioned
4	2021 PubMed	Shahmoradi *et al.*, 2021	Applied-developmental study	The pain management Application	83 samples, consisting of 55 undergraduate students and 28 M.Sc. nursing students	Not mentioned
5	2022 Science Direct	Seok & Suh, 2022	Applied-developmental study	Health Promotion Application on Cancer Survivorship	25 samples, consisting of 20 nursing students and five experts in nursing	Based on previous studies, the experts ranged from 2 to 69 people, and the users ranged from 5 to 35
6	2023 Science Direct	Huang & Fang, 2023	The quasi-experimental study	i-STAR applications	There were 163 nursing students in the third grade of their associate's degree. Divided into associate experimental group of 77 participants and a control group of 86 participants.	G* Power software program (Version 3.1.9.7)

DISCUSSION

Table 2 shows that six journals are eligible out of the 18 journals assessed. The most significant number of samples used by previous researchers was 256, while the smallest number of samples was 25. All samples were nursing students and involved five experts in the nursing field. Three journals divided the total sample into two groups: the intervention and control groups. Two journals were divided based on characteristics, and one did not divide the sample into groups. Three journals did not explain the technique for calculating the sample size. Two journals explained that the sample size calculation was done with the help of the G*Power software application, while one journal determined the sample size based on previous studies.

Judging from the research concept, according to Creswell & Creswell (2017), the sample is a part of the accessible population with the same characteristics. Meanwhile, the population is the totality or generalization of units, individuals, objects, or subjects with specific quantities and characteristics to be studied, such as people, objects, institutions, events, etcetera, which can be obtained or can provide research information (data) that can then be concluded (Creswell & Creswell, 2017; Memon *et al.*, 2020; Reichardt, 2019). A research study must clearly define the population: what, who, where, or when (Kumar, 2019; Thomas *et al.*, 2022). The question is what or who is more concerned with the content of the research, while where is defined as the extent of the research, and when is meant as time (LoBiondo-Wood & Haber, 2002; Polit & Beck, 2019). Research does not always involve the entire population but must be based on academic and non-academic considerations. Some of its members, called samples, can represent the population and will not reduce its weight or accuracy. Because the sample has the same characteristics as the population, the information extracted from the sample is the same as the characters that apply to the population (Polit & Beck, 2019).

Each researcher has considerations and reasons to determine the sample and sample size. Several reasons for considering the use and sampling of research are (1) cost savings, (2) time savings, (3) energy savings, and (4) a guarantee of accuracy and weight of results (Campbell *et al.*, 2020; Polit & Beck, 2019; Saunders & Townsend, 2018). Meanwhile, based on the sampling process, according to Lohr (2021), three stages must be gone through in the sampling process, namely as follows: (1) defining the target population; (2) determining the sample frame; and (3) determining the sample size. Apart from that, some factors can influence the size of the research sample, namely: (1) research objectives; (2) energy, costs, and time; (3) the degree of uniformity of the population; (4) the analysis plan; (5) desired precision; (6) heterogeneity of the population; (7) the number of variables used; and (8) the sampling technique used (Campbell *et al.*, 2020; Lohr, 2021; Saunders & Townsend, 2018). This type of descriptive research usually requires a large sample size, but if it is only to test a hypothesis, the sample size does not need to be significant. The larger the sample size, the greater the statistical power, and conversely, the smaller the sample size, the smaller the statistical power, which will influence the research results (Lohr, 2021; Majid, 2018; Mweshi & Sakyi, 2020).

The following steps in quantitative research are calculations and sampling techniques: The sampling formula for a known population can use the Slovin formula, proportion formula, estimating the population mean, estimating the difference between 2 proportions of independent groups, estimating the difference between 2 independent group means, estimating the difference between 2 proportions of paired groups, estimating the difference between 2 means, estimation based on drop-out predictions, and many other calculation formulas (Dharma, 2011; Gil-Lacruz, Gil-Lacruz & Gracia-Pérez, 2020; Kumar, 2019; LoBiondo-Wood & Haber, 2002; Lohr, 2021; Sugiyono, 2018). Meanwhile, the sampling technique, according to Stratton (2021), is the process of selecting several elements from the population being studied to be used as samples and understanding the various traits or characteristics of the sampled subjects, which can then be generalized from the elements of the population. The sampling technique is divided into (1) probability sampling, which consists of simple random sampling, proportionate stratified random sampling, disproportionate stratified random sampling, and cluster sampling; and (2) non-probability sampling, which consists of systematic sampling, quota sampling, accidental/incidental sampling, purposive sampling, saturated sampling, and snowball sampling (Creswell & Creswell, 2017; LoBiondo-Wood & Haber, 2002; Polit & Beck, 2019; Sugiyono, 2018).

Based on several concepts above and linked to the analysis results in the six journals obtained, So, the researcher assumes that in deciding to determine the sample size, whether small or large, previous researchers have applied it based on existing concepts, even though two journals did not explain the calculation method used

and one journal used the previous study method. Meanwhile, in terms of calculations, the two journals explained that they used application-assisted calculation methods. It indicates that technological developments in research science have also experienced developments in using technology, one of which is sample calculations. Of course, in this calculation, the researcher must also look at the research objectives to be carried out. It can be interpreted that in determining the number of samples, whether research aims to develop or create applications, the number of samples used must be calculated based on the size of the population, and the calculation method can be done using manual calculation formulas or application software. However, using sample calculation application software has the advantage of being able to simplify and speed up the calculation process, as well as minimizing errors in calculations.

CONCLUSION

The number of samples used in mobile application research among nursing students does not have to follow trends. However, the number of samples taken must be calculated according to a representative portion of the subject population to be studied. Determining the sample size can be influenced by the design, objectives, and research population chosen, while calculating the sample size can be done using a manual calculation formula or application software.

Conflict of Interest

The author declares no conflict of interest.

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