

การศึกษากลยุทธ์ในการพัฒนาทักษะการคำนวณยาของนักศึกษาพยาบาล: การทบทวนวรรณกรรมอย่างเป็นระบบ (Educational strategies aimed to improving student nurse's medication calculation skills: A systemic review)

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การวิจัยเชิงปริมาณด้วยการทบทวนวรรณกรรมอย่างเป็นระบบครั้งนี้มีวัตถุประสงค์เพื่อเพื่อสรุปองค์ความรู้ของการศึกษาเกี่ยวกับกลยุทธ์ในการพัฒนาทักษะการคำนวณยาของนักศึกษาพยาบาล โดยการสืบค้นหางานวิจัยที่มีการรายงานไว้ระหว่างปี พ.ศ. 2554-2564 จากฐานข้อมูล 1) Science Direct 2) CINAHL 3) Web of Science 4) ฐานข้อมูลวิทยานิพนธ์อิเล็กทรอนิกส์ (Thailand Library Integrated System: Thai LIS) 5) Google scholarship ใช้เกณฑ์ในการคัดเลือกงานวิจัยที่มีเนื้อหาสอดคล้องกับวัตถุประสงค์ของการทบทวนวรรณกรรมตามแนวคิดของ PICO ประเมินคุณภาพงานวิจัยโดยพิจารณาบทคัดย่อที่มีเนื้อหาของบทคัดย่อสอดคล้องกับตามเกณฑ์การคัดเลือกเข้าและตัดออกตามเกณฑ์การคัดเลือกออก วิเคราะห์และสังเคราะห์โดยใช้สถิติเชิงพรรณนา และนำเสนอโดยการสรุปความ ผลการสืบค้นอย่างเป็นระบบพบว่ามีความวิจัยจำนวน 10 เรื่อง ที่มีคุณสมบัติตรงตามเกณฑ์การคัดเลือกเข้า มีพยาบาลนักศึกษาทั้งหมด 2,862 คน กลยุทธ์ในการพัฒนาทักษะการคำนวณยาของนักศึกษาพยาบาลที่พบในบทความวิจัยมี 4 กลยุทธ์ ได้แก่ 1) กลยุทธ์การสอนแบบดั้งเดิม 2) กลยุทธ์การสอนโดยผ่านเทคโนโลยี 3) กลยุทธ์การสอนแบบใช้ทักษะในการปฏิบัติ และ 4) กลยุทธ์การสอนแบบผสมผสาน ทั้งนี้ นักศึกษาพยาบาลได้รับประโยชน์ที่แตกต่างจากการจัดการเรียนการสอนในแต่ละกลยุทธ์

จากการศึกษาค้นคว้าในครั้งนี้จะช่วยให้นักวิจัยหรือผู้ที่สนใจในกลยุทธ์การพัฒนาทักษะการคำนวณยาที่ได้จากการวิเคราะห์ สังเคราะห์ โดยการทบทวนวรรณกรรม อย่างเป็นระบบดังกล่าวไปใช้เป็นแนวทางในการจัดการเรียนการสอนที่เหมาะสมกับบริบทต่อไป

คำสำคัญ

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ABSTRACT

This quantitative research with systematic review of the literature aims to summarize the knowledge about strategies for developing medication calculation skills of nursing students. By searching for the research reported between 2011-2021 from the database 1) Science Direct 2) CINAHL 3) Web of Science 4) Electronic Thesis Database (Thailand Library Integrated System: Thai LIS) 5) Google scholarship. Uses criteria for the selection of research that is in accordance with the objectives of literature review according to PICO's concept. Assess the quality of research by considering abstracts with content in accordance to include and exclude criteria. Analyzed and synthesized using descriptive statistics and presented by summarizing.

The systematic search results found that there are 10 research papers that meet the include criteria. There are 2,862 nursing students. Strategies for developing medication calculation skills found in the research paper are 4 strategies: 1) Traditional pedagogy strategies 2) Technology strategies 3) Psychomotor strategies and 4) blended strategies. However nursing students receive different benefits from teaching and learning in each strategy.

In this study, researchers or anyone interested in the strategy for developing medication calculation skills obtained from synthetic analysis by reviewing literature. Systematically as mentioned as a guideline for teaching and learning that is appropriate for the context.

Keywords

Improving medication calculation skills, Student nurse, A systemic review

Introduction

According to the report, the number of deaths worldwide caused by medical errors in hospitals is 98,000 per year, with a higher incidence of death than the incidence of death from a car accident. breast cancer or AIDS and injuries from work. Most of the deaths were due to drug inaccuracies. Therefore, drug discrepancies have become a top priority. of health team personnel who need to focus on and take corrective action (The National Coordinating Council for Medication Error Reporting and Prevention: NCC MERP, 2019).

Medication error is a preventable and avoidable event. It is an event that causes or leads to inappropriate drug use or harm to the patient, While the drug is under the responsibility of health care personnel. (NCC MERP, 2019), The incidence of medication error can occur at any stage of drug administration. Prescribing, medication copying of prescriptions, transcribing, dispensing, administrating and monitoring, prevention requires systems and procedures in place to ensure that the dosing process is accurate. (WHO, 2017; Chongjit Saneha et al., 2018), which the process of drug administration to patients involves at least 3 professional health team personnel; doctors, pharmacists and registered nurses (Supanee Senadisai and Wannapa Prapaipanich, 2021)

Nursing profession is one of the professions in the team of medical personnel, who provide the closest care to the service patients. It is responsible for medication administering to patients according to the principles of drug administration. Therefore, it is imperative that the nurses study the details of each drug in order to understand its properties, dosage, method of use, action and side effects from various medications. Carefully and comprehensively to prevent medication discrepancies (Administration error)., which is an error that occurs in the process of giving the drug to the patient that is different from the prescription. Or the error that causes the patient to receive the wrong medication from the intention of the medication user (Supanee Senadisai and Wannapa Praphaipanich, 2021). Calculating the drug is one of the important functions of the nurse profession in drug administration, to ensure accuracy. Prevent wrong dose or wrong strength error, which is a dose that is higher or lower than the dose in the prescription. which nurses must to have knowledge, an understanding of the fundamentals of medication computation. Obtained from teaching, while being a nursing student which must emphasize accuracy, accurate drug calculation skills for effective implementation in real-world situations.

Nursing students are part of a nursing team who practice in wards under the supervision of professional nurses. The drug administration is one of the roles that nursing students must treat directly to the patient. This is to ensure that drug administration is safe and in line with quality assurance standards of nursing institutions and hospitals. Causing educational institutions to open bachelor's degree programs in nursing throughout the country.

Focus on teaching and learning that integrates the safety of patient care both in theory and in practice. including the content of Rational Drug Use (RDU), but the literature review also found that there was an incidence of errors in the practice of nursing students. without a clear system to prevent discrepancies from drug administration. Discrete incidence collection (Yongyuth Kaewteem, 2013) by type of medication discrepancy among nursing students, including omission error, wrong-dose error, and wrong time (Wrong-time error). The most common cause of discrepancies in drug administration among nursing students is performance deficit, means that students have the skills and knowledge to perform safe drug administration according to criteria. But failed to perform successfully, 51.01 percent, the second most common cause was 31.89% did not meet the requirements, 26.52% lacked knowledge, and 16.92% had poor communication (Wolf, Hicks & Serembus, 2006; emphasis added). Chongjit Saneha et al., 2018), which is consistent with a Stolic (2014) literature review that found that nursing students still have deficiencies in knowledge, skills and ability to calculate drugs. which will result in drug administration errors.

From the aforementioned problems and importance, it can be seen that the preparation of basic knowledge in drug calculation and drug administration skills is essential and necessary. The World Health Organization has required all professional courses related to health services to include basic computational courses. Pharmacology Basic nursing practice, including patient nursing in various fields which must focus on practice in the process of drug preparation, drug administration and various precautions However, nursing students had little experience in giving medication. However, practice is needed to improve medication administration skills in order to prepare students to be nurses with appropriate skills for safety. And improve the quality of patient care to be more efficient. This research aims to summarize the knowledge of the study on the development of medication calculation skills of nursing students by means of a systematic research review. To apply the knowledge results to suggest guidelines for teaching and learning management in nursing students and is a suggestion for further research.

Objectives

To summarize the knowledge of the study on strategies for improving medication calculation skills of nursing students by means of a systematic research review, 2011-2021.

Population and sample studied

Population used in systematic reviews is a research study on the development of skills Calculating medicines of nursing students by defining the properties of the sample group as follows:

1. It is an academic article or research study in Thailand and abroad. that has been published Published 10 years retrospectively reported from 2011 to 2021.

2. This is a research study on the development of medication calculation skills in nursing students. which is the starting variable for the review

3. This is a research study on strategies, methods, and outcomes from the development of drug calculation skills in nursing students. where strategies, methods, and outcomes were the dependent variables of the research reviewed.

4. It is an academic paper or research paper (Full text) that has been reviewed by experts (Peer review).

5. It is an academic article. Or research that includes keywords used in relevant searches based on PICO principles.

(P = Participation, I = Phenomenology of Interest, Co = Context)

The eligibility criteria are as follows:

1. It is an academic article. or research published before 2011
2. It is an academic article. or unstudied research in nursing students
3. It is a report that presents only an abstract or does not have access to a complete research report.

Methods

This research is a quantitative research. through a systematic review of the literature to analyze empirical data from relevant research; It covers topics related to the development of nursing students' drug calculation skills. from past research both domestically and internationally in order to obtain reliable educational results with the following steps

1. Searching process; The researcher searches for relevant academic articles and research articles. from electronic journal database

The criteria for selecting the database are as follows: 1) It is the source of information on health sciences. at the Office of Academic Resources Buriram Rajabhat University which the researcher is a member 2) able to search and retrieve the full article from 2011-2021 3) the nature of the academic articles and research articles searched for have been published in the past 10 years, i.e. since the year B.E. 2011 -2021 both Thai and English It is reviewed by experts (Peer review) and 4) there are keywords used in searching for academic articles. and related research articles according to PICO principles (P = Participation, I = Phenomenology of Interest, Co = Context).

2. Data sources; The researcher has selected data sources from electronic journal databases and meets the criteria specified by the researcher above. There are 5 databases as

follows: 1) Science Direct 2) CINAHL 3) Web of Science 4) Thesis database. Electronic (Thailand Library Integrated System: Thai LIS) 5) Google scholarship

3. Process of Selection and Analysis/Synthesis of Data The researcher proceeds as follows;

3.1 The selection criteria are academic articles and research articles published in the specified database. and has the following features

3.1.1 The title corresponds to the research objectives. The researcher used the concept of PICO in the selection. The research is as follows:

P (Participant): the desired sample group English keywords include Student nurse, Nurse student, Nursing student, Undergraduate nursing students and the Thai language keywords include student/ nursing student/ nurse.

I (Phenomenal of Interest): Phenomenon to be studied English keyword Consists of Medication calculation skills, Medication administration, Medication administration skills, and Thai keywords include drug calculation/ drug administration/ drug administration/ drug calculation skills/ drug administration skills.

Co (Context): Context studied English keywords include Hospital, Faculty of nursing, Nursing laboratory, Simulation learning environment, and Thai keywords include: Hospital/ Faculty of Nursing/ Nursing Laboratory/ Simulation

3.2 Selection process; The researcher has searched for articles that have the steps to extract and analyze/synthesize the data as follows:

Step 1: Search for academic articles and research articles in the journal database system, consisting of The database selected according to the criteria has been published in the past 10 years, reviewed by experts. Full report can be accessed with keywords used to find relevant work, articles and research articles.

Step 2: Select the titles of academic and research papers that meet the inclusion criteria. and cut out according to the selection criteria

Step 3: Consider by reading abstracts of academic articles and research articles, selecting only academic articles and research articles whose content of abstracts corresponds to the inclusion and exclusion criteria according to the inclusion criteria.

Step 4: Read the content of the research in detail by selecting only academic articles and research articles. whose content is consistent with the objectives of the literature review.

Data analysis and the statistics used

The researcher used the information obtained from the research summary form to analyze and synthesize the knowledge in detail. by general information of the research Analyzed using descriptive statistics. and presented using a summary

Findings

From the search results of a total of 2,525 academic articles and research articles, it was found that they were duplicates. A total of 87 related researches remained. After evaluating the quality of research used in the systematic review of the literature, 10 subjects were able to show steps. The selection of research results is shown in Figure 1. The selection process for academic articles and research articles.

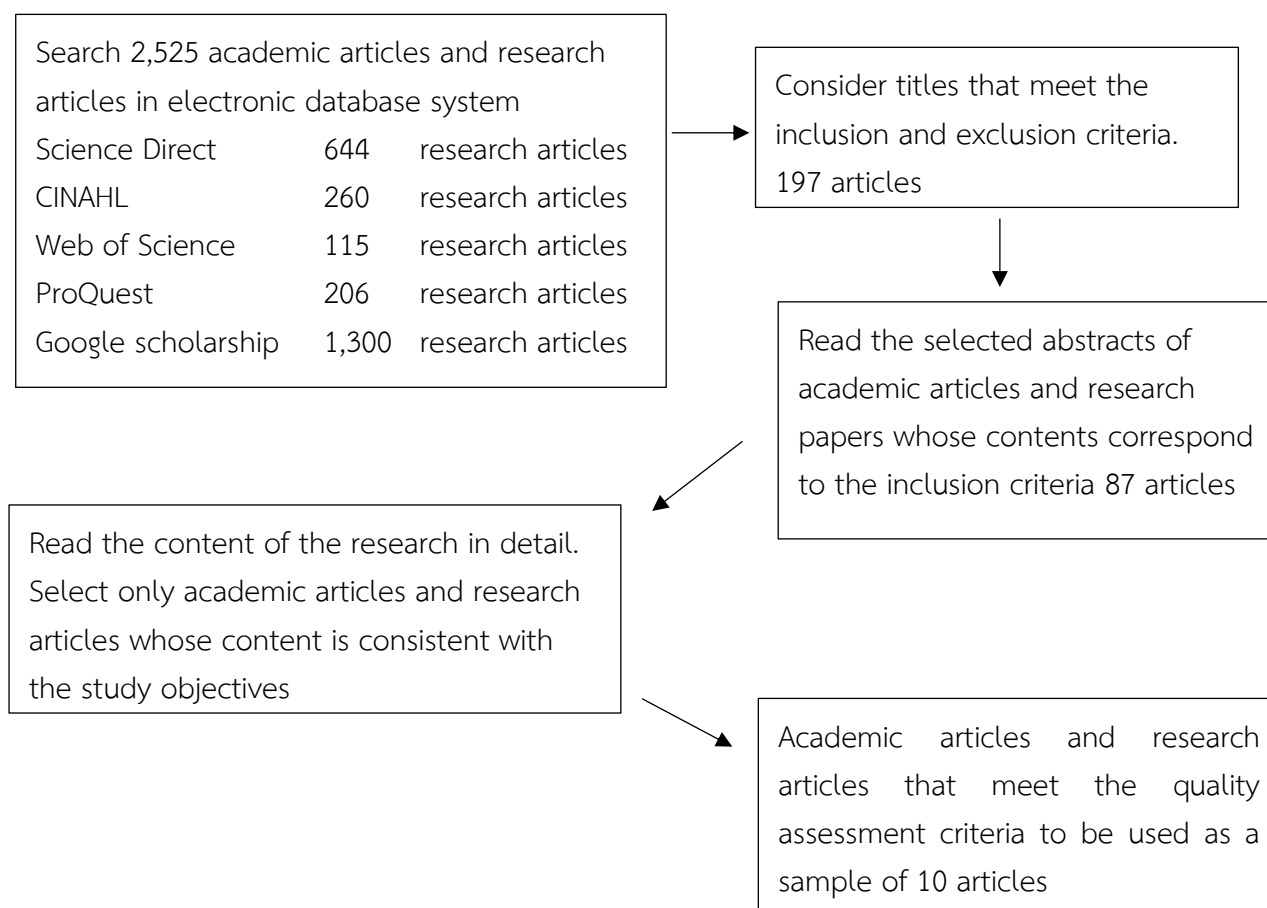


Figure 1 Selection process for academic articles and research articles

From a total of 10 academic articles and research articles, the results of the study of academic articles and research articles are shown in Table 1

Table 1 Table showing the results of the study of academic articles and research articles

Author/year	Research title	Objective	Place of research	Sample size	Type of research	Results
1. Ozunal, Boran & Saglam (2020)	Investigation of drug dose calculation skills and self ratings among nursing students.	Medication errors are important concerns in terms of patient safety. Dose calculation skills contribute to medication errors. The aim of this study is to evaluate the calculation skills and self-ratings of	Maltepe university, Tukey	120 students nurse	Retrospective descriptive study	<ol style="list-style-type: none"> 1. The rates of correct answers to the questions varied between 20% and 63%. 2. In their self-assessments, 26.4% of them stated that they had sufficient dose calculation skills. 3. The rate of correct answers in self ratings among 31.9% and 25% of them stated that had sufficient dose calculation skills.

Author/year	Research title	Objective	Place of research	Sample size	Type of research	Results
		nursing students.				
2. Unver., et al, 2013	An evaluation of a course on the rational use of medication in nursing from the perspective of the students	<p>1. Investigate the effect of using a simulated patient as a teaching method on the performance of students in medication administration.</p> <p>2. Explore the students' views on the simulated patient teaching method in</p>	Tukey	85 students nurse	Quasi-experimental pre test post test	<p>1. The mean pre-test score on the evaluation form was 24.02 ± 16.06, whereas the mean post-test score was 54.28 ± 14.54. Therefore, there was a statistically significant difference between the mean pre- and post-test scores ($p < 0.01$; $t = 14.35$).</p> <p>2. The use of a simulated patient in a course on the rational use of medication proved effective. Furthermore, the students gave positive feedback regarding the use of the simulated patient as a teaching method.</p>

Author/year	Research title	Objective	Place of research	Sample size	Type of research	Results
		terms of the skills acquired in administering medication.				
3. Suthisa Lamchang, Thitima Suklertrakul and Preecha Lamchang, (2019)	Development of pediatric medication administration multimedia for nursing students	(1) to develop the pediatric medication administration [PMA] multimedia resources for nursing students, and (2) to evaluate the efficacy of this PMA multimedia resource	Faculty of Nursing, Chiang Mai University, Thailand	A purposive sample included 47 senior year nursing students	Developmental research	The results of this study revealed that the efficacy of PMA Multimedia materials were 89.15 / 81.33 higher than the 80 / 80 standard. Post-test learning scores were higher than pretest ($t = 12.09, p < .001$) and most students indicated that their overall satisfaction with the multimedia materials was at the high or highest level (46.7% and 50.0% respectively).

Author/year	Research title	Objective	Place of research	Sample size	Type of research	Results
4. Gunes, Baran., & Yilmaz, (2016)	Mathematical and drug calculation skills of nursing students in Turkey	Investigate the mathematical and drug dose calculation skills of nursing students	2 nursing schools in two different Turkish cities.	128 nursing students	A descriptive and cross-sectional design	<p>1. The median of the mathematical skill scores was 50%, and the range was between 0% and 100%. The drug dose calculation score varied between 10% and 100%, and the median was 60%. Of the 128 students, 36.4% scored below 60%, and 82.9% scored below 80%.</p> <p>2. The nursing students have poor mathematical and drug dose calculation skills.</p>
5. Elonen., et al, 2021	Medication calculation skills of graduating nursing students within European context	1. Evaluate the medication calculation skills of graduating nursing students in six European countries	Finland, Germany, Iceland, Ireland, Lithuania and Spain	1,796 students, 538 managers and 1,327 patients participated	A multinational cross-sectional survey design	<p>1. Almost all (99%) of the students performed the tablet calculation correctly, and the majority (71%) answered the fluid calculation correctly.</p> <p>2. Older age, a previous degree in health care and satisfaction with their current degree program was positively associated with correct fluid calculations.</p> <p>3. The patients evaluated the students' medication skills higher than the nurse</p>

Author/year	Research title	Objective	Place of research	Sample size	Type of research	Results
		2. Analyse the associated factors.				managers did and the evaluations were not systematically aligned with the calculation skills tested.
6. Lancker., et al, 2016	The effectiveness of an e-learning course on medication calculation in nursing students: a clustered quasi-experimental study	Evaluate the effectiveness of an e-learning course compared with a face-to-face lecture on medication calculation.	University Centre for Nursing and Midwifery, Department of Public Health, Faculty of Medicine and Health Sciences, Ghent University, Belgium	- the e-learning course (intervention group) (seven schools; 189 students) - face-to-face lecture (control group) (six schools, 222 students)	A stratified-clustered quasi-experimental study	1. Both medication calculation courses had a positive effect on medication calculation skills. 2. Students receiving traditional face-to-face lecture improved significantly more than the students receiving the e-learning course.
7. Coyne., et al, 2013	Enhancing student nurses' medication calculation knowledge; integrating	This study evaluated teaching interventions that focused	Australian University	156, 2 nd year Bachelor of Nursing students	Evaluation study with teaching interventions and Time 1 and Time 2 medication	For Time 1 medication test pre interventions, the mean was 7.3 with a mode of 8 out of ten. Maths and incorrect medication formula were the most common mistake. For Time 2

Author/year	Research title	Objective	Place of research	Sample size	Type of research	Results
	theoretical knowledge into practice	on improving the students' understanding of mathematical calculations, medication formulas and conceptualising medication doses.			tests.	medication test post interventions, the mean was 9.3 with a mode of 10. The most common reason for incorrect answer Time 2 was incorrect medication formula. The students identified that the smaller tutorial sizes and remediation of errors was the main reason for continued attendance.
8. Wright, 2012	Student nurse perceptions of how they learn drug calculation skills.	Blended learning and psychomotor skills online workbook simulated drug session maths tutorial	United Kingdom	1 group, 2 nd year 60 Student Nurse	Quasi-experimental post test last day of study	From this analysis three main themes emerged; students being able to measure their skills and gain feedback about their progress; being able to learn in their 'own way' and being given opportunities for this to happen; and being focussed on the goal of being able to calculate drugs in the 'real world'. The implications of these findings

Author/year	Research title	Objective	Place of research	Sample size	Type of research	Results
		(Optional off campus Clinical placement self learning				are explored in relation to nurse education.
9. Stolic, 2014	Educational strategies aimed at improving student nurse's medication calculation skills: A review of the research literature	The aim of this integrative review was to examine the literature available on effective education strategies for undergraduate student nurses on medication dosage calculations	Australia	Research articles on medication calculation educational strategies were considered for inclusion in this review. The search yielded 266 papers of which 20 meet the inclusion criteria.	A Systemic review literature	The review revealed educational strategies fell into four types of strategies; traditional pedagogy, technology, psychomotor skills and blended learning

Author/year	Research title	Objective	Place of research	Sample size	Type of research	Results
10 Navarat Waichompu, et al., (2019)	Principles in administrating high alert drug in labor room : Development of a learning model for nursing students Boromarajonani College of Nursing, Yala	study the principles and practice for administration of high alert medication in labor room with nursing students, 2) develop a learning model for administration of high alert medication in labor room for nursing students, 3) study the effectiveness	Boromarajonani College of Nursing, Yala	59 nursing students in Boromarajonani College of Nursing, Yala	Research and Development	<ol style="list-style-type: none"> 1. Overall knowledge, attitude and nursing practice regarding administration of high alert medication was at a high level ($\mu=3.70$, $\sigma=0.83$). 2. The learning model for the principles of administrating high alert medication in labor room for the nursing students was composed of three steps including before practice, practice, and after practice (Before-Action-Review: BAR). 3. After implementing the learning model, there was no incidence of error in high alert drug administration in labor room caused by the nursing students. 4. Overall the effectiveness of the learning model was at a high level ($\mu=3.85$, $\sigma=0.44$).

Author/year	Research title	Objective	Place of research	Sample size	Type of research	Results
		of the learning model, and 4) evaluate the effectiveness of the learning model.				

Discussion

Based on a systematic review of research on the study of strategies for improving drug calculation skills among nursing students from 2011 to 2021. Of the 10 studies, 2 were in Thai articles. 8 were in English articles. All articles divided into 3 quantitative studies, 4 quasi-experimental studies, 2 research and development studies and 1 literature review. The sample consisted of 2,862 nursing students. In many contexts, both in the conventional (n = 6) classroom, online or with electronic teaching devices (n = 2) and in the health care setting (n = 1), The most were strategic studies, used in teaching and learning that is effective in increasing the skill of calculating medicines. It was found that there were 4 types of teaching-learning strategies: 1) traditional teaching strategies; 2) strategies for teaching via online systems or using electronic teaching devices; 3) practice-based teaching strategies in both real and simulated situations in nursing laboratories; and 4) blended teaching strategies.

A literature review found that nursing students had more effective drug calculation skills if the students had basic math skills. According to the survey, students with low math and drug calculation skills (Gunes, Baran., & Yilmaz; 2016, Ozunal, Boran & Saglam, 2020). It's even better to teach basic formulas in a math course first. Subsequently, he taught how to calculate drugs using a variety of methods, such as using virtual simulations. Using the application helps to calculate medicines. Teaching in real situations on the ward or using various models/programs to help in teaching and learning, such as BAR (Before-Action-Review) or OCEF (Objectively constructed evaluation form), etc. The students had better calculation skills in pill form than liquid pill form. However, nursing students benefit differently from teaching and learning in each strategy.

The expected value of research is to get guidelines for teaching and learning for students. Nurses who have been examined by qualified and up-to-date

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