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Implementation of Research-Based Learning to Encourage the Educational Research Quality of Preservice Science Teachers

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Abstract

Research-based learning management is a learning approach that enables students to conduct their research following the research process. It is a tool to help students learn and develop their creative thinking abilities. This research aimed to study the quality of research papers of 57 preservice science teachers published in 2022. The research tool was a quality assessment consisting of 18 sub-items. Data were analyzed with basic statistics, including frequency, mean and standard deviation. The results showed that the overall quality of the research was at a good level. The three highest quality list is the significance of the study, research instrument, and data analysis, respectively. The research articles in this study were educational studies, each of which had different teaching styles and objectives depending on the context of each school. Inquiry-based learnings are the most used learning management. Creative thinking is the most popular objective to study.

Keywords: Research-based learning, Educational research, Preservice science teachers

1. Introduction

Nowadays, there is education research that has received interest from kindergarten right up to higher education (Agustin et al., 2021; Avci, 2021; Eti & Sıgırtmaç, 2021; Poonputta, 2021; Sarıcan & Güneş, 2021; Saribas & Ozer, 2022). Educational leaders recognize the importance of conducting research in education and encourage educators to conduct research in their context (Efron & Ravid, 2019). The ultimate goal of the research in education is to help teachers develop relevant knowledge in their classrooms (Lufungulo et al., 2021) and consider the student's needs and the classroom environment to become more diverse (Fischer

et al., 2014). New instructors are required to perform the project research, which can be seen from teacher candidates who must gain fundamental skills in research techniques. For new teachers to be more precise about the research process, they must learn: 1) how to develop research questions; 2) how to create an adequate study model; 3) how to collect data, and 4) how to properly assess and interpret research results (Universitat Munster, 2014; Behrmann, 2019).

However, teachers must have more research skills and understanding (Udompong et al., 2014). While, preservice teachers often learn through theory and do not address practical issues relating to theory, emphasizing knowledge acquisition rather than applying scientific concepts to real-world events or circumstances (Çepnİ et al., 2017). The realization of problem analysis and identification can be accomplished by a learning model that integrates research and learning (Blume et al., 2015; Brew & Jewell, 2012). Therefore, a method of instruction for developing the research abilities of future teachers is research-based learning management (Yanti et al., 2019).

Research-Based Learning (RBL) is a strategy for learners' growth that focuses on using procedures in research design as the primary activity (Dambudzo, 2015). Timiyo and Sriram (2021) define RBL as a process where students are paired with an instructor who serves as a facilitator and oversees assisting them as they conduct their research. According to previous studies, preservice teachers' research activities involve problem-solving, developing hypotheses, establishing research plans, assembling data, and drawing conclusions. These responsibilities also involve increasing meetings and growing more generally. Furthermore, preservice educators are considered good researchers (Yanti et al., 2019). The outcome inspired this study's goal.

This research aimed to study the educational research quality of preservice science teachers (PSTs) in the undergraduate General Science program after implementing RBL instruction, which the instructors designed.

2. Method

The research assesses the quality of educational research on PSTs in the General Science program. All educational research was published in 2022. PSTs have designated educational research as part of the internship. The "educative research technique" principles are taught in the research methodology subject to prepare PSTs for their research responsibilities during the practical semester. These contents outline a professionalization process in which PSTs use research techniques to respond to research issues that primarily stem from their personal experiences after completing internship 1 at school.

These fundamental skills are covered in a course designed by our lecturers. The six lecturers covered science education, educational measurement and evaluation, and curriculum and teaching subjects. The research designs, acquiring data, analysis of data, interpretation of the data, and the validity of a causal statement were implemented for four modules and assigned into 16 weeks. There were also two six-hour receiving for the seminar session. The improvement of manuscript research was submitted to several Thai national conferences upon

their interest. The details are shown in Figure 1.

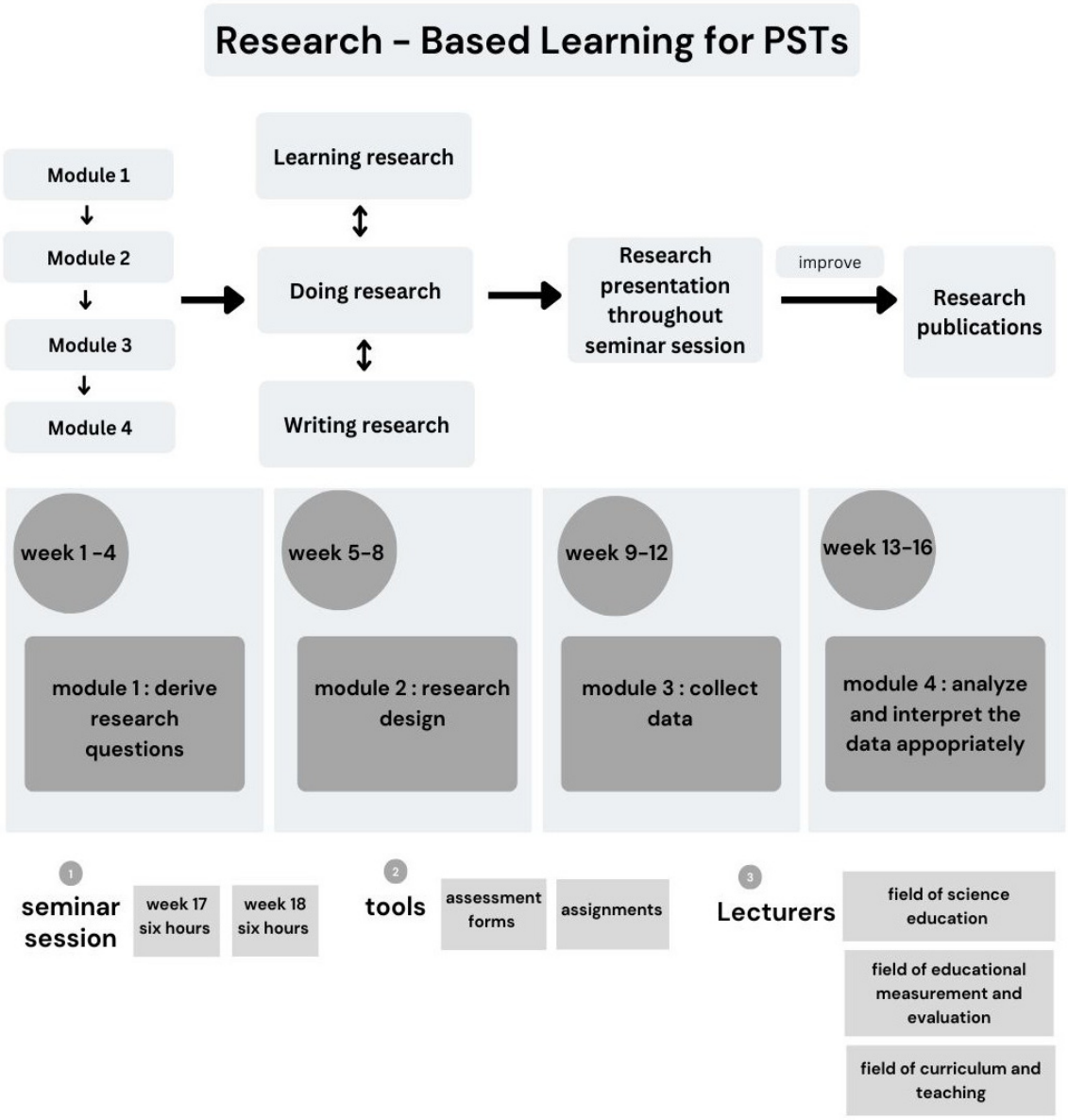

Figure 1. The research-based learning instruction framework for PSTs

2.1 Sample

Samples are educational research of General Science undergraduate students. The research, published in 2022, contains 57 articles, consisting of 38 articles in "The 3rd National and 2nd International Conferences on Education 2022" (https://edu.snru.ac.th) and 19 articles in "The 2nd Kamphaeng Phet Rajabhat University Student National Conference" (https://research.kpru.ac.th/std-conference).

2.2 Research Tool

The research tool used was the applied research quality assessment form of (Chanchusakun,

2017; Wongwattana et al., 2018). There are six areas of assessment subjects: 1) significance of the study; 2) literature review; 3) research methodology; 4) research instrument; 5) data analysis; and 6) conclusion, discussion, and recommendation, totaling 18 items, are characterized by a five-level estimation scale: very good, good, moderate, not good, and not very good.

2.3 Data Collection and Analysis

The PSTs educational research articles published in 2022 were surveyed. Data analysis uses frequency, percentage, mean, and standard deviation statistics. The criteria for interpreting quality assessment results are divided into 5 quality levels as follows: very good (4.51-5.00), good (3.51-4.50), moderate (2.51-3.50), not good (1.51-2.50), and not very good (1.00-1.50).

3. Results

The target groups presented in 57 published proceedings consisted of Grade 4, Grade 5, Grade 6, Grade 7, Grade 8, and Grade 9 students in the published number of 3, 2, 1, 24, 16, and 11 articles, respectively. Each grade level uses different learning management for a variety of purposes (Table 1).

Table 1. General data of research used to evaluation

Level	Grade	Learning management method		Main objective	
	No. of publications	Learning approach	No. of methods	Objective	No. of issues
4	3	- Inquiry-based learning - Online Lessons	2 1	Achievement Analytical Thinking Online lesson	1 2 1
5	2	- Inquiry-based learning - Problem-based learning	1 1	Analytical Thinking	2
6	1	Creative-based learning	1	Creative thinking	1
7	24	- Brain-based learning - Concept of Gamification - Creative-based learning - Inquiry-based learning - Problem-based learning - Project-based learning	1 6 5 5 6 1	Analytical thinking Creative thinking Critical thinking Learning motivation Problem-solving thinking Scientific thinking	5 8 2 7 1 1
8	16	- Collaborative learning - Concept of Gamification - Creative-based learning - Five-Step ladder learning - Inquiry-based learning - Problem-based learning - Project-based learning - STEM Education	1 5 2 1 2 2 1 2	Achievement Analytical thinking Creative thinking Learning motivation Scientific thinking	1 6 4 4 1
9	11	- Concept of Gamification - Creative-based learning - Game-based learning - Inquiry-based learning - POE* learning - Problem-based learning	1 3 1 4 1 1	Analytical Thinking Creative thinking Critical thinking Learning motivation Scientific concepts understanding Scientific thinking	1 5 1 2 1 1

Note. * Predict, Observe, and Explain.

The overall quality of the research was assessed at a good level ($\bar{x}$ = 3.77, SD = 0.54), including the assessment of all aspects consisting of 1) the significance of the study, 2) the literature review, 3) the research methodology, 4) the research instrument, 5) data analysis,

and 6) conclusions, discussion, and the recommendation was also evaluated at a good level with mean values of 3.85, 3.73, 3.71, 3.80, 3.78 and 3.74, respectively (Table 2).

Table 2. Research quality of undergraduate

Item	$\bar{x}$	SD	Quality level
Significance of the study	**3.85**	**0.50**	**Good**
The research problem is clear	3.82	0.57	Good
The objective is clear	3.86	0.48	Good
The title, objective, and research problem are consistent	3.88	0.47	Good
Literature review	**3.73**	**0.55**	**Good**
The definition of a term is clear	3.77	0.54	Good
The literature review is relevant to research problems	3.68	0.57	Good
The literature review is modern	3.72	0.56	Good
Research Methodology	**3.71**	**0.56**	**Good**
The research plan is appropriate for the research problem	3.70	0.57	Good
The research process is appropriate	3.72	0.56	Good
Determining the population and sample is appropriate	3.72	0.56	Good
Research instrument	**3.80**	**0.52**	**Good**
The quality development of research tools is appropriate	3.77	0.54	Good
Reliable research tool	3.79	0.53	Good
Data collection relevant to the research tool	3.82	0.50	Good
Data analysis	**3.78**	**0.54**	**Good**
The statistics used are appropriate	3.82	0.50	Good
Data analysis is consistent with the objective	3.79	0.53	Good
The presentation of the analysis results is appropriate	3.74	0.58	Good
Conclusions, discussion, and recommendation	**3.74**	**0.55**	**Good**
The conclusion of the research results consistent with the objective	3.72	0.56	Good
The discussion is linked to relevant research	3.75	0.54	Good
The suggestion can be useful	3.74	0.55	Good
Average	**3.77**	**0.54**	**Good**

4. Discussion

Among the reported of 57 published articles, inquiry-based learning was the most applied in up to 14 papers. The learning process is the main focus, and teachers encourage their students to ask questions, come up with ideas, and act to acquire knowledge that they may then process to arrive at their conclusions. This learning management is student-centered, keeping students interested and motivated in science and achieving academic performance (Rubio & Conesa, 2022). In addition, inquiry-based learning was applied in various ways to study learning achievements (Bantaokul & Polyieml, 2022; Yonyubon et al., 2022), skills (Nunaki et al., 2019; Rodríguez et al., 2019; Yuksel, 2019), and scientific attitudes (Sandika & Fitrihidajati, 2018; Wildan et al., 2019).

The classroom action research has different objectives, and the article's goals were based on the situations at each school. Creativity thinking received the most study of 18 articles because students were reluctant to express their ideas, afraid of criticism, and lack of enthusiasm in activities resulting in less creativity, which are terms of life skills (Ormanci et al., 2022). Moreover, Creativity thinking skill is one of the most life skills and work skills of the 21st century and one of the keys to industry 4.0 (Grzybowska & Lupicka, 2017).

The mean of research quality was 3.77, a good level. The result reflexed from the PSTs consulting with an advisor and presenting the research outline to the committee for recommendations before conducting research. This process yields a good quality of research corresponding to 37 thesis quality assessments. It was found that the assessment results were at a good level (Nuangchalerm & Prachagool, 2021). The significance of the study was that the main item with the highest mean of 3.85 against the research instrument, data analysis, conclusions, discussion and recommendation, and literature review had lower averages with mean values of 3.80, 3.78, 3.74, 3.73, and 3.71, respectively. The sub-item with the highest mean is the list of the title, objective, and research problems consistent because most research objectives are specific and consistent with the titles. This topic is so important that there is research on the quality evaluation of undergraduate theses (Jin et al., 2014; Benito & Oscar, 2018). On the other hand, the lowest mean sub-item is the list of the literature review relevant to research problems. The PSTs need to be proficient in foreign languages, mainly searching for relevant research within the country. The literature review is a problem facing teachers in conducting educational research, which corresponds with research about challenges and difficulties in conducting teacher education research (Bullo et al., 2021).

In this regard, the results of collecting research recommendations from research evaluators in both national academic conferences have two interesting issues as follows:

(1) Research evaluators from both national academic conferences gave PSTs the most advice on conducting research to review and adjust their research. An example of advice from research evaluators in both academic conferences is that more detail on the quality of research tools should be added. It should include details of the steps in the learning management plan. This recommendation is consistent with the topic that received the least average from the research methodology topic (Table 2). More attention should be paid to the learning management plan details (Prahmana, 2017).

(2) Research evaluators from both national academic conferences gave the least advice on research questions and objectives. An example of a recommendation from an assessor is those unclear research goals resulting from the research question, and writing a research problem is too long. The results correspond to the topic with the highest mean from one of the significances of the study assessments (Table 2). It was found that focusing on finding research problems and setting clear objectives can lead to clear research goals (Kakupa & Xue, 2019).

5. Conclusion

Research results show that preservice science teachers' research in this study found that the overall quality of the research is at a good level. The undergraduate research articles are educational research that focuses on learning management, which is organized in different ways according to the situation in each school. Inquiry-based learning and creative thinking were the most employed for learning instruction and objectives.

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