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Problem-based Learning (PBL) with Reading Questioning and Answering (RQA) of Preservice Elementary School Teachers

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Abstract. Preservice elementary school teachers' critical thinking skills were compared during this quasi-experimental study of PBL (Problem-based Learning) and RQA (Reading-Questioning and Answering) science practicum learning. Following the Covid-19 protocol, the science practicum course was completed online in both the PBL and the PBL with RQA. Face-to-face interaction was limited. Blended learning is completed synchronously by Google Meet and asynchronously by Schoology. The science practicum was conducted offline regarding the limited face-to-face material discussed at the Laboratory. The independent variable consists of two learning models, PBL (control group) and PBL with RQA (treatment group), with critical thinking skills as the dependent variable. The program, which emphasized students' critical thinking skills, lasted about eight weeks. The instrument utilized in this study was a 16-item critical thinking skills test includes indicators of interpretation, analysis, explanation, evaluation, and inference. The data were analyzed by one-way ANCOVA, with critical thinking skills pretest scores as covariates. The findings show that the PBL with RQA has more significant potential to increase students' critical thinking skills than the PBL. RQA allows students to learn independently by reading, summarizing, asking, and answering questions.

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1. Introduction

Higher education strives to prepare competent graduates to enter the world of work and the dynamics of a more globalized period and wide-open rivalry among nations. Higher education is meant to contribute to a country's progress by generating graduates with skilled specialties, increasing competence in scientific areas, and expanding knowledge into important and practical goals for society (Susanti, 2011). Higher education catalyzes teaching high-quality graduates and responsible citizens to develop excellent learning opportunities and support lifelong learning. Similarly, higher education is essential for cultural, social, economic, and political development. It is a pillar of long-term growth to achieve justice, democracy, and peace (Unesco, 1998). The main aim and hope that is still aspired to is a generation that is independent, advanced, qualified, and has superior competence. As a result, higher education learning must be capable of responding to the challenge in question.

Elementary School Teacher Education (PGSD) is one of the higher education study programs, particularly in Indonesia. It features a graduation profile that produces excellent prospects for elementary school teachers. Due to this curriculum, preservice educators at the basic education level have legal qualifications and competencies. They are prepared to teach in elementary schools. As a result, there is a significant demand for graduates who can educate and instruct professionally while also responding to the issues of the times. Globalization and information are the two most pressing concerns in preparing future primary school teachers in the twenty-first century. Through the growth of technology and globalization processes, industrialized countries' culture has expanded worldwide through the international circulation of cultural items. It can impact teachers' mindsets, ethics, and academics. The information element is strongly tied to information technology, where information technology characterizes the social context. Virtual space arises as the fourth space after material, cultural, and spiritual freedom. In terms of nature and image, everything is visible. It is closely tied to education for both instructors and students, and it represents a new issue that impacts students' morals, value systems, cognition, and skills (Lan, 2006).

Compared to students from other faculties or study programs, PGSD students as preservice elementary school teachers from Pattimura University, Ambon-Indonesia, have unique characteristics. They generally come from weak economic backgrounds and have diverse cultural, ethnic, religious, and social aspects. A more in-depth search found that they came from various regions in the Regency/City in Maluku, especially from remote areas. A small proportion (5%) are vocational high school graduates. More than 50-70% tend to choose social studies at the high school level, and only 30% choose science interests. This heterogeneity is the main element that educators and students themselves need to be aware of as capital and strength to create a dynamic and conducive learning environment. Heterogeneous students have different cognitive abilities or performance levels (Dotzel et al., 2022). Within that framework, teachers need to build a simple and well-structured learning environment through efficient classroom management, foster student-centered interactions, provide students with adequate instruction, and learning support (Cornelius-White, 2007; Hattie, 2009).

Training inside the next generation, of course, has distinctive processes and dynamics than inside the beyond. Within the 21st century, schooling targets to prepare students to cope with the complexities of current society. Subsequently, twenty-first-century life abilities want to be designed in learning. There are three additives of these capabilities, namely 1) cognitive domain names as capabilities associated with cognitive procedures and strategies, understanding, and creativity, along with important questioning capabilities, reasoning, and argumentation. Moreover, 2) the intrapersonal area issues ideals and motivations in getting to know, metacognition, and impartial learning. 3) The interpersonal domain consists of abilities related to collaboration and leadership, consisting of powerful verbal exchange and responsibility (Haug & Mork, 2021). Critical thinking skills are one of the essential effects produced by higher education. This skill is the form of thinking wished in solving problems, formulating conclusions, making predictions, and making decisions (Hart et al., 2021).

Maximum learning results can be achieved with good critical thinking skills (Malahayati, 2011; Setiawati & Corebima, 2017). However, the learning evaluation findings suggest that the final semester examination of Basic Science Concepts for the 2019/2020 academic year has 60% of students in the poor group. The assessments used an essay format to assess students' critical thinking skills. In May 2020, researchers discovered that the average critical thinking skill score of PGSD students in the Basic Science Concepts course was 30-40. According to this study, students' critical thinking skills still need to be strengthened and have not yet achieved the required level. The students' lack of critical thinking skills can be apparent in their decisions when completing activities. Because approximately 20% of students do not develop critical thinking skills when completing assignments, some plagiarize their classmates' assignments and still struggle to provide arguments against the cases presented (Leasa & Lesnussa, 2021). Due to a lack of reading, their argument is brief and obvious. According to Leasa et al. (2020), primary school students' critical thinking skills averaged 46.27 or were at a moderate level. It suggests that elementary school teachers' critical thinking skills still need to be improved.

One way that can be taken to equip students with a few values is to apply a learning version that could train and broaden critical thinking. The learning model considered to empower these talents is a model primarily based on a constructivist model inclusive of problem-based learning (PBL). PBL is based totally on the reality that getting to know isn't always just a method of memorizing standards or data but additionally an interplay between individuals and their environment. Several studies found the capacity of PBL in empowering critical thinking skills (Sellnow & Ahlfeldt, 2005; Allison & Pan, 2011; Gholami et al., 2016). PBL calls for an awful lot of fabric and makes students search for more information (Akinoğlu & Tandoğan, 2007). Students also sometimes have difficulty solving problems due to a lack of prior knowledge regarding the topics discussed due to a lack of student interest in reading (Oclarit & Casinillo, 2021).

PBL problems are typically structured and complicated. Issues that are too simple can dull students and prevent them from learning. The problems, however, must be related to the student's prior knowledge. Both teachers and students can voice issues. The challenge must be relevant to the student's basic understanding, even if the teacher suggests it. One of the cornerstones of PBL learning is for teachers to grasp what students already know. Problems must build on students' existing knowledge to be tough enough for students to experience the learning process (Otting & Zwaal, 2006).

According to Barrett (2013), the fundamental drawback of PBL is that students do not understand the problem and cannot identify the challenges encountered with the material being studied. The PBL problems studied are of excellent grades. It indicates that the challenge is genuine, faced in real-life practice, engaging, hard, purposefully unstructured, and stimulates students to think for them to build profound insights and knowledge. Problems in problem-based learning are authentic and relevant to the actual world (Barrett et al., 2010; Jonassen & Hung 2008).

We need another learning model expected to overcome the shortcomings of PBL, such as the reading questioning and answering (RQA) learning model. RQA is divided into three stages: reading, questioning, and answering. Reading is the process by which students gather knowledge about the learning material they are studying. Reading is beneficial for acquiring prior information. Prior knowledge required to recognize and understand problems can be improved through reading comprehension. Reading is also helpful in formulating challenges to address (Taboada & Guthrie, 2006). Reading can thus increase past comprehension, which affects prior knowledge (Tarchi, 2015). Reading is a concrete activity that contributes to acquiring sufficient beginning knowledge to foster students' initial abilities that enable problem-solving. Reading, even at the point of reading comprehension, is the learning process that grows this information. To fill in the gaps, we need a learning model whose activities include reading and asking questions. Another learning paradigm, such as the reading, questioning, and answering (RQA) learning model, is required to solve the drawbacks of PBL.

RQA is a learning model developed by Aloysius Duran Corebima, a genetics lecturer in Indonesia to cultivate the habit of reading as much as possible among students. In the reading phase, students read various learning materials according to the topic. Furthermore, students make a summary of the material read. The next phase is questioning, where students compose questions from the topics. These questions are an attempt to build curiosity and not to show ignorance. That question is a trigger for students' critical thinking and metacognition. The questions that are made are questions that do not have answers directly in the book, thus encouraging students to find out, read as much as possible, or even re-read the lesson material or previous summaries to carry out an analysis or find answers to these questions. The final stage of RQA is Answering. In this phase, students try their best to find answers to the various questions developed (Sumampouw, 2013; Hariyadi et al., 2017).

RQA is a newly developed model because almost all students do not read the teachers' material, which causes the designed teacher strategies to be challenging to implement. In the end, their understanding of the teacher's material becomes low. The implementation of RQA can force students to read learning material so that the designed learning process can be implemented and students' critical thinking skills are trained. In RQA, students are required to read and understand the reading content, then try to find parts of the reading content that are substantial or very substantial (Amin & Corebima, 2016; Amin et al., 2019). RQA can develop cognitive learning outcomes, which are expected to improve students' critical thinking skills (Bahri et al., 2016).

It is possible since each phase of RQA demonstrates students' efforts to develop critical thinking. During the asking phase, students consider constructing queries for unknown answers. Quality inquiries can help in the development of scientific knowledge and reasoning. Good questioning abilities assist students in thinking critically and understanding scientific discourse, which might include theoretical assumptions, evidence, explanations, and even reasoning to clarify uncertainties or ambiguities about learning materials (Stokhof et al., 2019). According to Amin et al. (2019), 60.53% of the questions produced by students were higher-order thinking skills (HOTS) questions.

RQA is expected to be able to compensate for PBL's inadequacies. The lack of PBL necessitates interdisciplinary science can be remedied by RQA, in which students collaborate to solve problems. Before sharing information with classmates during class presentations, RQA can be an excellent technique for more profound learning. The combination of RQA and PBL encourages students to read more and seek knowledge, which helps them improve their critical thinking skills. As a result, this study aims to investigate the impact of the PBL learning model with RQA on the critical thinking skills of preservice elementary school teacher students. So, the research hypothesis is there is a substantial difference in the critical thinking skills of preservice elementary school teacher students between the PBL and PBL learning models with RQA.

2. Methodology

This study is a quasi-experimental study with a pretest-posttest nonequivalent control group design. Thus, the findings can be easily applied (Maciejewski, 2020). Table 1 showed the treatment's incorporation into the research design.

Table 1: The treatment classes based on variables

Pretest	Treatment	Posttest
O1	S1	O2
O3	S2	O4

Note: O1, O3 = *pretest score*, O2, O4= *posttest score*
S1 = PBL learning model group with RQA
S2 = PBL learning model group

2.1 Sampling

The population of this study included all students at PGSD Program, Pattimura University in Ambon, Indonesia, in the seventh semester, with a total of 95 students divided into three classes, including 13 male and 82 female students. Participants have the same qualifications because they passed the required courses in semesters 1, 3, and 5: basic science concepts, science education in elementary schools, and development of elementary science learning. Random sampling was used to choose the research sample. One class was a PBL class with RQA, and another was a PBL class for each learning model. The number of classes used was two, which were chosen by lottery after the equivalency and placement test.

2.2 Instrument and Procedures

In this study, the main instrument was a critical thinking skill test question consisting of 16 items in the form of an essay that included five critical thinking indicators: interpretation, analysis, evaluation, explanation, and inference (Facione, 1990). Students are directed to generate questions important to critical thinking skills when learning PBL with RQA, particularly during the questioning phase. Then, during the group research stage, students are directed to answer questions. The practicum report describes all of the student activities in detail. Table 2 contains examples of questions used to assess students' critical thinking skills.

Table 2: Critical thinking skills question grid

Subject Matter	Critical Thinking Skills Indicator	Question Items
Structure and function of plant organs	Interpretation	Sugar palm plants have a stem size that is almost the same from the base to the stem. Why is that?
Frog blood circulation	Analysis	The heart of frogs (Amphibians) consists of one ventricle and two atria, in contrast to the heart of Mammalia which is complete with four chambers. In your opinion, how does the structure of the frog's heart chamber affect its blood circulation?
Fish breathing	Evaluation	Is the average number of movements of the fish operculum in the treatment with the initial temperature before being given detergent or vinegar solution and after being given detergent or vinegar solution? Give strong arguments/support your answer.

Subject Matter	Critical Thinking Skills Indicator	Question Items
Insect breathing	Inference	The data from the cricket breathing experiment using a respirometer are as follows. a. Cricket 1 has a mass of 2.2 grams, the amount of oxygen needed is 0.083 mL, while the average oxygen demand is 0.013 mL/minute. b. Cricket 2 has a mass of 4.7 grams, the amount of oxygen needed is 0.678 mL, while the average oxygen demand is 0.013 mL/minute. Based on this information, what can be concluded?
The cycle of living things	Explanation	How do you do an analysis of the cycle of living things such as butterflies or mosquitoes? (Also include tools and materials needed).

The validity and reliability of this test instrument were 0.68 and 0.87. A critical thinking test was conducted 2 times. The first time was carried out before the treatment was given, and the second was carried out after the treatment ended, with the period of the pretest and post-test being 8 weeks (2 months).

Critical thinking skills are also assessed when students give presentations on the questions and answers raised during the RQA process and by reviewing the practicum report. Teachers attend student presentations and examine practicum reports every time. Teachers then continue to encourage students to practice compiling questions demonstrating critical thinking skills, finding answers, and learning a lot through reading articles connected to the content. As a result, they have broad perspectives. As a result, it is simple to connect one thought to another. Teachers discovered that they needed to provide instructions and learning tools to encourage the development of critical thinking skills. During the lesson, teachers stated this to students.

This research was carried out by following several procedures. 1) Based on the letter of the university leadership regarding learning activities during the Covid-19 pandemic, it was decided that the implementation of learning in the Science Practicum course in both the PBL group and the PBL group with RQA was carried out online and limited face-to-face by following the Covid-19 protocol. 2) Assessing learning patterns relevant to these provisions in applying the PBL and PBL with RQA. Asynchronous learning was carried out to discuss problems related to material topics given by teachers through Schoology or known as asynchronous discussion forums/ADF (Yang et al., 2005). It was followed by synchronous learning through Google Meet, known as synchronous online discussion/SOD (Ackerman & Gross, 2021), to present the studies and discussions discussed previously in groups asynchronously. The science practicum was conducted offline regarding the material discussed in a limited face-to-face form at the Zoology Laboratory of the Faculty of Math and Science (FMIPA) Pattimura University. 3) The next step was to pretest critical thinking

skills. 4) Implementing treatment in learning by applying PBL to the control group and the PBL with RQA in the treatment group every week. Learning time duration in a meeting was 2 x 50 minutes for 7 times learning meetings through Google Meet. On the other hand, learning activities were asynchronously done at any time until the group finished the discussion. The science concepts studied included: the structure and function of plant organs, animal respiration, digestion of food in humans and animals, human and animal blood circulation, animal reproduction, and the cycle of living things.
The learning syntax in the PBL group was adapted from Arends (2015), including:

a. Phase 1: Student orientation on problems
During this phase, the teacher gave learning direction/orientation and informs the teacher and practicum mechanisms. Furthermore, students received lecture materials based on the topic of the studied material by reading or downloading them from Schoology and studying them.

b. Phase 2: Organizing students to study
To conduct ADF, students were separated into groups using Schoology. Previously, students may develop multiple puzzles based on the teacher information. It would be preferable if the issue formulation were geared toward developing critical thinking skills. Students were also provided with proper materials to use in the laboratory.

c. Phase 3: Guiding individual/group investigations
In Schoology, groups asynchronously discussed concerns to reach an agreement by providing remarks on the issues highlighted. Limited face-to-face sessions aided students in doing laboratory research to address questions about the material supplied and continuing with presentations (SOD) via Google Meet.

d. Phase 4: Developing and presenting the work
Students produced group presentations about the challenges examined at the ADF stage and reported on practicum activities in the form of PowerPoint presentations (SOD) during this phase.

e. Phase 5: Analyzing and evaluating the problem-solving process
Teachers and students carried out evaluations and asynchronous and synchronous reflections on the learning process. At the PBL stage, the RQA treatment was the same for the PBL class.

The RQA syntax was only slightly modified. The RQA stage was completed before the lecture or ADF, SOD, and laboratory practicum stages. The RQA steps (Hariyadi et al., 2018) were as follows:
a. Reading
Each student was asked to find their own and read carefully and read sources relevant to the lecture material to be studied. From the reading results, they write a summary containing important information so that they have an understanding of the concept.

b. Questioning
Students posed a number of questions that were not only informational but led them to higher-order thinking, including critical thinking. Allowing students time and space to construct questions regarding the content being studied was one technique to get them to ask. The teacher proposed and invited students to create questions that demonstrated their critical thinking skills during SOD learning via Google Meet. Furthermore, the teacher offered appropriate reading materials for students to use. The teacher also encouraged and demonstrated how to construct questions that demonstrate critical thinking skills.

c. Answering
Students prepared responses to pre-written questions. The solution must be rational and scientific, with accurate library sources. After completing all learning activities, the final stage was administering a final test/post-test of critical thinking skills.

2.3 Data Analysis
To test the research hypotheses, the data were quantitatively analyzed using one-way ANCOVA. It was ensured that the data met the normality and homogeneity parameters before the one-way ANCOVA test. The SPSS 18.00 for Windows tool was used to help with data analysis.

3. Results
The unstandardized residual value with linear regression was employed in the PBL and PBL with RQA groups, followed by the One-Sample Kolmogorov-Smirnov Test analysis. The study results suggest a significant value of Asymp. Sig. (2-tailed) of 0.200, which is greater than alpha (0.05). As a result, the critical thinking skills data were distributed regularly. The data homogeneity test was performed using Levene's Test of Equality of Error Variances statistical test. The results show that the data homogeneity was 0.827, greater than alpha (0.05), and thus it was pronounced homogeneous. The data met the hypothesis testing requirements with parametric analysis and a one-way ANCOVA. The data met the hypothesis testing requirements with parametric analysis using a one-way ANCOVA (Table 3).

Table 3: One-way ANCOVA test results on the effect of learning models on critical thinking skills

Source	Type III Sum of Squares	df	Mean Square	F	Sig.	Partial Eta Squared
Corrected Model	2063.616[a]	2	1031.808	7.614	.001	0.220
Intercept	3738.273	1	3738.273	27.585	.000	0.338
CTS-Pretest	1016.206	1	1016.206	7.499	.008	0.122
Model	1475.095	1	1475.095	10.885	.002	0.168
Error	7318.103	54	135.520			
Total	75002.000	57				
Corrected Total	9381.719	56				
a. R Squared = .220 (Adjusted R Squared = .191)						

Table 3 shows that the learning model's F_{count} value is 10.885, with a significance value of 0.002. The significance value (0.05) is less than the alpha value. Then, Ha, which demonstrated that the learning model significantly affected critical thinking skills, is accepted, but H0 is denied. It means that the learning model considerably impacts preservice elementary school teacher students' critical thinking skills.

Because there are just two data groups, PBL and PBL with RQA, the least significant difference (LSD) was not required. However, it is possible to establish whether there is a substantial difference between the two learning models that were treated by reviewing the corrected mean data for critical thinking skills in each learning model. The treatment group with the highest corrected mean is considerably higher than the other groups. Table 4 displays each learning model treatment group's adjusted mean critical thinking skills.

Table 4: Corrected mean of critical thinking skills in each learning model

No.	Model	Pretest	Posttest	Difference	Corrected Mean
1	PBL	25.01	29.08	4.07	28.04
2	PBL-RQA	21.16	37.72	16.56	38.53

According to Table 4, the PBL with RQA has a higher corrected mean than the PBL learning model. The hypothesis that there is a substantial difference in critical thinking skills of preservice elementary school teacher students between PBL and PBL with RQA is accepted. Students who study using the PBL with the RQA model have higher critical thinking skills than those with the PBL model. As a result, PBL with RQA has a greater potential to increase critical thinking skills than PBL. Table 4 further shows that the critical thinking skills score in PBL with RQA is 37.41% higher than in PBL alone.

4. Discussions

There are various potential benefits for critical thinking skills while learning with PBL and RQA. These aspects include the existence of questions, the process of answering questions, and the process of problem-solving. Students' inquiries are critical in science learning, as are cognitive skills. High-quality cognitive questions can help scientists build scientific understanding and reasoning. Questions might motivate students to engage in essential thinking or scientific discourse. It entails making assumptions, comparing information, developing explanations and reasoning, and clearing ambiguity. Questioning is a structurally integrated thinking processing skill used in critical thinking, creative thinking, and problem-solving (Chin & Osborne, 2008; Hu et al., 2019). The ability to ask appropriate questions and develop one's thinking skills should be the primary objective of science education. In the context of this research, a good question exhibits students' critical thinking skills or a HOTS question based on research interests, as modeled by Facione (1990). Students can be taught to accomplish this by providing explanations, demonstrating critical thinking skills, and encouraging students to cultivate the curiosity required to write good questions. Students are encouraged to think more critically while formulating questions rather than just following the formats presented in textbooks (Lustick, 2010).

Questions play an essential function in developing critical thinking skills with concerning degrees of education. Questions are one of the fundamental gears for instructors to attain students and understand pedagogical goals. Questions are considered in a manner to feed one's skills or one's perspectives and articulate one's thoughts. In studying contexts that encourage students' critical thinking skills, teachers must use questions that inspire students to interact in evaluation, problem-solving, and investigation. Additionally, questions can actuate metacognitive cycles that outcome in more proficient learning (Seker & Kömür, 2008).

According to Elder & Paul (2003), asking questions drives thinking rather than providing answers. Students' thinking processes are sparked by questions. However, not all questions can foster critical thinking development. Only higher-order thinking skills (HOTS) questions can empower critical thinking skills (Barnett & Francis, 2012). HOTS questions encourage students to rethink each answer submitted by including logical and rational arguments. They try to analyze various possible feedback questions that can be given in response to these answers, thereby stimulating broader and critical thinking. Questions are essential for defining assignments and describing problems students need to solve. At the same time, questions can stimulate initial thinking (surface). They tend to encourage students to deal with complexity. Questions intention to direct students to determine and perform responsibilities. On the other hand, confirmatory questions enable them to examine the facts' sources. Students learn how to organize or convey information through interpretive questions.

Questions can also encourage students to build a sense of ownership and responsibility at work. Questions evoke emotions in interacting and communicating more effectively to study science more deeply. A question is vital in scientific inquiry activity that fits perfectly with the PBL syntax. From the questions, students are stimulated to conduct investigations both individually and in groups, postulate and test hypotheses, analyze and evaluate the evidence found. Such learning activities can also make students perform other cognitive processes such as observing and reading more deeply so that critical thinking develops rapidly. In this way, attitudes, knowledge/literacy, and science process skills are growing in learning science in elementary school (Singh et al., 2019; Reinsvold & Cochran, 2012).

Answering questions is another phase that has the potential for critical thinking skills. Students' inquiries are undoubtedly more focused on higher-order thinking skills. As a result, the solution is obtained through extensive inquiry and exploration by students who explore and extract data or information from many sources or references. These cognitive processes are quite helpful in improving critical thinking.

Students completed the RQA phase after reading and summarizing the material. This method necessitates a grasp of the reading material to assist students in solving problems through answered questions (Rouet et al., 2017). When students select reading material to use as a reference source, they practice critical thinking. Students must have researched multiple sources and determined which sources were more relevant and logical to use as a reference in responding. The decision of when to look for reading sources and how to analyze and critique the current information becomes critical in this process. In completing the assignments, students can learn from one another. Students who are less critical when seeking experience must learn to be more critical when assembling replies, examining facts, and conducting more research. Meanwhile, critical students are expected to provide more information and aid to less critical students (Máñez et al., 2019).

In addition to RQA, the critical thinking process in PBL can be further enhanced through individual or group investigations to solve challenges. PBL is a modern learning technique that stimulates students by presenting them with dependant or real-world challenges to infuse the learning procedure by building new information about how to address the problem. PBL incorporates constructivist contextual standards into learning to motivate prior knowledge and collaborative studying and encourage students to be independent learners (Zhou, 2018; Dolmans, 2019). There is an investigative technique in PBL, which includes locating important records, creating current information, and having fun solving challenges. Academics, as facilitators, aid students in developing knowledge and connecting concepts with varied records, directing exploration and expanding understanding.

Similarly, there is a reflection on studying PBL as an essential aspect of developing metacognitive recognition to increase the quality of problem-solving, comments, and encouragement. During PBL implementation, the teacher's job remains to support the development of critical thinking skills through inquiry activities in the context of problem-solving (Seibert, 2021). Compared to traditional learning models, studies demonstrate that PBL enhances students' academic accomplishment, allows them to communicate in group discussions, builds their knowledge, and improves awareness of learning and critical thinking skills (Khoiriyah et al., 2015; Hung et al., 2019).

PBL is a learning model based on real-world situations. In other words, each student's life experience helps in problem-solving. Then, the idea of critical thinking is not limited to consistent and logical reasoning but also includes rational or practical behavior. Critical thinking also seems to include a moral attitude with respect for the opinions of others, taking into account the tendency to introspection. All things considered, PBL, RQA, as well as critical thinking skills are not just limited to seeking information or knowledge. They involve a lot of ethical attitudes and wisdom acting in the problem-solving process (Wang et al., 2008). PBL provides space for open-mindedness, curiosity, and an analytical, systematic search for the truth. Open-mindedness is needed to accept different challenges, thus leading students to think critically, be confident, develop curiosity, and achieve cognitive maturity (Khoiriyah et al., 2015; Hung et al., 2019).

5. Conclusions

The learning model was found to have a considerable impact on the critical thinking skills of preservice elementary school teacher students. Furthermore, it was discovered that, of the two learning models, PBL with RQA had the greater ability to increase critical thinking skills. The average score of students' critical thinking skills in PBL with RQA learning was greater than in PBL learning. As a result, teachers should be able to use a combination of PBL and RQA models in both online and offline lectures. RQA can be used to prepare students for learning by reading, summarizing, compiling HOTS-oriented questions, and attempting to answer them. PBL occurs after RQA during online/offline, face-to-face learning activities by presenting various challenges relating to learning materials and instructing students to perform investigations to answer problems. If carried out continually, this approach is ideal for developing and empowering students' critical, analytical, and logical thinking.

More study is needed to investigate the impact of the PBL model with RQA on critical thinking while considering other moderating characteristics such as preservice primary school teachers' academic ability, specialization (natural science, social science, or mathematics), and gender. Furthermore, it is vital to investigate the obstacles students encounter when studying with PBL with RQA to increase the effectiveness and maximize student learning results.

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