

***Higher Order Thinking Skills (HOTS) of Elementary School Teacher Education Students
in Indonesia: A Systematic Literature Review***

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Abstract

As prospective teachers, HOTS among elementary school teacher education students is very important to develop. Teaching and learning problems require HOTS to solve them. This literature review aims to determine the profile of HOTS among primary school teacher education students in Indonesia and the efforts that have been made by academics to optimize students' HOTS. The method used in this study is the Preferred Reporting Item for Systematic Reviews and Meta-Analyses (PRISMA). We conducted an extensive review of 997 articles obtained from the Google Scholar database using Harzing's Publish and Perish on the HOTS proficiency profile of primary school teacher education students in Indonesia published in the period 2017–2023. This research was conducted in five stages: 1) determining eligibility criteria; 2) determining information sources; 3) study selection; 4) data collection; and 5) data item selection. As a result, we identified that 77% of articles describing the HOTS of elementary school teacher education students were in the low category, and 22% of articles were in the good or optimal category. Efforts have been made by academics to improve the HOTS of elementary school teacher education students by developing HOTS-oriented learning strategies. This study underlines the importance of improving the HOTS of prospective elementary school teachers and suggests the use of a more comprehensive lecture program to bridge the gap between the skills possessed by prospective elementary school teachers and the skills required by a teacher in the 21st century.

Keywords: HOTS, Elementary School Teacher Education Students

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Introduction

One of the education programs that plays a major role in improving the quality of education in Indonesia is the primary school teacher education program. The primary school teacher education program is one of the educational programs in higher education that has the task of educating and producing prospective elementary school teachers following what is needed in the field. In the formulation of the Indonesian Primary School Teacher Education Program Lecturer Association, it is stated that prospective teachers printed by universities are expected to be able to train and develop high-level thinking skills, scientific attitudes, and creativity as early as possible in elementary school students by what students get while studying in college (Julianto et al., 2018).

Elementary school teachers have a very important responsibility in laying the foundation for future student success, shaping student development, and understanding the learning process (Dahlqvist, 2023). Future generations must be equipped with higher-order thinking skills to compete and survive in the face of global challenges (Zivitere et al., 2015). It is believed that it is important to explicitly train students to think at a higher level in the learning process, as it cannot be assumed that students will automatically become good thinkers. Therefore, teachers are expected to stimulate students to engage in higher-order thinking (Wijnen et al., 2021).

However, HOTS-oriented teaching practices are not optimal (Miedijensky et al., 2021). The learning process still tends to be oriented towards memorization and understanding, not reaching the level of analysis, so students have not made meaning of the material they have learned (Usmaedi, 2017).

The low level of higher-order thinking skills is also shown by the PISA (Program for International Students Assessment) results in 2022. PISA is a study conducted by the Organization for Economic Co-Operation and Development (OECD). The 2022 PISA results showed that Indonesia ranked in the bottom 13 out of 81 participating countries. The average reading, math, and science skills of Indonesian students are below the average of ASEAN students (OECD, 2022). The tests given by PISA are tests that require higher-order thinking skills. Thus, it can be seen that most students are not optimal in solving HOTS (high-order thinking skills) type questions.

The above problems have triggered educators, especially at the university level, to try to find strategies or solutions to improve the quality of learning. Improving the quality of learning is directed at developing the skills to think, communicate, and collaborate in solving problems and being able to make decisions appropriately (Djufri et al., 2022).

There have been many analyses of students' higher-order thinking skills, but no studies have reviewed and detailed the results of previous research on the thinking skills of primary school teacher education students over the past five years. Moreover, some studies show that the thinking skills of elementary teacher education students are not always low, some studies show the results that the high thinking skills of elementary teacher education students are optimal. Therefore, it is important to analyze and detail the results of previous research and synthesize and review them systematically.

Given the importance of the achievement of thinking skills of elementary school teacher education students based on the results of previous research to know the comparison between

HOTS and LOTS that have been achieved by students to be followed up with further research. This research is a preliminary study that aims to conduct a literature review on the results of previous research on higher-order thinking skills of students majoring in Elementary Teacher Education over the past five years.

Methods

This systematic review used the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) reporting guidelines to guide the review process. Based on these guidelines, there were several steps in this study:

- Step 1, determine eligibility criteria. The inclusion criteria set for this review guideline were: a) original research written in Indonesian and English; b) research aimed at investigating the higher-order thinking profile of Primary School Teacher Education students in Indonesian universities. The latter criteria were included to answer the research questions. Figure 1 describes the steps in conducting a systematic review.
- Step 2, determining sources of information. Online database search through Google Scholar database using Harzing's Publish and Perish.
- Step 3, study selection. Study selection was conducted in the following four phases: a) keyword searches were selected according to the research interest in reviewing higher-order thinking profiles. The search strings were related to "HOTS profile", "higher order thinking skills", "higher order thinking skills profile", "higher order thinking skills", "higher order thinking skills of PGSD students", b) exploration of the selection of titles, abstracts, and keywords of identified articles was carried out based on eligibility criteria, c) reading of provisions that were not eliminated in the previous stage was carried out in full to determine whether or not they were included in the review, according to the eligibility criteria, d) the article reference list was scanned to find related research.
- Step 4, data collection process. Data collection is done manually using a data extraction form consisting of content, article type, journal name, year, and topic. The assessment consists of reading the full text and extracted data.
- Step 5, data item selection. The information extracted from each data article consisted of the purpose of the study, the type of study and the results of the study. This data is used to determine the profile of PGSD students' high-level thinking skills and the things that influence them.

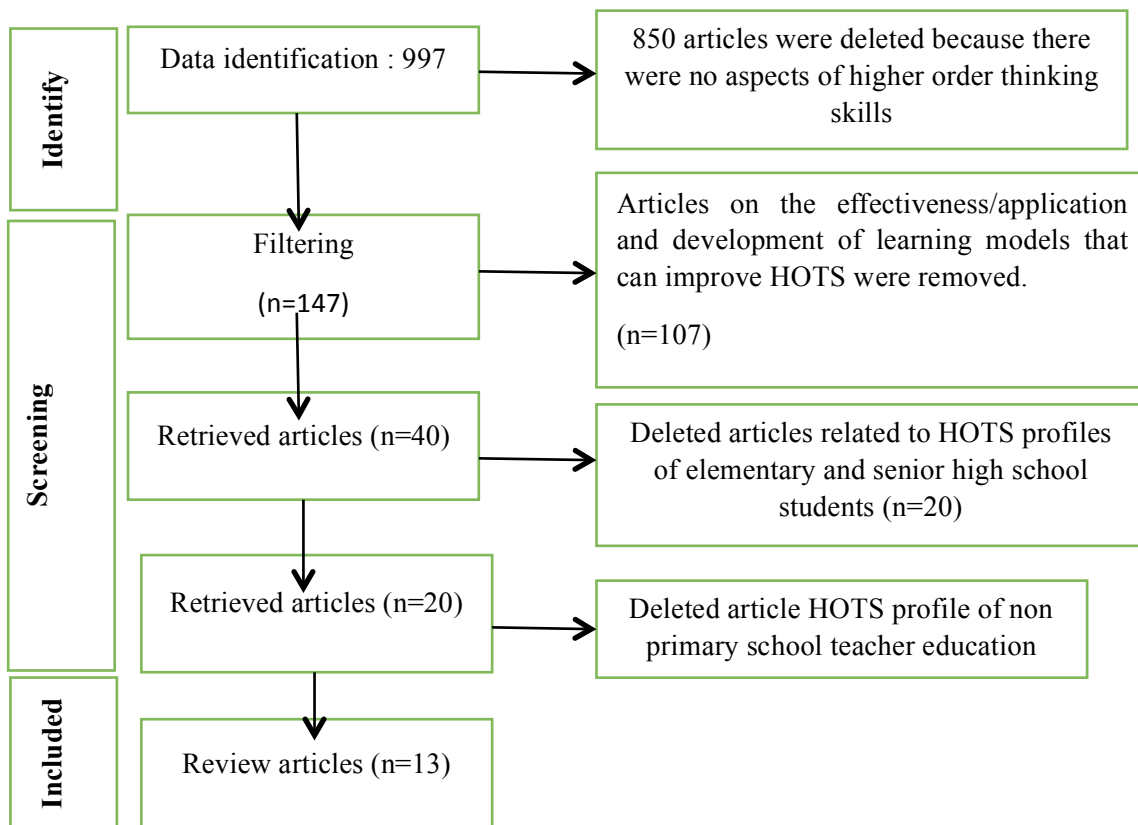


Figure 1: PRISMA Flow Chart

Results and Discussion

The search results on the selected databases provided a total of 997 articles written in English and Bahasa Indonesia studies published from 2015 to April 2023. Of the 997 articles generated from the first study and after the papers were removed before screening; 850 articles were removed because there were no aspects of higher order thinking skills, and 107 articles were removed because they were effectiveness/application and development of learning models that can improve HOTS. 40 articles were selected based on title and abstract, and then the synthesis papers were checked for eligibility by reading the full text. Some articles did not include HOTS profiles of students from elementary to high school (n=20), HOTS profiles of science education students (n=7). Finally, 13 articles were included in this study.

The research topics in the articles that have been screened and deemed appropriate are then reviewed and extracted and analyzed. The extraction results can be seen in Table 1.

Table 1: Extracted Articles

No.	Authors	Aim of study	Method	Result
1	Wiyoko, Tri., & Aprizan. (2020).	Describe the results of the analysis of the skills of the cognitive level of Elementary School Teacher Education students in learning basic natural science.	Qualitative descriptive	Shows that the skills of primary school teacher education STKIP MMB students are still at the Low order thinking skills (LOTS) level.)
2	Djufri, E., Septiani, D., & Hidayatullah, A. S. (2022).	Describing the skills of elementary school teacher education students in critical thinking in science concept courses.	Qualitative descriptive	The results showed that only 6.25% of students had good critical thinking skills, so most students still had low critical thinking skills.
3	Purwanti, Siwi. (2020).	Describe the results of the analysis of students' thinking skills in solving HOTS model science tests in advanced science learning.	Qualitative descriptive	The results showed that students' skills in analyze (C4) were quite good, but at the evaluation (C5) and creation (C6) levels it still had to be improved (Purwanti, 2020).
4	Jusuf, R., Sopandi, W., Ratnawulan, A., & Sa'ud, U. S. (2018).	Describe the results of the analysis of the distribution of National Science Examination questions in 2007-2016 based on the cognitive process dimension and the dimension of student thinking.	Analytic descriptive with a qualitative approach	The results showed that overall the questions made by the central and regional UN organizers in the cognitive process dimension with an average aspect of remembering (C1) 1%, understanding (C2) 13%, application (C3) 35%, analysis (C4) 41%, evaluation (C5) 9%, and creating (C6) 2% while the average basic thinking category was 48% and the high-level thinking category was 52% (Jusuf et al., 2020).
5	Indriani, I. (2021).	To describe students' skills to think at a high level on HOTS questions in the form of problem solving about environmental damage.	Qualitative descriptive	The results showed that students' higher-level thinking skills were optimal (Indriani, 2021).

No.	Authors	Aim of study	Method	Result
6	Nurhayati & Anggraeni (2017).	Describing students' skills to think at a high level on optics material	Qualitative descriptive	The results showed that students' skills to think at a high level was in the moderate category (Nurhayati & Anggraeni, 2017).
7	Wiyoko, Tri., & Aprizan. (2019).	Describe the results of analyzing the profile of critical thinking skills of primary school teacher education students using graded response models in science learning.	Qualitative descriptive	The results showed that critical thinking skills that reached high criteria were only 11.6%. This article presents an example of data collection techniques with written test techniques with description questions. Scoring written tests in this study using Graded Response Models.
8	Rahmawati, S., Hariyadi, S., & Febrianto, F. (2020).	Describe the profile of the cognitive skills of primary school teacher education students in the Teaching and Learning Strategy course.	Qualitative descriptive	The results showed that the skills of school teacher education students at Muhammadiyah Kudus University in the LOTS (Low Order Thinking Skill) cognitive process was higher than the skills of the HOTS cognitive process (Rahmawati, Hariyadi & Febrianto, 2020).
9	Arda. (2020).	Describing the profile of students' cognitive skills levels in learning basic science concepts	Qualitative descriptive	The results showed that the level of thinking skills of students was still at the LOTS level (Arda, 2020).
10	Julianto, Wasis, & Agustini, R. (2018).	Describe the creative thinking skills of students	Qualitative descriptive	The results showed that students' creative thinking skills were in the low category (Julianto et al., 2018).
11	Saila, Nurul. (2022).	describe the results of the analysis of the skills level of students of the Faculty of Teacher Training and Education in solving HOTS (high order thinking skills) questions in statistics courses.	Qualitative descriptive	The results showed that students of the Faculty of Teacher Training and Education of Panca Marga University had mastery of HOTS aspects in solving statistical problems but were uneven, so efforts were needed to improve them (Saila, 2022).
12	Firmansyah, Arif., & Rizal. (2019).	Describe critical thinking skills and student	Qualitative descriptive	The results showed that elementary school teacher education students at STKIP

No.	Authors	Aim of study	Method	Result
		achievement motivation.		Tadulako University had critical thinking skills at low criteria (Firmansyah & Rizal, 2019).
13	Sulistyaningrum, H., Winata, A., & Cacik, Sri. 2019.	To determine the initial skills of 21st century skills so that it can be used to improve the quality of learning.	Qualitative descriptive	The results showed that the initial skills of 21st century skills of Unirow elementary school teacher education students still showed low results. These results are shown from the average skills to think critically students show average results of less than 30%, communicative skills are less than 50%, collaborative skills and creative thinking are less than 45% (Sulistyaningrum et al., 2019).

Based on data extraction, the results show that there are three articles that show the results that the higher-level thinking skills of elementary school teacher education students are in the good category, while ten articles show that they are in the low category. The comparison is described in Figure 2.

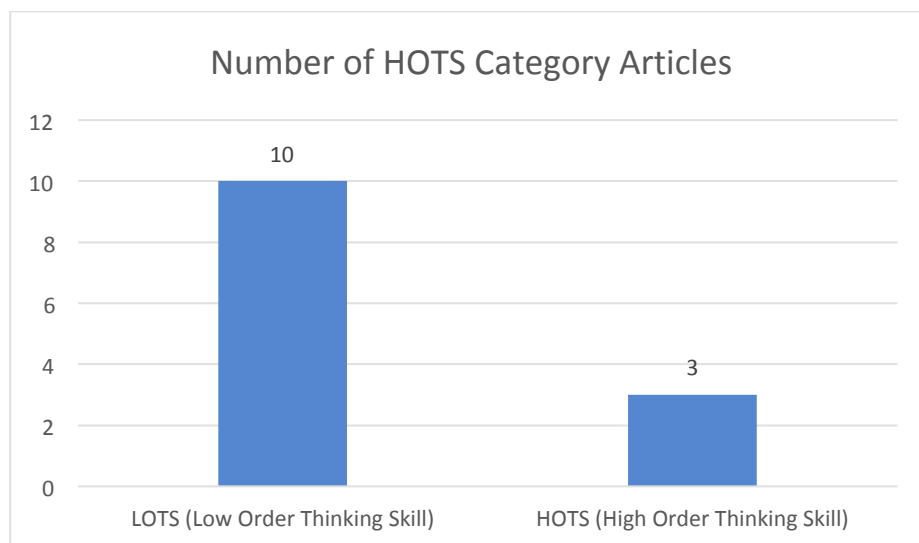


Figure 2: Comparison Diagram of Extracted Articles

Based on the analysis of articles related to level thinking skills, the results show that 3 articles (23%) describe student HOTS at a good or optimal level. Meanwhile, 10 articles (77%) describe the HOTS of PGSD students are still at a low level or Low Order Thinking Skill (LOTS) level, namely at the C1, C2, and C3 levels. This means that the cognitive skills of most PGSD students are still at the LOTS (Low Order Thinking Skill) level.

HOTS is one of the student skills that must be developed through teaching and learning. Teachers' knowledge of HOTS and their teaching and learning tactics are key to successful

education (Retnawati et al., 2018). The low HOTS of students can be caused by several factors including: a) HOTS-oriented learning has not been optimally used, even though students know a concept, they do not necessarily know how to apply it (Wiyoko, 2019), b) student-centered learning (Ichsan et al., 2019), c) the biggest obstacle in teaching and learning higher order thinking is the lack of teacher training and learning time (Davies & Willing, 2023), d) the learning strategies used are less effective in creating and improving HOTS (Misrom et al., 2020).

Strategies that can be done to improve students' HOTS are to design HOTS-oriented learning, including a) using learning models that can improve HOTS can be one of the solutions in improving the quality of learning and of course improving the quality of graduates ((Dewi et al., 2021; Handayani et al., 2019; Wiyoko & Aprizan, 2020), b) creating a smart classroom environment, namely using digital technology or online learning applications (Letchumanan et al., 2022; Lu et al., 2021; Nadarajan et al., 2023; Prahani et al., 2020; Venkatraman et al., 2022), c) using HOTS-oriented assessments (Hadzhikolev et al., 2020; Rintayati et al., 2020), d) implementing collaborative systems in the learning process (Zaid et al., 2018).

Conclusion

The thinking skills of most elementary school teacher education (PGSD) students is still at a low level, namely still at the C1, C2 and C3 levels. This is due to many factors including the skills of lecturers to design learning. HOTS-oriented learning has not been optimally used, so this can be used as a foothold for further research, namely developing learning or lecture programs oriented towards increasing the HOTS of elementary school teacher education students.

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