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## **Evaluation on Lesson Plans of Elementary Pre-Service Teachers Fostering HOTS within Shulman's Framework**

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### **Abstract**

This study aimed at explaining the capacity of pre-service teachers in designing teaching activities to foster Higher Order Thinking Skills (HOTS). The research participants were 35 pre-service teachers attending Madrasah Ibtidaiyah Teacher Education department at a state university in Malang. The research method was descriptive quantitative. The assessment was conducted by reviewing lesson plans designed by the pre-service teachers. Rubric within Shulman's framework was used for assessing the lesson plans by considering some key aspects of teaching to foster HOTS, namely content knowledge, the use of questions, and problem-solving. The results have revealed that the pre-service teachers did not show a good ability to interpret contents. Besides, the pre-service teachers tended to use clarifying questions in learning. This was due to the fact that the designed learning had not been based on problems. It can be said that the capacities of the pre-service teachers in both content knowledge and pedagogical knowledge were considerably low. Both types of knowledge have shown a significant correlation in the context of teaching to foster HOTS.

**Keywords:** Pre-service teacher; HOTS; Lesson plan; Shulman's framework; Teaching Activities

### Abstrak

*Penelitian ini bertujuan untuk menjelaskan kapasitas calon guru (mahasiswa) dalam merancang aktivitas pengajaran yang menumbuhkan Higher Order Thinking Skills (HOTS) siswa. Partisipan penelitian yakni 35 mahasiswa Program Studi Guru Madrasah Ibtidaiyah pada salah satu universitas negeri di Malang. Metode penelitian ini yaitu deskriptif kuantitatif. Penilaian dilakukan dengan meninjau Rancangan Pelaksanaan Pembelajaran (RPP) yang dirancang oleh mahasiswa. Penilaian menggunakan rubrik dalam kerangka kerja Shulman dengan mempertimbangkan aspek-aspek pengajaran untuk menumbuhkan HOTS yakni pengetahuan konten, penggunaan pertanyaan, dan pemecahan masalah. Hasil penelitian menunjukkan bahwa mahasiswa belum mempunyai kemampuan yang baik dalam menginterpretasikan konten. Selain itu, mahasiswa cenderung menggunakan pertanyaan klarifikasi dalam pembelajaran. Hal ini karena pembelajaran yang dirancang tidak berbasis pada masalah. Dapat dikatakan, bahwa kapasitas mahasiswa baik dalam pengetahuan konten maupun pengetahuan pedagogik masih rendah. Kedua jenis pengetahuan ini menunjukkan korelasi signifikan dalam konteks pengajaran untuk menumbuhkan HOTS.*

**Kata Kunci:** *Mahasiswa calon guru; HOTS; RPP; Kerangka kerja Shulman; Aktivitas pengajaran*

## INTRODUCTION

Being a teacher equipped with high-quality teaching competences must be addressed as the ultimate educational goal of teacher training program. In this current research, a high-quality teaching is defined as a planned teaching procedure that can foster students' Higher Order Thinking Skills (HOTS). To arrive at such a quality, teachers are strongly required to master two types of knowledge as proposed in Shulman's (1987) framework, namely content knowledge and pedagogical knowledge, which, in this case, is referred to teaching strategy to deliver the contents. Up to present, researches regarding the development of teacher training program within this framework is still of massive limitation (Gess-Newsome *et al.*, 2019).

Within the notice at the discourse of elevating the quality of Indonesian teachers, a big informational gap in connection with the education itself remains unanswered over time. In its simplest way, it is still quite unobvious if the teacher training program in Indonesia has been qualified enough to prepare quality teachers in upcoming time, primarily in delivering remarkable skills of the 21st century with a strong emphasis on fostering students' HOTS. Nonetheless, the highlight here is not only about to discuss whether teachers' educators have well succeeded



in performing their main duties, but also about answering a question of 'to what extent is the educators' success in preparing prospective teachers?'. Answering the question will generate an amount of information with respect to the most effective way that teacher educators must take up for the actualization of preparing teachers with high-quality teaching competences.

In Indonesia, Teacher Competency Test was used to assess/measure the basic competence of the field of study and teacher pedagogy. The results of the elementary school teachers' quality based on the Teacher Competency Test were still low (Kawuryan *et al.*, 2021; Sikki *et al.*, 2013; Tjabolo, 2020). This shows that the competence of Indonesian elementary school teachers still needs a lot of improvement.

Elementary (Madrasah Ibtidaiyah) pre-service teachers as a candidate of elementary school teachers must be able to master a variety of lesson plan formats and design them well in order to develop students' competence, especially HOTS. Elementary school teachers use written plans to organize thought and material but never consult plans when teaching, preferring to respond to students spontaneously so that lesson plans are less detailed and lack of guiding the learning process (Kagan & Tippins, 1992). Seeing this fact, it is important for elementary pre-service teachers to make detailed lesson plans and trigger the growth of students' HOTS. The results of research by Namdar and Kucuk (2018) showed that pre-service teachers were less able to design lesson plans that have alternative assessments, trigger scientifically oriented questions, and formulate explanations. Sawyer *et al.* (2020) reported that elementary pre-service teachers collect, curate, synthesize, and apply ideas in designing lesson plans based on inspiration. The major aspect in developing HOTS is learning activities in the evaluation of lesson plans (Suwarma & Apriyani, 2022).

Many scholars have conducted several studies on lesson plans based on HOTS. The preparation aspect in designing lesson plans for elementary school teachers is one of the challenges in teaching and learning for HOTS (Seman *et al.*, 2017). The results of research by Haryati *et al.* (2021) showed that HOTS was not clearly stated in the teacher's lesson plans. Kartika *et al.* (2019) found that the lesson plans prepared by mathematics teachers were not entirely based on HOTS. Gabriele *et al.* (2019) investigated pre-service teachers' lesson plans that can cultivate computational thinking skills. Hastuti *et al.* (2019) evaluated the lesson plans for pre-service English



teachers who can train HOTS, namely focusing on critical thinking skills. Whittington et al. (2022) examined lesson plans for pre-service science teachers with the results that they were able to design lesson plans that direct students to construct the students' knowledge. Hastuti et al. (2022) reviewed the lesson plans for elementary pre-service teachers that focused on problem-solving and critical thinking skills. Cao (2018) explored the teaching competence of mathematics teachers to develop higher order thinking skills through reviewing lesson plans. However, special research that focuses on pre-service elementary teachers (especially Madrasah Ibtidaiyah pre-service teachers) in developing lesson plans based on students' HOTS is currently still very rare. In fact, elementary pre-service teachers are the pioneer in the progress of primary education in the future after implementing their knowledge and competencies in classroom learning.

A meta-review study carried out by Coe et al. (2019) asserts that these two types of knowledge are the most significant factors to influence students' learning success. The significance is also found by a number of researches in the past three decades, still has it not touched any coherence to the best way of developing the knowledge (Shulman, 2015). According to Neumann et al. (2019), the underlying reason why this phenomenon occurs lies on unique issues that happen to pre-service teachers as well as the procedure of policy making on prospective teacher development that has not been well adjusted to the needs of institutions. Accordingly, this current research aims at explaining elementary pre-service teachers' advancement in the context of teaching planning that fosters students' HOTS so that the information obtained can be the basis of formulating several contextualized policies as needed.

## **METHODS**

### **Participants**

The selected participants involved in this research were students of Madrasah Ibtidaiyah Teacher Education Department (PGMI) at a state university in Malang. In total, 35 students attending Science course were recruited. The participants (further mentioned as pre-service teachers), with an age interval of 18-20 years old. In addition, they had been stated 'passed and successful' to accomplish a number of courses in educational areas, such as learning strategy and learning evaluation.



## **Measurement**

The researchers developed a scoring rubric to assess the quality of the pre-service teachers' lesson plans. The rubric development was meant to portray some features of lesson plans that typified instructional activities that fostered students' HOTS as defined by Cao (2018) regarding elements of teachers' competences in conducting HOTS teaching. The features identified in this current research were classified into three domains, such as content knowledge, the use of questions, and problem-solving. Referring to Shulman's (1987) definition, the first category belongs to Content Knowledge (CK); whilst the second and third refer to Pedagogical Knowledge (PK). The assessment of lesson plans was not only primarily focused on their completeness but also on their coherence to the standard of students' competence outlined in the elementary school level. Further, the rubric consisted of series of scores ranging from 1-4, in which 1 represented 'poor', 2 'less', 3 'fair', and 4 'good'.

The first category was used to examine content knowledge. In general, an in-depth and extended understanding of contents are the most primary competence with which teachers must be equipped (Baumert *et al.*, 2010; Shulman, 1987). Teachers, in addition, are strongly required to understand teaching contents substantially, that are facts, concepts, principles, and procedures (Lederman & Lederman, 2014). On top of that, teachers are also to be able to recognize key words, names, features, descriptions, and examples (also referring to facts, concepts, principles, and procedures), which can be translated explicitly into their lesson plans. It is also strongly suggested that teachers not only deliver materials under the remembering phase (based on Bloom's taxonomy), but also guide students to arrive at the application phase of the materials to be taught.

The second category was used to examine the use of questions. Teachers can foster HOTS by giving students critical questions (Barnett & Francis, 2012; Hill, 2016). In addition, teachers are supposed to be able to give the questions by grading them from the lowest to the highest level. Consequently, Bloom's Taxonomy exists as the framework that can guide teachers to formulate graded questions (Cao, 2018). Another possible way that teachers can make use of to foster students' HOTS is Socrates method (Cao, 2018; Suhadi *et al.*, 2016). The last method, then, was set as the research focus under the second category.



The third category, thus, was occupied to assess problem-solving. Teachers are allowed to operate problem-solving-based instructional strategy for the sake of their students' competence advancement in problem-solving (Chen, 2015). By means of this approach, students will not only understand concepts, but also be trained to think complexly, critically, and creatively when trying to find out the best solution. Practically, teachers are to master how to relate materials with real life practices, by providing them with relevant examples within their students' daily life context (contextual learning) (Madhuri *et al.*, 2012). When students encounter problems, teachers should be prepared to provide them with adequate assistance based on Vygotsky's theory about ZPD (Zone Proximal Development) (Cao, 2018). In addition, teachers must be competent in connecting students' mistakes or errors with misconceptions. Principally, all students, without any exception, can learn from mistakes. For that reason, teachers must be trying so hard to isolate the misconceptions and to fix them up.

### **Procedure**

The researchers collected the documents in the form of lesson plans that had been developed by pre-service teachers as one of requirements to meet mid-term assignment. Prior to the assignment, they had been informed by the convener to design lesson plans that could foster students' HOTS. After the pre-service teachers submitted the lesson plans, the researchers used an existing rubric to assess the quality of the lesson plans. This current research was begun after obtaining approval from the convener to get involved during the review on the lesson plans. The result of the review was permitted to be used for the purpose of this research, but without any participants' demographical information included.

### **Data Analysis**

The lesson plans that had been reviewed using the rubric were analysed using percentage measurement in order to delineate the students' distribution on the basis of their practical competence of developing a lesson plan. Meanwhile, the correlation between CK and PK was defined by using a simple linier regression.





## **RESULTS AND DISCUSSION**

This research reported to which extent pre-service teachers could show up their competences in designing lesson plans that could foster students' HOTS. Therefore, a Pedagogical Content Knowledge (PCK) model proposed by Shulman (1987) was applied as the framework, with exclusive foci on two initial competences, namely CK and PK. It is evident that an effective teaching does not only require a teacher's being equipped with CK (Baumert *et al.*, 2010), but also demands the teacher's classroom management skill with proper instructional strategy implementation, defined as PK (Shulman, 1987). Teachers who are equipped with PK are highly potential to create a quality teaching. In short, CK is a key to ensuring that teaching is of high quality and positivity (Neumann *et al.*, 2019) so that it can significantly contribute to students' learning advancement (Großschedl *et al.*, 2014).

Referring to the result of the review on the lesson plans based on CK category (content knowledge aspects), the majority of pre-service teachers were found to be able to incorporate instructional materials explicitly into their lesson plans (with 51.43% in Category 2). However, almost all of whom did not know how to organize the materials well based on informational type (with almost 95% in Category 1 and 2). Only a few of them showed good competence (with 5.71% in Category 3), but none of whom levelled up to application phase.

On one hand, the review on the lesson plans based on PK category (the use of questions and problem-solving aspects) revealed that all pre-service teachers made use of 'clarification' questioning method (with 100% over Category 1), and most of whom were able to relate with instructional goals (with 45.71% within Category 4). Nonetheless, the use of questions leading to point of view, assumption, opinion, and consequence was still relatively low (with more than 75% within Category 1 and 2). This was probably due to the fact that the instructional activities designed by the pre-service teachers did not really emphasize problem-solving (with 60% in Category 1). In addition, Vygotsky's theory was rarely used as the principle to provide the pre-service teachers with adequate assistance (with 77.14% within Category 1). On the other hand, there was a pleasing result in which the pre-service teachers tried to relate students' daily life practices with classroom instructions (with 100% over Category 1) in addition to making an effort for giving explanation that referred to



their students' mistakes despite merely a short session at the end of the instructions (with 100% over Category 1). More detailed information can be found in Table 1.

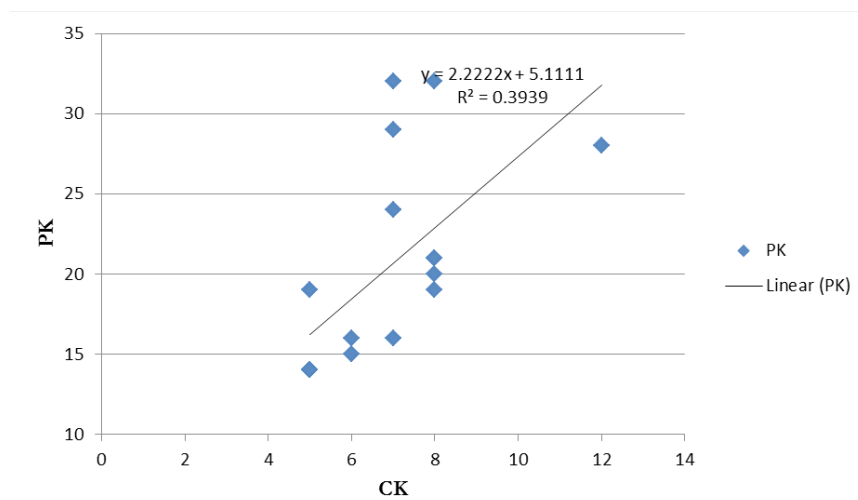
Referring to the findings, the pre-service teachers suffered the most from problems related to CK. They lacked understanding on how to convert their knowledge into a material that was meant to be taught. This sort of problem had been found and reported previously (Hadjioannou & Hutchinson, 2010; Washburn *et al.*, 2011). A serious consequence that might come into reality due to the low level of CK was narrowed pedagogical sense so that teachers would tend to refer to their own past experiences in conducting their instructional activities (Shulman, 1987). This was indicated from the pre-service teachers' PK that was still deemed relatively low. They were not really skilful in performing their teaching. Even they did not know much about 'what' and 'how' to execute teaching activities that could foster HOTS. It is corroborated by Shulman (2015) stating that one of consequences triggered by weak material preparation is a rigid pedagogical sense. If teachers cannot understand materials really well and how to convert them into instructions, they are labelled unaware of what knowledge to learn and what potential difficulties to encounter by their students. As a consequence, teachers will find it hard to understand how to isolate mistakes and misconceptions faced by the students (Şen *et al.*, 2018). With reference to the review on the lesson plans, the pre-service teachers had yet to be capable of integrating mistakes with misconceptions. The result of this current research pinpointed that the pre-service teachers with low level of CK indicated that they had no adequate competence to convert contents, which resulted in incompetence primarily in selecting the best teaching method needed to accommodate the teaching of Science for elementary school students (Leader-Janssen & Rankin-Erickson, 2018), especially the one fostering HOTS (Ishartono *et al.*, 2021).





**Table 1. The distribution of pre-service teachers' competence in designing lesson plans for HOTS-based teaching**

| Aspects              | Sub-aspects                                      | Frequency (Percentage) |             |            |             |
|----------------------|--|------------------------|-------------|------------|-------------|
|                      |  | 1                      | 2           | 3          | 4           |
| Content Knowledge    | Facts  | 15 (42.86%)            | 18 (51.43%) | 2 (5.71%)  | 0 (0.00%)   |
|                      | Concepts   | 13 (37.14%)            | 20 (57.14%) | 2 (5.71%)  | 0 (0.00%)   |
|                      | Principles                                       | 13 (37.14%)            | 20 (57.14%) | 2 (5.71%)  | 0 (0.00%)   |
|                      | Procedure  | 8 (22.86%)             | 25 (71.43%) | 2 (5.71%)  | 0 (0.00%)   |
|                      | Clarification                                    | 0 (0.00%)              | 13 (37.14%) | 6 (17.14%) | 16 (45.71%) |
| The Use of Questions | Assumption                                       | 2 (5.71%)              | 17 (48.57%) | 4 (11.43%) | 12 (34.29%) |
|                      | Reason and evidence                              | 19 (54.29%)            | 8 (22.86%)  | 6 (17.14%) | 2 (5.71%)   |
|                      | Perspective and point of view                    | 17 (48.57%)            | 10 (28.57%) | 8 (22.86%) | 0 (0.00%)   |
|                      | Consequence                                      | 27 (77.14%)            | 4 (11.43%)  | 4 (11.43%) | 0 (0.00%)   |
|                      | About questions                                  | 25 (71.43%)            | 6 (17.14%)  | 4 (11.43%) | 0 (0.00%)   |
| Problem-Solving      | Reconstruction of problem-solving-based teaching | 21 (60.00%)            | 4 (11.43%)  | 8 (22.86%) | 2 (5.71%)   |
|                      | Explanation and examples in real life practices  | 0 (0.00%)              | 19 (54.29%) | 0 (0.00%)  | 16 (45.71%) |
|                      | The use of Vygotsky's theory                     | 27 (77.14%)            | 4 (11.43%)  | 4 (11.43%) | 0 (0.00%)   |
|                      | Integrating misconceptions                       | 0 (0.00%)              | 27 (77.14%) | 8 (22.86%) | 0 (0.00%)   |



**Figure 1. The correlation between CK and PK**

The correlational calculation between CK and PK through simple linear regression (Figure 1) indicates  $p$ -value = 0.000, which means that both correlated significantly. The  $r$  coefficient obtained signifies 0.628, which demonstrates that the degree of correlation is very strong (bigger than 0.5) and the direction is positive, with the  $r$  square of 0.394, indicating that CK contributes to PK by 39.4%.

According to the findings, it is clarified that CK can be the primary requirement of PK as both have shown strong degree of correlation (Davidowitz & Potgieter, 2016; Kleickmann *et al.*, 2013). This current research revealed that CK influenced the selection and implementation of teaching strategy (that belonged to PK), despite the correlation did not imply direct relationship (Gess-Newsome, 2019). Further, the finding of this research proved that CK was utterly relevant to develop Pedagogical Content Knowledge (PCK) (Großschedl *et al.*, 2015). Teachers equipped with good CK will have good PK subsequently (Käpylä *et al.*, 2009) since they have been able to translate the instructional structure quite well into the real instructional practices (Bartos *et al.*, 2014). However, there was another research indicating a contrastive result, that those equipped with low level of CK could teach better (Kind, 2009). In other words, these kinds of knowledge were proved to possess low degree of correlation or even negative correlation (Großschedl *et al.*, 2014; Jüttner & Neuhaus, 2013).

Preparing teachers to be highly CK- and PK-equipped is dependent on education and professional development intended for pre-service teachers (Kind & Chan, 2019). Therefore, the implication pronounced by this current research is that the pre-service teachers need deeper practices on more advanced teaching materials so as to make them CK-equipped (Şen *et al.*, 2018). The point is that teaching sessions intended for pre-service teachers should solely focus on CK development (Großschedl *et al.*, 2014). In general, the main problem that rises in this case lies on the teaching content that is found to be inconsistent and fail to support teaching practices at school setting (Armour & Makopoulou, 2012). In addition, referring to the participants' cases, the development of pre-service teachers needs to focus more on PK enhancement (Großschedl *et al.*, 2015). It is found that the most common factors of this occurrence comprise the lack of implementation of special subjects (such as 5E learning cycle, argumentation) and alternative assessment methods (performance assessment) (Şen *et al.*, 2018). It is, accordingly, suggested that those



two be enhanced as well. Other alternative teaching schemata for implementation are reinforcing self-study by means of journal article reading (Großschedl *et al.*, 2014) and learning by doing (through experiences), for instance community service program (Großschedl *et al.*, 2015). As for university proper, there should be holistic understanding on the interdependence between CK and PK that is potential to create an innovative reconceptualization of education applicable to educational programs for pre-service teachers (Bostock, 2019). By this approach, it is assumed that CK and PK are not difficult to be developed on pre-service teachers, with an expectation that they can put it into practically meaningful implementation at school setting (Hwang *et al.*, 2018).

The limitation of this current research was noticed at its number of samples that was relatively small and only involving pre-service teachers in the third year of their bachelor degree program. Previous research on freshmen had shown that PK was closely related to general pedagogical knowledge; whilst in the following years, it was close to CK. This implies that students develop from general knowledge to learning specific content (Sorge *et al.*, 2019). From this result, therefore, a further research is urgent in order to involve larger samples through a comparison between freshmen and senior students for the sake of seeking the clarity upon students' CK and PK development.

## **CONCLUSION**

To conclude, this study found that pre-service teachers of Madrasah Ibtidaiyah (MI) have failed in designing lesson plans that can foster students' HOTS. They demonstrated low level of CK in which they did not perform good competence in organizing and converting materials to teach, and so did they in terms of PK. They were found to have no strong basic understanding on teaching methods that could foster students' HOTS. In this research context, it was unveiled that there was a correlation between CK and PK, in which low level of CK resulted in low level of PK. Therefore, further research is needed to develop students' HOTS in pre-service teachers.



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