



Implementation of *Hard-Scaffolding* in Building Basic Teaching Skills for Prospective Biology Teachers

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Abstract: This study aims to determine the effect of implementing the strategy of hard scaffolding to build the basic teaching skills of prospective biology teacher. This research used a Quasi-Experimental - Posttest-Only Control Group Design. Saturated sampling was used, with Class A as the experimental class, consisting of 43 students, and Class B as the control class, consisting of 39 students. Quantitative data consisted of mid-term exams, final semester exams, and basic teaching skill. The mid-term exams and final semester exams data were measured using tests, while the basic teaching skills data were measured using observation sheets. All three data sets were analyzed using Mann-Whitney U statistical tests. Qualitative data in the form of student opinions were measured using observation sheets and analyzed descriptively. The results of the study showed that the abilities of students in the experimental class were higher and significantly different than those in the control class (Mann-Whitney U Test: $0.023 < 0.05$ for mid-term exams and $0.000 < 0.05$ for final exams). The students' ability to practice basic teaching skills in the experimental class was also higher and significantly different compared to the control class (Mann-Whitney U Test : $0.000 < 0.05$). Among the three stages of learning, only the experimental class's lesson opening skills were higher and significantly different compared to the control class. Thus, it is concluded that the implementation of the strategy hard scaffolding able to develop the basic teaching skills of prospective biology teachers. This result is supported by the opinion of almost all students that LKM (as hard scaffolding) effectively helps students master basic teaching skills.

Keywords: *Basic Teaching Skills, Hard Scaffolding, Prospective Teacher Students*

INTRODUCTION

Teachers at the elementary and secondary levels are a determining factor in students' success in developing their competencies. Teachers are not only tasked with transferring knowledge (cognitive), but also with shaping

character, morals (affective), and skills to face the complexities of the future. Based on this, Law No. 14 of 2005 concerning Teachers and Lecturers requires every Teachers must have academic qualifications, competencies, teaching certificates, be physically and mentally healthy, and possess the ability to achieve national education goals. These requirements are expected to foster professional educators and produce competent graduates who meet the demands of today's changing times.

The reality shows that the quality of education in Indonesia is not yet classified as "good" and "competitive." The results of the TIMSS study (*Trends in International Mathematics and Science Study*) also showed results that were not different from PISA. The mathematics and science abilities of Indonesian students in 2015 in the category *Low International Benchmark* with a score below 400 (Puspendik Kemendikbud, 2015). The results of the National Assessment (Kemendikbudristek, 2021) show that students' literacy and numeracy achievements are still below the minimum standards. It is this low quality of education that is suspected to be the cause of the low competitiveness of Indonesia's human resources. A World Bank study shows that *Human Capital Index* Indonesia's (HCI) in 2020 was 0.54, lower than Singapore (0.88), Vietnam (0.69), Brunei (0.63), Malaysia (0.61), and Thailand (0.61). Meanwhile, the HDI score (*human development index*) Indonesia in 2025 is 75.90, still below Singapore (0.95), Brunei Darussalam (0.82), Malaysia (0.81) and Thailand (0.80) (UNDP, 2025; Central Statistics Agency 2025).

There are many factors that influence the quality of education, but the teacher factor is the main factor (Darling-Hammond, 2000; Mulyasa, 2007; Hamalik, 2008; Hattie, 2009). Teachers play a direct role in determining the quality of learners in the classroom because teachers are tasked with planning learning, implementing learning, and assessing learning (Ministry of Education and Culture, 2005). Therefore, teachers must be truly professional, utilizing all their competencies to design and implement learning, and conduct assessments. However, the opposite is true. Several official measurements conducted by the Indonesian government indicate that teacher competency generally falls short of standards. The results of the Teacher Competency Test (UKG) conducted by the Ministry of Education (2015) showed a national average of 53.02 (on a scale of 0-100), particularly for pedagogical competency. National teacher competency assessments (AKG) indicate that teacher competency still varies and is not evenly distributed across regions, with the majority falling into the adequate and inadequate categories (Education Assessment Center, 2021).

Based on the description above, it is time for every Teacher Training Institution (LPTK) to be serious in equipping prospective teachers, especially in basic teaching skills (KDM). Mastery of pedagogical competencies, including KDM, is the key for teachers to create active, enjoyable, and meaningful learning (Mulyasa, 2007; Harjun, et al; 2025). Student learning success is determined by teacher competence in applying various teaching skills (Hamalik, 2008; Sagala, 2010; Etkina, Gregorcic, & Vokos, 2015). Currently, every LPTK (Institution for Teacher Training) has prepared its prospective

teachers through microteaching courses. However, in practice, students are less actively involved in developing their understanding and skills in microteaching. This is expected to impact the quality of learning that will be carried out when the prospective teachers become teachers. Therefore, this study will use a microteaching with hard scaffolding approach by giving assignments to students through student worksheets (LKM) containing material and videos about KDM. The use of *hard scaffolding* at *Microteaching* Lectures is very helpful to reduce *cognitive load*. Student teachers often feel overwhelmed when they have to think about material, classroom management, and body gestures simultaneously. *Hard scaffolding* taking over the task of “remembering the structure” so that students can focus on “teaching performance”. In practice, students are asked to read, examine, and discover facts about basic teaching skills and then apply them to planning and implementing learning. This allows students to play a more active role in developing their understanding and basic teaching skills.

METHOD

This study employed a rigorous methodological framework to examine the effectiveness of hard-scaffolding in enhancing the basic teaching skills of prospective biology teachers. The chosen design and procedures were intended to ensure the reliability of data collection, the validity of the findings, and the alignment of instructional interventions with the research objectives.

Research Design

This study used a *Quasi-Experimental - Posttest-Only Control Group Design*. The experimental class received treatment by being given student worksheets (LKM) to identify and discover about the teaching profession and basic teaching skills (KDM), using learning resources in the form of articles, books, and learning videos. The results of the study were discussed. Meanwhile, the control class used a regular lecture system, namely material discussions and exercises for each stage of KDM.

Population and Sample

Saturated sampling was conducted because the availability of students in the even semester of the 2025-2026 academic year was only grouped into two classes. Class A, consisting of 43 students, served as the experimental class, and Class B, as the control class, with 39 students. Both classes used the microteaching cycle from Cavanaugh and Kristina (2023).

Research Instrument

The data about basic teaching skills (KDM) was measured using mid-term and final exam tests, while teaching skills were measured using observation sheets during teaching practice. Quantitative data, including knowledge of basic competencies (KDM) and teaching skills, were statistically analyzed to

determine normality and homogeneity. Further testing was then conducted to determine whether there was a significant effect of the treatment.

RESULT AND DISCUSSION

Result of Research Procedure

Implementation of strategy *hard scaffolding* succeeded in increasing the understanding of experimental class students regarding KDM material as measured through mid-term and final exams which was higher and significantly different compared to the control class (Table 1).

Table 1. Results of Statistical Tests of Students' Understanding of Material and Microteaching Practice

Mark	Class	$\bar{x} \pm Sd$	Normality Test	Homogeneity Test	Uji Mann-Whitney U
UTS	Control	69,87 $\pm$ 13,40	0,222 > 0,05	0,392 > 0,005	0,023 < 0,05 Ho is Rejected
	Experiment	76,63 $\pm$ 11,89	0,024 < 0,05		
UAS	Control	74,84 $\pm$ 8,58	0,013 < 0,05	0,508 > 0,05	0,000 < 0,05 Ho is Rejected
	Experiment	82,42 $\pm$ 9,58	0,001 < 0,005		
Practice	Control	75,94 $\pm$ 8,86	0,000 < 0,05	0,000 < 0,05	0,000 < 0,05 Ho is Rejected
	Experiment	77,47 $\pm$ 2,05	0,005 < 0,05		

The experimental class's skills in applying KDM through microteaching practices were also significantly better and significantly different compared to the control class. However, considering the three stages of teaching practice: opening activities, core activities, and closing activities, not all were significantly higher. Only the experimental class's skills in opening lessons were significantly better and significantly different compared to the control class (Table 2).

Table 2. Statistical Test Results of Student Ability in Microteaching Practice

No	Learning Stages	X ± Sd	Normality Test	Homogeneity Test	Uji Mann-Whitney U
1	Opening Activities				
	Control	75,49 ± 1,34	0,000<0,05	0,000<0,05	0,000<0,05 Ho is Rejected
	Experiment	79,28 ± 2,67	0,000<0,05		
2	Core activities				
	Control	76,10 ± 0,45	0,000<0,05	0,000<0,05	0,897>0,005 Ho is Accepted
	Experiment	76,58 ± 1,69	0,001<0,05		
3	Closing Activities				
	Control	76,23 ± 1,27	0,002<0,05	0,020<0,05	0,931>0,005 Ho is Accented
	Experiment	76,56 ± 2,07	0,000<0,005		

The increase in knowledge and teaching skills of students in the experimental class is supported by the opinion of almost all students that the use of LKM (as *hard scaffolding*) effective and very effective in helping students master KDM material and learning practices (Table 3).

Table 3. Opinions of Experimental Class Students (n = 39)

No	Statement	Rating	Percentage
1	The effectiveness of using the “cycle” learning technique	Very effective	64,9
		Effective	35.1
2	The effectiveness of LKM on mastering knowledge about KDM	Very effective	54.5
		Effective	45.5
3	Contribution of mastery of material about KDM to KDM	Very effective	62.3
		Effective	33.8
4	The effectiveness of watching learning videos on KDM	Very effective	63.6
		Effective:	36.4
6	The effectiveness of “practice teaching” in teaching practice skills.	Very effective	67.5
		Effective:	32.5
7	The effectiveness of “reflection and evaluation” on KDM	Very effective:	63.6
		Effective	36.4

Discussion

Based on the research results, it shows that the use of students worksheet (LKM) as *hard scaffolding* able to develop understanding and skills in KDM which can be seen in mid-term test, final semester test, and *microteaching* practice (Table 1). For all three indicators, the experimental group performed significantly higher than the control group. These results indicate that student's worksheet truly serves as a bridge for students to master basic teaching skills.

The improvement in students' basic teaching skills in the experimental class was supported by students' opinions that the use of LKM was effective in improving understanding of KDM material and effectively improving KDM skills in teaching practice (Table 3). Both research findings corroborate previous findings which stated that structured guidance (*hard scaffolds*) can reduce cognitive load so that students are able to achieve high levels of understanding (Quintana, et al., 2004), solve problems beyond their independent capacity (Wood, Bruner, & Ross, 1976) and help overcome learning difficulties (Saye & Brush, 2002).

The significant increase in KDM did not occur at all stages of learning, but only at the opening of the lesson, while there was no significant increase in the core and closing activities (Table 2). This result is very important considering that opening a lesson is a very critical stage that determines the success of

subsequent learning (Gagné, 1985; Hasibuan & Moedjiono, 2012). Opening the lesson is an important stage because at this stage there is activation of cognitive structures (Ausubel, 1968), determining the learning climate, motivation and mental readiness before entering the stage of exploring the core material (Joyce, Weil, & Calhoun, E., 2015), and this stage is crucial for attracting attention and providing references (Turney, Eltis, Hatton & Owens, 1983).

The results of the observation show that of the 7 (seven) components of lesson opening skills, those that rarely appear during *microteaching* practice. In both the experimental and control groups, the skills of "providing references" and "making connections" were used. Meanwhile, the components of the lesson opening skills that consistently appeared were "attracting attention, linking topics, communicating learning objectives, and directing students' attention". The difference between the experimental and control classes lay in the quality of learning in each component of teaching skills, where in general the experimental class was of higher quality.

In the core and closing activities, although the experimental class performed better than the control class, there was no statistically significant difference. The lack of significant differences between students and between classes may be due to the peer-teaching effect, where students are easily managed classmates and students are tied to pre-prepared learning scenarios. Blegur & Lumba (2022) stated that in the core and closing activities, students tend to memorize teaching steps or imitate their peers, and the classroom atmosphere is unrealistic and not a real situation that tests a variety of high-level skills (Subkhiyatun, 2023).

CONCLUSION

Based on the results of the research and discussion, it was concluded that the use of strategies *hard scaffolding* in *Microteaching* course can significantly build the basic teaching skills of prospective biology teachers. Significant differences in students' skills in opening lessons, while there were no significant differences in core activities and closing lessons between experiment class and control class. Prospective biology teacher students gave a positive response to the use of *hard scaffolding strategy* in *Microteaching* course. Almost all students stated that the use of student's worksheet (LKM) was effective and very effective in building basic teaching skills.

GRATITUDE

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