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The Profile of Students' Pedagogical Knowledge on the Implementation of Mentoring Program

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ABSTRACT

This study aims at revealing the students' pedagogical knowledge on the implementation of a mentoring program. There were 60 students of Biology Education Study Program from Muhammadiyah University of Bengkulu involved in this study. The students' pedagogical knowledge is considered as students' competency within five aspects (Knowledge of learning processes, Knowledge of individual characteristics, Knowledge of classroom assessment, Knowledge of teaching methods, Knowledge of classroom management). The instruments for data collection were essay tests which had been validated through the expert judgment. The scores representing the students' pedagogical knowledge were categorized into three categories (low, medium, and high). The collected data were analyzed using a descriptive quantitative approach. The results of the study reveal the students' competency in the ten indicators of pedagogical knowledge consisting of learning strategies (85%); feedback provision to students (76%); knowledge of cognitive development (78%); motivatingstudents (70%); formative and summative assessment (73%); lesson plan evaluation (78%); various teaching methods (73%); appropriate teaching method (83%); conditioning a conducive atmosphere (80%); classroom management (86%). Thus, it can be concluded that the students' pedagogical knowledge on the implementation of a mentoring program can be categorized as high and able to improve their experiences of teaching practices as prospective teachers.

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1. INTRODUCTION

Material knowledge is vital for teachers to have a strong grasp of the material they are teaching. On the other hand, teachers must also develop their knowledge of teaching (Purwianingsih, 2011). In line with this, Harlen & Holroyd (1997) state that teaching knowledge can have a positive influence on decision making related teachers' teaching strategies in order to create better learning experiences.

Teachers who have good pedagogical knowledge will be able to construct material simultaneously in their working memory by paying attention to students' initial knowledge. As mentioned by Kunter et al. (2013) that the quality of education is determined by teachers'professionalization todealing with various problems related to learning implementation, such as the development of science and technology, global competition, regional autonomy and applied curriculum system. It challenges sustainable and dynamic efforts to enhance teachers' competence and professionalism based on the current era (Anif et al., 2019).

Related to teaching practice, several studies assume that it requires basic knowledge of teaching (Brown et al., 2013; Hanuscin, 2013; Seung, 2013). It means becoming a teacher needs basic knowledge to succeed in the learning process. This knowledge focus on developing teachers' knowledge or called pedagogical knowledge, content knowledge, and integrated knowledge between content and pedagogy (Gess-Newsome et al., 2017). The last has been regarded as the most prominent knowledge (Anwar et al., 2013; Aydeniz & Kirbulut, 2014) where it emphasizes that learning is not only knowledge of material content but also its integration with pedagogical knowledge (Brown et al., 2013; Donnelly & Hume, 2015).Moreover, pedagogical competencies include the teacher's ability to understand teaching and learning theories, while professional competency emphasizes an in-depth understanding of subject matter. According to Nilsson & Vikström, (2015) both pedagogical and professional competencies are an integral part of Pedagogical Content Knowledge (PCK). Each teacher needs to possess the PCK ability to create and facilitate effective learning. Consequently, prospective teachers should not only grasp teaching knowledge and skills to achieve learning goals but also learning strategies to encourage students' involvement. To realize it, Biology Education program provides basic knowledge for prospective teachers in order to design and implement effective Biology learning. Rusilowati et al (2012) stated that prospective teachers need to be equipped with integrated teaching skills to optimize students' potential. These skills cover the utilization of classroom environment, media, worksheets, reflective journals, and certain characters for the subject matter. It is clear that teachers need to have pedagogical and professional competency and well-mastery of learning material.

Those requirements should be the main focus from Teacher Education Institution (TEI) that is responsible to prepare professional teachers. As a professional career,the teacher must provide expert services and requirements of academic, pedagogical, social, and professional abilities. However, the results of the 2015 teacher competency test towards 2,430,427 teachers showed the national average of53.05 which was below the target of 55. In details, the average score of the professional competence was 54.77 and the pedagogical competence was 48.94. Moreover, only 7 provinces reached the national average, such as Yogyakarta (62.58), Central Java (59.10), Jakarta (58.44), East Java (56.73), Bali (56, 13), Bangka Belitung (55.13), and West Java (55.06). The lowest average in one province beyond Java was 41.96 (Ministry of Education and Culture, 2016). These results reflect the urgency to make effort and hard work to improve the quality of Indonesian teachers, especially TEI in order to produce professional teachers. Mulyasa (2005) points out that professional teachers are those who have pedagogical competency related to students' understanding and effective learning management. Managing learning is referring to the ability to design and implement learning, to evaluate learning outcomes, and to develop students'potentials. Besides,Pedagogic competency is an important element that must be mastered by teachers as the main requirement in directing the learning process.

During the learning implementation, the mastery of the teachers' basic competency can be clearly seen since professional and pedagogical competency plays a dominant role in learning. In fact, some teachers are lack of pedagogical competence. It has been revealed by Rachman (2013) that the average of pedagogical competence among science teachers in junior high school of Ternate city was in the medium category with 49.18%, while the remaining 34.34% was in a good category, and 16.39% was categorized low. Similarly, Syahruddin's et al. (2013) explained that the teacher's pedagogical competence had not been developed as expected where teachers' creativity seemed to be limited due to government domination. They do not show the teaching process that can be accepted by students. On the other hand, they admit that the most important thing in learning is the interaction between a

teacher and students. This result indicates that the PCK ability among the prospective teacher's has not been integrated yet between the content and their pedagogical competence (Nurmatin & Purwianingsih, 2017). To overcome this problem, a better management system and other alternative efforts are needed to develop teachers' quality.

Based on the observation results of teaching practices in Biology Education Study Program in Muhammadiyah University of Bengkulu, the prospective teachers found several obstacles, such as shallow material mastery and narrow scope of teaching materials, even misconceptions in teaching. They also still have a weak understanding of the curriculum system that can be seen from the incompatibility indicators of basic competency, and minimal use of media. These constraints were caused by a lack of experience and pedagogical knowledge (PK). This is in accordance with the previous studies which revealed that prospective teachers were unaware to involve pedagogy and actions to facilitate students learning activities (Hume & Berry, 2011).

Teachers' efforts to improve the quality of learning process is crucial to achieving the educational goals (Ramdiah et al., (2019). The experience of prospective teachers in education will influence the way of teaching and the approach to helping and motivating their students. Teachers must be able to provide students with the opportunity to understand concepts and make judgments. They should also create meaningful interaction with students during the learning process (Kusaeri, & Aditomo, 2019; Skilling et al., 2016). Mishra and Mattew (2006) express that teachers who do not have pedagogic understanding will find it difficult to present materials to their students.These facts indicate that prospective teachers must own accurate knowledge of teaching. Thus,they need to take part in a mentoring program related to teaching and learning. This program is an educational model to improve understanding of pedagogical knowledge. It can also be a beneficial reference to enhance the quality of prospective teachers. Mentoring is defined as interpersonal relationships in the form of care and support between an experienced and knowledgeable person with inexperienced ones (Crawford, 2010). The mentoring model aims at enhancing the pedagogical knowledge and participating in problem-solving among prospective teacher before the implementation of teaching practice in schools.

Based on the problem identification and the lack of data or information related to PK profile among biology prospective teachers in Muhammadiyah University of Bengkulu, it is urgent to investigate PK profile of prospective teachers on the implementation of mentoring-based learning. Based on the results of the study (nopriyeni et al., 2019) that pedagogical knowledge instruments can be used to measure the increase in teacher-candidate pedagogical knowledge based on mentoring. By doing so, this is expected to provide an initial description of prospective teachers' pedagogic competency before real teaching in schools. Thus, the research question can be formulated as"How is the PK profile among the prospective teachers through the implementation of mentoring-based learning?" The obtained data can be used as evaluation materials related to the learning process and curriculum system in the current lecturing program.

2. METHODS

This study employed a quantitative descriptive. The research subjects were 60 students of Biology Education Study Program Muhammadiyah University of Bengkulu, Indonesia, in the academic year of 2017/2018. This research was done for one month in June 2018. Two meetings were held with the allocation of 190 minutes for each meeting. The procedure of the mentoring program to improve pedagogical knowledge (PK) of Biology prospective teachers are presented in Table 1 below.

Table 1. The procedure of the mentoring program to improve pedagogical knowledge (PK)

The data were analyzed by descriptive quantitative techniques. The research instrument was the essay

Stages	Mentoring Activities
I. Preparation	- Explaining the learning purpose and motivating the students to be involved in the learning activities - Organizing the learning - Establishing good relationships among the mentors and setting their roles
II. Implementation	- The mentor encourages participants to listen to more specific information to gain better understanding - Managing relationships and supporting active learning to maintain students' motivation during the learning process - Assessing the progress related to the learning objectives. - Maintaining the students' involvement to realize collaborative learning with the students. - Demonstrating behaviors that can be observed and imitated by the students
III. Reflection and evaluation	- Assessing progress related to the learning objectives - Reflecting the learning outcomes - Evaluating the improvement of pedagogical knowledge

test that had been validated through expert judgment. The instrument guideline was arranged based on the aspects, the descriptions, and the indicators of PK as presented in Table 2.

Table 2. The PK guidelines of prospective teachers

Aspects	Descriptions	Indicators
Knowledge of learning processes	Knowledge to reach competency development based on certain theories through interaction with certain learning strategies	Ability to implement learning strategies Ability to give effective feedback to students
Knowledge of individual characteristics	Knowledge about students' characteristics based on learning styles, cognitive abilities, and motivation improvement to achieve learning goals	Students' cognitive development Students' learning motivation
Knowledge of classroom assessment	Knowledge about procedures of learning assessment in the aspects of formative/ summative assessment, and plan of systematic, comprehensive, continuous,and objective evaluation	Ability to make formative dan summative assessments Ability to plan learning evaluation
Knowledge of teaching methods	Knowledge on the use of various learning methods which is relevant to achieve learning goals (when and how to apply each of these methods)	Ability to implement various learning methods Knowing when and how to apply appropriate learning method

Knowledge of classroom management	Knowledge of learning to maintain a conducive atmosphere to support the learning process in achieving learning goals	Conducive classroom Ability to manage learning activities

The guideline of the test instrument that had been formulated was then arranged into the 10 test items. The arranged instrument was validated by the five science experts and all instrument items were declared valid with the value of 0.8 ($p < 0.05$). Meanwhile, through Cohen Kappa (κ) coefficient, itwas gained the score of 0.94 and it indicated the high reliability (Taber, 2017). The essay answer score ranged from 0, 1 and 2. The PK answer was given with the following criteria: the score (2) if the answer was complete and correct, score (1) if the answer was partially incorrect, score (0) if the answer was wrong (Brookhart, 2010). The scores to represent the students' PK were divided into two categories (low and high categories); ≤ 50% for the low category and> 50% for the high category (Suciati et al., 2018).

3. FINDINGS AND DISCUSSION

Based on the results of data analysis, it was obtained the scorefor each of PK competency indicators, i.e.learning strategies (85%); feedback provision to students (76%); knowledge of cognitive development (78%); motivating students (70%); formative and summative assessment (73%); lesson plan evaluation (78%); various teaching methods (73%); appropriate teaching method (83%); conditioning a conducive atmosphere (80%); classroom management (86%). The percentage score of each indicator was obtained through the division of the maximum score with the student number and the result was multiplied by 100%. The outcome indicated that the ten indicators obtained the percentage above 50%. It means the students had high PK competence as presented in Table 3.

Tabel 3. The Students' Competence in Aspects and Indicator of Pedagogical KnowledgeTest Results

Aspects	Indicators	Score (%)
Knowledge of learning processes	Implementing learning strategies	85%
	Ability to give effective feedback to students	76%
Knowledge of individual characteristics	Ability to describe knowledge of cognitive development	78%
	Ability to motivate students	70%
Knowledge of classroom assessment	Ability to make formative dan summative assessment	73%
	Ability to plan learning evaluation	78%
Knowledge of teaching methods	Ability to implement various learning methods	73%

	Knowing when and how to apply appropriate learning method	83%
	Conditioning conducive classroom	
Knowledge of classroom management		80%
	Ability to manage learning activities	86%

In Table 3, it can be seen several differences in the distribution of students' answers scores based on each indicator. These results illustrate the PK of prospective teachers who get mentoring training. It showed that the students' PK profile can be categorized as high. They had already mastered deep science materials or concepts. In addition, the prospective teachers had understood the way to formulate and link the suitable indicators in achieving basic competencies based on the applied curriculum. They also performed better media use. As mentioned earlier that mastery of PK competency is crucial for teachers, so it becomes one of the main focused on mentoring training. In addition, the lecturers as a mentor must have a comprehensive understanding of various teaching practices. The development of PK requires some process to be mastered as new sources of skills and knowledge to support teachers'professionalism (Kartal et al., 2012). Moreover, the prospective teachers must be aware of the PCK mastery in the integrated materials (Loughran et al., 2012).

The arrangement of the learning plan and various teaching methods through mentoring program succeeded in improving the teachers' pedagogical competencies, such as in the formulation of learning objectives indicators. This is in line the theory from Hudson, Skamp, & Brooks (2005) and Erossman, Baldwin, & Garry (2007) that a mentoring program is intended to allow prospective teachers to interact with someone who has better skill and knowledge. Mentoring program to improve pedagogical knowledge (PK) is able to develop the teaching performance. Hudson, (2004) suggests that professional development programs that are well-structured with mentoring can advance the quality of education in case of the improvement of teachers' teaching practices.It is supported by several research findings which conclude that teachers' professional competence on PCK development can be realized through a mentoring program (Olszewski, 2010; Mailani, 2014; Agustina, 2015; Purwianingsih, 2011).

The results in Table 3 also showed that prospective Biology teachers were able to manage effective teaching because they had sufficient teaching experiences. The repeated and abundant teaching experiences can enhance teaching skills, especially for well-organized time allocation and classroom management. By comprehending the complexity of classroom learning, the prospective teachers are able to select appropriate methodsor techniques for maintaining the conducive atmosphere. It has been emphasized by Sukaesih, Ridlo, & Saptono (2017) that teachers' self-control have to be adjusted with the classroom environment to support the learning process. In the assessment aspect or plan, the students have generally made the correct instruments though it is incomplete to assess cognitive, affective, psychomotor aspects.

The importance of pedagogical knowledge (PK) for teachers has been asserted by Ball & Bass (2000: 101) in which knowledge of subject matter is very important for being a teacher, but it is not enough for effective teaching. The teacher must know how to deliver the subject matter and other factors that influence the learning processes, such as curriculum, students, and teaching strategies. The same thing was also highlighted by Arends (2013: 56) that teachers must at least master a broad basic knowledge as a guide for their teaching. A good teacher must master the content (subject matter/subject matter) and the science of teaching (Pedagogy). Pedagogy means the ways that can be through to help students learn and solve problems in science (Enfield, 2007: 89). The pedagogy knowledge equips teachers the insight that can help students to deal with their science problems. Thus, teachers must possess knowledge about teaching methods, classroom management, assessment, lesson plans, and student

learning processes. By having deep pedagogical knowledge, they will understand how to build students' knowledge, skills acquisition, and positive thinking development. It means that pedagogical knowledge requires an understanding of cognitive, social, and learning theories as well as the way to apply them in the classroom context.

Considering the importance of the pedagogical knowledge (PK) components, it is necessary to be developed optimally in pre-service teacher training of Biology. If many biology prospective teachers are trained withthe mentoring program, their pedagogical competence will be improved because this program is intended to provide assistance for prospective teachers in acquiring special skills and qualified teaching practices. This is supported by research (nopriyeni et al., 2019) that the application of the mentoring model has a significant influence in improving the pedagogical knowledge of prospective teachers compared to conventional models. Furthermore, there are several factors that influence the development of students' PK, namely external and internal factors. The external factors are guidance patterns, and intensity as well as lesson study activities. Meanwhile, the internal factors refer to the psychological effects of both teachers and students. It also covers motivation from one self to broaden the horizons of science, communication skills, and teaching experience (Rahmi, 2011).

The mentoring program is proven effective to enhance pedagogical knowledge (PK) among prospective biology teachers. The pedagogical knowledge and experience during learning implementation should be developed continuously to arise teachers' sensitivity in managing effective learning and active students involvement, especially in the aspects of concepts (content) mastery, time management, classroom management, and learning media use (Sukaesih, Ridlo, & Saptono, 2017). Thus, the development of teachers' skills must be implemented in the form of an organized mentoring model for teaching skills related to theoretical mastery and its application inthe learning process. Moreover, the teachers have a very strategic role and determine the success of education since they are dealing with adolescent students who are in a critical period for their personality development.

4. CONCLUSION

The implementation of the mentoring model is a good alternative strategy to improve pedagogical knowledge (PK) among prospective biology teachers. The mentoring model is proven effective to develop the teaching quality in case of the content understanding and its delivery. PK should be taught to prospective biology teachers in order to prepare and equip them to direct the learning process. The mastery of content and pedagogy among prospective teachers is still low and this study suggests the procedures to optimize it, as follow.The first is providing training and preparation before prospective teachers carry out teaching practices in schools; the second is offering text books that can be used as teacher guides in developing pedagogical skills and content mastery. The third is strengthening effective learning systems, developing student center learning, and creating educational apprenticeship programs as well as basic education courses.

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