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Research Artikel

PEDAGOGICAL CONTENT KNOWLEDGE (PCK) ABILITY OF PRE-SERVICE BIOLOGICAL TEACHERS BASED ON LESSON PLAN AND TEACHING PRACTICE

PEDAGOGICAL CONTENT KNOWLEDGE (PCK) *KEMAMPUAN GURU BIASA PRA PELAYANAN BERBASIS RENCANA PELAJARAN DAN PRAKTEK PENGAJARAN*

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Abstrak

Penelitian ini mengidentifikasi empat aspek berbeda dari pengetahuan pedagogi dan tiga aspek dari pengetahuan materi, serta terkait di antara aspek-aspek PCK. Penelitian ini menunjukkan bahwa skor PCK calon guru biologi dalam menyusun rencana pelajaran dan praktik mengajar berada dalam kategori baik, dengan hasil persentase skor CK 70,83% (baik), hasil persentase skor PK 75,70% (baik), dan hasil persentase skor PCK 66,67% (sangat baik). Temuan dalam penelitian ini adalah kemampuan mahasiswa calon guru mulai berkembang mengenai PCK melalui cara penyampaian materi pelajaran biologi dengan menghargai ide-ide siswa sebelumnya dalam pembelajaran, meskipun kedalaman pemahaman bervariasi. Selain itu, hasil PCK menunjukkan banyak perkembangan dalam perancangan rencana pelajaran melalui pengetahuan konstruktivis. Pengembangan terhadap pengetahuan pedagogi, konten dan PCK berkaitan dengan keterampilan mengajar merupakan aspek yang sangat penting. Penggunaan rencana pelajaran yang mudah diakses dapat meningkatkan kemampuan PCK untuk mengembangkan prinsip-prinsip pedagogis. Meskipun pengembangan konten dan PCK terkait pedagogis, mungkin cukup untuk memungkinkan mahasiswa calon guru untuk membuat dan menghubungkan konteks materi pelajaran biologi yang memfasilitasi siswa dalam pembelajaran kontekstual.

Kata Kunci: pedagogical content knowledge; *praktek mengajar*

Abstract

This study identified four distinct aspects of pedagogical knowledge and three aspects of content knowledge, as well as related among these PCK aspects. This study shows that the PCK scores of pre service biology teachers in preparing lesson plan and teaching practice are in good category, with result of CK score percentage 70.83% (good), result of PK score percentage 75.70% (good), and result of PCK score percentage 66.67% (very good). Finding in this study were pre service students ability about PCK began to develop an understanding of the way to deliver biology subject material that values students' prior ideas in learning, eventhough the depth of this understanding varied. In addition, PCK show as much growth in their lesson plan with respect to the constructing knowledge. In developing a pedagogy and content knowledge of PCK, relating to skills about teaching, appears to be critical. Using lesson plan that is simple accessible seems to increase PCK ability to develop pedagogical principles. Although development of content and pedagogical related PCK, it may be enough to allow pre-service student to create and relate the biology subject material contexts that facilitate students in contextual learning.

Keywords: pedagogical content knowledge; teaching practice

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INTRODUCTION

One factor that can support the success of the teaching and learning process is about the ability of the teacher to present a good teaching process based on the lesson plan. The role of the development of teachers' quality in education is an effort that continues to be carried out by the government through the targets of national education standards. Aspects of competencies and academic qualifications become the government's consideration for improving the quality of teachers. (Kemendikbud, 2005). Therefore, teachers are expected to have various abilities related to creativity, tenacity, understanding, and problem solving (Resbiantoro, 2016).

The aspect of the professional competence of the teacher is also necessary because the quality of teaching is very significant to improve the quality of students' knowledge (Olfos, Goldrine, & Estrella, 2014; Kuhn, Alonzo, & Zlatkin-Troitschanskaia, 2016). Teaching quality of teachers realized from the planning done by themselves (Ariyati, 2018). Because the design of teaching programs has an impact on the success of teaching. The scheme of teaching principles must be prepared based on the learning objectives. Therefore, pre-service teachers must have the ability and understanding of teaching (pedagogy) as well as knowledge of the material and strategies in teaching the material. (Anwar, Rustaman, Widodo, & Redjeki, 2014).

The teacher's understanding and knowledge of the material and how to teach is the foundation of quality teaching. Therefore teachers and prospective teachers must be able to analyze curriculum demands through the achievement of competencies of a subject matter, delivery of material through learning models or strategies, media/tools for learning, and mastering the level of depth of the material to be taught. The achievement of quality teaching that can be used by teachers is Pedagogical Content Knowledge (PCK). Pedagogical Content Knowledge (PCK) as the knowledge that can help students to understand the subject matter to the maximum. This means that the causes of student learning difficulties regarding the subject matter can be done with PCK (Ward & Ayvazo, 2016). Because the students' learning

difficulties can be overcome by analyzing the scope of preconception and conception of the students through the formulation of the material so as to provide a comprehensive understanding of the material that is considered difficult (Anwar et al., 2014).

Most pre-service teachers in Indonesia taught by specialized institutions, namely the institution of educators and Personnel (LPTK). Each education study program provides teaching materials in accordance with their respective fields of study and knowledge about teaching (pedagogical knowledge) that is presented in a balanced manner. Biology Education Study Program in Universitas Kristen Satya Wacana, is one of the study programs that have a focus on strengthening PCK teacher candidates. Pre-service teachers are equipped with pedagogical knowledge as well as a strengthening of biology materials in high school level. Presentation of pedagogy and biological content is presented on an ongoing basis in each semester. Based on preliminary studies that have conducted, many of the pre-service teachers are still weak categories in the preparation of lesson plans. The pre-service teacher still has difficulty in linking learning strategies with the context of biological material. Besides, determining learning objectives to adjust the scenarios for learning becomes difficult for a pre-service teacher in designing lesson plans.

METHOD

This type of research is a qualitative descriptive through observing phenomena and a process of work steps. The method used is a survey so that the data obtained are natural or without any treatment.

The subjects of this study were the student of 2015 class year, Biology Education Study Program year 2018/2019 with 3 male students and 7 female students. The sampling technique uses the saturated sample method by using all students as participants. The research instrument used was a rubric sheet which describes the teaching skills of pre-service teachers, a rubric use for the implementation of the lesson plan, and a rubric on the assessment of

teaching practice. The data used for the analysis are the results obtained from the rubric of teaching prospective teacher's teaching skills and the rubric of the lesson plan. Sources of data in this study were students as research subjects. The data analysis technique used is the concept of interactive data analysis according to Miles and Huberman's theory, namely data collection, data reduction, data presentation, and verification.

The data which analyzed in this study were the teaching skills of pre-service teacher students in the PPL 1 (microteaching) course. The indicators for the design of lesson plans and the implementation of teaching practices are described as table 1 and 2.

Table 1. PCK Indicator

Aspects	Indicator
Skills to open lessons	Attract the attention of students Give a reference to students Motivate learning skills to open lessons
Giving question and answer skills	Provide references / hints for questions Provide guided questions Give a turn / spread of questions
Skills in mastering and explaining the material	The breadth and depth of the material Present oral information delivered systematically The ability to develop material
Skills for using instructional media	Suitability of the media with the subject matter The suitability of the media with the competencies achieved
Skills for using methods/approaches and learning strategies	Use methods and strategies relevant to learning material. Perform a variety of methods
Class management skills	Creating an optimal, safe and conducive learning atmosphere Manage learning variations
Ability to close the lesson	Strengthen student retention Conclude and evaluate learning Conduct assessment and reflection

Tabel 2. Criteria and Score Interpretation

Range	Category
≤ 20%	Very poor
> 21% - ≤ 40%	Poor
> 41% - ≤ 60%	Adequate
> 61% - ≤ 80%	Good
≥ 81%	Very good

RESULT AND DISCUSSION

Data acquisition on the ability of Pedagogical Content Knowledge (PCK) includes teaching

practices and preparation of lesson plans by pre-service biology teacher student. The ability of PCK is measured by Content Knowledge, Pedagogical Knowledge, and Pedagogical Content Knowledge. Biology teacher candidates are the subjects studied in the Academic Year 2017/2018 as number 10 students in a microteaching course.

Table 3. Capabilities Content Knowledge of pre-service teacher based on Learning Practices

Aspect	Indicator	Category
The ability to open lessons	82%	Very good
Ability to explain material	78%	Good
Ability to close the lesson	80%	Good
Average	80%	Good

Through the explanation of the material carried out by pre-service teacher, it can be seen that it can already explain the material following the learning objectives. The concepts conveyed are easy to understand. Students also seem to overcome and understand the material described in the teaching process. Pre-service teacher have also tried to link the material with the application in daily life at the end of the explanation session. This is in accordance with the demands contained in Regulation of the Ministry of Research and Technology No. 35 of 2017 which states that each graduate must hold competencies in the field of science or expertise including mastery of the subject matter being taught, development of instructional media, understanding, and implementation of the teaching process (pedagogy).

The implementation of CK is designed so that prospective teacher students can understand the material in depth by curriculum demands. So that the material content can be conveyed properly, then it needs to be supported by the selection of media that is following the content. The result of study from Arham & Dwiningsih (2016) stated that the use of learning media elements in the form of videos, images, and animations can help students in obtaining more comprehensive of information to improve the performance of their memory of the brain in remembering the content of the lesson.

Pedagogical Content Knowledge (PCK) Ability of Pre-Service Biology Teachers

Pedagogical Knowledge Ability is the management of teaching carried out by teachers as

teaching through planning, implementation, reflection and evaluation processes. PK ability of prospective biology teacher candidates measured was questioning and answering skills, learning media usage skills, model using skills, method, learning strategies, and classroom management skills

Table 4. Pedagogical Knowledge Ability of Pre-Service Teachers based on Learning Practices

Aspect	Indicator	Category
Giving question and answer skills	73%	Good
Skills in using the media pembelajaran	79%	Good
Skills using models, method, and strategy pembelajaran	78%	Good
Class management skills	75%	Good
Average	76%	Good

The selection of models, methods and learning strategies by the pre-service teacher is good. This can be seen from the accuracy of the pre-service teacher in choosing models, methods and learning strategies with the material to be taught. Prospective teacher students have tried to adjust the learning model with aspects of competence, the background of students being taught, and the extent and depth of teaching material. Besides, prospective teacher students have also been able to implement learning models under the steps of learning optimally. Lestari (2013) explained the accuracy of the selection of methods, approaches and learning models aimed at creating a learning atmosphere and learning process so that students achieve basic competencies and indicators that have been set. This statement is supported by Prihatini (2014) stated that the learning method has a role as one of the espousal and supporters of the effectiveness of the learning process, the use of learning methods can facilitate students in learning so that students are expected to get good learning outcomes.

The way for teachers to relate the material to be relevant to students is to make examples that can be easily identified by students. The interpretation process carried out by students will provide attraction to students so students can associate the material learned with experiences gained in

everyday life (Hartmann et al., 2018). Mastery of pre-service teacher in pedagogical competencies has led to the principles of educative learning. Pedagogical competencies include curriculum development and student potential, ways of communication teacher to student and mastery of theories in learning principles (Prabu & Puspitasari, 2015).

Table 5. Pedagogical Content Knowledge Ability based on Learning Practices

Aspect	Achievement (%)	Category
Introduction activities	75%	Good
Main activities	77%	Good
Closing activities	83%	Very good
Average	78%	Good

Ability of pre-service Biology Teachers about PCK

Based on the results in Table 5. illustrate the ability of the pre-service teacher to practice PCK. The average ability of prospective teacher students in all aspects of getting a good category. This means that pre-service teacher has been able to practice PCK optimally. Overall learning steps have been implemented optimally following the specified assessment indicators. Besides that the process of delivering the concept of material is very clear, practicing students have been able to design connections between the material and learning activities. In the learning process, teacher candidates are also able to manage students in groups, guide small groups, and build interaction in groups. At the end of the lesson, practicing students have also tried to link the application of concepts to the daily life experienced by students. This effort was made to stimulate students' curiosity and activeness in learning.

If reviewed from the ability of prospective teacher have delivered the material in a systematic and orderly manner so that it is easy to understand. This is very helpful for students in understanding biological concepts. The pre-service teacher has also tried to package material in the form of games. The aim is to establish student cooperation in groups and apply concepts in the form of game

activities. This condition creates students' enthusiasm in learning, especially interactions in groups. Presentation of material oriented to activities and demonstrations shows that biology is not just rote learning but requires an understanding of the concepts of the material being studied. Support from the use of learning media is one factor that can provide a more varied approach to students. The pre-service teacher students have taken the initiative to use information technology-based media such as animation and video media in presenting abstract characters. The selection of appropriate learning media is inseparable from the understanding of the pre-service teacher students of the material being taught. The use of instructional media will provide convenience for teachers in presenting material that requires authentic aspects of visualization and objects. The use of instructional media provides an important role in assisting teachers in stimulating student learning. Students become easier to understand the material. Student involvement through interactive media will provide experiences as well as meaningful learning.

PCK has a focus on the relationship between mastery of knowledge, pedagogical knowledge and subject matter being one of the processes in teaching (Cochran, DeRuiter, & King, 1993).

Tabel 6. Pedagogical Content Knowledge Ability based on Implementation of Lesson Plan

Aspect	Achievement (%)	Category
Opening activities	78%	Good
Core activities	79%	Good
Closing activities	85%	Very good
Rata-rata	81%	Very good

Based on Table 6, the acquisition of PCK for pre-service teachers is included in the excellent category at 81%. This is supported by the results obtained on the indicator of opening activities 78% (good), core activities 79% (good), closing activities ability 85% (very good).

Based on the results of the assessment from the design of the lesson plan by pre-service teacher shows that pre-service teacher has been able to design the lesson plan following the components of the preparation of the lesson plan. But sometimes

still found the design of the apperception who still do not match the specified conformity learning indicators. Lack of comprehensive understanding triggers difficulties faced by teacher candidates to be able to connect apperception activities with the main material to be studied. Furthermore, students also still have a weakness in associating apperception with the material being studied. This happens because some pre-service biology teachers who have not been able to condition their students to begin teaching, sometimes forget to convey learning goals. Though preparing students is very important to do at the beginning of learning. The importance of apperception is the teacher's attempt to cultivate the concept or initial definition before explaining the material in depth (Majid, 2013). Submission of learning objectives is important because it becomes the teacher's reference in the process of achieving student competence. In addition, the learning objectives become a benchmark for the learning process to evaluate students, and the results become a picture of students' ability to understand the material.



Figure 1. Comparison of PCK pre-service teacher based on planning and implementation

Even the importance of the cooperation of teachers and students in providing conceptions between teachers and students regarding the knowledge to be obtained. This means that the teacher needs to diagnose the student's prior understanding so that the teacher can link the knowledge to be learned through the problem solving process. Thus, the teacher can anticipate all potential misconceptions and student learning difficulties regarding a subject matter (Krauss,

Baumert, & Blum, 2008). Efforts in building knowledge for students through the learning process are the foundation to provide opportunities for students to build their own knowledge and realize that each student has ideas that can be constructed through the reorganization of the knowledge possessed by students (Top, Schoonraad, & Otero, 2018).

The findings in this study indicate that the weakness felt by prospective biology teachers is the depth of biological knowledge to be mastered orally. They need a long preparation to learn the material to be taught so that they can think the type of model or learning strategy that is following the material. Even though the presentation of the lesson plans have been well prepared (table 4), pre-service biology teacher also needs small notes to help them in explaining the material. The level of an arrangement affects teaching performance in explaining the material, guiding students, giving variety, and feedback to students (Csíkós, Kovács, & Kereszty, 2018).

The knowledge that comes from the teacher has a role in building the skills, knowledge, and character of the students being taught. Also, the knowledge that is applied through action will provide wisdom for students through examples of behavior given by the teacher. Therefore, teacher knowledge is holistic, not only on knowledge based on subject matter but also on the teacher's daily behavior into lessons for students (Rohaan, Taconis, & Jochems, 2010). The pedagogical and professional abilities of teachers are very important to be developed because they can affect the performance of teachers in teaching so that the way teachers teach can be directly felt by students. Teacher performance must be trained and related to commitment, integrity, morale and work loyalty (Hairunisya, 2018). Therefore, the commitment of teacher candidates is also trained to form ideal teacher competencies.

CONCLUSION

Based on the results of research and discussion on the analysis of pedagogical content knowledge skills of pre-service biology teachers in

the Biology Education Study Program at Satya Wacana Christian University, it was concluded that the PCK abilities of prospective biology teachers have good categories based on the results of observations of the implementation of learning and the design of learning plans. The results of the lesson plan and implementation of PCK obtained become profiles of pre-service teachers in their teaching practice. Although the design of lesson plans by prospective biology teachers is lower than teaching practice, based on the assessment of the lesson plan, its get good results. This means that pre-service teacher has an understanding of designing lesson plans and connecting to prepare their self for practicing, but the process of writing lesson plans is not done in detail.

The results of this study can be used as reference material as well as consideration for the management and development of the ability of biology teachers to improve the competencies of pre-service teachers through the implementation of teaching practices especially in the aspects of Pedagogical Content Knowledge (PCK).

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