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# Understanding of Pre-Service Biology Teachers Students Toward Pedagogical Content Knowledge (PCK)

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**Abstract.** The Research Objective is to know understanding pre-service biology teachers students toward Pedagogical Content Knowledge (PCK) and to know teachers and lecturers responses to PCK of the pre-service biology teachers students on Field Practice. The research used qualitative approach with case study method. Research subjects were 40 students in semester VII at Department of Biology Education at a College in Cirebon. Techniques of collecting data used were interviews, observation, quisionare and documentation. Data analysis technique used was qualitative descriptive. The results showed that of the seven dimensions of PCK, four dimensions had been mastered by the pre-service biology teachers. Three dimensions of PCK that could not be mastered and understood. Supervising teachers and lecturers in the Field Practice responded positively to PCK of the pre-service biology teachers students. The conclusion of this research is that the understanding of PCK by pre-service biology teachers students is good, but the students still need to be equipped and trained to develop PCK component, the teachers and supervising lecturers provided positive and excellent responses to the basic teaching skills and PCK of the pre-service teachers students when they were conducting field practice activities.

## 1. Introduction

In 21st century learning, professional educators are the main factor to improve the quality of human resources. Teachers as professionals have a key role to increase the knowledge, skills and attitudes of learners so that later they can be useful for the nation and state. Teachers are the main pillars to realize the goal of educating the nation and achieving quality education. Teachers are also expected to be able to implement the four learning pillars advocated by UNESCO, namely learning to know, learning to do, learning to be, and learning to live together. Based on the four pillars a teacher is demanded to be creative, diligent, and able to increase his/her knowledge.

Given the importance of teachers role in the learning process, provides science teacher preparation standards covering 3 levels, namely pre-service levels, novice teachers and professional teachers[1]. Competence that must be owned by an educator includes four competencies namely professional, pedagogic, social, and personality competence stipulated in the Government Regulation no.19 of 2005 on National Education Standards. The four competencies are clarified in Law no. 14 of 2005 on Teachers and Lecturers. The existence of Education Ministers Regulation No. 16 of 2007 affirms that science teachers must have complex academic requirements, and the Minister of Administrative and



Beurocratic Reforms Regulation No. 16 of 2009 as a whole contains a spirit that aims to improve the competence and professionalism of teachers which will further make teachers as professionals governed by the standard rules of profession. And in the end one of the programs that will produce professional teachers is the undergraduate program (S1) that is held at various teacher training institutes (LPTK) in Indonesia.

## 2. Method

This research uses qualitative approach with case study method. The place of research was conducted in the Department of Biology Education at one of the universities in Cirebon. The subject of the research was the pre-service biology teachers students at semester VII who were doing the Field Practice in Senior High Schools in Cirebon totalling 40 pre-service teacher. The sampling technique used random sampling. Data collection techniques in this research used interviews, observation, quisionare and documentation. The research instruments consist of interview guides, observation sheets to observe PCK of pre-service biology teachers tudents and quisionare with open ended question to find out teachers and supervisors response.

There are seven categories of basic knowledge on dimension of PCK that must be mastered by a teacher, they are knowledge of: (1) content; (2) pedagogical content; (3) the characteristics of the students (Knowledge of Learners); (4) General pedagogical knowledge; (5) general education (Knowledge of Educational Context); (6) curriculum (Curriculum Knowledge); and (7) educational goals (Knowledge of Educational purposes and values)[8].

After all data were collected then checking the validity of the data with triangulation technique was done. The researcher validated the data obtained through participants observation and then followed by interviewing them. If the first and second data were the same, then the two data was said to be valid and reliable, so it could be used as a tool for obtaining data on Pedagogical Content Knowledge (PCK).

Data analysis in this research is done by using analysis technique model which include activity in data analysis i.e [9]. Data validity is done by the following technique: Credibility; a) Triangulation, b) Discussion with colleagues (peer debriefing). c) Utilization of reference materials, d) Conduct member check; Transferability; a) Dependability and Confirmability, b) Comprehensive recording and note-taking of the results of interviews, observations, and documentation studies as raw data for further use. c) Preparing the results of the analysis by preparing the raw data then summarizing or rearranging it in a systematic description, d) Giving the attachment or conclusion as the result of data synthesis.

## 3. Result and Discussion

Based on the result of interview and observation about pre-service teachers students understanding toward PCK, it can be described as follows: PCK consists of two components of knowledge, namely PK (pedagogical knowledge) and CK (Content Knowledge). This indicates that pedagogy needs to be linked and tailored to the characteristics of the content. One of the important competencies associated with PCK is understanding of various learning approaches for different materials with different characteristics. This is seen from the results of Lesson Planning and assessment of learning simulation as a form of lesson planning implementation.

The students understanding of PK is limited to understanding of lesson planning and its implementation, and the ability to evaluate learning outcomes. The results of observations and interviews on students showed that in general, students understanding of pedagogical knowledge (PK) was quite good, although some were still experiencing difficulties. The mastery of PK especially the mastery of learning strategy becomes an important part, more especially the mastery of instructional strategy that emphasizes the students activeness in digging for knowledge independently and still considers the characteristics of students. Table 1 shows result description of Pedagogical Knowledge (PK).

**Table 1.** Pedagogical Knowledge (PK)

No.	Criteria	Description
1	Pedagogical Knowledge student in carry out teaching practice	<p>1.1 80% of students understand well the differences of facts, concepts, principles, theories and laws and their examples on biological materials;</p> <p>1.2 60% of pre-service teachers still have difficulties in applying the understanding of facts, concepts, principles, laws when analyzing biological materials Student prospective teachers still have difficulty determining the depth of material based on selected basic competence.</p> <p>1.3 This can be seen from 75% of the students who choose the material that is too broad so that no focus because too many concepts are presented.</p>
2	Student pre-service teachers still difficulty in determining the breadth and depth of the material according to the characteristics of education level and competency demands according to the curriculum,	<p>2.1 70% of students have been able to compile and package learning materials into interesting material to be studied either in the form of student worksheets, learning cards, discussion sheets, word square,</p> <p>2.2 60% of the students are still difficult in relating the material taught to everyday life so that the material that should be more contextual but very theoretical in teaching it.</p>

Pedagogical Competence is important to be instilled in pre-service biology teachers in order to prepare and equip them to better manage the learning process. A systematic effort is required to develop the skills of teachers in managing learning well, designing learning activities, and carrying out the evaluation. And improvement of learning can be done through various training and workshops for teachers and preparing the pre-service teachers in managing learning. Providing pre-service teachers with the needed skills is expected to overcome various problems in the world of education related to the skills of managing learning.

Pedagogical Knowledge (PK) deals with ways and processes of teaching that include knowledge of classroom management, task, planning and implementation of learning[10]. PK in Education Ministers Regulation No. 16 of 2007 on teachers Standards of Academic Qualification and Competencies called pedagogical competence is the ability of teachers to manage learning that consists of understanding of the students, planning, implementation and evaluation of learning outcomes. The ability to communicate pre service teachers during teaching practice is quite good and also interactive. Although there are still a few pre service teachers who are still consultants when delivering materials according to what is written in the lesson plan. Table 2 shows result description of Content Knowledge (CK).

**Table 2.** Content Knowledge (CK)

No.	Criteria	Description
1	Content Knowledge (CK) is based Lesson plan	<p>1.1 80% of students have been able to carry out the teaching practice in school well, although there are some pre-service teacher who are still not suitable to implement the lesson with the lesson plan that is made due to time constraints. In the implementation of teaching practice,</p> <p>1.2 About 20% of students who are proficient using information technology facilities, such as the Internet in implementing learning.</p>

In addition to understanding of the PK, the next is the understanding of Content Knowledge (CK) which is understanding about the subject matter that must be mastered at the time of teaching. Pre-service biology teachers understanding of CK was obtained from the results of material analysis in the scenario and the **results** of material observation at the time of learning process. The analysis is conducted on the correctness of the subject matter and its suitability with the level and the demands of competence in the curriculum. Based on the results of the analysis we obtained a summary of the preservice teachers CK based on the learning scenarios developed.

Pre-service understanding of PCK was obtained from the analyzed lesson plans they developed and analysis of learning simulation. Based on the analysis of learning scenarios it is known that in the scenario developed, 65% of students still had difficulty in adjusting the material with the chosen approach and instead determine the approach / model / strategy / method for the material that had been determined. That the difficulty often experienced by prospective teachers is to integrate PK with CK. Some studies show that pre service teachers are often very lacking in conceptual understanding of the content to be taught. Pre service teachers often understand the subject matter in isolation and unorganized so that they have difficulties to access the knowledge when they will teach it.

Content Knowledge (CK) is knowledge of concepts, theories, ideas, frameworks, knowledge of evidence, and the practices and approaches to develop the knowledge[11]. PK in Minister of Education Regulation Number 16 years 2007 regarding Teachers Standard Academic Qualification and Competency is defined as professional competence which is wide and deep mastery of learning material covering subject curriculum in schools and scientific substance that overshadow the material and mastery of its structure and methodology. In this study, students CK mastery was obtained from the analysis of the material in the lesson plans and discussion sheets given before the learning process and the results of the material observation at the time of learning process in the classroom. The analysis is conducted on the correctness of the subject matter and its suitability with the level and the demands of competence in the curriculum. Based on the results of the analysis we obtained summary of the pre-service biology teachers Content Knowledge.

Knowledge of pre-service biology teacher students on the characteristics of learners in an effort to assist the learning process which includes the physical, intellectual, social, emotional and socio-cultural background so far has not been developed well. It was due to the limitations of the prospective teacher to practice it. The limitations were: time which was only two months, the number of learners in one class was big enough, then the lack of knowledge of pre-service teachers on how to identify the characteristics of learners, so that the relationship of teachers with students covering aspects of social, intellectual, emotional, moral and socio-cultural background had not been well established. Learning activities will be more meaningful if the teacher knows the advantages and weaknesses of each learner in his/her class.

Pre-service biology teachers students knew and understood about the material to be conveyed to the learners. Based on the research it could be seen that when pre- service biology teachers were going to carry out teaching activities in the classroom they did not do analysis and mapping of teaching materials based on the level of difficulty, both when designing the materials and when doing reflection of teaching materials after learning activities was over through the identification of learning difficulties experienced by learners, but in terms of setting different approaches, and learning techniques they had applied them well through a learning that educated creatively based on the experience of teaching they had.

Pre-service biology teachers students were not sufficiently competent in preparing syllabus, lesson plans and compiling learning materials that were in accordance with the needs of learners. From the results of observation and documentation obtained the syllabus and lesson plans used were still much of the results of adoption and revision to meet the obligations of completing the learning tools before the learning activities were conducted. A teacher should consider that the curriculum as a learning program should be given to learners not as a dead item, so that what is contained in the curriculum can be described by the teacher into an interesting material and to be presented to learners during the learning process[12].

Pre-service biology teachers students already knew and able to design and implement a good learning strategy with a learning that educate according to the needs of learners, able to compose and use various learning materials and learning resources in accordance with the characteristics of learners, able to utilize information communication technology for the benefit of learning so that learners were more motivated in every learning activity. However, based on observations in the schools, IT was unable to be used at maximum level because of limited facilities and infrastructure.

Pre-service biology teachers students had not been able to analyze the learning potential of each learner and identify their interests, talents and potentials, so that they still had difficulty in designing and developing learning activities that can increase interest, talent, and potential of learners, which is expected to generate power creativity and critical thinking skills of learners. States that talent and human ability (potential) is not something that has been standard on a certain form (not fixed ability), but the ability of the nature to continue developing (developing ability). It is the role of the teachers to be able to develop the potential of the learners. Often talent is paired with intelligence. They are related but they are different, the talent is obtained from the potential that is within oneself, while intelligence can be obtained from perseverance in learning something.

Pre-service biology teachers students knowledge in communicating with students had been very good. They had been able to communicate effectively, courteous and had positive attitude in responding to any question that arose from learners. From the results of field observations made when prospective teachers were interacting with the students in the learning process at class the questions asked were then responded by the pre-service biology teachers students. This made the learners satisfied. Prospective teachers also responded to questions from students with complete and relevant answers.

Knowledge of pre-service biology teachers students in the assessment and evaluation was quite good. Pre-service biology teachers students had been able to conduct assessments and evaluation and had been able to evaluate the effectiveness of the process and learning outcomes, and use analysis of the results of assessment and evaluation as a consideration for further learning activities[13]. However no data / documents of assessment result analysis were found which should have been used as a reference in giving remedial and enrichment and improvement in the next learning process.

As a whole the pre-service biology teachers had a good understanding of PCK. From the seven dimensions of PCK, there were four dimensions that had been mastered by pre-service biology teachers, namely knowledge of learning strategies, knowledge of learning materials and educative learning, knowledge of communication with learners, and knowledge of assessment and evaluation. These four dimensions that had been mastered by the pre-service teacher are a fundamental knowledge that must be mastered by a teacher. Three dimensions of the study on the pre-service biology teachers student PCK that could not be mastered and understood were knowledge of learners and



characteristics, knowledge of curriculum development, and knowledge of developing learners potential. Based on the results of this study, these three dimensions had not been mastered because of the limited knowledge and skills of pre-service biology teachers to implement them, and the number of students in the schools at an average of 40 people per class was too big, and teaching practice time was only two months.

Based on the results of interviews with teachers and lecturers of pre-service teachers who were carrying out Field Practice activities, we obtained information that the teachers at the schools and supervising lecturers gave a very positive response to the basic skills of teaching of the pre-service teachers students in the teaching and learning process, and their mastery of PCK was already good. The 10 supervising teachers and lecturers in the Field Practice said that the pre-service biology teachers had been able to apply their content knowledge (CK) and pedagogical knowledge (PK) well, but they still need to be equipped and trained in class management, curriculum understanding and recognizing characteristics and potential of learners so that when they have been posted as a teacher can further develop their competence. Most of the pre-service biology teachers have been able to demonstrate their mastery of the four competencies (pedagogy, professional, social and personality) well during Field Practice activity.

#### 4. Conclusion

Based on the results of research and discussion, it can be concluded as follows: The pre service biology teachers students have a good understanding of PCK. From the seven dimensions of PCK, there are four dimensions that have been mastered by pre-service biology teachers students namely knowledge of learning strategies, knowledge of learning materials and educative learning, knowledge of communication with learners and knowledge of assessment and evaluation. These four dimensions that have been mastered by the pre-service biology teachers student are fundamental knowledge for a teacher. Three dimensions of study on the pre-service biology teachers student PCK that have not been mastered and understood are knowledge of learners and characteristics, knowledge of curriculum development, and knowledge of developing learners potential. The teachers and supervising lecturers provided positive and excellent responses to the basic teaching skills and PCK of the Pre-service biology teachers students when they were conducting Field Practice activities.

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