Profile of pedagogical content knowledge ability of science teacher in learning

S Nurmatin
Departemen Pendidikan Guru Madrasah Ibtidaiyah, STAI Tasikmalaya, Jl. Noenoeng Tisna Saputra No. Tasikmalaya, Indonesia
*suci.nurmatin@gmail.com

Abstract. This study aims to analyze the ability of Pedagogical Content Knowledge (PCK) in implementing learning in the classroom. A number of two students who have become teachers as research subjects. Data on the ability of PCK subjects in carrying out the learning obtained based on observations and video recordings made during the subject to implement learning in the classroom, and then analyze based on pedagogic competence and professional competence in Ministerial Regulation No 16. The result of observation and video shows that the ability of PCK of two subjects who have become good teachers especially in the implementation of learning to ask questions, reasoning and communicate.

1. Introduction
Teacher profession has the main task in educating, teaching, guiding, directing, training, assessing, and evaluating learners at early childhood education formal education, primary education, and secondary education [1]. Based on Government Regulation No. 74 Year 2008, the teacher is a professional educator. The main task of the teacher as a professional educator is seen when a teacher in a lesson. Each lesson shows a unique combination of students, content and pedagogy [2,3]. Learning to teach science is a complex process, where early knowledge and experience evolve into new knowledge [4]. Therefore, the knowledge that science teachers need to have is very complex in addition to having knowledge of science also must have the ability to convey the concept of science to be accepted by learners. The knowledge need to be owned by teacher is divided into three domains.

The domain of knowledge that teachers need to possess consists of three domains: the pedagogic knowledge domain, the knowledge domain of the subject, and the pedagogical content knowledge domain [2,5,6,7]. Among the three domains of teacher knowledge, it was reported that Pedagogical Content Knowledge (PCK) has had a great influence on teacher teaching practices and student learning [6]. PCK needs to be developed because from several studies it was found that PCK served as a center of teacher knowledge gained through practice and teaching experience in the classroom [2]. PCK was first introduced as a core component of basic knowledge for teaching, which emphasized that teaching is not merely a knowledge of delivering the subject matter, but teaching is the knowledge of how to deliver the subject matter to be accepted by learners [5,4,8]. PCK became the focus of science educators in investigating the profile and improvement of science teachers [9].

Ability of PCK science teacher highlighted in this study are in accordance with the teacher's competency standards established by the government. The teacher competency standard that has been established by the government in Ministerial Regulation No.16 of 2007 [10] consists of four competencies namely, pedagogic competence, personality competence, social competence, and
professional competence. In this study only focused on two competencies namely pedagogic competence and professional competence. The pedagogic competencies that a subject teacher needs to possess include mastering the characteristics of learners, organizing educational lessons, implementing learning, assessing learning processes and outcomes, and continuously improving. Professional competence in question is the ability of teachers in mastering the knowledge of science, technology, and art and culture. Thus, the ability of PCK is a combination of pedagogical competence and professional competence of teachers. The achievement or lack of pedagogical competence and professional competence will be seen when reflection after learning. Through this reflection is expected to increase the quality of continuous learning in accordance with the principle of continuous quality improvement [11]. Thus the ability of teachers to reflect on learning is part of the ability of PCK that need to be owned by the teacher.

Thus, based on some of these reasons it is necessary to do research that captures the ability of PCK teachers while implementing learning in the classroom. The purpose of this study is to analyze the ability of PCK teachers in implementing learning in the classroom.

2. Method
Two schools serve as research sites. One school is in Purwakarta and one school is in Bandung. Consideration of the two schools as a place of study are the two subjects who have teaching experience in the same time teaching in the school. Both teachers who serve as the subject is a graduate student of science education. Furthermore, the research subjects in this study were named as participants. The research method used is qualitative i.e. research without providing treatment in its implementation [12]. Qualitative research methods used in this study to describe the ability of participants in implementing learning in the classroom. Prior to data collection, a curriculum study should be conducted to find out the curriculum used in the school to be used as a research site. After the curriculum study, the researcher participated in the activity of teaching participants in the class to observe the ability of participating PCK in implementing the learning in accordance with the competence referred to in the Ministerial Regulation No. 16 of 2007 [10].

3. Result and Discussion
The ability of a teacher's PCK will be visible when the teacher carries out the learning in the classroom. Implementation of good learning will be seen by carrying out reflections on the learning that has been implemented. Learning reflection is based on the indicators contained in pedagogical competence and professional competence in Ministerial Regulation No. 16 of 2007 [10]. Results of reflection on the pedagogic competencies of the two participants are shown in table 1.

Table 1. Analyzed reflection learning on pedagogic competence

| No | Aspect Analyzed                                                                 | Reflection Result                                                                 |
|----|---------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| 1. | Mastering the characteristics of learners from the physical, social, cultural,   | Mastery of the characteristics of learners is still lacking, This is seen when    |
|    | emotional, and intellectual aspects.                                             | the stimulation. Teachers' attention at the time of stimulation is concentrated   |
|    |                                                                                 | in only one less comprehensive place.                                            |
| 2. | Mastering learning theories and learning principles that educate.                | The sequence of learning activities is in accordance with the RPP starting from   |
|    |                                                                                 | the introduction, core, and closing.                                             |
| 3. | Develop a curriculum related to the field of developed development.              | Curriculum development is lacking. This is evident from the absence of KD 1.1,    |
|    |                                                                                 | KD 2.1 and KD 2.2 in the learning activities.                                    |
Table 1. Cont.

|   | Organizing educational development activities. | Learning activities have been seen to develop educational activities. This is seen when students learn in groups, they work together to achieve the same goals so that with group activities they can be responsible and respect each other. | Students learn not individually in groups. And the interaction between students with textbooks is still lacking, because all the learning materials already provided by teachers in the media power point. So that development activities on the educational process is still lacking. |
|---|---|---|---|
| 4 | Utilizing information and communication technology for the benefit of organizing educational development activities. | Learning activities have been seen make use of information and communication technology. This is evident from the activities of students when they are asked to fill the LKS, they seek information not only from books but the internet and communication with with peers. The media used for practicum in the form of virtual lab to make students motivated to participate in learning, but not all students centered on the concept of learning objectives | Learning activities look less utilize information and communication technology. This is evident from the media used to describe the form of charts or images of substances in the form of additives and addictive substances that have been provided by the teacher, so less raises the creativity of students in finding information. |
| 5 | Facilitate the development of potential learners to actualize various potentials | Learning activities with experimental activities determine the mechanical advantages and balance requirements of the levers by using virtual lab has been able to actualize the potential of learners. | Facilitating the development of potential students is still lacking. This is seen when: • At the time the teacher's introduction does not provide apperception, the teacher immediately asks the students to open LKS about the concept to be studied. We recommend that teachers provide apperception of the concepts that students have learned related concepts to be studied. • It looks more like teacher-centered learning. In the core activities of learning, the teacher should continue to deliver the material of the students not to be left to seek their own information about additives and addictive substances. Instead, teachers provide a problem about addictive substances and additives and then students in groups solve the problem. In order for the problems can motivate students to try those problems that are close to student life |
| 6 | Communicate effectively, empathically, and well mannered with learners | Communication done by teachers with students already looks effective, empathic, and polite. This is seen when teachers guide students while experimenting using a virtual lab and when the teacher's preliminary activities provide questions related to concepts that motivate students to participate in learning activities. | Communication done by teachers with students already looks effective, empathic, and polite. This is seen when the way the teacher convey from the grammar is good, but lack of motivation to students so that students would participate in learning. |
Table 1. Cont.

| No | Conduct assessment and evaluation of learning processes and outcomes. | The learning activities undertaken have not yet conducted assessment and evaluation of the learning process and outcomes. | The learning activities undertaken have not yet conducted assessment and evaluation of the learning process and outcomes. |
|----|--------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------|
| 7  | The learning activities undertaken have not yet conducted assessment and evaluation of the learning process and outcomes. | The learning activities undertaken have not yet conducted assessment and evaluation of the learning process and outcomes. | The learning activities undertaken have not yet conducted assessment and evaluation of the learning process and outcomes. |
| 8  | Utilizing assessment and evaluation results for learning purposes. | Learning activities have not utilized the results of assessment and evaluation for the interest of learning. | Learning activities have not utilized the results of assessment and evaluation for the interest of learning. |

Table 1 shows that the pedagogical competencies possessed by both subjects are good enough, especially in the aspect of communicating effectively, empathically, and courteously with learners as well as aspects of mastery theory in learning. In the aspect of communicating the two subjects with experience teaching for one year already can communicate well to the learners. With good communication competence, it means that both subjects can already apply their pedagogical knowledge in classroom learning. It is in line with opinion Balqis [13] which states that the interaction or reciprocal relationship between teachers and students is a key requirement for teaching and learning process. The results of learning reflection analysis on professional competence are shown in table 2.

**Table 2. Analyzed reflection learning on professional competence**

| No | Aspect Analyzed | Subject A | Reflection Result | Subject B | Reflection Result |
|----|----------------|-----------|-------------------|-----------|-------------------|
| 1  | Mastering the materials, structure, concepts and patterns of science that support the subjects. | Mastery of teacher material is good. This is evident when teachers convey concepts related to their lives. | Mastery of teacher material is good. This is evident when teachers convey concepts related to student life. |
| 2  | Master the core competencies and basic competencies of the subjects. | For core competencies and basic competencies 3 and 4 have been seen to master but for the mastery of KI and KD 1 and 2 are still not seen. However, Questions posed by students have not spread to C5 because in this learning indicator only up to C3. | For core competencies and basic competencies 3 and 4 have been seen to master but for the mastery of KI and KD 1 and 2 are still not seen. However, Questions posed by students have not spread to C5 because in this learning indicator only up to C3. |
| 3  | Develop creatively-taught learning materials. | Developing creatively-taught learning materials is good enough. This is seen when students enthusiastically pay attention to the teacher at apperception because the questions raised by the teacher during apperspsi is a contextual activity. Activities close to everyday life. | Developing learning materials that are creatively handled well enough that is by connecting the concepts to be learned with everyday life. |

Table 2 shows that the professional competence of both subjects is good. The results show that both the pedagogical competence and the professional competence of both subjects are well developed proving that with one year of teaching experience the ability of both subjects developed. The results are consistent with research [2,14,15] statement which states that expertise teacher’s PCK will evolve with increasing teaching experience.
4. Conclusion
The results of the reflection of the learning activities of both subjects in general show the ability of PCK when delivering the subject matter is good enough. Seen from the activities undertaken by students during the learning activities. Practical activities using virtual labs and observations on food packaging are good enough.

Acknowledgments
The authors wish to thank the two teacher who have been willing to be the subject of research.

References
[1] Pemerintah Republik Indonesia 2008 Peraturan Pemerintah Republik Indonesia Nomor 74 Tahun 2008 Tentang Guru (Jakarta: Departemen Pemerintahan Republik Indonesia)
[2] Seung E, Bryan L A, and Haugan P M 2012 Examining Physics Graduate Teaching Assisstants’ Pedagogical Content Knowledge for Teaching a New Physics Curriculum Journal Science Teacher Education 23: 451-479 DOI 10.1007/s 10972-012-9279-9
[3] Hume A, and Berry A 2011 Constructing CoRes – a Strategy for Building PCK in Pre-service Science Teacher Education Research Science Education 41: 341-355. DOI 10.1007/s11165-010-9168
[4] Brown P, Friedrichsen P, and Abell S 2013 The Development of Prospective Secondary Biology Teachers PCK Journal Science Teacher Education 24: 133-135.
[5] Gess-Newsome J, Taylor J A, Carlson J, Gardner A L, Wilson C D, and Stuhlsatz M A M 2017 Teacher Pedagogical Content Knowledge, Practice, And Student Achievement IJSE (0), 1 20. https://doi.org/10.1080/09500693.2016.1265158
[6] Kaya O N 2009 The Nature of Relationships among the Components of Pedagogical Content Knowledge of Preservice Science Teachers: ‘Ozone layer depletion’ as an example IJSE 31 (7) 1 May 2009 pp. 961–988 DOI: 10.1080/09500690801911326
[7] Seung E 2012 The Process of Physics Teaching Assisstants Pedagogical Content Knowledge Development International Journal of Science and Mathematics Education 11: 1303-1326
[8] Hanuscin DL 2013 Critical Incidents in the Development of Pedagogical Content Knowledge for Teaching the Nature of Science: A Prospective Elementary Teacher’s Journey Journal Science Teacher Education 24: 933-956. DOI. 10.1007/s10972-013-9341-4
[9] Rustaman N Y and Widodo A (not year) Profile Of Prospective Science Teachers’ Pedagogical Content Knowledgeas Documented From Videotapes And Thesis (Indonesia University of Education)
[10] Menteri Pendidikan Nasional 2007 Peraturan Menteri Pendidikan Nasional Republik Indonesia Nomor 16 Tahun 2007 tentang Standar Kualifikasi Akademik dan Kompetisi Guru (Jakarta: Departemen Pendidikan)
[11] Widodo A 2011 Peningkatan Kemampuan Mengajar Guru-Guru SD Melalui Lesson Study Jurnal ABMAS [online] urnal.upi.edu/abmas/view/870/peningkatan-kemampuan-mengajar guru-guru-sd-melalui-lesson-study.html
[12] Cresswel J W 2012 Educational Research: Planning, Conducting, and Evaluating Quantitative and Qualitative Research (Boston: Pearson)
[13] Balqis P, Usman N, dan Ibrahim S 2014 Kompetensi Pedagogik Guru dalam Meningkatkan Motivasi Belajar Siswa Pada SMPN 3 Ingin Jaya Kabupaten Aceh Besar Jurnal Administrasi Pendidikan Pascasarjana Universitas Syiah Kuala ISSN 2302-0156 pp25-38
[14] Loughran J, Berry A, and Mulhall P 2012 Understanding and Developing Science Teachers’ Pedagogical Content Knowledge (Rotterdam: Sense Publishers)
[15] Driel JHV and Berry A 2012 Teacher Professional Development Focusing in Pedagogical Content Knowledge Educational Researcher, (41) 1 pp 26-28