

PCK analysis of teachers in Biology Learning Process using teaching material based on local wisdom by integrating character education through PBI models

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Abstract. The success of the learning process affects the skills possessed by the teacher such as pedagogic skills, content skills, and knowledge skills. This study aims to determine the PCK owned by teachers and its effects on student learning outcomes. This study uses a qualitative approach with type of descriptive research. The population in this study consisted of 12 teachers and 228 grade X students from 5 high schools in West Aceh. The research sample consisted of 5 teachers and 111 students of class X science. The research instrument used in this study was the PCK observation sheet of the teacher learning process and student learning outcomes tests. Data from observations and results of student learning tests were analyzed using the average value test formula. The results of this study indicate that (1) PCK of teachers is in the bad category totaling two, good enough totaling one, good totaling one, and very good totaling one, and (2) However, when comparing the results of PCK teacher observations with student learning outcomes it is known that the higher the PCK knowledge of the teacher, the higher the student learning outcomes.

1. Introduction

The teacher is an individual who has been equipped with knowledge and skills through a series of processes and a long time. The teacher is in the main position and has an important role in the progress of a nation. Because the increase in human resources in a country is produced through an educational process that involves teachers as the frontline in producing quality resources. In the process of developing quality citizens, teachers have an important role in education reform and science education [1]. To achieve these goals, a teacher must constantly hone his abilities. The success of education reform depends on the quality of teachers [2].

Talking about the quality of teachers is inseparable from the competencies they have. In the learning process a teacher is said to be of quality if he can understand and carry out the learning process according to planning which has an impact on students' curiosity on the material being taught.



So therefore a teacher needs to understand and understand related to how to teach and the material being taught. A teacher needs to have personality, master the subject matter, and master the ways of teaching as his competence [3]. Teacher competence related to understanding teaching methods and teaching materials is referred to as pedagogical content knowledge (PCK).

PCK consists of two teacher's knowledge, namely pedagogical knowledge (PK) and content knowledge (CK). Mastery of the material (content) that is taught by mastering how to teach (pedagogy) are two inseparable things[4]. PCK is an important and critical element in determining the success of teachers in handling teaching and learning processes and subsequently producing effective teaching [5]. Teachers can be called professional in implementing the teaching and learning process if they understand PK and CK. Teachers who understand PK and CK will have an impact on improving the quality of education. Teacher's knowledge of PCK can stimulate student understanding better in the learning process [6].

Problems related to PCK are due to the lack of awareness of the teacher of the importance of PCK so that the lack of understanding of the subject matter [7]. Apart from that, the PCK problem that often arises is the discrepancy between the learning model and the reality in the field. PCK is the knowledge of how a teacher combines CK and PK in managing learning so as to improve and achieve students' academic abilities optimally [8]. PCK explains how teachers can transform pedagogical and content knowledge into teaching and learning activities, taking into account the situation and conditions of students. The PCK category includes teaching strategies, students' way of thinking, presenting detailed and appropriate concepts, knowledge of examples, assignments, explanations, knowledge of learning resources, knowledge of curriculum, and learning objectives [9]. PCK identifies the importance of teachers' knowledge of subject matter, teaching experience of the specific topic, knowledge of students' conceptions and learning difficulties, and participation in workshops on teaching [10]

Biology which is part of science plays an active role in increasing human resources to realize human resources that have competitiveness through innovations in the learning process. The innovations outlined in this study are biological teaching materials on biodiversity materials that are integrated with local wisdom and national character values and the use of problem based learning models in the learning process. Related to this research, PCK analysis indicators used are (1) Presentation of material based on local wisdom, (2) Integration of character values in the learning process, (3) mastery of concept materials, and (4) use of models in learning.

2. Method

2.1. Approach and Types of Research

This study uses a qualitative approach to obtain an in-depth overview of teacher PCK in the process of learning activities using biodiversity teaching materials based on local wisdom and character education and the use of PBL models. This type of research is a type of descriptive research, aims to describe systematically, factually and accurately about the facts about teacher pedagogical content knowledge (PCK) in conducting learning activities using biodiversity teaching materials based on local wisdom and character education and the use of PBL models.

2.2. Population and Sample

The population in this study consisted of 12 teachers and 228 grade X students from 5 high schools in West Aceh. The research sample consisted of 5 teachers and 111 students of class X science.

2.3. Instrumen and Data Collection Techniques

The research instrument used in this study was the PCK observation sheet of the teacher learning process (table 1) and student learning outcomes tests. Observation sheet is used when the teacher conducts the learning process in class which is assessed by two observers using an assessment scale of 1 to 4. The learning process carried out by the teacher uses teaching materials on biodiversity based on local wisdom and character values and the use of problem based learning models in the learning

process. The learning achievement test used in this study is a learning achievement test on biodiversity material which is carried out at the end of the learning process. The questions used are multiple choice questions with alternative choices a, b, c, d, and e with a total of 20 questions.

Table 1. Indicators and Grid of Teacher PCK Observation Sheet in using teaching materials based on local wisdom and character values and the use of PBL models

Indicator	Observation Grid
Presentation of the learning process	Explain the purpose of learning
	Explain the importance of understanding biodiversity material
	Directing students' knowledge of the concept of biodiversity
	Directing students to think about the concept of biodiversity.
	Provide motivation to students so that the emergence of reciprocity in learning activities
	Encourage students to do or do things better even though the problems faced are more difficult
	The effectiveness of time allocation
Presentation of material based on local wisdom	Give examples of the concept of biodiversity based on local wisdom
	Demonstrating or illustrating the concept of biodiversity based on local wisdom
	The suitability of the use of local wisdom with the concept of biodiversity
Integrating character values	Teacher activities in the learning process can provide good examples for students
	Character values that have been set in the learning implementation plan can be integrated
Mastery of Material	Explain biodiversity material systematically (from easy to difficult)
	Select and explain the important components and underlie the concept of biodiversity so that it is easily understood by students
	Explain the concept of biodiversity and relate it to other biological concepts
	Give and explain examples that contain the concept of biodiversity
	Summarize material from various sources into a unified concept that can be understood
	Deliver concepts according to competence
	Delivering material / presenting material systematically (easily difficult, from concrete to abstract) in accordance with the plans that have been prepared.
	Using learning resources that can support student understanding.
Use of learning models	Student orientation to problems (Problems raised by teachers in accordance with teaching material and can be understood well by students)
	Organize students to learn (Teacher guidance can be a positive response from students by marked students understand in formulating the problem proposed)
	Assist in inquiry (The teacher guides students in observing activities / gathering information / carrying out discussions with groups to find solutions to problems)
	Develop and present the work (Teacher guides students to complete an inquiry report)
	Analyze and evaluate the problem solving process (The teacher encourages students to think and / or reflect on their newly discovered knowledge)
	The learning process activities are in accordance with the PBL model

2.4. Data and Data Analysis Techniques

The data in this study were produced from observations of the teacher learning process conducted by the observer and the results of student learning tests. Data from observations and results of student learning tests were analyzed using the average value test formula. The average observations are then converted into words (table 2). While the average value of student learning test results is then compared with the results of PCK teacher observations.

Table 2. Conversion of observational mean values

Score	Conversion
$X \geq 3,25$	Very good
$3,25 > X \geq 2,5$	Good
$2,5 > X \geq 1,75$	Good enough
$2,5 > X \geq 1,75$	Less good

3. Results and Discussion

Overall teachers who are the subjects in this study are teachers who are civil servants with undergraduate qualifications. The overall educational background of teachers comes from educational institutions of educational staff. Teacher PCK observations in the learning process in this study involved two observers. The results of PCK observations of teachers in using biodiversity-based teaching materials based on local wisdom integrated character education through PBL models in the learning process are as follows.

Table 3. Observation results of PCK teachers using teaching materials based on local wisdom integrated character education through the PBL model

No	Indicator	School Code / Score				
		A	B	C	D	E
1	Presentation of the Learning Process	2.36	2.07	2.79	3.43	3.07
2	Mastery of material	2.3	2.13	2.88	3.75	3.06
3	Presentation of material based on local wisdom	2	2	3.17	3.5	3
4	Integrating character values	2.5	2.5	3	3.25	3
5	Use of learning models	2.42	2	2.91	3.42	3
Average value		2.32	2.14	2.95	3.47	3.03
Description		Less good	Less good	Good enough	Very good	Good

From table 3 it is known that the PCK of teachers in the poor category is two, good enough is one, good is one, and very good is one. In presenting the learning process generally teachers still have low knowledge in directing students' knowledge to think about concepts, encouraging students to do or do things better even though the problems they face are more difficult, and the use of time allocations is not effective. So that students can solve a difficult problem in the learning process can be done by guiding and giving maximum attention to all groups and classical explanations so as to make students learn comfortably and understand the forms of subject matter that they convey. Providing assistance from the supervising teacher to students by developing a conducive learning atmosphere and fostering the ability to overcome student learning difficulties to the expected goals [11]. As an alternative teacher to direct or introduce a particular activity, prospective teachers can accelerate the teaching and

learning process so as to save teaching time, and can optimize the teaching aids that are limited because students can use the tools alternately [12].

In the aspect of mastery of the material, teachers generally still have low knowledge in explaining the material systematically, summarizing material from various sources into a unified concept that can be understood, and using learning resources that can support student understanding. The teacher must understand, master and skillfully use the new learning resources in himself [13]. Teachers who have knowledge of the material will know concepts that are difficult for students to understand, misconceptions with students, sources of student errors and know how to prevent mistakes and misconceptions. [14]. Knowledge of subject matter is important because it defines and develops teacher teaching content [15].

In the aspect of presenting material based on local wisdom, generally teachers still have low knowledge in providing examples of concepts based on local wisdom. In the aspect of integrating character values, teachers generally have low knowledge in integrating overall character values that have been formulated in the learning implementation plan and teaching materials. In the aspect of using the learning model, teachers generally have weaknesses in inviting students to the inquiry process and looking for references from various sources. This might be caused by the teacher not getting knowledge about integrating local wisdom and character values in the learning process. PCK knowledge also requires a thorough understanding of the integration process in delivering teaching material [16].

Student learning test results show that students can already understand the material taught by the teacher. This was identified from the students' average scores (table 4) where the whole school received an average grade of more than the minimum completeness criteria set, which was 65. Even though the PCK of teachers in several schools of research subjects is still classified as not good, it does not affect student learning outcomes. This can be caused because certain students have already obtained material through tutoring institutions. However, when comparing the results of PCK teacher observations with student learning outcomes it is known that the higher the PCK knowledge of the teacher, the higher the student learning outcomes.

Table 4. Student Learning Test Results

School Code	Average Student Learning Outcomes
A	79.81
B	77.63
C	80
D	83.75
E	81.25

The teacher has special knowledge about students, learning characteristics, ways of thinking, including about the conceptions owned by students during learning. Teacher's knowledge of the characteristics of students in an effort to help the learning process which includes aspects of physical, intellectual, social, emotional and socio-cultural background. A good teacher should recognize each student in his class individually with all its uniqueness, through careful observation, so they can understand the advantages and disadvantages of each student [17]. The PCK of the teacher can be seen through the teacher's knowledge of how the concepts are given, understood by students and the teaching strategies of prospective teachers in preventing student mistakes. Knowledge of subject matter is not enough to be able to teach effectively, but prospective teachers must also have general knowledge about pedagogical. Pedagogical general knowledge is important for all teachers because it includes general knowledge about teaching, such as classroom management, providing guidance, and questions or feedback strategies [18]. The PCK of the teacher is said to be good if the teacher can

design learning activities for students and build what students do not know and increase the level of difficulty in students [19].

4. Conclusion

PCK of a good teacher will help students understand learning material easily. Teachers need to continuously improve knowledge about PCK and the need for facilitation from the government. The results of this study indicate that the PCK of teachers is in the bad category totaling two, good enough totaling one, good totaling one, and very good totaling one. The higher the PCK of teachers' knowledge, the higher student learning outcomes

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