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Evaluation of Pedagogical Content Knowledge (PCK) in the Readiness of Biology Education Students as Prospective Educators

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ABSTRACT

Knowledge about how to present material so that it is easier to understand is called PCK (Pedagogical Content knowledge). PCK needs to be owned by teaching staff or prospective teaching staff to determine the approach or method used in delivering learning material so that it is more effective and meaningful. Apart from that, PCK is also one of the standards in preparing teaching staff. The aim of this research is to evaluate PCK in the readiness of biology education students to become prospective teaching staff. This research uses descriptive methods and is quantitative research. The research subjects were nine biology education students. Samples were taken using purposive sampling. PCK data is collected using a questionnaire while data on teaching ability is taken through assessment sheets. Data were analyzed descriptively with percentages and categorized based on score interpretation criteria. The results of this research show that PCK is included in the good category with a percentage of 77.72% and basic teaching abilities are also included in the good category with a percentage of 78.92%. Teachers who have good PCK are able to prepare learning optimally. Teaching ability is also the key to the success of the teaching and learning process, because students gain a lot of experience during the learning process. The conclusion from the results of this research is that the overall PCK of biology education students is included in the good category, which proves that they have the preparation to become educators.

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INTRODUCTION

Education develops inside a framework system. Several people claim that the term "system" refers to a collection of components or individual parts that are connected by a loose network of functional relationships that are always working to help achieve a specific goal (Elsheikh, 2023; Juan, 2022; Uno, 2009). A system is a unit of elements that interact

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with each other functionally which obtains input into output (R. S. Dewi, 2018). This means that education is a unity of elements such as students, teaching staff, curriculum, media and other elements which interact with each other based on their respective functions which process input into output (Pertiwi*, et al.*, 2021). So, to carry out a learning process, the presence of these components is definitely required.

Educational activities are governed by educational objectives. Educational objectives serve two purposes: they give all educational activities direction and serve as a common goal for all of them. As a result, those who can advance the teaching profession are needed. (Behling*, et al.*, 2022; Schiering*, et al.*, 2023).

A profession is a job that in carrying out its duties requires or demands expertise, using scientific techniques, high dedication, and including expertise in the field of science (Ali & Ishak, 2019). This expertise is obtained from educational institutions specifically intended for this purpose with an accountable curriculum. The definition of profession comes from Latin, namely "Professio" which has two meanings, including a promise or vow and a job (Astuti, 2019; Xue, 2022). However, if the definition is expanded to mean, a profession can be defined as "any" activity and carried out by "anyone" to earn a living which is done with a certain skill. In a narrow sense, profession means activities that are carried out based on certain skills and at the same time require good implementation of social norms (Welter*, et al.*, 2019; Nilsson & Karlsson, 2019).

Educators are a profession, which means a position that requires special skills and cannot be done by just anyone outside the field of education (Booth*, et al.*, 2021). People who are good at speaking in certain fields cannot yet be called educators (Babaii*, et al.*, 2016). Becoming an educator requires special conditions, especially as a professional person who must truly master the ins and outs of education and teaching with various other knowledge that needs to be fostered and developed through a certain period of education or pre-service education (Busch*, et al.*, 2023; Kulgemeyer*, et al.*, 2020).

The teaching and learning process is an important part of the overall educational process. One of the teacher's tasks is to create a collection of interrelated behaviors that are carried out under certain conditions. They must also be linked to the progress of behaviour change and the development of the students they target. His ability at work can be defined as the ability to achieve the expected goals under the expected conditions (Ikramatul Atiyah, *et al.*, 2016; Sanjani, 2020; Syafriani, *et al.*, 2022). According to Kunandar (2015), in the context of teaching staff, this ability can be described as a qualitative representation of teacher behaviour, which appears to be very important. Therefore, different abilities are needed for each type of work. However, an educator's ability in their work will be demonstrated by their abilities in teach.

Professional teachers must have educational qualifications and this can be obtained at the teacher education level, especially in biology education programs (Asdiqoh, 2019). The knowledge and abilities of college students must be sufficient for them to be future educators, this is necessary so that prospective teachers are ready to teach science and are able to be positive role models for students (Dewi, 2018; Halimah*, et al.*, 2021).

Being a competent teacher requires a lot of preparation. According to Pratama (2020), the ability to mature to a degree of maturity that is conducive to putting something into practice defines readiness. The student's capacity to complete instructional assignments and comprehension of the competencies required of a teacher indicate their readiness to become an educator. Four competencies can be used to determine a person's readiness to become a teacher. Personality, social, professional, and pedagogical competences are the four categories of competencies. Different signs are

associated with each competency, indicating the specific skills that educators need to possess. It is crucial that students comprehend these abilities and work to become proficient in them by continuing their studies and practice as future educators. So, after graduating, students are ready to become teachers.

A teacher with a deep understanding of the subject matter will be able to construct multiple elements of the lesson in working memory and deliver it effectively, taking into account the abilities of the students (Sriani, 2022). According to the needs of both individual students and groups of students, they can structure learning situations using this knowledge (Idris*, et al.*, 2018; Vázquez-Bernal*, et al.*, 2022). You must understand and be able to integrate content knowledge into pedagogical knowledge in addition to having knowledge of the relevant scientific or content field material (Mientus*, et al.*, 2022; Schiering*, et al.*, 2023).

Pedagogical knowledge includes learning planning (choosing a model or method, a learning medium, and a selection of assessment domains), material delivery, student conditioning, and evaluation of learning outcomes (Haka & Rosida, 2020; Muhyidin*, et al.*, 2022; Pertiwi*, et al.*, 2021),. Pedagogical Content Knowledge (PCK) refers to the understanding of how to present information in a way that makes it simple to understand. The concept of pedagogical content knowledge developed as a result of the teaching process, which not only imparts knowledge to students but also allows them to put that knowledge into practise (Chan, 2022; Moh'd*, et al.*, 2021). PCK is a type of content knowledge that teaching staff or prospective teaching staff must comprehend and possess in order to carry out learning as effectively as possible (Chan, 2022; Magnusson*, et al.*, 2023).

Increasing the effectiveness and significance of education, PCK aids teaching staff in choosing the strategy or method for imparting information (Melo*, et al.*, 2020). PCK can be acquired through practice or education. According to Junaid & Baharuddin (2020), PCK competency is an effort to achieve graduate quality in line with the needs of 21st-century education. In addition, PCK is one of the requirements for training teaching staff (Gao*, et al.*, 2021; Poti*, et al.*, 2022). On the other hand, literacy and communication activities must be added to improve pedagogical competence because they are the source of various knowledge and skills (Ebyatiswara*, et al.*, 2023).

Initial observation results indicate that while most students are aware of the stages and components of teaching, they have not yet demonstrated these abilities or learned how to present the material effectively. In light of the description above, the problem formulation for this study is how to assess biology education students' readiness as potential teaching staff in terms of PCK. The purpose of this study is to assess how prepared biology education students are to work as future teachers based on their PCK.

METHOD

Types of research

This is a quantitative study that employs descriptive methods.

Research location and time

This research was carried out at the Department of Biology Education, Faculty of Teacher Training and Knowledge Education, Maros Muslim University, Maros City South Sulawesi Province. Research time on month June until with August 2023 in the even semester year 2022-2023 teachings.

Research Subject

The subjects of this research were 13 students in the seventh semester of the biology education study programme at Muslim Maros University who had taken the microteaching course. Purposive sampling was used to collect

samples because the students had participated in microteaching courses

Research procedure

The data used in the research was collected directly from the source, namely in the form of data obtained from the results of assessing student activities in microteaching learning, the results of assessing student teaching tools, and the results of assessments when students carried out practice in class. This is summarized in the questionnaire used in the research, namely the questionnaire regarding pedagogical content knowledge and the Basic Teaching Skills Questionnaire for Biology Education Students.

Research instrument

The research instrument used was a questionnaire related to statements that support this research, namely pedagogical content knowledge and a questionnaire on the basic teaching ability of biology education students.

Data collection technique

The data collection technique used in this research is practical observation of learning activities during microteaching, assessment of teaching tools prepared by students for learning activities, and student competence in class.

Data analysis technique

Data were analyzed descriptively with percentages and classified using score interpretation criteria obtained from Table 1.

Table 1. Score Interpretation Criteria

Score	Category
≥ 81 %	Very good
61 – 80 %	Good
41 – 60 %	Enough
21 – 40%	Not enough
≤ 20 %	Very less

RESULTS AND DISCUSSION

An assessment sheet about the teaching abilities of the students and a PCK questionnaire were used to gather research data. Following collection, the information is inserted into a questionnaire. Creating a research instrument grid and assembling an instrument in the shape of a questionnaire that will be distributed to students as respondents are the steps that are completed. Subsequently, a percentage-based descriptive analysis was conducted, and the results were categorised using the score interpretation criteria. The research's findings have been examined using two different types of data: information from a questionnaire on students' basic teaching abilities and information about their PCK.

Research that has been conducted regarding student readiness to become teachers is obtained Table 2 displays data from questionnaires related to student PCK.

Based on the data in Table 2, Biology Education students' PCK is classified as good, with an average percentage of 77.72%. Meanwhile, Table 3 shows the basic teaching abilities of students.

Tabel 2. Data on PCK (Pedagogical Content Knowledge) for Biology Education Students

Statement	Percentage (%)	Category
Capable of creating lesson plans based on the material	79,5	Good
Able to choose effective strategies and methods	80,85	Good
Capable of making concepts more understandable	78,50	Good
Capable of creating learning evaluations	75,09	Good
capable of assisting students in understanding the material	75,70	Good
capable of motivating students	79,84	Good
Capable of inviting students to solve learning problems	75,80	Good
Capable of altering students' thought processes so that they easily comprehend the material	76,85	Good

PCK gives higher weight to content elements that are directly relevant to attaining teachability. In order to create the best way to represent and formulate a subject so that it can be understood as a whole (comprehensive), this PCK also includes the best forms used to represent an idea, the best attempts to make analogies, illustrate, explain, and demonstrate (Shulman, 2019). In this study, PCK refers to an understanding of what can be done to help students with conceptions and misunderstandings acquire a particular idea, regardless of how easy or difficult it is.

Tabel 3. Basic Teaching Abilities of Biology Education Students

Aspect	Percentage (%)	Category
Questioning skills	78,50	Good
provide reinforcement Skills	77,09	Good
Skills in carrying out variations	79,41	Good
skills Explaining	80,50	Good
Skills for opening and closing learning	80,80	Good
Skills to guide discussions	77,03	Good
Class management skills	78,20	Good
Teaching skills	79,80	Good

According to the research findings, students' PCK as measured overall shows good results as shown in Table 3. The component of opening and shutting learning skills is of the highest degree when it comes to student teaching activities. In fact, a teacher has to possess these fundamental abilities in order to facilitate effective, efficient, engaging, and joyful learning. According to this study, students were able to pique students' interest in learning because they were adept at starting and stopping lessons and had a lot of excitement for what they were teaching. So that the content is enjoyable and not dry.

The ability to provide reinforcement has the lowest quality. The capacity to respond to student behaviour in teaching and learning activities, or the skill of delivering reinforcement, is needed to motivate students to exhibit more of this positive behaviour. When a teacher compliments a student's behaviour, it motivates them to perform better. Offering reinforcement is straightforward and quick to put into practice, but it's probable that teachers frequently give out prizes or awards to their pupils in an attempt to motivate them to learn because they want to win something. Students' continued ability to offer greater incentives, however, keeps this feature rated as positive.

PCK (Pedagogical Content knowledge) is the relationship between knowledge of the material (concepts) and the pedagogy applied by teachers in learning (Muhyidin*, et al.*, 2022). Teachers who have good PCK (Pedagogical Content knowledge) are able to

prepare learning processes that suit the material optimally (Haryono*, et al.*, 2019; Perdani & Andayani, 2022). From designing, carrying out, reflecting on, and evaluating learning, PCK is closely related to a person's teaching ability (Chan, 2022). The teaching ability assessment in Table 3 and the PCK data collected for this study using the questionnaire both indicate the same perception, namely falling into the good category. Future educators must possess the knowledge and abilities to design learning, effectively instruct, create teaching materials, make the best use of media and learning resources, and create evaluation tools.

The results of students' fundamental teaching abilities are also positive (Table 3). Because learning is considered to be of high quality if students gain a lot of experience during the learning process, teaching ability is the key to the success of the learning process (Sothayapetch*, et al.*, 2021). Adryawin*, et al.* (2018) added that aspiring teachers who have not mastered teaching techniques frequently struggle with making friends at school. Basic teaching abilities can be enhanced by microteaching activities that are focused on experience learning and lesson study (Akbar, 2021; Susanto*, et al.*, 2020). Apart from pedagogical abilities, role models are also needed to prepare oneself to become a teacher (Fitriyah*, et al.*, 2018).

CONCLUSION

Overall, the PCK (Pedagogical Content Knowledge) of Maros Muslim University's biology education students falls into the "good" category, according to the study's findings. These findings demonstrate that the students are prepared to work as teachers. Several aspects and indicators used as references in this study are still limited and in the early stages of scientific development. Perhaps there are still many theories circulating that can explain pedagogical competence, resulting in different findings in other studies.

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