PCK OF PROSPECTIVE MATHEMATICS TEACHERS' THROUGH COLLABORATIVE ONLINE LEARNING

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Abstract

Teachers play a determining role in students' success in achieving learning goals. Therefore, Pedagogical Content Knowledge is an ability that teachers and prospective teachers must have. This research aims to describe the Pedagogical Content Knowledge profile of prospective mathematics teachers in collaborative online learning, especially in courses evaluating mathematics learning processes and outcomes. This research is descriptive qualitative research. Prospective mathematics teacher students who contracted courses in evaluating the process and results of mathematics learning from Wiralodra University and Nahdlatul Wathan University of Mataram, were the subjects of this research. The instruments used in this research were a test of understanding the concept of evaluating mathematics learning processes and outcomes, questionnaires, and learning documentation via the Phytagoras LMS. The data analysis techniques used include data reduction stages, data presentation, and drawing conclusions. Based on the research results, it was found that students in the mathematics learning process and outcome evaluation course whose lectures were held collaboratively online had a very good Pedagogical Content Knowledge profile and gave a positive response to the implementation of collaborative online learning.

Keywords: Pedagogical Content Knowledge, Prospective Mathematics Teachers', Collaborative Online Learning.

A. Introduction

The quality of education is determined from several components, one of which is the teacher. Teachers play a determining role in students' success in achieving learning goals (Pratama & Lestari, 2020). A teacher in carrying out learning in the classroom must have professional knowledge, namely general pedagogical knowledge, subject matter knowledge, general contextual knowledge, and pedagogical content knowledge (Jong, 2009). Mastery of broad material concepts and good pedagogical aspects will shape teachers' professional understanding. Pedagogical content knowledge integrates teacher knowledge regarding content

and pedagogy (Baran et al., 2011), where in teaching teachers must be able to interpret learning material in a simple way so that students can easily understand it through appropriate teaching strategies (Johar & Hanum, 2021) in diverse groups and individuals (Nissa, 2018). Thus, Pedagogical Content Knowledge (PCK) is an ability that teachers and prospective teachers must have.

Good PCK abilities in prospective teachers describe professional teachers in the future. With professional teachers, the quality of education is expected to be better in the future. One of the PCK ability profiles of prospective teachers can be analyzed from how prospective teachers understand the concepts and practices of making evaluation instruments for mathematics learning processes and outcomes. Evaluation in learning needs to be carried out to be used as a consideration for teachers in improving and perfecting learning activities (Zainal, 2020).

In the mathematics learning process and outcome evaluation course, prospective teachers are provided with the concept of evaluation, the purpose of evaluation, how to develop evaluation instruments and how to analyze the results. Through these materials, prospective teachers are not only asked to understand conceptually what and how to evaluate the process and results of mathematics learning, but also practically through the assignments and exams given. Prospective teachers also learn how to consider several aspects such as material, students' cognitive development stage, and high order thinking abilities in creating evaluation instruments. This allows prospective teachers to improve their abilities regarding PCK.

In the 21st century, digital literacy is a skill (Sulistyawati & Rahayu, 2022), what prospective teachers need to become professional teachers. With the characteristics of students that will be faced in the future, namely generation z and generation alpha, which are digital natives (Prismanata & Sari, 2022), Using technology in learning that is appropriate to the material can increase interest (Meduri et al., 2022; Kurnia & Sunaryati, 2023), motivation (Solviana, 2020), and students' abilities in learning mathematics (Rahmawati, 2018). Digital literacy is very much needed in implementing online learning (Nahdi & Jatisunda, 2020; Dinata, 2021; Ningsih et al., 2021; Fadhilah, 2021; Fitriani et al., 2022).

Through lectures held online, prospective teachers are required to be able to use the LMS. Lectures using digital technology online bring out online pedagogy skills in students (Crisan & Geraniou, 2017). In the collaborative online learning grant program organized by the Ministry of Education and Culture through the Directorate General of Higher Education, Research and Technology, one of the collaborative online lectures is organized by Wiralodra University in collaboration with Nahdlatul Wathan University of Mataram. Collaboration is one of the skills that must be possessed to face the challenges of 21st century life (Partnership for 21 st Century Skills, 2015). Collaboration entails working together toward a common goal (Haythornthwaite, 2019). Collaborative learning creates an interactive learning atmosphere and creates cooperation between students both in answering problems and completing assigned tasks (Purwati & Erawati, 2021). Collaborative online learning between Wiralodra University and Nahdlatul Wathan University of Mataram, implemented through the Phytagoras LMS (https://phytagoras.unwir.ac.id/). In the Pythagorean LMS, prospective teachers take lectures in three segments, namely offline individually, online exchange, online together. Where, synchronous learning is carried out through zoom meetings (online exchange and online together) and asynchronously through assignments that must be done. Based on this description, this research aims to describe the PCK profile of prospective mathematics teachers in collaborative online learning carried out in mathematics learning process and outcome evaluation courses.

B. Method

This research is descriptive qualitative research. The subjects in this research were prospective mathematics teacher students who contracted courses on evaluating the process and results of mathematics learning from Wiralodra University, namely 12 students and Nahdlatul Wathan University of Mataram, namely 23 students. The instruments used in this research were a test of understanding the concept of evaluating mathematics learning processes and outcomes, questionnaires, and learning documentation via the Phytagoras LMS (https://phytagoras.unwir.ac.id/), namely video recording during collaborative

online learning. The data analysis techniques used include data reduction stages, data presentation, and drawing conclusions.

The test of understanding the concept of evaluating the process and results of mathematics learning is given as a tool for evaluating students' understanding of the basic concepts of evaluation, the relationship between learning objectives and the objectives of learning evaluation in schools, mathematics learning evaluation instruments so that they are able to design, compile evaluation instruments and can carry out analysis and also create evaluation instrument trial results report. With a maximum test score of 100 and a minimum test score of 0. The following is the classification of test results based on the Wiralodra University assessment guidelines.

Table 1. The Wiralodra University Assessment Guidelines

Score	Quality Letters	Quality Score
80-100	A	4
75-79,99	AB	3,5
70-74,99	B	3
65-69,99	BC	2,5
60-64,99	C	2
55-59,99	CD	1,5
50-54,99	D	1
0-49,99	E	0

A questionnaire was given to find out collaborative online learning that had been implemented from a student perspective. The questionnaire contains statements about learning planning, learning presentation, learning interactions, and learning evaluation. The questionnaire consists of 20 Likert scale statements, with the criteria 1 = very bad; 2 = not good; 3 = Fairly Good; 4 = good; 5 = very good.

C. Result and Discussions

Lectures in collaborative online learning are carried out synchronously and asynchronously on the Phytagoras LMS (https://phytagoras.unwir.ac.id/). Synchronous learning is carried out through zoom meetings and asynchronous learning through assignments that students must complete. Learning implementation is divided into three segments, namely offline individually, online exchange, and online together. The implementation in the LMS is as in the following picture.

Figure 1. Implementation of Offline Learning

The first segment of implementing collaborative online learning is individual offline learning, where learning is carried out face-to-face in class, with lecturers at each university. Offline learning was carried out in 6 out of 14 meetings each. The implementation in the LMS is depicted in Figure 1.
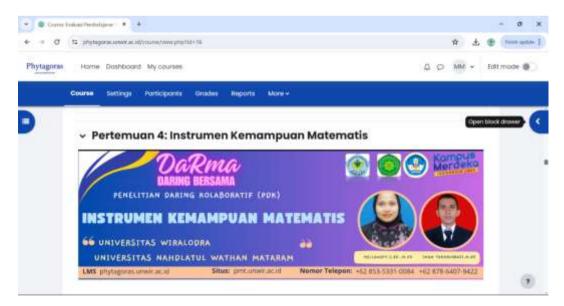

Figure 2. Implementation of Joint Online Learning

Apart from being carried out offline, collaborative online learning is also carried out online. Online learning is carried out in two ways, namely joint online learning (figure 2) and exchange online learning (figure 3). Joint online learning was carried out 6 times, while exchange online learning was carried out 2 times, out of a total of 14 meetings. All students from both universities participated in joint online learning, while exchange online learning was carried out by exchanging lecturers from both universities.
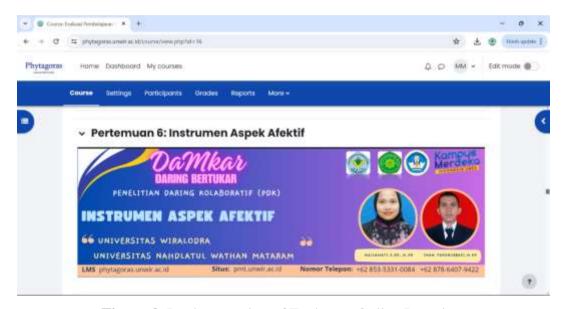

Figure 3. Implementation of Exchange Online Learning

To determine student teacher students' conceptual understanding of the material that has been provided, a conceptual understanding test was carried out to evaluate the process and results of mathematics learning given at meeting 8 and meeting 16 which were carried out offline. Students' understanding of concepts can also be seen from the assignments they complete. The following are the accumulated scores from the tests and assignments completed by students.

Table 2. Concept Understanding Score Evaluation of Mathematics Learning Process and Outcomes

Subject	Score	Subject	Score	Subject	Score	Subject	Score
S-1	92.5	S-11	91.5	S-21	78.8	S-31	81.9
S-2	91.1	S-12	78.8	S-22	78.8	S-32	83.3
S-3	91.1	S-13	92.5	S-23	78.8	S-33	76.3
S-4	91.1	S-14	79.4	S-24	82.2	S-34	71.5
S-5	78.8	S-15	78.8	S-25	78.7	S-35	77.7

Subject	Score	Subject	Score	Subject	Score	Subject	Score
S-6	78.8	S-16	78.8	S-26	83.1		
S-7	78.8	S-17	78.8	S-27	75.6		
S-8	78.8	S-18	78.8	S-28	70.3		
S-9	78.8	S-19	79.4	S-29	85.9		
S-10	78.8	S-20	78.8	S-30	72.5		
Average							80.8

In table 2, it was found that the scores for understanding the concept of process evaluation and mathematics learning outcomes obtained by students were very good. Where, the lowest score is 70.3 with Quality Letters B and the highest score is 92.5 with Quality Letters A, while the average score is 80.8 with Quality Letters A. Table 2 shows that students in the mathematics learning process and outcome evaluation course whose lectures are held online Collaborative has an excellent PCK profile. An LMS that can be accessed either via PC or Android makes the implementation of online learning run effectively and produce good results. This is in line with previous research, which concluded that easy access allows students to study more freely, so that learning becomes effective (Solviana, 2020; Hasriadi et al., 2021). Apart from that, students' activeness in discussions during collaborative online learning makes learning effective (Curtis & Lawson, 2001). After attending lectures through collaborative online learning on the course evaluation of mathematics learning processes and outcomes, students have mastered the concept of evaluating mathematics learning processes and outcomes, namely regarding the basic concepts of evaluation, the relationship between learning objectives and learning evaluation objectives in schools, and mathematics learning evaluation instruments. and students are also able to design and compile evaluation instruments and can carry out analysis and also make reports on the results of testing evaluation instruments. This understanding can be a provision to become a professional teacher in the future (Octavianingrum, 2020; Alexandro et al., 2021).

Good understanding of concepts in students after participating in collaborative online learning carried out through the Phytagoras LMS, due to the ease with which students can access learning materials (Hasriadi et al., 2021) and the learning carried out is well documented (Hidayat & Yuniva, 2017; Firmansyah et al., 2019; Purnamasari & Kamal, 2021; Zahra & Sani, 2024), making it easier for students to learn learning material (Dhika et al., 2020; Wiragunawan, 2022).

Positive results were also shown from the questionnaire scores obtained. From a student perspective, lectures through collaborative online learning have gone well. In terms of learning planning, the average statement score obtained was 4.4. For the presentation of learning, the average statement score was obtained, namely 4.2. Meanwhile, learning interactions obtained an average statement score, namely 4.1. In implementing the learning evaluation, the average statement score was 4.1. So the average collaborative online learning score is 4.2 in the very good category.

The implication of the results of this research is that the implementation of collaborative online learning in mathematics learning process and outcome evaluation courses has a positive impact so that it can be applied and developed to be implemented in lectures in other courses. The limitation of this research is the number of participants in the collaborative online learning carried out, namely 35 students. The number of participants was relatively small, because the participants came from two universities. With this number of participants, learning went very well. It is necessary to carry out collaborative online learning with a large number of participants so that it can be seen whether different results are obtained.

D. Conclusion

Based on the analysis of research results, it was concluded that students in the mathematics learning process and outcome evaluation course whose lectures were held collaboratively online had a very good PCK profile and a positive response to the implementation of collaborative online learning. For further research, collaborative online learning can be implemented in other courses with a large number of participants.

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