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ICT Literacy and Problem Solving Skill of Senior High School through Discovery Learning Assisted by Moodle

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Abstract: This research was an explanatory mixed method design which aims to analyze the influence of discovery learning assisted by moodle on the problem-solving skills and ICT literacy of SMA Negeri 1 Purwoharjo student. The research subjects consisted of 37 XI grade students from each experimental class and the control class. Instruments test was in the form of five description questions to measure problem-solving abilities and performance questionnaires to measure ICT literacy skills. The results of the manova statistical test showed that the value of wilks lamda has Sig. (0.005) < (0.05). This shows that discovery learning assisted by moodle influences ICT problem solving and literacy ICT skills.

Key Words: problem-solving skills, ICT literacy, discovery learning, moodle

Abstrak: Penelitian ini memiliki desain *mixed method explanatory* yang bertujuan untuk menganalisis pengaruh pembelajaran *discovery* berbantuan *moodle* terhadap kemampuan pemecahan masalah dan literasi ICT siswa SMA Negeri 1 Purwoharjo. Subjek penelitian adalah 37 siswa kelas XI dari masing-masing kelas eksperimen dan kelas kontrol. Uji instrumen berupa lima soal uraian untuk mengukur kemampuan pemecahan masalah dan angket kinerja untuk mengukur kemampuan literasi ICT. Hasil uji statistik manova didapatkan nilai *wilks lamda* sebesar Sig. (0,005) < (0,05). Hal tersebut menunjukkan bahwa pembelajaran *discovery* berbantuan *moodle* berpengaruh terhadap kemampuan pemecahan masalah dan literasi ICT.

Kata kunci: kemampuan pemecahan masalah, literasi ICT, pembelajaran *discovery*, *moodle*

INTRODUCTION

Within the Physics learning process, problem-solving skill serves as one of the most important objectives to be accomplished. It is undeniable that students possessing sufficient problem-solving skill will be able to solve the problem they encounter, particularly which occurs in their surrounding environment. Furthermore, during the 21st Century, students will survive the competition. At the very basic level of Physics learning objective, it demands students to generate problem-solving approach by applying the obtained understanding of Physics learning (Sujarwanto, Hidayat, & Wartono, 2014; Walsh, Howard, & Bowe, 2007). A survey conducted among students passing Physics subject and have occupied in particular job argues that problem-solving in Physics learning takes a role as a pivotal element during work accomplishment (Heller & Heller, 2010).

As the rapid growth of technology development, students cannot independently rely on problem-solving. They indeed need to keep up with complementary skill—ICT literacy as supplementary to survive in the digital era. For modern society, ICT literacy should be served as a basic skill (Claro et al., 2012). What we mean by ICT literacy itself is a use of digital technology, communication devices, and also internet networks to access, manage, integrate, evaluate, and create information to function in people's lives (Educational Testing Service, 2002). Technologically literate students will be able to comprehend learning material better and faster, able to generate proper problem solving, and able to create better control during the learning process (Katz et al., 2008). ICT, in

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the context of the outside classroom setting, provides an opportunity for people to be productive based on the rapid growth of science and knowledge (Jizat, 2012).

In improving problem-solving skills and ICT literacy in high school students, appropriate learning is required. Discovery learning assisted by Moodle is considered appropriate to enhance both abilities. Discovery learning is claimed to be effective (Joy, 2014). In basic understanding, discovery learning indirectly guides students to certain material. Unlike conventional learning which focuses on the lecturing approaches, discovery learning let students obtain certain understanding by themselves. Discovery learning is specifically designed to involve students in investigations guided by teachers and learning instruments (Hammer & Hammer, 2009). Hence, through discovery learning with sufficient direction and the right strategies will help students to transfer and improve problem-solving skills (Abdisa & Getinet, 2012). Combining discovery learning with computer simulation will create a more effective learning process, although it requires specific skills to implement (De Jong & Van Joolingen, 1998; McDaniel & Schlager, 1990). Therefore, Moodle has an important role in supporting discovery learning. Moodle is a device that allows online learning by registering all students into the Moodle system (Costa, Alvelos, & Teixeira, 2012). Involving information and communication technology in learning such as Moodle will support learning, develop infor-mation literacy, ICT comprehension skills, and encourage self-reflection (Jizat, 2012; Vaièiiniene & Gedviliene, 2008). By employing moodle in discovery learning it is expected to reduce discovery learning weaknesses and can improve students' problem-solving skills and ICT literacy.

METHOD

This research was conducted to XI graders of SMAN 1 Purwoharjo. It employed mixed method explanatory by conducting quantitative data analysis first then followed by qualitative data analysis and proceeded by result interpretation of both quantitative and qualitative data. Quantitative data was carried out through quasi-experimental non-equivalent control group design with the control and experiment groups were randomly determined. While the collection of qualitative data was done by employing purposive sampling technique, to choose students intentionally according to the needs of research data.

The study sample consisted of 37 students divided into the experiment and the control class. The experimental and control classes were given four meetings with the following topics: eye and glasses, big glasses, microscopes, and binoculars. On the other hand, the experimental class was taught by discovery learning assisted by moodle. Then both of them were tested with five description questions and corrected using the developed rubric (Docktor et al., 2016) to obtain the score of students' problem-solving skills. To obtain ICT literacy data at the fourth meeting, both classes were given task instruments. The task was related to the learning that had been done and consisted of an indicator of ICT literacy. Then from the assignment data and student activities, while accessing Moodle, it can be seen that students' literacy skills through performance questionnaires.

The data that has been obtained was then analyzed quantitatively using the manova test. From the results of the quantitative analysis, it was selected according to the needs of the study and were then conducted semi-structured interviews. The interview data was then analyzed to support data from quantitative analysis.

RESULTS

Both results of problem-solving skill were obtained from pretest and posttest. The questions given were in the form of description with a number of five questions with material on glasses, magnifying glass, microscopes, and star binoculars which are completed within 90 minutes. From 37 students each of the experimental class and control class, the data can be seen in Table 1.

Table 1. Problem Solving Skill Data Description

Data	Experimental		Control	
	Pretest	***Posttest***	***Pretest***	***Posttest***
Highest Score	20	51	20	31
Lowest Score	74	97	74	96
Avg	50,3	72,8	44,2	66,5
gain-score avg	0,45		0,39	
Data Number	37		37	

Both experimental and control class obtained a similar score in the pretest, but it was different in the average score. In addition, experimental class obtained higher average score than control class. The table also presents gain-score of problem-solving skill of both classes; 0.38 for control class and 0.45 for experimental class. It further affirms that both experimental and control classes score was increased. Whereas, the findings of literacy skills were obtained through all student activities on Moodle open learning and assessed through performance questionnaires. Data on ICT literacy in the experimental class and control class can be seen in Table 2.

Table 2. ICT Literacy Data Description

Data	Experimental	Control
Highest Score	7	6
Lowest Score	19	17
Avg	13,43	11,03
Std. Deviation	3,96	3,90
Data Number	37	37

Table 2 presents that experimental class obtained higher average score compared to the control class. From the description of the data between problem-solving skills and ICT literacy, then the prerequisite test analysis was carried out; normality and homogeneity test. The results obtained in the normality test of problem-solving skill was Sig. (0.85) and ICT literacy was Sig. (0.288) while for the prerequisite test, the homogeneity of the problem solving was Sig. (0.125) and ICT literacy was Sig. (0.766). From all the data, it was seen to have a value greater than 0.05, it can be concluded that the data was normally distributed and homogeneous. The following is the hypothesis test using manova (Table 3).

Table 3. Manova Analysis

Effect		*Sig.*
Class	**Wilks Lamda**	**0,005**

From Table 3, it is known that the significance value of the manova test is 0.005, this value is smaller than 0.05 hence there is an influence between the classes given moodle-assisted learning and class taught through conventional learning on students' problem-solving skills and ICT literacy. To find out the differences in each variable, it can be seen in Table 4.

Table 4. The Result of Individual Variable Effect Analysis

Source	*Dependent Variable*	*F*	*Sig.*
Class	ICT Literacy	6,918	0,010
	Problem Solving	5,349	0,024

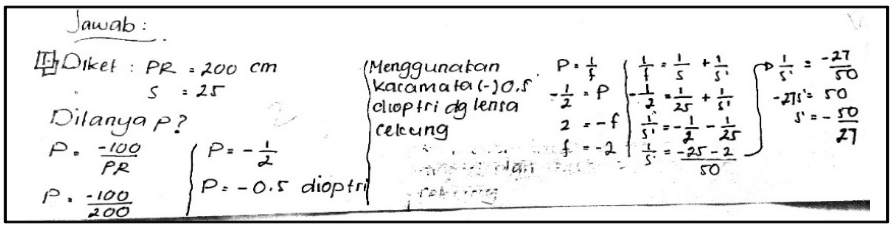
Problem Solving Process of Students

In question number 1, students have to solve how to find out the point near the eyes of someone who has nearsighted eye defects while still using glasses. Some students understand the problem, but there are various differences in the solution.

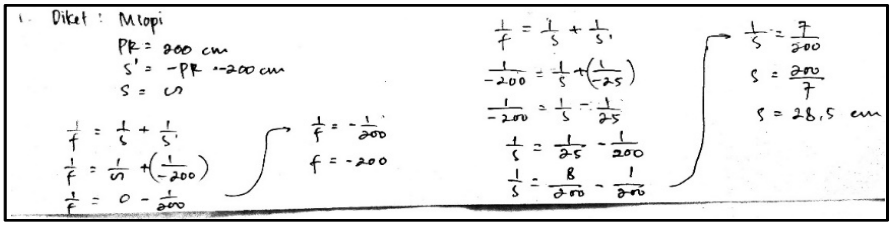
In Figure 1, the two solutions have almost the identical method but have different results. The results of student work in figure (a) can be observed that students are not careful in using units. At that stage, students looked for the focus of the lens of the glasses used using units of meters while looking for a point near the eyes when using a lens of glasses in centimeters. In addition, from the beginning students have not written the unit on the results obtained, it can be classified that students do not use specific physics applications in solving these problems. In addition, if it is observed in the process of looking for a lens focal point in figure (a), it has a different approach to figure (b). In figure (b) students use the basic equation on the lens while in figure (a) directly use instant equations. The weakness of instant use is that it is difficult to track errors in the completion step, particularly in unit assignments.

DISCUSSION

The advantages of discovery learning assisted by moodle in teaching students problem-solving skills are by instilling strong concepts to students. Since the concept of understanding is high, it can help students solving problems (Kohl & Finkelstein, 2007). Discovery learning prioritizes exploration and discovery process which begin from stimulation, problem statements, data collection, data processing, verification, and generalization (Syah, 2004). This provides students a considerable amount of learning experience. In addition, the utilization of Moodle as online learning conducted outside of school hours will further deepen students' understanding of the optical instrument material. Students' difficulties when learning both during practicum and at the verification stage can be discussed again in



(a)



(b)

Figure 1. Students Work No. 1

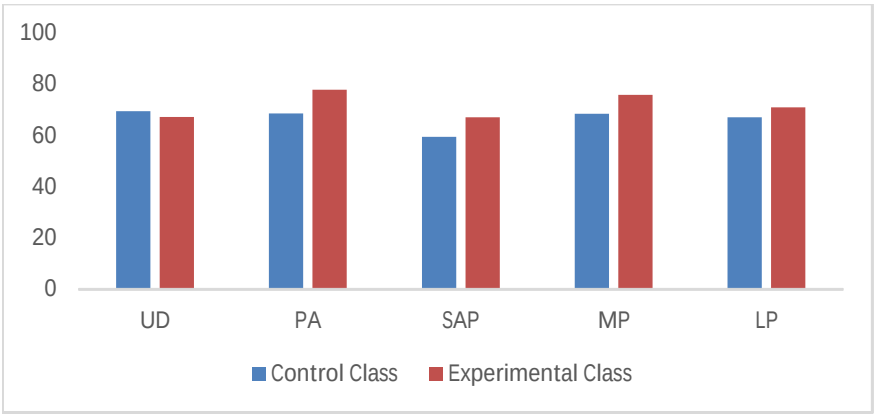


Figure 2. Indicators of the Ability to Solve Problems in the Control and Experimental Classes

online discussion forums available on the moodle, thus through the learning activities students in the experimental class have better problem-solving skills than the control class. Problem-solving skills between the experimental class and the control class are presented in Figure 2.

In Figure 2, almost all indicators of the experimental class's problem-solving skills have a greater percentage compared to the control class. Only the useful description indicator of the control class has a higher score while the other indicators are dominated by the experimental class. It is due to the conventional lecture method given to control class in which students are more familiar with the description of the concept given, while the experimental class is partially spent on lab work. As a result of the practicum, students have a deeper understanding and stronger memory of the concept of learning. It is proven by the physical indicators approach and specific application of physics which obtained a significant score.

For ICT literacy skills, the values that have been analyzed using the manova test in table 4 obtained significant values of Sig. (0.01), the value is less than 0.05. Thus, it can be concluded that there are significant differences in ICT literacy skills between the experimental class and the control class. The total score of each ICT literacy task item between the experimental class and the control class can be observed through the Figure 3.

In Figure 3, the ICT literacy value of the experimental class is higher than the control class. Almost all items of the experimental class assignment have a higher value than the control class. The indicator of using Microsoft Word has the same score between the two classes. This shows that students of both classes are able to use Microsoft Word with the same a-

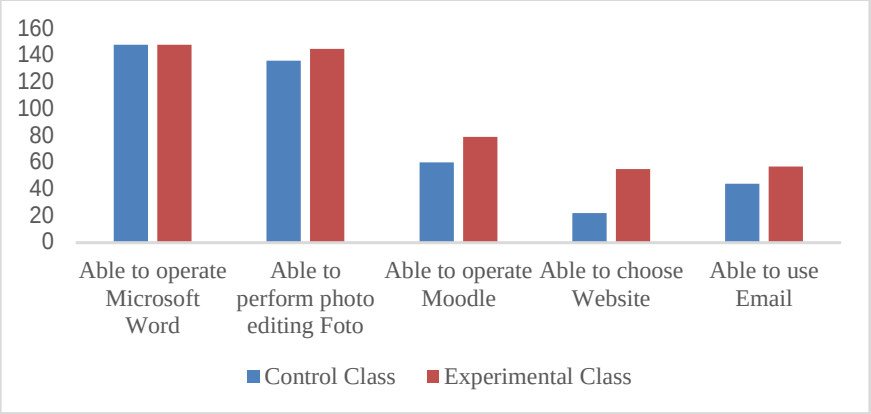


Figure 3. ICT Literacy Score in Experimental Class and Control Class

bilities. While the other indicators, especially those related to internet connections, students still encounter problems, both from the lack of students' own abilities and connections that do not allow students to access the internet. The role of moodle in this learning is to provide learning environments that support learning, so students are able to develop information literacy, ICT capabilities, and encourage self-reflection (Vaièiiniene & Gedviliene, 2008). This makes the ICT literacy skills of classes with discovery learning assisted by moodle better than classes with conventional learning.

CONCLUSION

Based on the results, it can be concluded as follows. 1) There are differences in problem-solving skills and ICT literacy between Discovery learning assisted by moodle and class taught through conventional learning. It is proven by the results of statistical analysis of Wilks Lamda's data with Sig. (0,005) which has a value smaller than (0,05). 2). Discovery learning assisted by moodle can improve students' problem-solving skills. Based on the average value obtained by problem-solving skills, students who learn with Discovery learning are assisted by Moodle is higher than students who learn with conventional learning. If observed from the indicators of problem-solving skills process, a class with Discovery learning assisted by moodle completing at 71.85% while the conventional class completing at 66.72%. 3) Discovery learning assisted by moodle can improve students' ICT literacy skills. Based on the average value obtained, the ICT literacy of students who learn with Discovery learning assisted by moodle has a higher score than students who learn with conventional learning.

In maximizing learning using Moodle, it is important to make sure the sample has a good internet connection beforehand. The features provided by the moodle are still less utilized, thus it still provides an opportunity to be explored. At the data collection stage during the learning, it is required to pay attention to students extra since it determines the success of learning.

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