



Using Cellphone in Problem-Based Biology Learning to Improve Students' Creative Thinking Skills

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Abstract: Students' creative thinking skills need to be developed in the learning process. However, the learning process in schools has not fully implemented learning models that develop students' skills. From the results of observations at SMAN 7 Padang, learning at school still does not make use of Information and Communication Technology (ICT) and lacks interest in learning in class. To overcome these problems, the Problem Based Learning (PBL) model which is intervened with the use of ICT is applied. The use of ICT used is utilizing cellphone and internet networks in obtaining broader information. This study aims to analyze the effect of the implementation of the problem-based learning model that is intervened by information technology on students' creative thinking skills. This type of research is quasi-experimental research with a randomized control-group posttest only design. The results of testing the hypothesis, namely $t_{count} > t_{table}$, indicate that the research hypothesis is accepted.

Keywords: problem-based learning, information and communication technology, creative thinking skills, cellphone.

Abstrak: Keterampilan berpikir kreatif peserta didik perlu dikembangkan dalam proses pembelajaran. Namun, proses pembelajaran di sekolah belum sepenuhnya menerapkan model pembelajaran yang mengembangkan keterampilan peserta didik. Dari hasil pengamatan di SMAN 7 Padang, pembelajaran di sekolah masih kurang memanfaatkan Teknologi Informasi (ICT) dan kurang minat belajar dikelas. Untuk mengatasi permasalahan tersebut, model Problem Based Learning (PBL) yang diintervensi dengan penggunaan ICT diterapkan. Penggunaan ICT yang digunakan yaitu memanfaatkan ponsel dan jaringan internet dalam mendapatkan informasi yang lebih luas. Penelitian ini bertujuan untuk menganalisis pengaruh implementasi model problem based learning yang diintervensi teknologi informasi terhadap keterampilan berpikir kreatif peserta didik. Jenis penelitian ini adalah penelitian eksperimen semu dengan rancangan penelitian randomize control-group posttest only design. Hasil pengujian hipotesis yaitu $t_{hitung} > t_{tabel}$ menunjukkan bahwa hipotesis penelitian diterima.

Kata kunci: pembelajaran berbasis masalah, teknologi informasi dan komunikasi, keterampilan berpikir kreatif, ponsel.

▪ INTRODUCTION

Education is already in the era of the 21st century. Therefore, learning also follows the competency demands of 21st century students. According to the Ministry of Education and Culture (2016), in the 21st century, students' abilities are closely related to the use of Information Technology (ICT) as a support in the learning process which leads to the ability to understand, process, identify information analytically, and critically. Integrating ICT in the learning process plays an important role in developing students' thinking skills (Darimi, 2017). ICT can change the world of education to be more advanced and can change human mindsets to be wiser and more intelligent from various aspects (Iswan, 2018). According to the Ministry of Education and Culture

(2018), in order to survive in the 21st century, students must master IT, develop 21st century competencies.

One of the 21st century competencies that students must achieve is Learning and Innovation Skills (LIS-4C), including: critical thinking and problem solving, creativity and innovation, communication and collaboration (Buckingham Shum, et al 2016; Wardani, 2018; González-Salamanca, et al 2020). The 21st century competencies are believed to enable students to solve problems in everyday life, be able to provide solutions, and become independent generations. IT-intervented 21st century learning serves to train students to be skilled in solving problems, wise in making decisions, think critically, like to negotiate, be able to communicate ideas effectively, be able to work efficiently both individually and in groups, and be able to provide meaning in learning (Palincsar, US, et al 2014; Amri, 2022).

21st century competence, especially in students' creative thinking skills, needs to be developed in the learning process. However, the learning process in schools has not fully implemented a learning model that develops the competencies of students needed in the 21st century. Based on the results of interviews with biology teachers in class XI MIA SMAN 7 Padang, information was obtained that problems in learning had not fully implemented 21st century learning. Learning was still predominantly teacher centered. In addition, the lack of variations in the learning model applied by the teacher, thus making students bored, not active in the learning process, and lacking interest in learning in class. In addition, learning does not involve students directly so they cannot hone and develop their creative thinking skills optimally. Another problem, when the teacher gives project assignments and practicum reports, students are less able to innovate to get ideas from their own thinking. This shows that the lack of creativity of students when given assignments. To overcome the problems stated above, the solution that can be carried out by teachers is to increase 21st century competencies through the application of learning models.

The learning model that can be applied is an active learning model that can develop students' HOTS skills and 21st century competencies. One of the active learning models that can be used is Problem Based Learning (PBL) which is intervened with the use of IT. With this PBL model, students are trained with various contextual problems. The PBL model can develop Learning and Innovation Skills students' (Huang, B., et al. 2019). The PBL model has several advantages, namely emphasizing meaning, increasing understanding, developing higher-order thinking skills, and developing self-motivation. The PBL model involves group discussions to solve problems as the main focus in teaching (Yeh, YC 2010; Yockhebed and Sunarno, 2012).

The PBL learning model can be intervened with various media, one of which is Information Technology (IT). ICT can assist the learning process in accessing teaching materials, as learning resources and learning media. ICT excellence is designed to help solve learning problems, as an alternative that is expected to provide many benefits in efforts to improve the quality of learning. By utilizing IT, ICT is hoped that learning messages can be packaged more systematically so that they can be easily accepted by students, create enjoyable learning, and develop the potential of individual students in the 21st century (Mukninan, 2012; Kuhlthau, CC, et al 2015). Based on the problems and some of the assumptions described above, the purpose of this study is to analyze the

effect of the implementation of the problem based learning on students' creative thinking skills.

▪ **METHOD**

Participants

The population in this study were all 208 class XI MIPA students at SMAN 7 Padang who were enrolled in the 2019/2020 Academic Year, which were divided into 6 classes. Determination of the sample was determined by cluster random sampling, namely taking samples (classes) that were chosen randomly. In addition, the reason for using the cluster random sampling technique is because the researchers are random from a large population. So that the population is selected based on the group/class. Sampling was done by lottery using a roll of paper. The class that was taken first was class XI MIA 6 as the experimental class and the class that was taken second was class XI MIA 4 as the control class.

Research Design and Procedures

This type of research is a quasi-experimental research with a randomized control-group posttest only design. The research design is summarized in Table 1 as follows.

Table 1. Randomize posttest only research design

Group	Intervention	Posttest
Experiment	X	T
Control	Y	T

where T, X, and Y are posttest results, PBL model with ICT intervention, and conventional learning, respectively. The experimental class was given treatment by applying the Problem Based Learning (PBL) model while the control class applied the direct learning (DI) model. After being given the next treatment given a posttest. The research period is 6 weeks. 8 class meetings. 2 times the collection of poster works.

Instrument

The instrument used is a non-test instrument. The instruments used have been validated by experts, namely Biology lecturers and teachers. Creativity competence is in the form of an assignment assessment sheet with a creativity assessment rubric when students make assignments in the form of posters. Creativity Assessment The assessment used is in the form of an assignment assessment sheet. This assessment sheet aims to assess the creativity of students in pouring new innovative ideas or ideas into an assignment in the form of a poster. Criteria for creativity according to the assessment guidebook (2016), namely. 80-100 is very good, 70-79 is good and 60-69 is fair.

The instrument used is the rubric to assess creativity that has been validated by experts. Assessment of student creativity is carried out by filling in the rubric that the researcher has designed with several aspects and criteria. The teacher assigns students to make posters. Technical data analysis in this research is quantitative data analysis by testing hypotheses. Hypothesis testing uses the average analysis technique of the similarity test of the two independents. The condition for testing the hypothesis must be homogeneity and normality.

The rubric used is the rubric for assessing the creativity of students. Researchers assessed the creativity of students from posters made by students. The researcher modified the indicators and aspects assessed from Aziz, 2010. The indicators and aspects assessed were Originality, students were able to make posters with the contents/text of the posters produced which were different from those shown by the teacher. flexibility (flexible thinking), students use 3 relevant references and according to the theme. elaboration (thinking in detail), students are able to present information according to the theme and provide appropriate colors to emphasize the information in the poster. fluency (fluent thinking), students can inform through pictures and writing on posters.

Data analysis

Technical data analysis by testing the hypothesis using the average analysis of the similarity test of the two unpaired sample groups. The results of testing the hypothesis, namely $t_{count} > t_{table}$, shows that the research hypothesis is accepted. In the sense that there is a significant difference between the PBL learning model which is intervened by information technology on students' creative thinking skills.

▪ **RESULT AND DISSCUSSION**

The research results were obtained from the average results of students' poster work (creative skills) which showed that the experimental class obtained a score superior. The results of the average achievement per indicator of students' creative thinking are summarized in Figure 1 below.

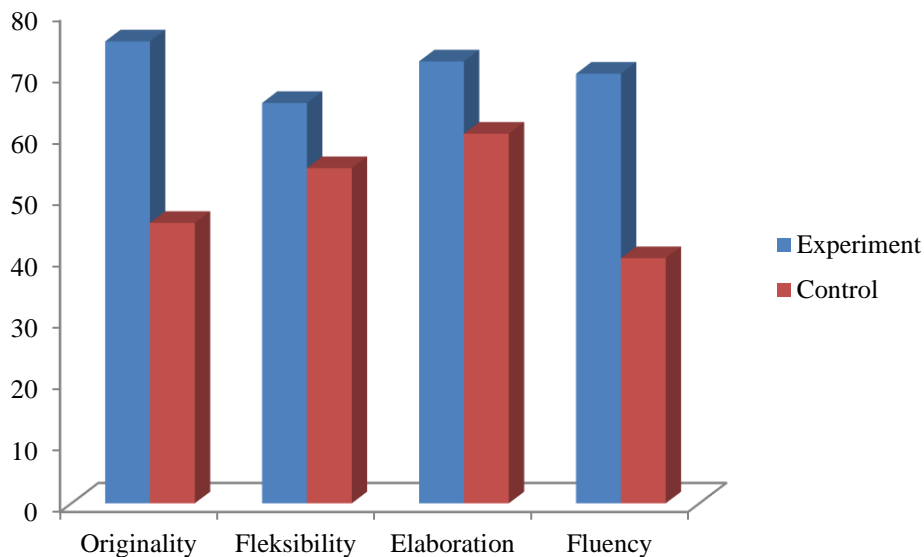


Figure 1. Students' mean score per indicator of students' creative thinking

The next step, from the results of the average score of the average results of the students' poster work, the hypothesis testing is carried out with the initial stage, namely testing the normality of the data. The results of the normality test in the sample class are normally distributed data with details, the experimental class's L_t value is 0.67 and the

Lt control class 0.71. The results obtained explain that the two sample classes are normally distributed so that they can proceed to the second stage, namely testing the homogeneity of the data. The results of the sample class homogeneity test have a homogeneous variance. With F_{count} of 1.1 and F_{table} of 1.56. This was because the two sample classes did not have a high or heterogeneous level of variation in test scores. Then ICT can be continued with the final stage of testing, namely the t-test. the results of the t-test are t_{count} of 1.72 and t_{table} of 1.66.

Learning is a process of developing overall personality attitudes (Kumar, V., 2018), thinking, and creativity through various interactions and learning experiences. However, in practice there are still many activities that have not involved students in the learning process. Recognizing the importance of the involvement of students in the learning process, research was carried out on Biology learning in class XI MIA SMAN 7 Padang by applying a learning model that could improve students' 21st century competence, namely the Problem Based Learning (PBL) learning model which was intervened by information technology (McGibbon, C., et al 2015). Creative thinking skills are the ability to find based on available data or information, find many possible answers to a problem, where the emphasis is on quantity, effectiveness, and variety of answers (Munandar, 2012). Creativity is a very complex phenomenon that manifests itself as a single process within the individual. Meanwhile, the process of creativity is seen as a complex phenomenon, and the basic definition is simple (Merrill, 2014).

The results of the study show that the creativity of students can be increased by applying the Problem Based Learning (PBL) learning model which is intervened by information technology. During the learning process the assessment of critical thinking will have an impact on the assessment of creativity. Competency assessment is carried out using various assessment techniques that are tailored to the characteristics of each Basic Competency (KD). The creativity assessment technique used in this study is making posters. Posters made are in accordance with KD 3.5 and KD 3.6, namely presenting the work.

Based on the average value of student creativity, the average value of the experimental class is higher than that of the control class. The experimental class that was treated by applying the PBL learning model that was intervened by information technology had an average KD combined value of 70.55 while the control class that applied the conventional model had an average value of 52.25. ICT is clear that the average value in the experimental class is higher than that of the control class. This means that learning by applying the PBL model which is intervened by information technology has a positive effect on student creativity. The increased creativity of students is due to the PBL learning model which is intervened by information technology (Jin, J., et al 2014) which is a learning model that presents problems related to everyday life, so that students become creative (Yerimadesi, 2022). The high acquisition of students' creative competence in the experimental class is a positive influence from learning that applies the PBL model which is intervened by information technology. In this creativity assessment, students work on posters in groups. With the use of information technology in the form of the internet, students can be as creative as possible in developing their creative abilities to make posters (Samerkhanova et al., 2016; Bereczki et al., 2021).

Furthermore, the assessment of creativity in the control class was lower than in the experimental class due to the lack of student activity, both in thinking, discussing and communicating with their group mates. In addition, students also do not use their cellphone to access the internet as a source in making their posters.

▪ CONCLUSION

Based on the results of the research that has been carried out, ICT can be concluded that. The Problem Based Learning model which is intervened by information technology has a significant effect on the creative thinking skills of class XI students at SMAN 7 Padang. The 21st century is marked by the use of technology where information technology has become the basis of life. With the use of information technology such as cellphone to access subject matter, ICT can make ICT easier for students when studying. This technology-intervented PBL model requires students to be able to solve problems given by the teacher to be solved together through group discussions. That way, the results of the 21st century competency of students' creative thinking are better. Therefore, ICT is hoped that schools, especially biology teachers, can apply the PBL model which is intervened by information technology in the learning process. Education practitioners are expected to be able to use the results of this study as information about a comparison of the PBL learning model that is intervened by information technology on the creative competence of students.

Based on the conclusions and implications that have been described, the findings are obtained which can be used as suggestions as follows. For teachers, to apply the Problem Based Learning model which is intervened in information technology, because ICT is one of the solutions to increase students' creative competence. For future researchers, ICT is better to carry out an assessment using more than four observers. Each observer should only observe one group so that they are not overwhelmed in observing them. Future researchers are also expected to be able to further develop the results of this research by varying the learning model with other media in a wider scope.

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