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The Influence of Flipped Classroom Learning Model Application on Problem Solving Ability and Learning Motivation

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Abstract

One of the 21st century skills that students need to own to be able to compete in the international world is thinking. Thinking is the ability to solve problems, this aspect is an important skill because a person's success is determined by his/her thinking skills, especially in solving a problem. Beside problem-solving ability, this research also examined the aspect related to learning motivation. One solution to improve problem-solving skills and learning motivation is by flipped classroom learning. It is kind of an experimental research. The population in this study was students of class X of SMK Yayasan Pharmasi Semarang. The data collection used pre-test and posttest to determine the value of problem solving ability and the value of questionnaires to determine students' learning motivation. The results: (1) there was an influence of the application of the flipped classroom learning model on the problem solving ability of students with> 75% and it met the minimum completeness criteria. Based on the Independent Sample T-test with the SPSS 25 program, significant results were obtained 2) there was an influence of the application of the flipped classroom learning model on students' motivation. The conclusion is that there was an influence of the application of the flipped classroom learning model on problem solving ability and students' learning motivation.

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INTRODUCTION

The 21st century skills that students need to own in order to be able to compete internationally include: *Thinking, Acting, and Living in the World. Thinking* includes: critical thinking, managing problems, creating, and metacognitive. *Acting*: communication, collaboration, technology literacy, initiative and digital literacy. Problem solving is one of the important aspects of the 21st century skills because a person is determined by his/her thinking skills, especially in solving problems. The importance of problem solving skills can be seen in terms of learning, that students quickly forget if they are taught orally, they will remember more easily if they are given examples, and they will understand if they are given the opportunity to solve problems.

Problem solving aspect is important, but the facts in the field show that the results of the problem solving skills possessed by students are still low. One of them is in biology subject. Students currently tend to only memorize the concepts given by the teacher without being balanced with the ability to apply the concepts on problems encountered both in the school environment and in the surrounding, so that in the learning process, students are unable to develop their skills in solving the problems in their surroundings (Rahmawati, 2016).

The results of a preliminary study carried out in schools that will be used as research, showed that the classical completeness of class X Pharmacy students had not reached 75%, and the level of problem solving ability of each student had different levesl. It showed that students had difficulties in learning Biology. Based on the results of interviews with teachers and students, the factors that could affect the above problems are as follows: teachers still often use power point media and textbooks and have not used many other medias to explore learning materials, teachers play a more active role in explaining so it tends to be *teacher centered* learning , teachers have not maximized the use of internet in the teaching and learning process even though the school has provided special wifi for students for teaching and learning process. Another obstacle is that some students have no bravery and feel embarrassed to ask if there is an explanation that is less clear from the teacher and when the teacher gives questions related to the material, students are hesitant in answering and there are even some students who seem to have less motivation in joining a discuss so that the communication and discussion have not been effective and skills to improve problem-solving ability that the teacher wants to improve in class discussions become less effective.

One way to apply problem-solving ability aspect in learning is by giving contents of material with practice questions and evaluations with the HOTS (High Order Thingking Skill) type. And another way to familiarize students with problem solving not only at the end of learning but at the beginning of learning is by making problem solving as a biology learning approach.

One of the innovations that can be used in improving problem-solving skills is by learning with *flipped classroom* model. This is related to the development of time and technology, various aspects of life are also developing, including in the field of education. Many have started to use information technology to deliver a learning, which we usually call digital learning which can be done by *e-learning*.

Learning using e-learning has many applications to choose from, one of which is *Content Management System, Modular Object-Oriented Dynamic Learning Environments*, commonly abbreviated as *CMS Moodle*.

Wartama, et al. (2015) states that there are significant differences in students learning outcomes after using *Moodle-based e-learning* for students in the science learning process. In addition, *e-learning* makes it easy for teachers to apply learning to students to be active and creative (student centered). By learning using e-learning, the teacher can carry out the *flipped classroom* learning model, which is a learning that utilizes learning media that can be accessed online by students who are able to support the learning material. This model is not just learning to use videos and online learning materials, but emphasizes how to use class time so that learning has higher quality and can improve students' knowledge and problem solving abilities (Maolidah, Irna Septiani, et. Al., 2017). So with the advantages of learning using e-learning with material content and HOTS questions using the Moodle CMS application to improve problem-solving abilities, it can be applied.

In addition to problem-solving abilities, this research also examined aspects related to learning motivation, this wass done because in certain cases

students had problems in the teaching and learning process which was indicated by the characteristics in the preliminary study stage that students were silent and lack of enthusiasm in participating in learning. During several class discussion activities, students awere more silent and did not want to discuss, and there are also those who pay attention to the discussion but are not interested in participating in the question and answer session. With such an attitude, the result of learning achievement will not be as expected. To overcome this problem, it is necessary to find out what the factors behind it, one of the factors that influence learning outcomes is learning motivation which is an absolute prerequisite for learning, and has a great influence in encouraging learning. Motivation to learn is a driving force that converts the energy within a person into real activities to achieve certain goals.

One of the innovations that can increase the learning motivation of students is by using e-learning with different method from the teacher and using communication tools such as cellphones and laptops, students can learn anywhere and anytime so that the learning outcomes of students also increase. . This is in accordance with Setiawan (2013) who shows that there is a significant increase in ICT learning motivation at the junior high school level due to the use of Moodle CMS-based e-learning, and there is a significant increase in ICT learning outcomes at the junior high school level due to the use of e-learning with Moodle. Another study by Safitri, et al. (2015) stated that e-learning developed with the Moodle application is effective for improving student learning outcomes as evidenced by the pretest and posttest scores.

Based on the researches above, many researchers use Moodle-based learning to improve students learning outcomes and learning motivation, but there are still few studies that use the flipped classroom model with the CMS Moodle application which is innovated using interesting material and HOTS questions to improve problem solving skills. So that in this study, researchers took the novelty, namely the application of the *flipped classroom* learning model to improve problem solving abilities and learning motivation. Thus the title of the research is "The Influence of *Flipped Classroom* Learning Model Application on Problem Solving Ability and Learning Motivation."

METHODS

The research was conducted using a quantitative research approach, with the type of experimental research. The population in this study was students of class X of SMK Yayasan Pharmasi Semarang in the academic year 2019/2020 which consisted of 5 classes.

The sample of this study was taken by using *cluster random sampling* technique. The sample consisted of 3 classes, 2 experimental classes namely class X Pharmacy 4 and 5 and 1 control class namely class X Pharmacy 3.

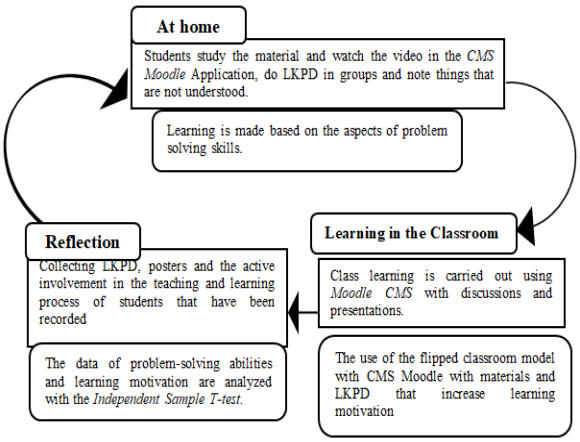

Figure 1. The Diagram of Flipped Classroom

Retrieval of data is related to problem-solving abilities and learning motivation. There are four indicators of problem solving ability: understanding the problem, compiling a problem-solving plan, implementing a solution plan, and checking the results of the solution. The data collection technique used was a test. The second data taken is learning motivation, there are five indicators, namely resilience in facing difficulties, interest and learning acuity, persistence in learning, independent in learning, and innovation in teaching and learning materials or the existence of interesting activities. The data collection technique used a questionnaire.

The data collection instruments were in the form of multiple choice question sheets for data on problem-solving ability and questionnaire sheets for learning motivation.

The data analysis technique for testing the problem-solving ability used the *Independent sample T-test* and learning motivation was analyzed using the *Independent Sample T-test* using the SPSS 25 computer program.

RESULT AND DISCUSSION

The results obtained include: a) The application of the *flipped classroom* learning model to problem solving ability and b) the learning motivation of students towards the flipped classroom learning model.

a. Analysis of Students' Problem Solving Ability Test with Flipped Classroom Learning Model

Analysis of the effectiveness of the Flipped Classroom learning model based on the *Moodle Course Management System (CMS)* based on students' problem solving abilities. The value of students' problem-solving abilities was obtained from the pre-test and posttest values, the mean value of the pretest and posttest was calculated using the *Independent sample T-test* with SPSS 25 and based on the t-test, the pre-test results obtained a significance value / Sig. (2-tailed) of 0.113 and 0.123 in each class and the value is more than 0.05, so that H0 is accepted.

Thus it can be concluded that there is no significant difference between the pretest mean of problem-solving abilities of students in the experimental class and the control class. Then it was calculated that the mean of the posttest results obtained a significance value / Sig. (2-tailed) of 0.000 in each class and the probability value of 0.000 is less than 0.05, so that H0 is rejected. Thus it can be concluded that there is a significant difference between the mean value of the posttest students' problem solving ability in the experimental class and the control class. Then the *N-gain test* was carried out to determine the increase in problem-solving ability. The data on the improvement of students' problem solving abilities using the N-gain test are presented in the table. 1

Table 1. The improvement of students' problem solving ability with N- gain test

Variabel	Pre-test Average	Post test Average	Class N-gain Average	Criteria
Control Class	36	75	0.61	Medium
Experimental Class	39	83.68	0.73	High

In the table 1, it can be seen that the problem solving ability of students has increased, the control class has increased with moderate criteria, the experimental class has increased with high criteria.

Learning outcomes are said to be classically complete if the percentage of students' classical learning completeness reaches ≥75% of the total number of students in one class. The results of the completeness of learning outcomes can be seen in Table 2

Table 2. The Result of Classical Learning Completeness

Class	Posttest			
	Number of Students Completing	Number of Students Completing(%)	Number of Students Completing	Number of Students Completing (%)
Control Class	21	63.3	12	36.3
Experimental Class	59	87	9	13

Based on the table 2, the percentage of classical learning completeness is more than the minimum completeness criteria (KKM), so that the learning outcomes using problem solving ability are declared complete classically.

The classical completeness test on the posttest value of students' problem solving ability was analyzed using the Independent Sample T-test using the SPSS 25 computer program. Based on the t-test, the significance value / Sig. (2-tailed) was 0.000 in each class. The probability value of

0.000 is less than 0.05, so H0 is rejected. Thus the completeness value of students' problem solving ability by learning using the *flipped classroom* learning model reaches the specified KKM.

The problem-solving ability of students after learning in each aspect analyzed in each class can be seen in Table 3

Table 3. The value of Each Aspect of problem Solving Ability

Aspect	The average of Control Class	The average of Experimental Class
Understanding the problems	74	84
Compiling a problem-solving plan	68	80
Implementing a solution plan	61	77
Re-checking the results of the solution	47	72

Based on Table. 3, it can be seen that the highest percentage is in the first aspect at the problem-solving ability level, namely understanding the problems and the value decreasing is in the aspect of which level is increasingly difficult, that is the problem-solving ability stage.

b. Analysis of Students' Learning Motivation with *Flipped Classroom* Learning Model

To determine the influence of the flipped classroom learning model on students' learning motivation, the results of the questionnaire value recapitulation were tested by using the Independent Sample T-test using the SPSS 25 computer program in each class. The probability value of 0.000 is less than 0.05, so that H0 is rejected. Thus learning with the *flipped classroom* model has an influence on the value of student learning motivation.

After the Independent Sample T-test had been carried out, the average value per aspect of learning motivation was calculated. The percentage results for each aspect are presented in the following table:

Table 4. The Results of Students' learning Motivation Analysis

Indicator	The average of Control Class	The average of Experimental Class
Resilience in facing difficulties	68	89
Interest and learning Acuity	73	90
persistence in learning	70	87
Independent in learning	64	86
Innovation in teaching and learning materials or the existence of interesting activities	65	86

Based on the table above, the experimental class average has higher learning motivation when compared to the control class.

The discussion will explain the problem-solving ability of students with Moodle Course Management System (CMS) -based learning with the flipped classroom model and student motivation

a. The problem-solving ability of students using the *flipped classroom* learning model.

Based on the data contained in Tables 1, 2, and 3 and the *Independent Sample T-test* tested using the SPSS 25 computer program, it can be seen that the learning tools developed are very effective in training problem-solving ability. This is because the learning process using the *flipped classroom* model makes students more active in encouraging problem-solving ability in the teaching and learning process. This is supported by the research by Ozhan & Kocadere (2020) which argues that online learning influences emotional intelligence and increases motivation to succeed in problem solving.

Students' problem solving ability can be improved through student-centered learning. One such learning model is the *flipped classroom*

learning model. *Flipped classroom* is student-centered learning, which consists of two parts, the first is interactive learning activities during face-to-face learning and the second part is direct individual teaching on the computer outside of class hours. The impact that can be generated in the use of *flipped classrooms* is an increase in motivation, involvement of students and an effect on learning outcomes including problem solving ability. This is because using the *flipped classroom* model with the CMS Moodle application, students have the literature material needed and the assignment is clearly conveyed. In face-to-face learning activities, students carry out discussions and complete problem-solving LKPD. In the classroom, they become more active in discussing between friends and teachers when completing

problem solving exercises in LKPD that have been studied at home, so that the time is also more effective, in addition discussions, questions and answers between friends and teachers are more focused because they have already known the topic to be studied beforehand. This is supported by Ismiati et al. (2020) stating that the *flipped classroom* model has a positive effect on the knowledge, skills and involvement of students in learning. This happens because students prepare themselves much better to study in class and feel satisfied and achieve better learning outcomes.

From the results of the posttest analysis to obtain an overview of students' solving ability, the posttest analysis was adjusted to the indicator of problem solving ability according to Polya, namely understanding the problem, compiling a problem-solving plan, implementing the solution plan, re-checking the results of the solution. The results obtained from the the first indicators or aspects (understanding the problem) has the highest percentage of 79% and the second order is the indicator of compiling a problem-solving plan with a percentage of 74 and the third is implementing a solution plan of 69% and the last is re-checking the results of the solution, which is 60% .

In the early stages of problem solving indicators, students are expected to be able to identify and analyze the problems contained in the questions so that students are able to understand the real problem (Aini, 2020). The results of the posstest and LKPD analysis showed that the initial stage of this problem solving indicator was the highest percentage in the posttest analysis and in working on LKPD students were able to describe in detail what was known in their own language. This shows that students meet the indicators of understanding the problem.

The second stage of the problem solving indicator is to compiling a problem-solving plan, the results of the posstest analysis of students' ability on the indicator was in the high category, namely an average of 74%. This is shown by students being able to design a problem-solving plan on the problem by putting forward a hypothesis after understanding the existing problem, besides that they could also use the knowledge they already had to be able to determine the most appropriate answer or solution to the problem. This shows that students can plan the direction of problem solving and meet the indicator of planning problem solving.

The third stage of the problem-solving indicator is implementing the solution plan or strategy. The results of the analysis showed that students were able to carry out the solution plan or strategy. This can be seen from the completion stage carried out by students completed in a coherent and complete manner and this is supported by the ability of students at the stage of understanding and planning strategies that could be done well, so that it made it easier for students to apply or implement problem solving.

The last stage of the problem-solving indicator is re-checking the results of the solution. The characteristic that students meet from this indicator was that students were really sure of the answers or solutions they wrote because they had rechecked the answers. But the value of the indicator stages from the beginning to the end, there was a decrease in each indicator, this was because there were a small number of students who still experienced difficulties at each stage of the problem solving indicators, for example in the early stages students fond it difficult to identify the problem. The triggering factors were several things such as inaccurate or careless in understanding the problem, reading the problem in a hurry and even because understanding the problem was not correct.

It can be seen from some students who provide identification descriptions when working on the LKPD. The results are not correct or in the wrong poststest questions or there are also some students who do not provide any descriptions to help in solving the problem. And for the second indicator of problem solving students can make mistakes by making the wrong hypothesis even though it was right at the initial stage, namely understanding the problem. For the third indicator, implementing a solution plan or strategy, errors can occur if students tend to carry out problem-solving procedures inappropriately. In the last stage, errors generally occur when students do not want to check the results of their answers again and are sure that the answers are correct. One of the reasons students do not want to check the answer again is that students find it difficult to connect the suitability of the concept to the results of its completion (Ismiati 2020). In fact, to do evaluation, students must understand the concepts well and be able to connect between concepts.

a. Learning Motivation of Students After Learning with the Flipped Classroom model

The application of learning using the Moodle CMS besides being able to improve problem-solving ability, it can also increase students' learning motivation. This is in accordance with the opinion of Soraya et al. (2020) stating that students are happy and satisfied following online learning, students feel the benefits of the learning process, so it can increase students' motivation to learn compared to full face-to-face learning. Also supported by Ardiansyah & Diella (2019) with the implementation of e-learning shows a significant effect on learning motivation, learning outcomes and students activeness.

Learning motivation is a condition in which someone has an urge to do something to achieve goals. Motivation can change the personal energy in a person which is marked by the emergence of feelings and reactions to achieve learning goals. The emergence of motivation is not solely from within students but teachers must involve themselves to motivate students' learning (Yul et al., 2020)

The data in the Table 4 showed the results that the percentage value of learning motivation of students in the experimental class was higher than the percentage value of learning motivation in the control class. The motivation to learn in the experimental class was better than the control class, indicating that learning with more mature readiness before starting learning would make students more ready and enthusiastic in learning. High enthusiasm will make learning more fun for students so that it creates a positive impression for students and has an impact on the growth of students' learning motivation. Learning motivation is very important to be participated in teaching and learning activities, because with the learning motivation, students can achieve a good achievement (Sobon, K & Mangundap, M. J., 2019).

The motivation of the control class tended to be lower than the experimental class. The causes of it are: (1) lack of readiness to learn (2) many tasks that must be done in one lesson (3) could not manage the time in the task so that many tasks had not been completed, resulting in decreased learning motivation.

The learning motivation in the experimental class increased slightly when compared to the control class. It was related to (1) the readiness of students to learn (2) the division of tasks at home and at school in a *flipped classroom* model that made students enjoy learning more (3) a more effective time in learning had a positive impact on learning motivation learners.

The application of *e-learning* learning that is made in an attractive manner is an important factor in increasing students' motivation to learn because fun learning will foster positive feelings for learning. According to Lin et al. (2017) E-learning based on Moodle's CMS shows a very good positive effect on increasing students' motivation to learn when compared to traditional teaching and e-learning learning can be used and its advantages are utilized to develop teaching strategies for practical and effective teaching.

Fflipped classroom model learning can be used in Biology learning because with e-learning students will be much more interested in the media provided by the teacher which is different from the usual so that students' enthusiasm for learning increases. The use of the *flipped classroom* model also has a positive effect on students because before learning in class, they are asked to

study first at home. This greatly helps the teaching and learning process because students' readiness to learn has been formed. The *flipped classroom* model is an inverted learning model (*flipped*) from the learning model that is usually applied by teachers in the classroom, which the material to be taught is given to students first, the material provided is in the form of discussion related to virus material and videos related to viruses that must be read and watched by students at home and understood and noted what they do not understand and also some important points. At school, the learning session is carried out by discussing and working on assignments from viral material so that students' learning hours are more focused and effective. According to Pierce & Fox (2012) and Asiksoy & Ozdaml (2015) the *flipped classroom* model can have an active role effect on students and make students actively participate in class discussions.

CONCLUSION

1. The application of the *flipped classroom* learning model to virus material influences positively toward students' problem solving ability at the high category. Classical completeness fulfills the minimum completeness criteria and there is an increase in learning outcomes in the pre-test and posttest with the criteria based on the *N-gain test.*
2. The application of the *flipped classroom* learning model has a positive influence on the learning motivation of students in learning. It is indicated by the average of each aspect of the experimental class motivation is much higher than the control class.

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