J. Pedagogi Hayati Vol. 5 No. 1 Listiani, dkk. (2021)
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FKIP Universitas Maritim Raja Ali Haji
ISSN 2503-0752 e-ISSN: 2579-4132

Improving Learning Outcomes Through The Science Technology Society (STS) Learning Model Based On Project Methods

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Dikirim: Oktober 2020; Diterima: Maret 2021; Publikasi: Juli 2021

ABSTRACT. Science learning should be learned by following the nature of science, which refers to the learning process, from the process of learning processed in such a way as to produce products, attitudes, and technologies used by students as a means to improve cognitive, affective, and psychomotor abilities. The observations showed that science learning is less inviting students to find and address problems in society, as a result of students' attitudes towards the environment less, and the learning outcomes obtained by students are also low. Therefore, there is a need for learning activities that can empower the learning process by using the project-based Science Technology Society (STS) learning model. The purpose of this research is: 1) knowing the implementation of the syntax of STS learning model based on project in students of the Elementary School Teacher Education Study Program Semester 7 academic year 2019/2020 FKIP Universitas PGRI Madiun in environmental pollution material, 2) knowing the improvement of learning results. This research is a type of class action research of partisipants, conducted in three cycles. Cognitive learning data collection techniques using tests, affective learning results using observation sheets and polls, and psychomotor learning results using observation sheets and tests. Data analysis using qualitative and inference analysis techniques. Concluded in the study namely: 1) STS learning model has been implemented well by STS syntax: problem orientation, concept formation, concept application, concept strengthening, and assessment in students of Elementary School Teacher Education Study Program Semester 7 academic year 2019/2020 FKIP Universitas PGRI Madiun environmental pollution material, 2) there is an increase in student learning outcomes in cognitive, affective, and psychomotor aspects. Implications in this study theoretically choose the right learning model and method can provide optimal learning outcomes, and the practical implications provide input for teachers and researchers to improve learning carried out using project-based STS models.

Keywords: *learning outcomes, science technology society, project methods.*

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FKIP Universitas Maritim Raja Ali Haji
ISSN 2503-0752 e-ISSN: 2579-4132

INTRODUCTION

Science learning that students learn through the Environmental Education (PLH) course only knows the concept. The learning process causes student understanding to be lacking. Incomplete understanding results in less than optimal learning outcomes. Students still have difficulty understanding the material because PLH courses have more theory and memorization, so students become bored and less interested (Oktaviani & Fitri, 2020). This situation results in low cognitive learning outcomes, especially in ecology and sustainable development materials. There are still many students who get scores below the pass criteria, namely ≤ 60 or classified in C criteria.

The learning experience gained in the Teacher Education Study Program of Elementary School, Faculty of Teacher Training and Education, Universitas PGRI Madiun has used a variety of methods, namely lecture methods, discussions, and presentations. The learning process has linked the concept to factual problems. The problems are reviewed in detail, but the solutions provided are not yet conservative. The impact of the skills acquired by students to solve problems has not been solutive.

The use of lecture methods has an impact on students less active in learning because students only come, sit, listen, and record so as to reduce the ability to think in solving problems (Hanney, 2018; Nahdi, 2015). As a result students only act as listeners who receive information from lecturers (Hutasuhut, 2010). Learning is directed to seek information and understand it, so that students only have theoretical knowledge but are less applicative in applying the theory. Students have not developed the ability to think to deal with problems that occur (Karina, Sadia, & Suastra, 2014). Students are also less skilled in developing their thinking creativity by using discussion methods and it is difficult to express their opinions (Maula, Prihatin, & Fikri, 2014). Students only perform activities according to procedure at the time of practicum. Students' skills in solving problems through practicum methods have not fully used or utilized technology or produced new technologies.

The observation results show that students still throw garbage in the classroom. Classrooms were dirty with candy wrappers, tissue, and paper after the lecture took place. The awareness to participate in maintaining and maintaining cleanliness in the campus environment is still lacking. The low attitude of students towards environmental conditions is caused by the learning process that has not provided solutions to various problems that occur. Students need to be invited to think about solving problems that occur so that they are more concerned about the environment. Science learning includes products, processes, attitudes, and technology that need to be developed in learning activities (Iskandar, 2014). Learning science that prioritizes the nature of science will be a strategic means to develop cognitive, affective, and psychomotor aspects. A comprehensive learning process can provide broad benefits in these three domains (Maisari et al., 2020). Science lecturers need to understand the nature of science learning so that lecturers are not only concerned with learning products but also pay attention to the ongoing process.

Activities carried out in science learning should be able to develop student psychomotor. In line with the statement by Afriana et al., (2016)that learning science will be experienced significantly by students if it involves cognitive abilities, manual skills, and social skills. Lecturers need to explain science not only limited to products and a little process, because the most important thing is the process to be able to prove a theory. Learning that puts forward the process will make students active, creative, and able to shape student character (Probosari, 2015).

The material used in the study is environmental pollution material. This material is very interesting to research because it deals with real life, has an element of novelty, and many problems that can be reviewed (Ariningtyas, Wardani, & Mahatmanti, 2017). Actions that lead to environmental and irresponsible damage need to be addressed immediately and sought solutions. The issue of environmental pollution has been reviewed during the lecture process, but a real solution to solve the problem has not been done.

Another problem with students is the results of learning. These problems can be solved by implementing learning activities that refer to the process, students are given real activities from real problems and real efforts in dealing with them. One applicable model is the project-based STS model. The implementation of project-based STS is expected to improve student learning outcomes. The project-based STS learning model is expected to help students develop creative thinking skills in addressing environmental problems. The project-based STS learning model has the main feature of addressing issues or problems that exist in the community that can be raised and criticized by students at the beginning of learning. Solve the problem by creating and utilizing alternative solution technologies provided by the project-based STS model. The purpose of conducting the research based on the above description is to know: (1) the implementation of the syntax of STS learning model based on the project on students of the Elementary School Teacher Education Study Program Semester 7 Academic Year 2019/2020 Faculty of Teacher Training and Education, Universitas PGRI Madiun in environmental pollution material, (2) improving student learning outcomes.

RESEARCH METHODS

The research was conducted in the Elementary School Teacher Education Study Program Semester 7 academic year 2019/2020 Faculty of Teacher Training and Education, Universitas PGRI Madiun on the course of Environmental Knowledge of environmental pollution materials. Subject of this study involved all students of the 7th semester Elementary School Teacher Education Study Program who took the environmental knowledge course of 38 students consisting of 12 male students and 26 female students.

This research is classified in qualitative research and is a type of Class Action Research (CAR). CAR aims to improve the learning process to improve the quality of education. CAR is carried out in a rational, systematic, and reflective empirical manner towards various actions taken from the formulation of a plan to an assessment of real action in the classroom in the form of teaching and learning activities, to improve and improve the conditions of learning carried out (Ferry & Kamil, 2019). The research was conducted with three cycles. This is stage of CAR:

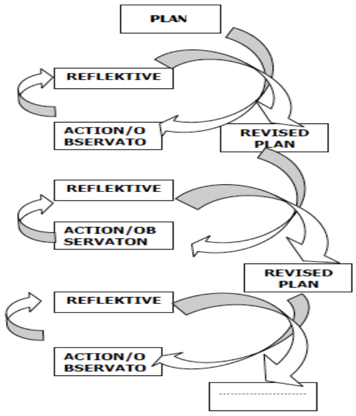

Figure 1. Stage of CAR

The planning phase is done by creating an action plan that will be carried out to improve or improve the quality of learning. The action stage is done by realizing the plan that the researcher has made. The observation stage is carried out by observing the implementation of actions including: the process, results and impact of the action. The last stage of reflection, at this stage conducts a review and considers the results or impact of the treatment which is then used to determine planning in the next cycle.

Data collection techniques consist of test and non-test. Aspect on cognitive and psychomotor learning results are obtained from tests. While non-test techniques are: (1) questionnaires for affective learning results, (2) observation sheets to obtain data on affective and psychomotor learning outcomes, (3) evaluation of projects for reports and products of projects that have been carried out. Instrument trials are conducted before retrieving data to ensure the instruments used have been tested for validity and reliability. The validity of cognitive test instruments is carried out with consultation on experts to ensure the theory's suitability with components and indicators. For affective and psychomotor instruments, construct validity tests and reliability tests are carried out.

Data validity checks are carried out through triangulation methods. Triangulation is done by using various sources to improve the quality of data by cross-checking. The triangulation used in this study is instrument triangulation and source triangulation.

Data analysis in this research uses qualitative analysis and inference analysis. Analysis activities are carried out continuously during and after data collection in the field (Miles & Huberman, 2007). Inference analysis is performed to test hypotheses, test analysis using paired sample T tests. Calculations are performed by looking for differences between the average learning outcomes for each cycle, then testing them to see if there are significant differences in average learning outcomes for each cycle.

Performance indicators in PTK are that there is an improvement from the previous cycle and students get a grade of sharpness namely: (1) cognitive learning results reach at least 60 or category C grades while the overall learning of the class is at least 75%, (2) affective learning results of at least 75, (3) the average psychomotor learning outcome of the class is at least 75.

RESULTS AND DISCUSSIONS

This research began from the pre-cycle phase in the Elementary School Teacher Education Study Program academic year 2019/2020 FKIP Universitas PGRI Madiun on the course of Environmental Knowledge of pollution materials. The purpose of the pre-cycle stage is to find out the class conditions and problems that occur in the classroom and find out the cause. Based on the initial observation results during the learning process, lecturers already use Methods that vary such as lectures, discussions, and practicum. The most commonly used method is lectures. Such learning results in students being less active because students only sit, shut up, and listen to lecturers' explanations. Comparison at the planning stage, and the action, observation and reflection the first cycle, the second cycle and the third cycle can be seen in Table 1, Table 2, Table 3 and Table 4 below:

Table 1. Comparison of planning

Stages	First Cycle	Cycle II	Cycle III
The orientation of the problem	Lecturers will serve youtube videos downloaded from the internet on the pollution of the river and will guide students seeking problem in the video.	Lecturers will provide an explanation at the beginning of the learning before a youtube video downloaded from the Internet rotated, so that students easily find or look for problems.	Lecturers will broadcast a video made last semester students about soil pollution in the surrounding environment of students and provide guidance to the students to focus on the issues to be resolved through the project.
concept formation	Lecturer planned to guide students in analyzing the video of pollution.	Lecturer planned to visit each groups and lecturers will guide the measures predicted to find the cause of the air pollution impact.	Lecturer planned to visit groups fairly and remind students of ways to predict the causes and effects of soil contamination.
application concept	Lecturers will guide students to design projects simple water purification technology.	Lecturers will discuss student time management when designing the air filter project, emphasized the importance of students working collaboratively and cooperatively use more than	Lecturers will provide help for students who have difficulty in designing the project and reiterated the importance of reference and learning resources in designing composting project, and the lecturer will provide direction and confirms that

		one source.	all the students to work together collaboratively in a group.
Stabilization concept	Lecturers will guide students presented a project assignment tool technology water purifiers and will provide a reconfirmation on the causes and effects of water pollution.	Lecturers will ask the student to streamline the current time presented air filters and lecturers will reconfirm and question and answer material that has not been understood.	Lecturers will condition effective learning both at inside / outside the classroom when composting project presentations, confirms the student to be more responsibility to work and provide reconfirmation and perform frequently asked questions about the material.
Evaluation	Lecturers will provide a written test to measure the extent to which the concept of student mastery of the material.	Lecturers will make the instrument test and non-test adapted to the actual conditions that occur in the community.	Lecturers will make the instrument according to the actual conditions that occur in the community and will motivate students to increase student learning outcomes.

Table 1 shows that plan of each cycle refers to the findings of the data analysis and reflection on the previous cycle.

Table 2. Comparison of Measures

Stages	First cycle	Cycle II	Cycle III
The orientation of the problem	lecturer play videos downloaded from the internet about the river pollution that occurred in the region and to guide students to find problems in the video.	Lecturers give an explanation at the beginning of the learning before the video is played. Youtube news videos downloaded from the Internet contain about air conditions Dumai polluted cities due to forest fires, smoke from factories and motor vehicle engine fumes.	Lecturer showed a video made by the previous generation students regarding environmental pollution in the soil around the students and look for issues raised in the video.
concept formation	The lecturer asked the students to determine the cause and effects of water pollution on the video.	Lecturers guide students in the steps predict the causes and effects of air pollution via video.	Lecturers guide students to predict the causes and effects of soil contamination.
application concept	Lecturers guide the group who designed the trial project tasks simple water purification technology.	Lecturers guide students to discuss in the project task of designing the air filter, will monitor the learning resources or references used by the student	Lecturers guide students in designing a composting project as decisive tools and materials as well as work procedures done and remind students to use reference or learning resources and be able to work together in one group.
Stabilization concept	lecturer guide students presented the project tasks.	Lecturers guide students present projects and reconfirm material.	The lecturer asked the students presented the results of the project, conditioned learning to be more effective, and provide re-confirmation in order to avoid misconceptions and do a debriefing.
Evaluation	Lecturers give kan test and non-test.	Lecturers provide test and non-test.	Lecturers provide test and non-test assessment.

Table 2 shows that the corrective actions performed at each cycle so that the quality of learning increases.

Table 3. Comparison of observation (observation)

Stages	First cycle	Cycle II	Cycle III
The orientation of the problem	Lecturer already memberipenjelasan beginning of the learning before the video is played, so that students easily finding problems. Lecturers set up a sound system so that the sound of video clearly audible.	Lecturers are looking for videos of air pollution problems that occur in the environment around the student in order to attract the attention of students. Lecturer already provides guidance to allow students to focus on the issues to be resolved.	Disclose environmental issues close to the student life to make students become easier to formulate the problem.
concept formation	Lecturers are advised to visit and guide students to predict concept measures water pollution.	Lecturers are advised to adilmembimbingserta recalls predicting step so as to find the concept of air pollution.	Tenured faculty guide students intensively despite all the students already have the skills to predict.

Advanced Table of Table 3. Comparison of Observation (Observation)

Stages	First cycle	Cycle II	Cycle III
application concept	Students have been advised to streamline project design discussion time. MFIs are collected prior to the presentation that the student focus groups during the presentation of the group.	Lecturers are already asking when discussing student difficulties in designing the project, faculty reaffirmed the importance of reference and learning resources in designing the project and asked the students to prepare for an after hours lectures. Lecturers provide guidance importance of students can work together in a group.	Tenured faculty guide students intensively when students design a composting project.
Stabilization concept	Lecturers guide students as a presentation tool and a simple water purifier. Explaining the importance of working collaboratively cooperative. Lecturer is expected to further streamline time well for reconfirmation.	Lecturers could condition for more effective learning environment for reconfirmation and debriefing. Lecturer affirm students to be more responsible for the job.	Lecturers can manage time well for presentations, reconfirmation and debriefing.
appraisal	Motivate and guide students to improve learning outcomes	Lecturer more motivated and focused on individuals who have difficulty in learning.	Lecturer more motivated and focused on individuals who have trouble both inside and outside learning.

Table 3 shows that from the observation already made some actions on each cycle.

Table 4. Comparison of reflection (reflection)

Stages	First cycle	Cycle II	Cycle III
The orientation of the problem	Lecturer giving explanation at the beginning of the learning before the video is played, so that students can easily find / find the problem.	Lecturers are looking for videos of air pollution problems that occur in the environment around the student in order to attract the attention of students.	Disclose environmental issues close to the student life to make students become easier to formulate the problem.
	Lecturers set up a sound system so that the sound of video clearly audible.	Lecturers provide guidance to allow students to focus on the issues to be resolved.	
concept formation	Lecturers are advised to visit each group and guide students measures to predict the concept of water pollution.	Lecturers are advised to be fair in guiding students and remind back steps predict.	Tenured faculty guide students intensively although students own
application concept	Students are advised to minimize the time when discussions of project designing a simple water purification technology. MFIs are collected prior to the presentation that the student focus groups when presenting the group and the importance of working in a collaborative and cooperative groups.	Lecturer asks students when discussing difficulties in project design of air filter, faculty reaffirmed the importance of reference and learning resources in designing the project and asked the students to prepare outside of lecture hours before the learning begins. Lecturers are advised to provide guidance importance of students can work together in one group	Tenured faculty guide students intensively when students design a composting project.

Advanced Table of Table 4. Comparison of reflection (Reflection)

Stages	First cycle	Cycle II	Cycle III
Stabilization concept	Students in the group participate Lecturer is expected to further streamline the time well and do stabilization concept.	Lecturers could condition for more effective learning environment and confirms the student to be more responsibility to the job.	Lecturers presented awards to a group of enthusiastic in learning.
appraisal	Motivate and guide students to improve learning outcomes	Lecturer more motivated and focused on individuals who have difficulty in learning.	Lecturer more motivated and focused on individuals who have trouble both inside / outside the classroom.

Table 4 shows that from the first cycle to the third cycle the overall student already has increased the quality of learning leading to a better direction. Pre-cycle cognitive results showed students who were able to achieve a grade of 60 or with c-grade criteria were only 16 or 50%. Observation results showed students were less collaborated and participated in group work. New Elementary School Teacher Education students have some skills/ psychomotor. The most commonly used psychomotor is the psychomotor observing and communicating (discussion) in the learning process, although not all students are involved in it.

Research is carried out in three cycles. The material in cycle I is the water pollution, the material in cycle II that is the air pollution, and the material in cycle III that is the soil pollution. Comparison of cognitive, affective, psychomotor learning outcomes and inter-cycle project results can be seen in the following figure 1, 2, and 3:

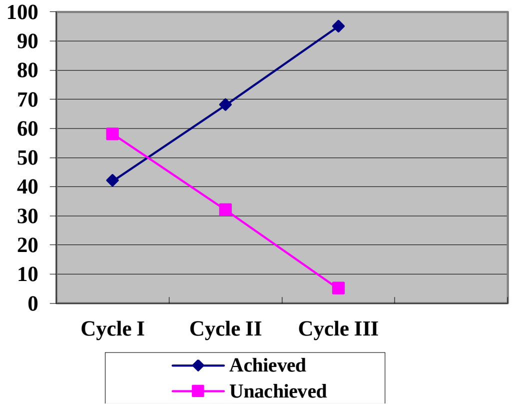

Figure 2. Cognitive learning outcome

The cognitive learning results shown by Figure 2 indicate the bonding of each cycle. At the end of the cycle of 96% improvement in cognitive learning outcomes, it can be concluded that performance indicators have reached more than 75% of students can achieve a score of 60. Based on these results the cycle can be stopped on the 3rd cycle.

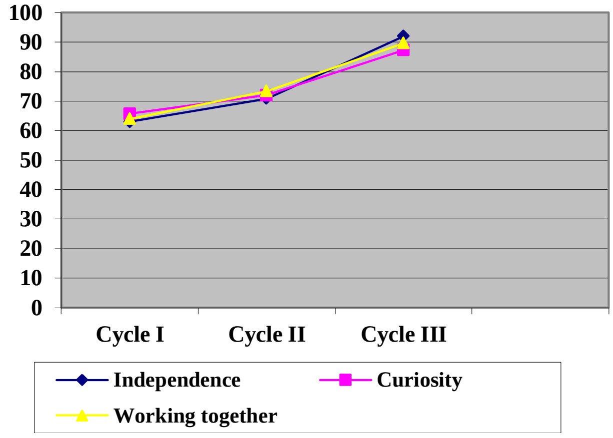

Figure 3. Affective learning outcome

Figure 3 shows an increase in affective learning outcomes in all indicators, namely aspects of self-reliance, curiosity and cooperation in each cycle. In addition to being viewed based on aspects of each cycle, the measurement of affective learning results is also seen from the grade level. The calculation of affective learning results from the class average of cycles I, II, dan III are 64.23, 72.06, and 89.63, respectively. Overall the average affective learning outcome at the end of the cycle has reached a performance indicator of at least 75%. So it can be concluded that the cycle is stopped in cycle III.

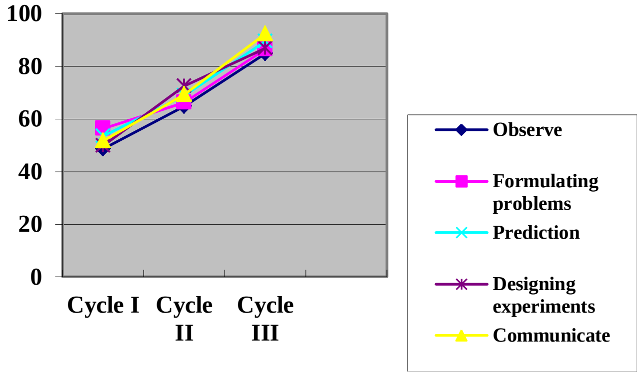

Figure 4. Psychomotor learning outcome

Figure 4 shows that there is an increase in psychomotor learning outcomes consisting of 5 aspects of observing, formulating problems, predicting, designing experiments and communicating from cycle I to cycle III.

Measurements of psychomotor learning results can also be seen from the average class.

Calculation of psychomotor learning results from the average cycle class I: 51.98, cycle II: 68.36, and cycle III: 87.43. Overall the average psychomotor study results at the end of the cycle have reached a performance indicator of at least 75%.

Table 5. Project Results

Cycle I	Cycle II	Cycle III
88,79	85,69	88,56

Table 5 shows that the average score of project results per group from cycle I to cycle III is different. The results of project cycles I to cycle II decreased but from cycle II to cycle III increased again. To find out the comparison of cognitive, affective, and psychomotor learning outcomes in cycle I, II, and III, further data analysis was conducted. The analysis of the data carried out starts with a description of statistics covering the average and standard deviation.

From the calculation results it is known that the average score and the standard deviation of the learning results in each cycle are different. The average score of student learning outcomes with the application of project-based STS learning models has been edified from cycle I to cycle II and from cycle II to cycle III. Data analysis is done to test the proposed hypothesis, the test analysis used t test samples in pairs. The study used the same sample but testing of the sample was done twice in different times. Testing is given by providing treatment i.e. STS learning of the sample. As for the benchmark of decision making if the probability or significance > 0.05 then H0 is accepted whereas if obtained the price of sig < 0.05 then H0 is rejected. The significant level (α) used in this study was 5%. Hypothetical conclusion:

Table 6. Hypothetical conclusion

Aspects of Measured	Test Results	Conclusion
Cognitive Learning Results Cycle I and II	0,849	Ho Accepted
Cognitive Learning Results Cycle II and III	0,017	Ho Rejected
Affective Learning Results Cycle I and II	0,002	Ho Rejected
Affective Learning Results Cycle II and III	0,024	Ho Rejected
Psychomotor Learning Results Cycle I and II	0,000	Ho Rejected
Psychomotor Learning Results Cycle II and III	0,006	Ho Rejected

Based on the above research results indicate that the application of the project-based STS learning model can enhance learning outcomes. The results of the hypothesis analysis on the cognitive aspect show that there is no significant difference in cognitive learning outcomes between cycle I and cycle II. This is because the project-based STS learning model is a new learning model applied to students. The application of the project-based STS learning model provides something different than the previous learning process. So that in cycle I students still adapt to learning conditions. Updates in learning are needed so that students do not get bored and can improve the quality and quality of learning activities (Efriana, 2014). At the beginning of project-based STS learning, students are invited to find problems and provide alternative solutions to solve them. Lecturers act as facilitators and mentors, when students encounter difficulties and when students need consultations to consider solutions found. The process of linking new information to relevant concepts in cognitive structures will provide real solutions (Listiani, 2015).

Better cognitive learning outcomes are obtained, namely that there are significant differences in cognitive learning outcomes between cycle II and cycle III. The application of project-based STS models makes it easy for students to find their own knowledge or concepts in the lecture material. students not only focus on the given project but also develop their knowledge through thinking activities in solving problems (Albritton & Stacks, 2016). In cycle I students still adjust to the learning stages carried out, but in the next cycle students are used to following the lesson. In the orientation stage, student problems are directed to find actual issues or problems in the environment where students live. Actual environmental problems will make it easier for students to better abstract knowledge, so that the solutions given are more concrete (Miller & Krajcik, 2019). In line with the statement of Webb & Rule, (2012) problems can be solved realistically if they know the original conditions.

Results obtained from the affective aspect hypothesis analysis show that there are significant differences between cycle I and cycle II and between cycle II and cycle III. The project-based STS learning model can be applied to Elementary School Teacher Education students. There is a change in student behavior in the learning process caused by the knowledge that is better so as to improve the learning outcomes. The behaviors studied are self-reliance, curiosity, and cooperation. Behavior is said to be good if students have initiative in carrying out certain activities without coercion or direction from lecturers (Hahl, 2017).

Hypothetical analysis of psychomotor aspects also shows there are significant differences between cycle I and cycle II and between cycle II and cycle III. There is an increase in the psychomotor aspect due to the project that students must work on in groups (Titu, 2015). Through the work of this project students have more skills in formulating problems in the form of questions, making predictions, planning experimental activities and presenting results. Psychomotor is needed so that the material can be absorbed properly by students (Nensy, 2019).

Based on the research results, it is known that the project-based STS learning model can develop psychomotor aspects. Each stage in the project-based STS learning model requires students to have a psychomotor. In line with research conducted by (Kurnia et al., 2014) where students who use STS tend to be better at understanding scientific processes, so that students have the ability in the form of knowledge to apply scientific concepts. Knowledge in applying concepts is the result obtained from skills that are empowered in the learning process (Nensy, 2019).

Improvements in cognitive, affective, and psychomotor aspects are supported by student data from cycles I, II and III. This is relevant to the (Rusilowati et al., 2016) STS model can meet the demands of the 2013 curriculum, namely developing student learning outcomes, in addition the STS model is a model that refers to scientifict approach so as to get students to solve problems by using scientific methods that have concern for the community and the environment.

The use of project-based STS models in learning produces products to solve problems. The results of the completion of student projects in the form of reports and products to solve the problems raised. Relevant to opinions Lee, (2014) the application of STS in learning can develop students' ability to utilize and produce new technologies to solve the problems that occur.

The project-based STS learning model is able to provide a science learning process in accordance with its essence (Afriana et al., 2016). STS model learning through a process that requires skills that include observation, formulating problems/ questions, making predictions, designing experimental activities, and communicating. Learning the STS model can develop an environmental care attitude. Learning the STS model can produce products either by utilizing technology or producing new technology. In line with the statement Abdul & Lidinillah, (2006) that science learning should include four things, namely products, processes, attitudes and technology. Science learning that is taught in accordance with the nature of science will be a strategic means to develop various cognitive, affective, and psychomotor aspects so that the output learningcan be developed completely. The resulting learning outcomes are the impact obtained from the learning process that is carried out optimally so that it can make changes to students (Inayah et al., 2018).

CONCLUTION AND SUGGESTIONS

The results of this study include:

1. Project-based STS learning model in Elementary School Teacher Education students 7th Semester academic year 2019/2020 Universitas PGRI Madiun can be implemented well using 5 sts stages as follows:

a) The orientation stage of the problem, at this stage the lecturer gives an overview of the problems that occur in the area that is shown through the video, then guides the student to find the problem.
b) The concept formation stage, lecturers guide students to discover the concept of water pollution, air pollution, and soil pollution; concepts, causes of pollution, and predicts the impact of pollution.
c) Concept application stage, at this stage lecturers guide students to design project tasks in groups, directing students to use valid references and learning resources and in accordance with the design of the project that has been created.
d) The concept strengthening stage, students present project tasks in groups and direct students to discuss for more effective learning, provide confirmation so that there is no misconception, then conclude the material together.
e) Assessment stage, at this stage lecturer provides evaluation in the form of tests and non tests, to measure cognitive, affective, and psychomotor learning results.

2. Student learning outcomes are improved by the application of project-based STS learning models. The improvements are as follows:

a) There is an increase in the completeness of cognitive learning outcomes through the application of project-based STS models from cycle I (37.50%), cycle II (65.63%), cycle III (96.00%). While the relationship of cognitive learning outcomes between cycle I and II is not a significant difference, but between cycle II and III there are significant differences.
b) There is an increase in the completeness of affective learning outcomes from cycle I (64.23), cycle II (72.06), cycle III (89.63) and there are significant differences in affective learning outcomes between cycle I and II and cycle II and III with the application of project-based STS models.
c) There was an increase in psychomotors from cycle I (51.98), cycle II (68.36), cycle III (87.43) and there were significant psychomotor differences between cycle I and cycle II and between cycle II and cycle III with the application of project-based STS models.

3. Implications in this study theoretically choose the right learning model and method can provide optimal learning outcomes, and the practical implications provide input for teachers and researchers to improve learning carried out using project-based STS models.

ACKNOWLEDGEMENT

This research was supported by Universitas PGRI Madiun. Researchers would like to thank the Head of Elementary School Teacher Education program and Rector of Universitas PGRI Madiun who has given the necessary permits and facilities during this research. The researchers also thanked all those who have helped and been involved in completing this research.

Follow-up recommendations from the study are: (1) the results of the study can be used as a reference to conduct similar research activities with different materials so that it can be known the significance of the application of project-based STS models in improving learning outcomes, (2) can be developed with different variables such as critical thinking ability, creativity, science literacy, and so on.

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