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Improving Natural Science Learning Outcomes on the Topic of the Human Excretory System through Contextual Learning of Modeling Techniques for Grade VIII Students of SMP

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ABSTRACT

The objectives in this study were: 1) to improve learning activities in Natural Sciences in class VIII B students of SMP Warga Surakarta, 2) to improve learning outcomes, especially learning outcomes in Natural Sciences through contextual learning methods modeling techniques about the Human Excretory System in class VIII B students of SMP Warga Surakarta. The method used is action research method. The research was conducted on class VIII B students of SMP Warga Surakarta in the 2022/2023 academic year, as many as 27 students consisting of 13 boys and 14 girls. The data collection techniques were carried out by observing student and teacher activities, tests, partner teacher responses, and monitoring classroom observations. From the assessment test of Natural Science learning outcomes for each cycle of class action always increases, namely; the percentage of pre-cycle KKM achievement is 29.62%, cycle I is 44.44% and in cycle II it becomes 100%. Based on student responses in the implementation of learning using modeling techniques, it becomes more fun, easier to understand, makes students want to be more active and creative, students can find or interpret more freely, and is not confusing. So that by using the modeling method in learning Natural Sciences can help students in increasing activity and learning outcomes in Natural Sciences.

KEYWORDS

aktivitas belajar, hasil belajar, pembelajaran kontekstual teknik pemodelan

1. Introduction

The quality of the teaching and learning process is one of the factors that determines success in achieving educational goals. Students who study are expected to experience changes in the areas of knowledge, understanding, skills, values and attitudes. In the learning process, teachers have the task of encouraging, guiding and providing learning facilities for students to achieve goals (Darling-Hammond et al, 2020; Van de Pol et al. 2010).

The author will carry out classroom action research at Warga Middle School. Citizen Middle School is located in the middle of the city of Surakarta. Warga Middle School has three classes at each level with a very comfortable classroom situation for studying. Where each classroom is equipped with air conditioning to make students comfortable studying in class. Each room is also equipped with complete multimedia. Has sufficient science laboratory space to accommodate 35 students. At class VIII there are three classes, where class VIII A has 28 students, class VIII B has 27 students and class VIII C has 27 students. At Warga Middle School there are two science teachers.

In this research, the author focused more on class VIII B. The reason for choosing class VIII B was because of the three classes at class VIII level, Class VIII B received the lowest completion score when compared to the other two classes. With the same lesson material and with the same teacher, data was obtained that students in class VIII A had achieved 57.1% learning completeness, class VIII B 29.6% and class VIII C 74%. At Warga Warga Middle School, the expected KKM subject is 75. Of the 27 students in class VIII B, only 8 students have succeeded in achieving the KKM target or 29.6%, so they have not achieved the desired KKM target. Seeing these conditions, the author focuses more on research in class

VIII B. In junior high school students in Class VIII on Biology Science material generally still use conventional learning models which still rely on the lecture method. Students are still considered as learning objects. Some students still feel embarrassed to express their opinions. Teachers also do not facilitate students to be able to speak or express their opinions in class. So it seems that learning in this class students become very passive.

To overcome this, there needs to be variations or innovations in biology teaching methods for students in class to improve their activities and learning outcomes. The success of the teaching and learning process in a school does not only depend on the teacher's ability to deliver the material, but also very much depends on the teacher's ability to see the differences in abilities possessed by students, which is why a teacher is really required to have the ability to choose a good learning model to achieve the goals. from the teaching and learning process can be achieved well.

In developing education, natural science lessons require a continuous learning process. There are several factors that influence learning achievement in Natural Sciences. These factors are internal and external factors. Internal factors concern the student's own personality, including will, intelligence, ability, creativity, motivation and so on, while external factors, namely factors that are outside the student's personality, include support from parents, the environment, teachers, school and so on. .

Therefore, it is necessary to change the learning approach to a more meaningful one so that it can equip students to face the life problems they face now and in the future. The learning approach that is suitable for the problems above is Contextual Teaching and Learning (CTL). The CTL approach is a learning concept that assumes that children will learn better if the environment is created naturally. This means that learning will be more meaningful if students work and experience for themselves what they are learning, not just "know". Learning is not just an activity of transferring knowledge from educators to students, but also how students are able to interpret what they learn.

Contextual learning is learning that helps teachers relate subject matter (content) to students' real world situations (context) and encourages students to make connections between the knowledge they have and its application in their daily lives as family members, communities and citizens. Contextual learning is based on the premise that the meaning of learning will emerge from the relationship between content and context. Context provides meaning to content (Hudson & Whisler, 2007; Johnson, 2002).

In increasing understanding of Natural Science concepts, especially regarding the Human Excretory System, one way is through Contextual Teaching and Learning (CTL) learning, which is a learning strategy that emphasizes the process of full student involvement to be able to find and understand the material being studied and relate it to the situation. real life so that it encourages students to be able to apply it in their lives. This relationship can be exemplified by the actual knowledge of each student.

One of the components or principles of contextual learning is the modeling principle, which is a learning process by demonstrating or imitating something as an example that can be understood and imitated by every student. For example, the teacher explains examples of the Human Excretory System to students. The modeling process is not limited to teachers alone, but teachers can also use students who are considered to have abilities. For example, students who are clever or have special abilities in the field of Natural Sciences can be asked to display or explain their abilities in front of their friends, by imitating what has been exemplified, in this way the students can be considered as models. Thus, through modeling other students are more active in the learning process and are expected to be able to understand subject matter more quickly and avoid theoretical - abstract learning which can allow verbalism to occur (Berns & Erickson, 2001).

To facilitate students so that they can express their opinions, teachers must use varied learning models. Here the author uses a modeling type, this model is a learning model that is used to increase student involvement in the learning process so that they become more active. In improving students' learning outcomes, especially natural sciences, it is necessary to improve contextual learning that involves students optimally so that the expected learning outcomes can be maximized, for example through learning modeling techniques. With a learning model for understanding Natural Sciences, it is hoped that it can increase student learning activities and the ability to understand subject matter so that it can improve

student learning outcomes. Contextual learning and modeling techniques have shown significant effectiveness in improving science learning outcomes, particularly on the topic of the human excretory system. Various previous studies have provided empirical evidence supporting this approach. Suryawati and Osman (2018) explored the effectiveness of modeling techniques in science learning. Their research revealed that students taught using modeling techniques showed improved learning outcomes compared to the control group using conventional methods. This suggests that modeling techniques can be an effective tool in visualizing abstract concepts in biology, including the excretory system.

Therefore, in order to increase student activity in the science subject sub-subject of the Human Excretory System, the researcher took the title Classroom Action Research. The purpose of this study is to apply contextual learning with modeling techniques on human excretory system material to improve student learning outcomes. By achieving these objectives, the research is expected to provide significant contributions to improving the quality of science learning at the junior high school level, especially in the topic of the Human Excretory System, as well as enriching the literature on the effectiveness of contextual learning and modeling techniques in science education.

2. Method

In this research, the method used is the Classroom Action Research (CAR) action research method. The research method is carried out directly in the form of an action and the researcher can be directly involved in obtaining data on the object being studied. This research is based on observations regarding student activities during the learning process in improving Natural Sciences learning outcomes using modeling for 2 cycles. The research subjects were 27 students in class VIII B of Surakarta Citizen Middle School for the 2022/2023 academic year, Central Java Province, consisting of 13 boys and 14

To obtain data as expected in research, tools are needed to obtain precise and objective data. Observations of student activities are carried out during the teaching and learning process in each cycle. Each cycle consists of planning, action, observation and reflection. Planning in this research is an activity carried out jointly between researchers and partner teachers to develop action plans that will be provided during the learning process.

The actions in this research take the form of actions carried out by partner teachers in the Natural Sciences learning process, especially the Human Excretory System material using the Modeling method. Observation is a direct observation activity carried out by researchers in the classroom, when partner teachers carry out learning facilitation activities. The observed aspects focused on student and teacher activities during the learning process (Kemmis, McTaggart & Nixon, 2014).

Reflection is a discussion activity carried out jointly between researchers and partner teachers after learning activities are carried out. Reflection material is focused on the results of observations by researchers, especially to pay attention to things that need to be improved in the next cycle. After the reflection is carried out, it continues with action planning activities in the second cycle.

The second cycle also consists of four stages, namely planning, action, observation and reflection. And so on, it continues with the third cycle at the next meeting until a learning pattern is obtained using optimal modeling which can improve learning outcomes in Natural Sciences. Teacher and student activities observed during learning are as follows, a) Teacher activities carried out in each learning cycle: explaining (apperception), Ask questions, Give answers, Using modeling to improve science learning outcomes, Guiding and directing in understanding the Human Excretory System in everyday life, Give motivation and praise, Give assignment practice, Not observed (not monitored by researchers); b) Student activities carried out in each learning cycle: Listen to the teacher's explanation, Answer questions, Take notes, Ask questions that are not clear, Cooperation within the group, Express opinions in discussions, Modeling to improve understanding of science material on the Human Excretory System, Try to understand and explain what the model conveys, Do practice questions, Not observed (not monitored by researchers)

In this research, the author carried out a test to obtain data related to the variable of improving learning outcomes in Natural Sciences on the Human Excretory System material that has been presented

by the model. The test is carried out twice at the end of each cycle of each classroom action in improving Natural Sciences learning outcomes through learning modeling techniques. The first test was carried out after the class action treatment. The test consists of multiple choice questions with 20 questions each for each cycle. Test results are used to obtain data regarding learning outcomes in Natural Sciences.

The next test was carried out after changes in teacher activities and student activities in increasing understanding of Natural Sciences on the subject of the Human Excretory System by learning modeling techniques in classroom action research.

Research instruments are tools used to collect data in a study. To obtain accurate data, good instruments are needed. The instruments used in this research include 1) Observation Sheet. Observation sheets are one of the instruments commonly used in classroom action research to collect data; 2) Learning Results Test. The learning outcomes test is an evaluation tool that will be given in the form of a daily test at the end of each cycle; 3) Student Worksheets (LKS). Student Worksheets are an evaluation tool that is used at every meeting. Group worksheets are given during the learning process.

The criteria used to determine the success of achieving the objectives of this research are if there is an increase in Natural Sciences learning outcomes during the learning process by modeling from one cycle to the next, otherwise dominance in the learning process increases Natural Sciences learning outcomes during the learning process which decreases.

The data analysis technique used in this research is a descriptive analysis technique including student activity data and learning outcomes. In the form of observation data during teaching and learning activities. Data on the implementation of learning activities can be taken using an observation sheet in the form of a check list during science learning. After the observation of the students is complete, it is analyzed using the formula:

Grade = (∑score obtained by the student)/(∑maximum score) x 100%

The criteria for presenting activities are (Arikunto: 2009):

81% - 100% = very good
61% - 80% = good
41% - 60% = sufficient
21% - 40% = less
0% - 20% = very less

The score scale used to observe student activities is 1 – 4 with the information 1 = poor, 2 = sufficient, 3 = good and 4 = very good.

Data on student learning outcomes is obtained based on students' skills in working on test questions. Students are declared complete if they get a score of 75 according to the specified KKM. To measure learning mastery, the formula is used:

Grade = (∑score obtained by the student)/(∑maximum score) x 100%

After obtaining the student learning outcome scores, classical learning completeness is calculated. The classical indicator of learning completeness is if 75% of the total number of students are declared to have completed learning. Completion is classically calculated using the formula:

Classical achievement = (∑completed students)/(∑all student) x 100%

The test is given after the end of the cycle in the form of a written test. After obtaining the student learning outcome scores, classical learning completeness is calculated. The classical indicator of learning completeness is if 75% of the total number of students are declared to have completed learning. Completion is classically calculated using the formula:

Classical achievement = (∑completed student)/(∑all student) x 100%

After the teacher gets an idea of the student's grades, the teacher can group students into very good, good, fair and poor categories. The categories and value ranges can be seen more clearly in the following assessment Table 1.

Table 1. Assessment Category

No	*Category*	*Interval*
1.	Very good	93 – 100
2.	Good	84 - 92
3.	Sufficient	75 - 83
4.	Poor	< 75

3. Results and Discussion

Based on a series of research activities, the following research results were obtained:

Table 2. Implementation of Research Actions

Step	*Action*	*Achievement*	*Reflection*
Pra cycle	Learning tends to be one way where the teacher dominates the learning.	29,6%	Teaching methods are needed that can improve student activity and learning outcomes, namely by utilizing contextual learning modeling techniques. The reason: a. By imitating the model presented by the teacher, students understand the material presented better and are more skilled at carrying out activities as modeled. b. Encourage student behavior so that students are no longer passive in learning.
Cycle I	Learning uses contextual modeling techniques, using images displayed and one of the students imitating the model in small groups.	44,44%	a. Students who take part in learning using contextual modeling techniques are still not ready. b. The model used is less clear and not large enough c. Students who act as models are not optimal d. The distribution of time is good but the implementation in the field is still not appropriate.
Cycle II	Learning still uses contextual modeling techniques, with picture models and demonstrations where students remain involved as models through small groups.	100 %	a. Students seem more enthusiastic in participating in learning. b. Students are braver in asking questions and providing answers. c. Student learning outcomes increased very significantly.

The results of this classroom action research can be described in two cycle stages. The implementation of learning for each cycle includes:

3.1. Cycle I

Planning. Partner teachers and observers/researchers discuss the students who will be observed and the learning methods that will be used in a learning implementation plan. In the planning stage of cycle I, the teacher as researcher prepares various equipment, materials and facilities needed, including: Compile the syllabus, prepare the Learning Implementation Plan (RPP) for cycle I. prepare learning resources in the form of lesson materials and Student Worksheets, prepare assessment formats, create student activity observation sheets, create test questions for cycle I.

Implementation of Action. At this stage, actions are carried out according to the Learning Implementation Plan that has been prepared. The learning was carried out in class VIII B of Surakarta Citizen Middle School, with 27 students attending, consisting of 13 girls and 14 boys. Carried out in one meeting for two hours of class where each hour is 40 minutes so that the lesson lasts for 80 minutes on May 3 2023, 07.15 – 08.35. Details of the actions taken include:1) Initial activities; the teacher greets and asks for the students' attendance; the students and teacher pray to start the lesson, the teacher stimulates the students with the question "try to imagine what would happen if you didn't urinate or didn't sweating?" Is your body getting better; the teacher provides an outline of the material coverage

and learning objectives as well as an explanation of the activities that will be carried out during the lesson; the teacher displays a chart of the Excretory System or a video related to the human Excretory System for students to show and observe; students observe the impressions presented by the teacher regarding the human excretory system.

2) Core activities: students enter groups that have been previously divided and receive Student Worksheets; 2in groups students hold discussions to discuss questions in the LKS; one of the students who acts as a model teacher leads the discussion and provide explanations to the group members. With the help of charts and videos about the human excretory system; give group members the opportunity to think, understand and record everything that has been conveyed on the Student Worksheet; continue in group discussions to answer the LKS; students present the results of observations and discussion results; students from other groups respond to students who are presenting; the teacher evaluates the results of student discussions.

3) Closing: students and teachers review the results of learning activities; the teacher gives awards (praise, etc.); the teacher assigns students to study the material at the next meeting, namely the process of filtering and forming urine.

Observation. Observers observe students' activeness in the process of implementing learning modeling techniques in science subjects on the main topic of the Human Excretory System. Based on the results of the first cycle of observations carried out by observers in learning, it was seen that the readiness of some students to take part in learning using the modeling method was still lacking. This is evidenced by the presence of several students chatting with their classmates and there are still students who are not enthusiastic about participating in learning activities. From the teacher's perspective, it can be seen that the teacher also takes too long in delivering the introduction. Teachers are still not maximal in distributing learning time so they appear rushed in every process. It is also felt that the use of students as models is not optimal in guiding their group friends. So there are still many students who still have doubts and have difficulty answering worksheets. The following is a summary of cycle i learning results data (Table 3).

Table 3. Summary of Cycle I Learning Results Data

No	*Data*	*Test's Result*
1	Highest score	85
2	Lowest score	50
3	Number of students who completed	12
4	Number of students who have not yet completed	15
5	Average	70,37
6	Mastery learning	44,44%

Reflection. This stage is intended to thoroughly review the actions that have been taken, based on the data collected in cycle I, then carry out an evaluation to perfect the next actions. The conditions that exist in cycle I are problems that must be found for solutions. To overcome this problem, researchers made improvements to learning which will be carried out in cycle II. Improvements that researchers need to make are: Teachers motivate students more in learning using modeling methods, teachers are more optimal in allocating time for each process, teachers are more optimal in guiding students, especially model teachers so that students better understand the material presented, and the learning process continues to use modeling techniques by adding experiments or demonstrations to make it more interesting

3.2. Cycle II

Planning. This cycle is the result of a revision of the actions in the cycle. In the planning stage of cycle II, the teacher as the researcher prepares various equipment, materials and facilities needed, including: Develop a syllabus, prepare a Learning Implementation Plan (RPP) cycle II, prepare learning resources in the form of learning materials and student worksheets, develop an assessment format, make an observation sheet of student activities, and create test questions for cycle II.

Implementation of Actions. Actions for cycle II are implemented to make each step of contextual learning of modeling techniques more effective. Actions in cycle II are almost the same as cycle I, namely at this stage, actions are carried out according to the Learning Implementation Plan that has been prepared. The learning was carried out in class VIII B of Surakarta Citizen Middle School, with 27 students attending, consisting of 13 girls and 14 boys. It is carried out in one meeting for two hours of class where each hour is 40 minutes so that the lesson lasts for 80 minutes on May 17 2023, 07.15 – 08.35. Details of the actions taken include: 1) Initial activities, the teacher greets and asks for the students' attendance, students and teachers pray to start the lesson, the teacher conducts an apperception relating the material at meeting 1 to the material to be studied by asking, that organs are involved in the process of excreting urine?, what is the function of the kidney?, parts of the kidney, the teacher informs the students of the activities that will be completed at today's meeting, namely carrying out a simple blood filter which shows the processes in the kidneys and analyzing urine output in the discussion group, the teacher informs the page of the science textbook that will be used, namely page 83, and students observe the presentation presented by the teacher regarding the process of filtering human urine. 2) Core activities: students enter into previously divided groups and receive a student worksheet; in groups, students hold discussions to discuss the questions in the Iks; one of the students who acts as a model teacher leads the discussion and carries out a simple blood screening demonstration for his group members; give group members the opportunity to think, understand and record everything that has been conveyed on the student worksheet; continue in group discussion to answer the Iks; students present the results of observations and discussion results; students from other groups respond to students who are presenting; the teacher evaluates the results of student discussions. 3) Closing: Students and teachers review the results of learning activities; The teacher gives awards (praise, etc.); Students answer a quiz about the human excretory system.

Observation. From the results of observations made by observers, in the second cycle of learning, every student seemed ready and enthusiastic in participating in the learning. Students also seem ready to do the assignments given by the teacher. Apart from that, students are more active in learning activities, especially in understanding model explanations, for example in the form of explanations of blood filtration by the kidneys, the sequence and types of urine produced so that students seem to feel enthusiastic in understanding each lesson and in conducting group discussions. This is because students already understand the material on the stages of urine formation, which has an impact on increasing test results. Thus it can be concluded that student behavior in learning using the modeling method shows changes that lead to positive behavior. In this learning, the teacher always monitors student activities and provides guidance as necessary in modeling activities and drawing conclusions about the purpose or meaning of the material discussed. The following is summary of cycle ii learning results data.

Table 4. Summary of Cycle II Learning Results Data

No	*Data*	*Test's Result*
1	The highest score	100
2	The lowest score	75
3	Number of students who completed	27
4	Avarage	86,11
5	Mastery learning	100 %

Reflection. From the results of observations made in cycle II, the learning process has been more focused according to the research objectives, students who are modelers are more optimal, each group has tried to understand the explanation given by the model and all students appear to be more active in asking and answering also in group discussions. . Students are able to work together and provide explanations to other friends in order to understand the material presented. In this reflection a test was carried out and 100% completeness was obtained. So it can be concluded that the learning carried out has shown changes in a positive direction and the expected results are in accordance with the established

success indicators. So it can be concluded that the learning carried out in cycle II no longer needs to be continued to the next cycle.

Based on the test results given by researchers at the end of each cycle, the following data was obtained (Table 5 and Table 6):

Table 5. Summary of Learning Result Data for Cycles I and II

No	*Data*	*Test's Result (Cycles I)*	*Test's Result (Cycles II)*
1	The highest score	85	100
2	The lowest score	50	75
3	Number of students who completed	12	27
4	Number of students who have not yet completed	15	0
5	Avarage	70,37	86,11
6	Mastery learning	44,44%	100 %

Table 6. Completeness of Student Learning Results in Cycles I and II6

No.	*The number of students*	*The number of students*	*Number of students who obtained a score ≥ 75*	*Percentage*
1.	Cycle I Daily Test	27 orang	12 orang	44,44%
2.	Cycle II Daily Test	27 orang	27 orang	100%

From the table above it can be concluded that with contextual learning of Natural Science modeling techniques on the subject of the Human Excretory System in class VIII B Surakarta Citizen Middle School, improved results are obtained. This can be seen from the number of students who completed the KKM 75. In the first cycle after using contextual learning modeling techniques from 27 students, it was found that the number of students who completed was 12 people (44.44%). Meanwhile, in cycle II there was an increase, namely from a total of 27 students, the number of students who completed was 27 people (100%). The diagram of the increase in the number of completed students can be seen as follows (Figure 1):

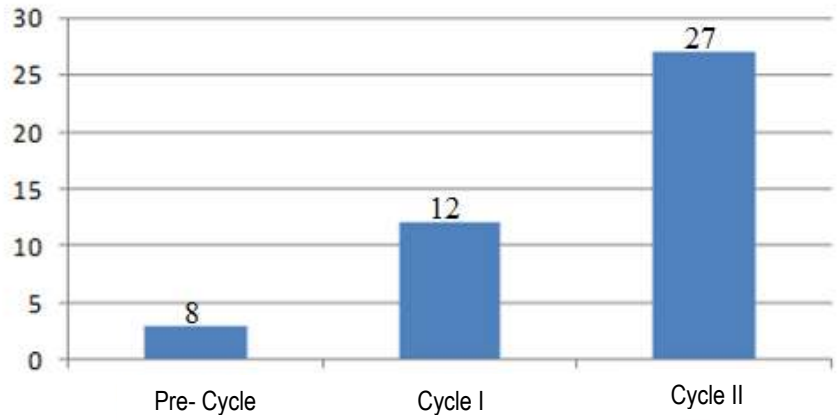

Figure 1. Bar Chart of Number of Students Who Completed

Pre Cycle, Cycle I and Cycle I. After carrying out a series of classroom actions on students in each cycle and based on observations, the researcher conducted an assessment of understanding of Natural Sciences with partner teachers to determine the ability to learn Natural Sciences which had been carried out using modeling techniques. The observation results from each stage can be seen from Figure 4.1 and are described as follows:

a) Analysis of Cycle I Results. Based on the results of the Natural Sciences learning assessment of the material discussed, after carrying out class actions in cycle I, the students' Natural Sciences learning achievement score was 44.44%. In cycle I, in the classroom action learning process, new teachers use modeling with modeling intensity that is not yet optimal and student activity in discussing and reviewing

material is relatively not optimal, this is indicated by the relatively low intensity of student participation in the learning process in cycle I. For In cycle II there is a need for more intensive modeling with better models in presenting material and stimulating students in the process of understanding Natural Sciences.

b) Analysis of Results in Cycle II. Based on the Natural Sciences learning assessment scores for the Human Excretory System material after cycle II with contextual learning modeling techniques, it shows that the completeness score for students' Natural Sciences learning outcomes is 100%. In cycle II, the teacher uses modeling intensity to increase natural science learning outcomes much more effectively and maximally and there is an increase in student activity in understanding the teaching material presented by the model. Teacher activity in explaining, asking questions and providing direct answers from students has decreased, and increased guidance and study, motivation and praise from teachers. The results of the pre-cycle, cycle 1, and cycle 2 achievements can be seen in Figure 2.

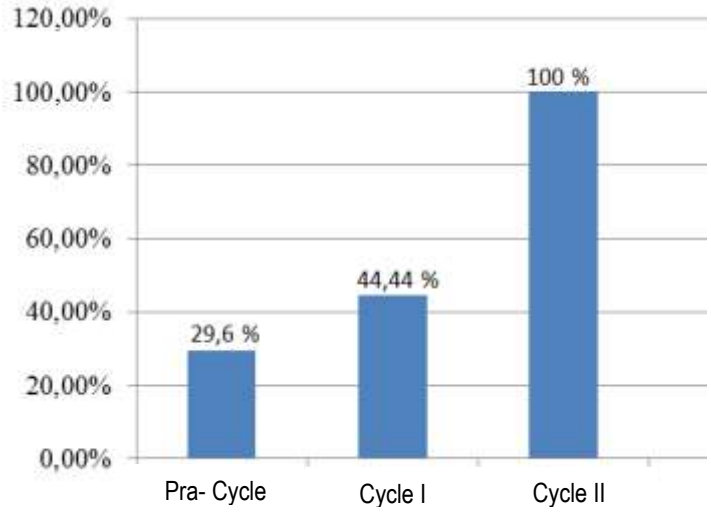

Figure 2. Completeness of Pre-Cycle, Cycle I and Cycle II

Paying attention to the assessment results from studying Natural Sciences and observations from contextual learning, modeling techniques in improving Natural Sciences learning outcomes, appears to be effective in increasing students' level of understanding in learning Natural Sciences. This is not only based on student assessment scores, but also on student activities in trying to understand the meaning conveyed by the model during cycle I leading to cycle II. Another description regarding the improvement in student learning outcomes can be explained as follows: 1) In cycle I, the results of contextual learning tests on Natural Science modeling techniques on the subject of the Human Excretory System in the good category were achieved by 2 students in the score range 84 - 92. The sufficient category was achieved by 11 students in the score range 75 - 83. Category 14 students achieved less in the score range of less than 75. 2) In cycle II, the results of contextual learning tests on Natural Science modeling techniques on the subject of the Human Excretory System in the very good category were achieved by 6 students in the score range 93 - 100. The good category was achieved by 13 students in the score range 84 - 92. Category enough to be achieved by 8 students in the score range 75 - 83.

Based on this, it shows that contextual learning with good and structured modeling techniques can improve students' understanding of Natural Sciences learning outcomes during teaching and learning activities. With the steps that have been determined by the author starting from cycle I to cycle II, there are changes as follows: 1) Students are more active in expressing opinions in discussions; 2) Students are more courageous to ask and answer the teacher, 3) Students begin to understand how to study Natural Sciences, 4) Students dare to try to convey ideas and ideas orally either with or without teacher guidance, 5) Students are more creative in understanding the material being discussed.

Contextual learning with modeling techniques shows significant potential in improving science learning outcomes of grade VIII junior high school students on the topic of Human Excretory System.

This approach not only improves conceptual understanding and cognitive learning outcomes, but also develops science process skills and increases student motivation. However, effective implementation requires careful planning and adequate support to overcome the challenges. Akınoğlu and Tandoğan (2007) in their study found that students taught using contextual approach showed significant improvement in concept understanding. The students' average score increased from 45.95 to 78.21 after the implementation of contextualized learning. These findings confirmed the effectiveness of the contextual approach in improving students' conceptual understanding of complex topics such as the Human Excretory System. Furthermore, modeling techniques in a contextual learning context have been shown to have a positive impact on students' cognitive learning outcomes. Hwang et al. (2018) reported that students who engaged in model-based learning showed a 23% increase in cognitive test scores compared to the control group. This suggests that modeling techniques can facilitate deeper and more comprehensive learning.

The process of learning Natural Sciences, especially material on the Human Excretory System, using a contextual approach to modeling techniques obtained positive results in increasing activities and learning outcomes in Natural Sciences. The results of this research are in line with the research results of I Gusti Ayu Ratnadewi (2013), Syahdan (2019). Research on improving science learning outcomes on the topic of human excretory system through contextual learning with modeling techniques for grade VIII junior high school students, although potentially providing valuable insights, has some limitations that need to be considered.

The main limitation may lie in the limited sample size and relatively short duration of the study, which may affect the generalizability of the results. The focus on one specific topic and possibly using only limited assessment methods could have hindered a more comprehensive understanding of the effectiveness of this approach. External factors such as student motivation and family background, as well as variations in teachers' implementation of the modeling technique, could also affect the results.

4. Conclusion

Based on the results of Class Action Research (PTK) with two cycles in class VIII B Surakarta Citizen Middle School for the 2022 / 2023 academic year, it can be concluded that the results of learning Natural Sciences on Excretory System Subjects through contextual learning of modeling techniques from each class action cycle always increase. It was proven that before the implementation of the research, student completion was 29.6%. After carrying out research actions in cycle I, completeness reached 44.44% and in cycle II, completeness reached 100%. Meskipun efektif, implementasi pembelajaran kontekstual dengan teknik pemodelan juga menghadapi tantangan. Suryawati et al. (2020) mengidentifikasi beberapa hambatan seperti keterbatasan waktu, kurangnya sumber daya, dan kebutuhan akan pelatihan guru yang memadai. Mereka menemukan bahwa 68% guru mengalami kesulitan dalam merancang aktivitas kontekstual yang efektif, menunjukkan perlunya dukungan dan pengembangan profesional yang berkelanjutan bagi para pendidik.

And based on observations in implementing learning using modeling techniques, it can increase student activity. It is easier for students to understand the material presented and it is not confusing. So it can be concluded that through contextual learning, modeling techniques in learning Natural Sciences, the subject of the Excretory System, can help students improve their activities and learning outcomes in Natural Sciences.

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References

Akınoğlu, O., & Tandoğan, R. Ö. (2007). The effects of problem-based active learning in science education on students' academic achievement, attitude and concept learning. Eurasia Journal of Mathematics, Science & Technology Education, 3(1), 71-81.

Arikunto, Suharsimi. (2009). *Prosedur Penelitian Suatu Pendekatan Praktek*, Jakarta: Rineka Cipta.

Berns, R. G., & Erickson, P. M. (2001). Contextual Teaching and Learning: Preparing Students for the New Economy. The Highlight Zone: Research@ Work No. 5.

Darling-Hammond, L., Flook, L., Cook-Harvey, C., Barron, B., & Osher, D. (2020). Implications for educational practice of the science of learning and development. *Applied developmental science*, *24*(2), 97-140.

Hudson, C. C., & Whisler, V. R. (2007). Contextual teaching and learning for practitioners. *Journal of Systemics, Cybernetics and Informatics*, *6*(4), 54-58

Hwang, G. J., Wu, P. H., & Chen, C. C. (2018). An online game approach for improving students' learning performance in web-based problem-solving activities. Computers & Education, 121, 43-56.

I Gusti Ayu Ratnadewi, (2012). Peningkatan Kemampuan Menulis Laporan Perjalanan Melalui Metode Pemodelan Pada Siswa Kelas VIII C Smpn 1 Anjongan Tahun Pembelajaran 2012 / 2013. *https://jurnal.untan.ac.id/index.php/jpdpb/article/view/474:*

Johnson, E. B. (2002). *Contextual teaching and learning: What it is and why it's here to stay*. Corwin Press

Kemmis, S., McTaggart, R., & Nixon, R. (2014). The action research planner: Doing critical participatory action research.

Suryawati, E., Osman, K., & Meerah, T. S. M. (2010). The effectiveness of RANGKA contextual teaching and learning on students' problem solving skills and scientific attitude. *Procedia-Social and Behavioral Sciences*, *9*, 1717-1721.

Suryawati, E., & Osman, K. (2017). Contextual learning: Innovative approach towards the development of students' scientific attitude and natural science performance. *Eurasia Journal of mathematics, science and technology education*, *14*(1), 61-76.

Syahdan, (2019). *Peningkatan Motivasi Dan Ketuntasan Belajar Melalui Penerapan Pembelajaran Kontekstual Berbasis Pemodelan Siswa Kelas Vii Mts. Baiturrahim Kabar Pada Mata Pelajaran Qur'an Hadits Tahun Pelajaran 2019/2020*

Van de Pol, J., Volman, M., & Beishuizen, J. (2010). Scaffolding in teacher–student interaction: A decade of research. Educational psychology review, 22, 271-296.