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The Application of 7E Learning Cycle Model Based on Multiple Representations on Understanding the Concept of Classification and Communication Skills in Protist Learning Material

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Abstract

The purpose of this study was to examine the effect of the 7E learning cycle model based on multiple representations on students understanding the concepts of classification and communication skills on Protist learning material. The research method uses a quasi-experimental design with a nonequivalent control group. The research sample is class X MIPA 4 and X MIPA 5 at MAN 02 Brebes. The data analysis technique used independent sample t-test. The results showed that understanding the classification concept and communication skills had a sig (2-tailed) value of 0.000 < 0.05 so that there was a significant difference in the average post-test scores and skill scores between the two classes. The percentage of understanding the concepts of classification in the experimental class was 33.33% (high) and 66.67% (medium), while the control class was 97.14% (medium) and 2.86% (low). The classical completeness of understanding the concept of classification in the experimental class was 16.67 %, while the control class was 0%. The percentage of communication skills in the experimental class is 75% (medium) and 25% (low), while the control class is 20% (medium) and 80% (low). The percentage of the implementation of the learning model in the experimental class based on observation was 100% (high), while the student questionnaire responses were 55.55% (high) and 44.45% (medium). Based on the research data, it can be concluded that the 7E learning cycle model based on multiple representations has a significant effect on understanding the concepts of classification and communication skills in Protist learning material.

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INTRODUCTION

Certain learning models have special characteristics when paying attention to certain learning theories, learning strategies, methods, techniques, and learning tactics (Alimah and Marianti, 2017). The application of the learning model according to the 2013 Curriculum must provide competency development according to the demands of the 21st century and a scientific approach (Ningrum and Sobri, 2014). Biology is one of the science subjects that must be studied by taking a scientific approach. One of the Biology learning materials in class X is the Protist learning material. The active mastery of the concept of classifying members of the Protist kingdom based on general and special characteristics is the character of the Protist learning material (Sari, 2013). The basic competencies for Protists include basic competencies 3.6 related to understanding and mastering the concept of classification, while basic competencies 4.6 are related to students communication skills in conveying classification and the role of Protists.

Based on the results of an interview with one of the Biology Subject Teachers at MAN 2 Brebes, he stated that the mastery of understanding the concept of diversity material, especially Protists, was low. In addition, students also tend to be passive in explaining the concepts they have, so that their communication skills are not well trained. Broadly speaking, these two problems are due to the incompatibility of the learning model applied in encouraging conceptual understanding and delivery of the concepts that students have in the material. Based on these problems there must be a way out to overcome these problems. One effort that can be made to be able to present Protist learning material is by applying the 7E learning cycle model based on multiple representations.

The 7E learning cycle model emphasizes understanding student concepts and scientific approaches in the learning process. The 7E learning cycle learning model has seven stages, including elicit, engage, explore, explain, elaborate, evaluate, extend. The 7E learning cycle model has a goal, namely active learning that emphasizes initial understanding, deepening the concept to finding the concept in an organized manner and communicating the concept (Eisenkraft, 2003). Multiple representations is the delivery of scientific ideas, concepts, or phenomena to help students develop their understanding in many specific forms (Treagust and Tsui, 2013). The use of various representations in each stage of the 7E learning cycle model during the learning process of Protist learning material can increase students understanding of conceptual knowledge and direct students' understanding of concepts to be more coherent (Eilam and Poyas, 2010). Concepts in Protist learning material must be taught in a representational manner so that students are able to understand and communicate important concepts from Protist learning material.

The 7E learning cycle model can increase activeness and learning outcomes (Kulsum and Hindarto, 2011), understanding scientific concepts and attitudes (Susilawati et al, 2015), increasing learning activities and critical thinking skills in students (Kurniasih et al, 2017). Based on the description above, research has been carried out to examine the effect of applying the 7E learning cycle model based on multiple representations on understanding the classification concept and students communication skills on Protist learning material.

RESEARCH METHODS

This research was conducted at MAN 02 Brebes for the academic year 2021/2022. The research design used a quasi-experimental design with a nonequivalent control group design. The selection of samples used purposive sampling technique with class X MIPA 4 as the experimental class and class X MIPA 5 as the control class. The experimental class applied the 7E learning cycle model based on multiple representations, while the control class applied the conventional learning model with lecture and discussion methods.

Student response scores were obtained from student responses questionnaires and scores for the

implementation of the learning model were obtained from the observation sheet on the implementation of the 7E learning cycle learning model based on multiple representations. The value of understanding the concepts of classification was obtained from the post-test while the score of communication skills was obtained from the skill observation sheet. Post-test score data and communication skill scores were tested for normality and homogeneity before hypothesis testing. The data analysis technique used the Independent Sample t-Test test to determine the difference in the average post-test scores in the experimental class and control class on understanding the classification concept and to determine the difference in communication skill scores in the experimental class and control class.

RESEARCH RESULT

Implementation of the 7E Learning Cycle Model Based on Multiple Representations

The analysis of the implementation of the 7E learning cycle learning model based on multiple representations includes descriptive statistical analysis of the observation scores of the implementation of the learning model and descriptive statistical analysis of student response scores. Descriptive statistical analysis of the learning model implementation observation scores aims to analyze the implementation scores obtained during the learning process by applying the 7E learning cycle learning model based on multiple representations on the Protist learning material. Educators and students in the experimental group were observed during the learning process for three meetings. The results of the observational analysis of the implementation of the learning model are presented in Table 1.

Table 1. Results of the analysis of the implementation of the 7E learning cycle model based on multiple representations

Meeting	Activity Step			Total Score
	Introduction	Core	Closing	
1	16	51	15	82
2	16	52	15	83
3	16	55	16	87
Average score	16	52.67	15.33	84

The score for observing the implementation of the 7E learning cycle learning model based on multiple representations that have been obtained is then made into data categories which are divided into three categories according to the scores obtained. The data categories used are high, medium, low. Analysis of the implementation of the 7E learning cycle model based on multiple representations according to categories is presented in Table 2.

Table 2. Analysis of the implementation of the 7E learning cycle model based on multiple representations according to categories

No.	Category	Student Frequency	Percentage
1.	High	3	100%
2.	Medium	0	0
3.	Low	0	0

Based on the table above , the implementation of the 7E learning cycle model based on multiple representations has a high category. Descriptive statistical analysis of student response scores aims to analyze the scores obtained after students implement the 7E learning cycle learning model based on multiple representations on Protist leaning material. Students in the experimental group filled out a questionnaire sheet to provide their responses during the learning process which is presented in Table 3.

Table 3. The results of the analysis of student responses to the implementation of the 7E learning cycle model based on multiple representations

Analysis Results	Learning stage							Total average score
	A	B	C	D	E	F	G	
Average score	6.72	6.78	7.98	9.53	5.89	3.11	6.03	45.14

Based on the table above, students responses to the implementation of the 7E learning cycle model based on multiple representations cover 7 aspects of the learning stages with varying average scores. Scores of student responses to the implementation of the 7E learning cycle model based on multiple representations that have been obtained are then made into data categories which are divided into three categories according to the scores obtained. The data categories used are high, medium and low. Analysis of the experimental class students' responses to the implementation of the 7E learning cycle learning model based on multiple representations according to the categories presented in Table 4

Table 4 Analysis of experimental class students responses to the implementation of the 7E learning cycle model based on multiple representations according to category

No.	Category	Student Frequency	Percentage
1.	High	20	55.56%
2.	Medium	16	44.44%
3.	Low	0	0

Based on the table above, students' responses to the implementation of the 7E learning cycle learning model have high and medium categories. The application of the 7E learning cycle model based on multiple representations consists of 7 stages, including elicate (acquire prior knowledge), engage (involve), explore (explore), explain (explain), elaborate (apply), evaluate (assess), and extend (include). and expand) using various symbolic representations of Protist learning material.

The elicate stage is used by educators to direct students in obtaining initial knowledge related to a scientific phenomenon. The implementation of this stage at the first meeting is the teacher gives a picture of the structure of prokaryotic organisms represented by bacteria and eukaryotes by euglena. The second meeting shows an image of the structure of the animal-like protist organism represented by Amoeba sp . and plant-like protists represented by Chlorella sp., while the third meeting shows a picture of the structure of plant-like protists represented by Spirogyra sp. and the fungus-like Protists represented by Physarum polycephalum . Students are directed to acquire prior knowledge related to the comparison between the two images at each meeting to connect the existence of a link between the concepts they have understood and the concepts they will learn to avoid misconceptions among students.

Implementation of the engage stage (involving) educators provokes students' knowledge of the material to be studied by showing an introductory video. The first meeting was shown a video related to malaria that occurred in an area then the educator asked the cause of the malaria disease, the second meeting was shown a video related to the manufacture of agar then the educator asked the basic raw material of the agar, the third meeting was shown a video related to the disease that occurred on the potato then the educator asked the cause of the disease in the potato. Giving a preliminary video to students is an effort by educators to provoke students' curiosity and students' motivation to phenomena that occur in life that are related to the material they are going to learn.

In the implementation of the explore stage, the educator directs students to work on the LDS (Student Discussion Sheet) in groups. The first meeting of students was directed to group the pictures of Protist species into phyla that exist in animal-like Protists, observing the structure of Paramecium sp. as one of the species of animal-like protists from an image to look for the role of animal-like protists related to the characteristics they have. The second meeting of students was directed to group pictures of Protist species

into phyla that exist in plant-like Protists, students observed the differences between plant-like Protists and true plants from an image to look for the role of plant-like Protists related to their characteristics. The third meeting of students was directed to collect data related to the grouping of mushroom-like Protists from several pictures of Protist species, observe the differences in the characteristics of members of Myxomycota and Acrasiomycota to look for the role of plant-like Protists related to their characteristics.

In the implementation of explain, the teacher directs students to explain the results of the discussion from each group. The purpose of this implementation is that educators know the extent of the concepts they get during group discussions and refine the concepts that students get. The teacher asked each group to provide an explanation regarding the concept of classifying animal-like protists and their role in life at the first meeting, the concept of classifying plant-like protists and their role in life at the second meeting, and the concept of classifying mushroom-like protists and their role in life at the third meeting. .

In elaborate implementation (applying) educator direct students to apply the concepts they have understood as a basis for relating to the surrounding environment using pictures and videos. The first meeting related to the classification of animal-like protists based on characteristics associated with roles in the surrounding environment, the second meeting related to the classification of plant-like protists based on characteristics associated with roles in the surrounding environment, and the third meeting related to the classification of mushroom-like protists based on characteristics associated with roles in life.

In the evaluation stage, the educator gives a simple quiz that must be done by individual students. Educators display several pictures of Protist species then students explain the basic grouping of these species and students are able to explain the role of the pictures of these species in each meeting. The purpose of this stage is that educators evaluate the achievement of learning objectives.

In the implementation of the extend stage (include and expand) educators direct students to connect the concepts they have learned during the learning process with phenomena that exist in the surrounding environment. In the process, educators ask students to stimulate students to find the relationship between the concepts they have learned and the material they are going to learn and then the students present their opinions.

The above description is in line with Ngalimun (2012), the 7E learning cycle learning model is included in the learning cycle which has phases of activities that are systematic and organized in the acquisition of concepts to be able to master certain competencies. Hanuscin & Lee (2008), stated that the model can also help students develop an understanding of the concepts obtained through a coherent learning phase. Kulsum and Hindarto (2011), stated that the 7E Learning cycle model can increase activity and learning outcomes where increased student activity is supported by an increase in both knowledge and skills learning outcomes. Konrad & Bogeholz (2013), states that communication skills are developed in using representations such as photos, micrographs, diagrams, pictures, graphics in Biology learning.

Treagust (2008), states that the functions of multiple representations include, 1) containing information to support complementary knowledge processes, 2) assisting students in developing a better understanding of the conceptual domain, 3) leading to a deeper understanding of concepts including encourage generalization and teach relationships between representations. Eilam and Poyas (2010), state that the use of multiple representations can increase conceptual knowledge of science as well as directed understanding of concepts that are more coherent. Nizarudin (2014), representation plays a role in increasing understanding of concepts, improving communication skills and solving problems in a material.

Understanding the Concepts of Classification

Descriptive statistical analysis of understanding the classification concept to analyze the ability to understand the concept of classification based on the results of the pre-test and post-test in the experimental class and the control class. Based on the results of research conducted in two class groups, namely the experimental class and the control class, the pre-test and post-test scores were obtained which are presented in Table 5.

Table 5 The results of the analysis of pre-test and post-test scores in the experimental class and control class on understanding the concept of classification

Analysis Results	Experiment Class		Control Class	
	Pre-test	Post-test	Pre-test	Post-test
The highest score	53.12	87.50	56.25	67.74
Lowest Value	12.50	43.75	15.63	25.81
Average value	28.21	61.89	33.84	51.71

The pre-test and post-test scores for understanding the concepts of classification that have been obtained are then made into data categories which are divided into three categories according to the values obtained. The data categories used are high, medium and low. The analysis of pre-test and post-test understanding of the classification concept in the experimental class and control class according to the categories is presented in Table 6.

Table 6 Analysis pre-test and post-test understanding the concepts of classification in the experimental class and control class according to category

Category	Student Frequency				Percentage			
	TO		KK		TO		KK	
	O1	O2	O1	O2	O1	O2	O1	O2
High	0	12	0	0	0	33.33%	0	0
Medium	13	24	17	34	36.11%	66.67%	48.57%	97.14%
Low	23	0	18	1	63.89%	0	51.43%	2.86%

Information
KE = Experiment Class
KK = Control Class
O1 = Pre-test
O2 = Post-test

Based on Table 6, students understanding the concepts of classification after being given a learning model in the experimental class has high and medium categories, while the control class has medium and low categories. The post-test is used as the final score in measuring understanding of the classification concept, followed by analysis related to classical mastery or learning completeness in both the experimental class and the control class. The minimum completeness criteria for Protist learning material is 75.

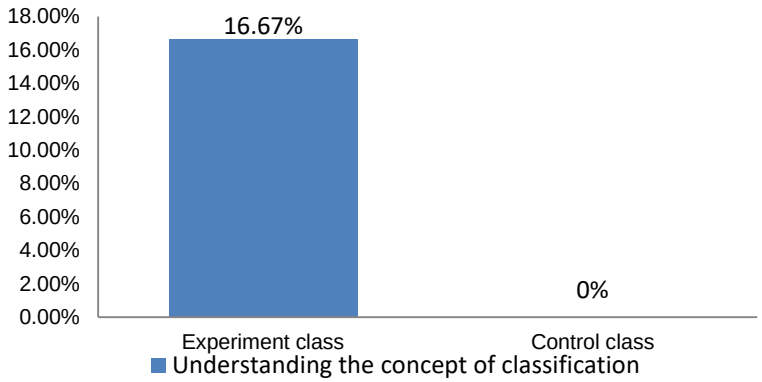

Figure 1. Complete classical understanding the concepts of classification of the experiment class and control class

Based on the picture above, the classical completeness of the experimental class and control class in understanding the concepts of classification has not reached 85%. Based on the results of classical completeness, the application of the 7E learning cycle model based on multiple representations is not yet fully optimal for understanding the concepts of classification. This is because in its implementation in the experimental class it is divided into two meeting sessions in one class so that in one class there is a slight difference, this also applies to the control class which causes learning not to be fully optimal so that the understanding of students' classification concepts has not exceeded the limits of classical completeness.

Table 7. Hypothesis testing of understanding the concepts of classification and communication skills in the experimental class and control class

Hypothesis testing	Understanding Classification Concepts
Sig. (2-tailed)	0.000

Based on the table above, the significant value (2-tailed) for understanding the concepts of classification is 0.000 less than 0.05, so H0 is rejected, so it can be concluded that there is a significant difference in the average value of understanding the concepts of classification between the experimental class and the control class. The difference in these categories can be caused by differences in the application of the learning model during the learning process. During the learning process in the control class using a conventional learning model with a simple lecture and discussion method. In practice, the teacher conveys the material in full and in detail in class so that students are not able to pick and choose which important concepts they should emphasize. A simple discussion process is carried out between the teacher and students where the teacher gives several oral questions that must be answered by students. These activities also have not been able to construct students' initial understanding to the organization of understanding the concepts of classification. This makes the control class have a low and moderate category in understanding the concept of classification.

The experimental class applied the 7E learning cycle learning model based on multiple representations during the learning process. Learning is carried out in small group discussions between students. Activities carried out by educators so that students can achieve an understanding of the concept of classification are directing students' prior knowledge regarding protists contained in the elicit stage, directing students to work on student discussion sheets (LDS) and collecting related data, identifying the characteristics of protists to be classified, identifying categories of protists members and explain why the members of the Protists are included in that category, identify one or more characteristics in the group of Protists and explain how they are related in the explore stage and the extend stage where students associate the concept of classification of Protists with their role in life which is assisted by various representations at each stage of learning . The purpose of conducting group discussions is so that students are able to build knowledge related to concepts and then organize these concepts to connect one concept to another so that learning objectives can be achieved.

The description above is in line with Sornsakda and Singseewo (2009), the 7E learning cycle model is a learning model that is more centered on student activity in the learning process Özbek et al. (2012), stated that the 7E learning cycle learning model can learn concepts in depth and adapt the learning obtained in school with everyday life. The 7E learning cycle model is effective in increasing mastery of concepts (Indrawati, 2015), and increasing learning activities in the classroom because there are discussion activities so students must be active in exchanging information (Kurniasih et al., 2017). Eilam and Poyas (2010), stated that the use of multiple representations in learning can improve students' understanding of concepts and can reduce difficulties in understanding the relationship between the use of more than one representation and the direction of a more coherent understanding of concepts to increase students' understanding of conceptual knowledge of science.

Communication Skills

Descriptive statistical analysis of communication skills to analyze students' skill scores during the learning process. Based on the results of research conducted in two groups, namely the experimental and control classes, the communication skills scores are presented in Table 8.

Table 8. The results of the analysis of communication skills scores in the experimental class and control class

Analysis Results	Experiment Class	Control Class
Highest Score	15.00	11.67
Lowest Score	8.00	6.00
Average Score	11.79	8.71

The communication skill scores that have been obtained are then made into data categories which are divided into three categories according to the scores obtained. The categories of data used are high, medium and low . The analysis of the communication skill scores of the experimental class and the control class according to the categories is presented in Table 9.

Table 9. Analysis of communication skills scores of experimental class and control class according to category

No	Category	Student Frequency		Percentage	
		Experiment	Control	Experiment	Control
1.	High	0	0	0	0
2.	Medium	27	7	75%	20%
3.	Low	9	28	25%	80%

Based on the table above, students' communication skills in the experimental class and control class have medium and low categories. Furthermore, hypothesis testing on communication skills in the experimental class and control class is presented in Table 10.

Table 10. Hypothesis testing of communication skills in the experimental class and control class

Hypothesis testing	Communication Skills
Sig. (2-tailed)	0.000

Based on the table above, the significant value (2-tailed) of 0.000 communication skills is less than 0.05, so H0 is rejected, so it can be concluded that there is a significant difference in communication skills scores between the experimental class and the control class. The learning process in the control class uses a conventional learning model with a simple lecture and discussion method. The implementation of simple discussions is shown by the existence of a question and answer system between teachers and students. Students have not been able to explain the concepts they know to exchange concepts with other students. Students tend to be passive and more often listen to teacher explanations during the learning process. This causes the control class communication skills to have a higher percentage of the low category than the medium category.

The experimental class applied the 7E learning cycle learning model based on multiple representations that focused on oral or oral communication skills. In practice, so that students are trained in communication skills, educators direct students to carry out discussions with other students to be able to find concepts from some of the questions presented in the student discussion sheet (LDS) at the explore stage. At the explain and elaborate stage students are able to explain the concept of classification and the

role of protists obtained through representative discussions, ask questions both asked by educators and students and answer these questions, exchange information and describe concepts to provide conclusions on the concept. In the extend stage, students are directed to be able to give their opinions in connecting the concepts they have learned during the learning process with phenomena that exist in the surrounding environment. Group discussions provide opportunities for students to be able to interact and exchange concepts they have.

Based on the results of this study, students' communication skills in both the experimental class and the control class have medium and low categories. This is due to the limitation of class hours. In the 7E learning cycle model based on multiple representations, there is an explain stage which aims for students to explain the results of the discussion to each group and the educator directs students to exchange opinions so that it takes more time than other stages.

The description above is in line with Eisenkraft (2003), the 7E learning cycle learning model can expand the concepts that students have obtained and then transfer these concepts between students. At the explain and elaborate stage, students are encouraged to explain and elaborate concepts using symbolic representations such as pictures and diagrams. Trilling and Fadel (2009), stated that communication can express ideas and opinions effectively orally in various forms and contexts. Apiyati (2016), states that communication skills in the learning process are very important, especially during discussions because students can express ideas and work together actively. Griffard (2013), states that communication can be through direct experience, verbal, text, and representations including animation, 3D models, images. Representation can affect various aspects of learning in students including being able to communicate ideas. Kurnaz and Arslan (2014), stated that representation was able to facilitate the transformation of information from one form to another for students.

Based on the discussion above, there are differences in the results of applying the learning model to the Protist learning material, both in understanding the concept of classification and communication skills. Conventional learning models with lecture and discussion methods have a character where educators deliver learning materials in full and clearly so that students are passive in participating in learning. The 7E learning cycle model based on multiple representations allows students to be active in constructing understanding during the learning process with a scientific approach and conveying this understanding to other students so that communication occurs. The learning theory contained in the 7E learning cycle model is constructivism. Constructivism theory of students is directed to be able to acquire new knowledge using the previous knowledge they have so that knowledge can be actively organized in the learning process. Constructivism theory requires students to be active during learning in the classroom. Constructivist learning is an approach that helps students to acquire new knowledge by using their previous knowledge and develop understanding by actively participating in the learning process (Özmen, 2004).

Briefly in the constructivism learning approach, knowledge is constructed by students through active participation in the learning process and connecting new knowledge with existing knowledge. Vygotsky's constructivism theory emphasizes the social aspect of the learning process and believes that social interaction is an important component to help students build new ideas and to develop their intelligence (Arends & Kilcher, 2010). One way to carry out student-centered learning activities is to use a learning cycle. The 7E learning cycle model based on multiple representations according to students to be active in constructing their understanding so that students are able to master the understanding of classification concepts and are able to communicate the concepts they have understood so that students' communication skills are trained by using various representations so that learning is more complete and meaningful.

CONCLUSION

Based on the results of the study, it can be concluded that the application of the 7E learning cycle model based on multiple representations has a significant effect on understanding the concepts of classification and students communication skills on Protist learning material in class X MIPA MAN 02 Brebes.

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