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Learning Cycle 7e Model-Based Multiple Representation to Reduce Misconseption of the Student on Heat Theme

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Abstract

Students' success is determined by the conceptual that has been owned by the students while studying certain theme. New concepts will be elusive if the relevant concepts have not been owned by the students. Based on the observation and interview in SMP Negeri 1 Doro indicated that the heat concept is one of the elusive concept in science learning by the students. This study aims to: (1) describe the misconception experienced by students on the heat theme using a diagnostic test that is three-tier multiple choice, (2) determine the implementation of learning cycle 7E model-based multiple representation on the heat theme, (3) determine the effectiveness of the application of the learning cycle 7E model-based multiple representation in reducing misconceptions students on the heat theme. This study used a mixed method research with concurrent triangulation strategy. The identification results of students misconceptions on the heat theme obtained by average percentage of students' conceptions in the category Know the Concept (TK) is 43.44%. The average percentage of students' conceptions in the category Don't Know the Concepts (TTK) is 15.31%. The average percentage of all misconceptions (MK) experienced by students in heat theme is 41.26%. Sub heat themes that most experienced misconceptions are ice melt events, boiling water events, heat calculations in the chart, the specific heat of water and oil, the absorption and release of heat, and the relationship of the specific heat with temperature changes. The implementation of learning cycle 7E model-based multiple representation obtained by the average percentage of 84.67% with the criteria very well. Learning cycle 7E model-based multiple representation became effective in reducing students misconceptions on the heat theme due to the decrease percentage of students misconceptions in the experimental class 18.72% is higher than the control class which only 9.68%. The analysis calculation result of the Equal Variance Assumed against independent sample of t test towards the decrease of misconceptions level indicate significance (2-tailed) of 0.003 < 0.05, which means that there are differences in average reduction of misconceptions in the experimental class and control class.

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INTRODUCTION

The way to improve the quality of human resource is through the learning process in the school as a place to discover, develop and equip students with the appropriate competencies. Learning success is largely determined by the concepts that have been owned by the students while studying certain theme. New concepts will be elusive if the relevant concepts have not been owned by the students. The failure of students in the classroom is often caused by the unpreparedness of the relevant concepts.

Based on the observations and interviews in SMP Negeri 1 Doro indicated that the concept of heat is a difficult concept to understand students in learning science. Based on the learning experience in the classroom still found misconceptions about the students' understanding of heat. In one case, when students are asked to determine the amount of heat required to change the ice temperature below 0 oC to water temperatures above 0 oC (1 atm), many students replied that the concept of heat is just to raise the temperature. The facts show that beside to raise the temperature, heat is also absorbed to change the form of ice (solid) into the water. The concept that is not understood fully and properly resulted in students experiencing misconceptions.

The misconception is defined as understanding the concepts included in the student's mind as opposed to the scientific concept, which is influenced by the experience of students (Hammer, 1996). Misconceptions that occur in students should not be ignored. Reduction of the misconceptions that must be done so that there is a misconception that the student does not spread to other students. The misconception has the potential to spread to other students, for example through discussions. The understanding of the concept of sustainable weakness certainly complicates students to receive advanced themes at the higher education level (Yoanita & Akhlis, 2015).

Misconceptions can be changed through the provision of questions, experiments (law of nature is always right), based on a hypothetical situation without the laws of physics, cognitive conflict, and experimental or demonstration to test the hypothesis (Dykstra et al., 1992). Possible misconception can be prevented by learning that teaches scientific methods in acquiring new knowledge, ie learning cycle 7E model. Learning cycle model can accommodate the whole activity is expected to reduce students' misconceptions (Taufiq, 2012).

Learning cycle 7E model developed by Eisenkraft (2003), which consists of bringing the students' beginning knowledge (elicit), generating interest (engagement), probe (exploration), explain (explanation), apply (elaboration), judge (evaluation), and expanding (extend). Learning cycle 7E model emphasizes the preconceptions of students as background to learn new information. In order implementation of learning cycle 7E model can accommodate the students who have lower concept mastery, learning applied with multiple representations. Multiple representation learning means use the various representations, the visual representation or iconic representation in the process of learning to master certain concepts.

The purpose of this study was to describe the misconception experienced by students on the theme of heat using a diagnostic test three-tier multiple choice, knowing the enforceability of the model of learning cycle 7E-based multiple representation on the theme of heat, and determine the effectiveness of the application of the learning cycle 7E-based multiple representation in reducing misconceptions students on the theme of heat.

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METHODS

Research conducted using a mixed method research with concurrent triangulation strategy. Source of research data in the form of quantitative and qualitative data. Sources of quantitative data in the form of the pre-test and post-test using instrument diagnostic test three-tier multiple choice, while the source of qualitative data in the form of interviews, the observation enforceability of learning and students' questionnaire responses. To test the

validity of the research instrument data, performed the validation phase through the consideration and assessment of experts and practitioners in the field of science education research.

This research was conducted in SMP Negeri 1 Doro 2017/2018 school year. Subjects in this study consists of two classes, VII D as the experimental class and VII E as the control class as selected by random sampling technique. The data collection was conducted using written tests, interviews, observations, and questionnaires. Quantitative data analysis techniques including analysis of misconceptions identification, analysis of the value of the pre-test and post-test, analysis of the reduction of misconceptions, and the hypothesis t test to determine the effectiveness learning cycle 7E models in reducing students' misconceptions. Qualitative data analysis techniques include interviews to support data misconceptions, observations to support data learning implementation, and student questionnaire to evaluate the response to learning.

RESULTS AND DISCUSSION

Students' misconceptions data on heat theme obtained through the pre-test using diagnostic test three-tier multiple choice instrument against experimental class and control class. The percentage of students' conception rate in the category Know Concepts (TK), Do not Know Concepts (TTK), and Misconceptions (MK) experienced by students in the experimental class and control class is different. Analysis of a conception rate of students in the pre-test experimental classes and control classes are presented in Table 1.

Table 1. Analysis of the conception of students at pre-test experimental class and control class

Classes	Level understanding of concepts					
	TK (%)	TTK (%)	MK1 (%)	MK2 (%)	MK3 (%)	MK (%)
Experiment	44.84	14.84	10.47	13.75	16.10	40.32
Control	42.03	15.78	10.94	14.84	16.41	42.19
Average	43.44	15.31	10.71	14.30	16.26	41.26

Table 1 shows the percentage of students' conceptions categories based on the answers of students in answering the pre-test question of the experimental class and control class. The average percentage of students' conceptions on TK category is 43.44%. The average percentage of students' conceptions on TTK category is 15.31%. The average percentage of the overall misconception (MK) experienced by students in heat theme is 41.26%.

The next stage is to analyze the misconceptions profile for each of the indicators in the theme of heat. Judging from the theme indicators of heat distribution throughout indicator misconceptions exist about the number of different. Misconceptions profile data per indicator on the heat theme is presented in Figure 1.

According to Figure 1 can be seen that indicators about the number 11 is an indicator with the highest percentage of 70.35% misconceptions. Indicator 11 is "Investigate the events that occurred during the ice melt". Most students misunderstand the concept of events during the ice melt. Instead, the indicators about the number 18 is an indicator with the lowest percentage of 14.05% misconceptions. Indicator 18 is "Identifying objects including the conductor". Most students already know about theconcept.

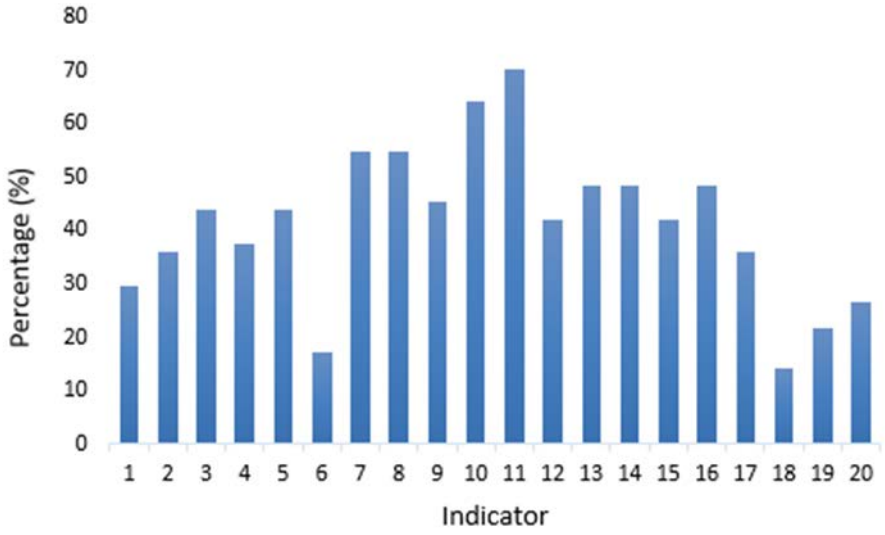

Figure 1. Misconceptions data per indicator profile in the theme of heat

Although it has been revealed misconceptions experienced by students, yet necessary clarification to the students concerned. It could be the answer given in the form of random answers or answers that only mimic his answer (Linuwih & Setiawan, 2010). Interviews were also required to reveal more about the background of the misconceptions. Based on the interview, identified the concept of what is elusive students and causes of the misconceptions in the theme of heat. In detail, misconceptions and misconceptions on the causes of the theme of heat that often arise from the results of student interviews are presented in Table2.

Table 2. Misconceptions and factors causing misconceptions

No	Sub Concept	Questions	Misconceptions	Causes
1	Event of boiling water	10	When boiling water, temperature will continue to rise	Early conception of students
2	Event ice melt	11	The process of ice melting into liquid temperature rise of	Early conception of students
3	Heat Calculation	13 14	The heat required to raise the temperature of a substance is the product of the mass, specific heat, and the final temperature substances	Learning method
4	Heat the type of water and oil	9	The water temperature is equal to the oil temperature when boiling	Early conception of students
5	Absorption and heat release	7 8	Heat absorbed differently by the heat released	Early conception of students
6	Relationship heat and temperature changes	12	Heat types of substances that are high will accelerate these substances absorb heat	Early conception of students

Sub heat theme that most experienced misconceptions by the students are ice melt events, the events of boiling water, heat calculations in the chart, the specific heat of water and oil, the absorption and release of heat, as well as the specific heat relationship with

change temperature. In the concept of event ice melt, students assume the change from solid to liquid releasing heat, there is also the opinion that the temperature of the object increases because of the influence of the temperature from outside so that the ice melts and the temperature rises. In the case of heat calculation, students still misunderstand the concept of using the right formula to calculate the heat, be it the heat to raise the temperature and heat to change the form of the substance. Theasy et al. (2017) explains that the difficulty experienced by students is the difficulty in distinguishing the symbols contained in physics. Symbols that have the same shape, but have the different meanings and purpose.

Linuwih (2011) explained that the factors that cause the occurrence of conception can be instuition in everyday life, learning, textbooks, conceptual appreciation knowledge as separate chips, as the structure of theoretical knowledge and understanding of less depth. Lebdiana et al. (2015) explains that one of the causes of misconceptions experienced by students is from the perspective of constructivism. Constructivism is the knowledge formed or constructed by the students themselves which is then linked with daily experience. However, students do not deepen the concept correctly so that they regard the concept they find by chance as a true concept.

Stein et al. (2008) suggests that misconceptions will become commonplace if left on a continuous basis. The high misconception experienced by students is very worrying if not realized, both by teachers and students themselves. Misconceptions experienced by students will disturb them in receiving new knowledge. Therefore, it is important to immediately determine whether students have misconceptions and on which parts of misconceptions that students have to do remediation before the concept has now firmly entrenched in students.

After identified the misconception, then that is applying the learning cycle 7E model-based multiple representation in the experimental class. RPP preparation adapted to the learning cycle 7E model. Learning cycle 7E model consists of seven phases, which bring prior knowledge of students (elicit), generating interest (engagement), probe (exploration), explain (explanation), apply (elaboration), judge (evaluation) and expand (extend). Implementation of the study was analyzed based on the implementation learning observation data by the observer by providing assessment scores at each stage of learning. Learning implementation analysis results are shown in Table3.

Table 3. The results analysis of the implementation learning cycle 7E model

No	Statement	Percentage (%)	Criterion
1	Elicit students' understanding by asking questions that can be interesting to learn	80	Very good
2	Asking problems associated with the theme to be studied	90	Very good
3	Give examples of problem-solving solutions based multiple representation	80	Very good
4	The division of the discussion group	90	Very good
5	Provide and distribute Student Worksheet (LKS)	100	Excellent
6	Monitor discussion and facilitate if students have difficulty	70	Good
7	Select and listen to the presentation results of group discussions	90	Very good
8	Directing discussion	70	Good

9	Provide input if there are things that are poorly understood	80	Very good
10	Summing up the results of the discussion together	90	Very good
11	Providing and distributing Sheet Question	100	Excellent
12	Providing opportunities for students to ask questions about issues that are considered poorly understood	70	Good
13	Using multiple representations to explain the poorly understood concept	80	Very good
14	Guiding students to link the concept that has been gained in the another context	80	Very good
15	To evaluate / test at the end of the study	100	Excellent
	Average	84.67	Very good

In Table 3 it can be seen that the results of the analysis instructional learning cycle 7E model-based multiple representations of obtaining the average percentage of 84.67% with the criteria very well. Students could've been clearer in conveying his opinion. Relationships between students in the group to grow compact, and the student's ability in drawing conclusions from the lab and discussion also increased. This is in line with the statement Kulsum & Hindarto (2011) that the model learning cycle applied gives students the opportunity to be active in learning, so as to enhance the activity through experiments or lab involving students directly. Lukito et al. (2015) revealed that the learning lab to train students for skilled in solving problems through problem identification, hypothesis formulation, the coupling tool, analyzing the results, and communicate their conclusions derived from the learning lab.

The use of multiple representations in the teaching of the concept maximizes implementation learning cycle 7E so as to accommodate students who have misconceptions, or have a low initial concept mastery. Results of research conducted by Suhandi & Wibowo (2012) demonstrated that multiple representation is one approach that is effective enough to be used in order to cultivate an understanding of science concepts.

Once applied learning cycle 7E model based multiple representation, the next is to do the post-test. The level of students 'conceptions of the pre-test and post-test on the experimental class and control class percentages are calculated to determine the amount of the increase or decrease in students' conceptions. Data reduction misconceptions students after learning cycle 7E model-based multiple representation can be determined by comparing the percentage level of misconceptions when pre-test and the percentage level of misconceptions when post-test.

Comparison of the percentage level of students 'conceptions of the pre-test and post-test on the experimental classes are presented in Table 4 and the comparison of the percentage level of students' conceptions of the pre-test and post-test on the control class are presented in Table5.

Table 4. Comparison of percentage level students' conceptions the pre-test and post-test experimental class

Test type	Level understanding of concepts					
	TK (%)	TTK (%)	MK1 (%)	MK2 (%)	MK3 (%)	MK (%)
Pre-test	44.84	14.84	10.47	13.75	16.10	40.32
Post-test	72.14	6.26	6.89	10.17	4.54	21.60
Difference	27.30	8.58	3.58	3.58	11.56	18.72

Based on Table 4 in the experimental class in mind the overall percentage of misconceptions experienced by students as a pre-test is 40.32%. After implementation learning cycle 7E model-based multiple representations, known to the overall percentage of misconceptions experienced by students when post-test is 21.60%. Thus there is a decrease in the percentage of students' misconceptions experienced by 18.72%. This is according to research conducted by Wulandari & Nasrudin (2013) that the model learning cycle 7E can reduce student misconceptions on salt hydrolysis theme, ie from 43.07% to 11.39%.

Tabel 5. Comparison of percentage level students' conceptions the pre-test and post-test control class

Test type	Level understanding of concepts					
	TK (%)	TTK (%)	MK1 (%)	MK2 (%)	MK3 (%)	MK (%)
Pre-test	42.03	15.78	10.94	14.84	16.41	42.19
Post-test	59.37	8.12	10.63	15.16	6.72	32.51
Difference	17.34	7.66	0.31	0.32	9.69	9.68

Based on Table 5 in the control class in mind the overall percentage of misconceptions experienced by students as a pre-test is 42.19%. After only do conventional learning, note the overall percentage of misconceptions experienced by students when post-test is 32.51%. Nevertheless, there remains a misconception decline experienced by students amounted to 9.68%. The percentage decrease in the level of misconceptions students in the experimental class that is larger than the control class indicates that the learning cycle 7E model-based multiple representations effective in reducing misconceptions students on the heat theme.

To determine the significance of differences misconceptions decline experienced by students in the experimental class and control class t test was used. Analysis calculations Equal Variance Assumed of the independent sample t test result in a decrease in the level of misconceptions indicate significance (2-tailed) of 0.003. Because 0.003 < 0.05, we conclude that there is a difference in the average decline of misconceptions in the experimental class and control class or in other words, the learning cycle 7E model-based multiple representations effective in reducing misconceptions students on the theme of heat. The results are consistent with results of previous studies conducted by Taufiq (2012) that the implementation of the learning cycle model capable of reducing the proportion of students who have misconceptions on the concept of style. The research result Agus et al. (2014) also explains that learning the concept of redox reactions with learning cycle 7E model used to prevent misconceptions significant impact on changes in student learning outcomes.

Misconceptions students may be prevented through learning that teaches scientific methods in acquiring new knowledge contained in the learning cycle 7E model.This model provides an opportunity for students to learn directly confronted with the object through the exploration phase in learning. The use of multiple representations in the teaching of the concept maximizes implementation learning cycle 7E that can accommodate students who have misconceptions, or have a low initial concept mastery.

CONCLUSION

The average percentage of all misconceptions (MK) experienced by students in heat theme is 41.26%. Most misconceptions on heat sub theme are events ice melt, the events of boiling water, heat calculations in the chart, the specific heat of water and oil, the absorption and release of heat, and the relationship of the specific heat with temperature changes. Implementation learning cycle 7E model-basedof multiple representations obtained by the average percentage of 84.67% with the criteria very well. Learning cycle 7E model-based multiple representation effective in reducing

misconceptions students on the heat theme due to the decrease percentage of students in the experimental class misconceptions 18.72% higher than the control class which only 9.68%. Learning cycle 7E model-based multiple representations can be applied as an alternative to the model of learning to reduce misconceptions experienced by students.

REFERENCES

Agus, S., Yuanita, L., & Suyono. 2014. Penerapan Model Learning Cycle 7E untuk Memprevensi Terjadinya Miskonsepsi Siswa pada Konsep Reaksi Redoks. *Jurnal Penelitian Pendidikan Sains*, 3 (2): 354-360.

Dykstra, D. I., Boyle, C. F., & Monarch, I. A. 1992. Studying Conceptual Change in Learning Physics. *Science Education*, 76 (6): 615-652.

Eisenkraft, A. 2003. Expanding the 5E Model. *The Sciences Teacher*, 70 (6): 56-59.

Hammer, D. 1996. Misconception or P-Prims: How May Alternative Perspective of Cognitive Structure Influence Instructional Perceptions and Intensions. *The Journal of the Learning Sciences*, 5 (2): 97-127.

Kulsum, U. & Hindarto, N. 2011. Penerapan Model Learning Cycle pada Sub Pokok Bahasan Kalor untuk Meningkatkan Keaktifan Dan Hasil Belajar Siswa Kelas VII SMP. *Jurnal Pendidikan Fisika Indonesia*, 7 (2): 128-133.

Lebdiana, R., Sulhadi, & Hindarto, N. 2015. Pengembangan Perangkat Pembelajaran Materi Suhu Dan Kalor Berbasis Poe (Predict-Observe-Explain) untuk Meremediasi Miskonsepsi Siswa. *Unnes Physics Educational Journal*, 4 (2): 2-6.

Linuwih, S. & Setiawan, A. 2010. Latar Belakang Konsepsi Paralel Mahasiswa Pendidikan Fisika dalam Materi Dinamika. *Jurnal Pendidikan Fisika Indonesia,* 6 (2): 69-73.

Linuwih, S. 2011. *Konsepsi Paralel Mahasiswa Calon Guru Fisika pada Topik Mekanika*. Disertasi. Bandung: Program Pascasarjana Universitas Pendidikan Indonesia.

Lukito, D. S., Rusilowati, A., & Linuwih, S. 2015. Pengembangan Bahan Ajar IPA Terpadu Berbasis Literasi Sains Bertema Perpindahan Kalor dalam Kehidupan. *Jurnal Pendidikan Fisika Indonesia*, 4 (3): 36-42.

Stein, M., Larrabe, T. G., & Barman, C. R. 2008. A Study of Common Beliefs and Misconceptions in Physical Science. *Journal of Elementary Science Education*, 20 (2): 1-11.

Suhandi, A. & Wibowo, F. C. 2012. Pendekatan Multirepresentasi dalam Pembelajaran Usaha-Energi dan Dampak terhadap Pemahaman Konsep Mahasiswa. *Jurnal Pendidikan Fisika Indonesia*, 8 (1): 1-7.

Taufiq, M. 2012. Remediasi Miskonsepsi Mahasiswa Calon Guru Fisika pada Konsep Gaya Melalui Penerapan Model Siklus Belajar (Learning Cycle) 7E. *Jurnal Pendidikan IPA Indonesia,* 1 (2): 198-203.

Theasy, Y., Wiyanto, & Sujarwata. 2017. Identifikasi Kesulitan Belajar Fisika Berdasarkan Kemampuan Multi Representasi. *Physics Communication*, 1 (2): 1-5.

Wulandari, W. & Nasrudin, H. 2013. Implementasi Model Learning Cycle 7E untuk Mereduksi Miskonsepsi Level Sub Mikroskopik Siswa pada Materi Hidrolisis Garam di SMAN 1 Tarik Sidoarjo. *Unesa Journal of Chemical Education*, 2 (2): 121-126.

Yoanita, P. & Akhlis, I. 2015. Pengembangan E-Diagnostic Test untuk Identifikasi Tingkat Pemahaman Konsep Siswa SMP pada Tema Optik dan Penglihatan. *Unnes Science Education Journal*, 4 (1): 815-822.