Mind Mapping Integration to Develop Learning Activities and Outcomes

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ABSTRACT
The learning process which tends to be less varied causes the low learning outcomes of students. In learning activities, students only accept facts that must be memorized and there is still a lack of student involvement in the learning process. The purpose of this study was to determine the implementation of mind mapping in learning to improve science learning activities and outcomes in straight motion material. By using this method students were expected to be able to identify and interpret concepts and principles of straight motion properly and correctly. The results showed 87.5% of students completed with an average value of 76.3. The application of concept maps in learning could develop the activities and learning outcomes of natural science in straight-motion material for Class VII D students of Junior High School 1 Maesan, Bondowoso, East Java, Indonesia.

Keywords: concept maps, learning activities, learning outcomes

1. INTRODUCTION

The teacher has a very important role for learning success [1]–[3]. Teacher creativity in developing learning has the potential to produce quality processes and learning outcomes [4], [5]. The quality of the process and learning outcomes will not be achieved if the teacher is not actively doing a variety of creative innovations in the development of various basic competencies for all subjects, one of which is learning science.

The science learning process must start with concrete materials [2], [6]. The concept of science is built and reconstructed from concrete materials that are abstract in the mind of the child. Straight motion is a science learning material for class VII semester 1 that discusses the notions of motion, distance and displacement, regular straight motion and irregularly changing straight motion. Conceptually this material is useful to provide knowledge about motion in everyday life.

The results of first observations are based on daily test scores and observations of the science learning process in the learning activities of basic competencies 5.2, namely analyzing experimental data on straight and regular motion and irregularly changing motion and its application in daily life. It is known that student learning outcomes are very low, which is 46.9%. Thus, out of 32 students, only 15 completed. This means that it has not reached the specified standard which is 85%. Mastery of students' concepts is low and many concept errors occur. Learners only memorize without knowing the concepts contained in the material being studied. In addition, the possibility of teaching the teacher is less appropriate because it uses more lecture methods.

To overcome the above problems, the teacher applies a concept map in science learning. By using this method, the natural workings of the brain can be involved from the start. Thus, it is hoped that recalling further information will be easier. Concept maps can make science more interesting and make students able to clearly identify and interpret the concepts and principles of science. The basis for establishing indicators of success in learning is classical completeness standards. A class is said to have finished its study (classical completeness) if in the class there are ≥ 85% of students who have finished learning [7], [8].

Learning is a process by which a person undertakes to obtain a new change in behavior as a whole, as a result of his own observations in interactions with his environment [9], [10]. From birth humans have begun learning activities to meet needs while developing themselves. From the understanding and explanation of learning from several experts it can be concluded that in learning a process of change in behavior that is permanent and continuous that includes cognitive, affective and psychomotor aspects [11]–[13]. Learning

outcomes are the result of a process carried out by students and teachers in the classroom, students try to get lessons and the teacher gives lessons. Learning outcomes are changes in behavior obtained by students after experiencing learning activities [11], [12].

The concept map is a schematic chart to illustrate a person's conceptual understanding in a series of statements. In addition to describing important concepts, concept maps also connect existing concepts. The concept maps are a good way to get new ideas and easy ways to get information from the brain [14], [15]. By using concept maps, the natural workings of the brain can be involved from the start. This means that to recall further information will be easier. One statement in Ausubel theory is that the most important factor influencing learning is that early knowledge is known to students [16], [17]. So, for meaningful learning, then new concepts must be linked to previous concepts that exist in the cognitive structure of students.

2. METHOD

This type of research is Classroom Action Research (CAR) using four stages, namely planning, acting, observing and reflecting [18],[19]. This study aims to improve the quality of learning and improve student activity and learning outcomes. The independent variable is the concept map, while the dependent variable is an increase in science learning activities and outcomes.

The study was conducted at SMP Negeri 1 Maesan Bondowoso with 32 research subjects, consisting of 16 men and 16 women. This Classroom Action Research was carried out in three cycles and each cycle was held 2 meetings. Cycle I meeting 1 was held on 6 September 2016 and meeting 2 was held on 7 September 2016, cycle II meeting 1 was held on 13 September 2016 and meeting 2 was held on 14 September 2016, whereas cycle III meeting 1 was held on 20 September 2016 and meeting 2 was held on September 21, 2016. Cycle I explained the notion of motion, distance and displacement, Cycle II explained about irregular straight motion, while Cycle III explained about straight-changing motion irregularly. The research design and process carried out in this study were adjusted to the PTK flow consisting of 4 stages.

3. RESULTS

3.1 Research Cycle I

3.1.1 Cycle I Research Planning (1st meeting)

The planning phase consists of: (a) mapping students' abilities based on their abilities in accordance with the results of the initial ability tests (entry behavior) as well as the main consideration in conducting grouping of students; (b) Prepare a Learning Plan (RPP) about the notions of motion, distance and displacement. The lesson plans that have been made and the learning tools are then delivered to the teacher who acts as a collaborator to be studied, then discussed and corrected as necessary by considering the available time allocation; (c) Creating Student Worksheets (LKS) and independent assignments; (d) Providing the required learning media; and (e) Developing student observation sheets, and observation sheets for the implementation of learning activities for teachers.

3.1.2 Implementation of Cycle I Research (1st meeting)

In the preliminary activities the teacher gives apperception and motivation to students by holding questions and answers about the unit of length and time in SI, understanding scalar quantities and vector quantities, understanding motion and their nature, then the teacher conveys the learning objectives. In the core activity, the teacher conveys the steps of learning to be carried out, beginning with dividing students into 6 groups, each consisting of 5-6 people, distributing LKS 1 about identifying distance and displacement to each group, appointing several participants students to demonstrate the distance and displacement.

Furthermore, the teacher asks students to present the results of their group discussions, and asks other groups to provide responses. The teacher gives reinforcement to students. At the end of the core activity the teacher together with the students conclude the results of group work. During learning, the teacher is assisted by 2 fellow teachers to observe the students about their activities adjusted to the criteria set. In the closing activity the teacher reflects on the learning activities that have been carried out and rewards the best groups, followed by an assessment by giving independent assignments.

3.1.3 Cycle I Observation (1st meeting)

Observation is intended to monitor the implementation of actions, activities of students and teachers conducted during the learning process. Activities at this stage include: (a) Observation of students' activities in learning activities using the observation sheets that have been prepared. The observed component was activity in discussion, collaboration in groups and the responsibilities of students in groups; (b) Observation of the implementation of the learning scenario presented by the teacher, using the observation sheet for the implementation of the learning scenario; (c) The collaborator analyzes the observations to be discussed with the teacher to review the results of the research and the follow-up.

The results of observations in the first cycle (meeting 1) are as follows: (a) students are interested and enthusiastic about the application of concept maps in science learning; (b) students are still having difficulty understanding straight motion material; (c) group discussion is not very active; (d) presentation activities

are less effective, because groups that presentations do not get a response; and (e) students are not ready to take part in learning. After evaluating and analyzing data in cycle I (meeting 1), the following student learning outcomes are obtained in Table 1.

Table 1 Data Based Observation of Cycle 1

No	Descriptors	Percentage (%)
1	The involvement in discussion	70
2	Group Collaboratives	72
3	Students' Responsibility in Group	73
	Percentage of Rate	**72**

The results of observations of the implementation of teaching and learning activities by the teacher are recorded as follows: (1) the teacher is good at managing the class and arouse the activities of the students to participate in learning; (2) teachers need to pay more attention to students who are passive in group activities so that discussions in groups come alive; (3) students have been directed to the subject matter that will be sought for answers or found a solution; (4) the teacher has given students the freedom to discuss, ask questions, or express opinions; and (5) submission of material by lecture method decreases in frequency.

3.1.4 Cycle I Research Planning (2nd meeting)

At the planning phase the things prepared are almost the same as meeting 1, namely: (a) Developing a Learning Implementation Plan (RPP) about the concept of straight-motion maps; (b) Making LKS 2 about concept maps and independent assignments; (c) Providing the required learning media; (d) Arrange student observation sheets, and observation sheets for the implementation of learning activities for teachers; (e) Arranging grids, question cards and final learning tests that will be tested in writing to students at the end of the cycle to find out the activities and learning outcomes of students in cycle I.

3.1.5 Implementation of Cycle I Research (meeting 2)

The teacher has given previous assignments to students to summarize the notions of motion and their nature so that learning readiness and the concepts to be learned will be more easily understood. Then explain the learning objectives. In the core activities of students have grouped, then each group is asked to work on LKS 2 in the form of a concept map about straight motion that is not yet perfect for discussion. Next students present the results of group work and other groups respond. The teacher reinforces the results of discussion and presentation of students. At the end of the core activity the teacher together with the students conclude the results of group work.

3.1.6 Observation of the End of Cycle I (meeting 2)

The results of research and discussion in cycle I (meeting 2) are as follows: (a) students are interested and enthusiastic about the application of concept maps in science learning; (b) students have begun to understand the material of straight motion; (c) group discussion has increased; and (d) presentation activities are starting to be effective, because the group whose presentation has started to get a response. After evaluating and analyzing data in cycle I (meeting 2), the following student learning outcomes are obtained in Table 2.

Table 2 Group Work Achievement of Cycle 1

No	Descriptors	Percentage (%)
1	The involvement in discussion	77
2	Group Collaboratives	80
3	Students' Responsibility in Group	78
	Percentage of Rate	**78**

When compared with learning activities at meeting 1, it appears an increase in learning activities of students. The percentage of students' activeness from meeting 1 and meeting 2 reached an average of 75% with the success of the action being in the high category, above the Minimum Learning Achievement Standard (KKM).

In general, all stages in the learning scenario were carried out well the final learning test results in the first cycle showed 25 students completed, and 7 people did not complete with an average value of 70.8. Classical completeness reaches 78.1%. When compared with learning outcomes in the pre cycle there is an increase in student learning outcomes as in the following Table 3.

Table 3 Students' Learning Outcomes for Cycle 1

KKM	Success Indicators (%)	Learning Mastery (%)	
		Pre-Cycles	Cycle I
75	85	46,9	78,1

3.1.7 Cycle Reflection Stage I

Based on the results of research in the first cycle there was an increase in student learning outcomes when compared to pre-action, although classical completeness has not reached 85%. In addition, there are still some weaknesses that need to be followed up so that it is determined to do a cycle II study. The results of the learning motivation questionnaire showed students' positive responses to learning on average reached 90%.

3.2 Research Cycle II

3.2.1 Cycle Research Planning II (1st meeting)

Based on reflection in cycle I, the teacher and collaborator agreed to make improvements to the plan by following up on the findings in cycle I and finding solutions for improvement in cycle II. Several activities

carried out at this stage, namely: (a) make improvements to the Learning Implementation Plan (RPP), with a focus on activating students; (b) Prepare LKS; (c) Students are tasked with making the next material summary with the aim that students are better prepared to learn; (d) Providing the required learning media; and (e) Developing student observation sheets, and observation sheets for the implementation of learning activities for teachers.

3.2.2 Implementation of Cycle II Research (1st meeting)

Learning begins with greetings, then the teacher conveys the learning objectives. Students group in accordance with the groupings that have been determined in cycle I. Each group exchanges tasks with other groups, followed by dividing worksheet 3 about regular straight motion. The teacher appoints a number of students to demonstrate about straight-line motion.

The teacher guides students to graph the relationship between s-t and v-t from the demonstration results, followed by questions and answers of the teacher and students. Furthermore, the teacher asks students to present the results of their group discussions, and asks other groups to provide responses. The teacher gives reinforcement to students. At the end of the core activity the teacher together with the students conclude the results of group work.

3.2.3 Observation Cycle II (meeting 1)

The results of observation in cycle II (meeting 1) are as follows: (a) Students enthusiastically exchange assignments with other groups, the class atmosphere becomes lively. Good cooperation between group members has been seen; (b) During the group discussion, the students were eager to answer the questions in LKS 3; and (c) By the time of the question and answer session independently in the group, students had gotten used to it, and had no difficulty in conducting independent question and answer with their friends.

The results of observations of students' activities at meeting 1 are presented in the following table 4.

Table 4 Data Based Observation of Cycle 2

No	Descriptors	Percentage (%)
1	The involvement in discussion	84
2	Group Collaboratives	82
3	Students' Responsibility in Group	83
	Percentage of Rate	**83**

The results of observations of the implementation of teaching and learning activities by the teacher are recorded as follows: (1) the teacher is good at managing the class and arouse the activities of students to participate in learning; (2) the teacher has begun to pay attention to students who are passive in group activities so that discussion in the group comes alive; (3) students have been directed to the subject matter that will be sought for answers or found a solution; and (4) the teacher has given students the freedom to discuss, ask questions, or express opinions.

3.2.4 Planning Research Cycle II (meeting 2)

Some of the activities carried out at this stage include: preparing Learning Implementation Plans (RPP), preparing worksheets on the concept map of irregular straight motion, Student Observation Activity Sheets, observation sheets of the implementation of learning by teachers, sheets of students' learning motivation questionnaires, grids and a test question card.

3.2.5 Implementation of Cycle II Research (meeting 2)

Learning begins with greetings, then the teacher conveys the learning objectives. After that, students' group in accordance with their respective groups as in the first meeting. Each group exchanged assignments with other groups about the tasks that had been done at home and completed worksheet 4 on the concept map of irregular straight motion. Students seem to have no difficulty in completing the worksheet. Then one group representative is appointed to present, while another group responds. The teacher reinforces the results of discussion and presentation of students. At the end of the core activity the teacher together with the students conclude the results of group work.

3.2.6 Observation of the End of Cycle II (meeting 2)

The results of the observations of the collaborators are as follows: (a) in the initial activity the students seemed enthusiastic about exchanging assignments with other groups, the class atmosphere became lively, all students were actively involved; and (b) during group work, students are eager to answer questions in LKS 4 and cooperation among group members is greatly increased, shown in the following Table 5.

Table 5 Group Work Achievement of Cycle 2

No	Descriptors	Percentage (%)
1	The involvement in discussion	87
2	Group Collaboratives	86
3	Students' Responsibility in Group	86
	Percentage of Rate	**86**

The learning scenario is done 100%. The results of the learning outcomes test in the second cycle showed 26 students completed, and there were still 6 incomplete people with an average value of 74.7, classical completeness reached 81.3%. When compared with learning outcomes in the pre cycle and cycle I there is an increase in student learning outcomes, as in the following Table 6.

Table 6 Students' Learning Outcomes for Cycle 2

KKM	Success Indicators (%)	Learning Mastery (%)		
		Pre-Cycles	Cycle I	Cycle II
75	85	46,9	78,1	81,3

Based on the results of student learning motivation questionnaire on average in the second cycle of 94% with a very high category.

3.2.7 Observation of the End of Cycle II (meeting 2)

Based on the results of the study in the second cycle it seems that there is an increase in student learning outcomes when compared to pre-action and cycle I, although classical completeness has not yet reached 85%, so it is necessary to do research on cycle III.

3.3 Research Cycle III

3.3.1 Planning Research Cycle III (1st meeting)

Based on reflection in cycle II, the teacher and collaborator agreed to make improvements to the plan by following up on the findings in cycle II and finding solutions for improvement in cycle II. Several activities carried out at this stage, namely: (a) make improvements to the Learning Implementation Plan (RPP), with a focus on activating students; (b) Prepare LKS; (c) Students are tasked with making the next material summary with the aim that students are better prepared to learn; (d) Providing the required learning media; and (e) Developing student observation sheets, and observation sheets for the implementation of learning activities for teachers.

3.3.2 Implementation of Cycle III Research (1st meeting)

Learning begins with greetings, then the teacher conveys the learning objectives. Students group in accordance with the groupings that have been determined in cycle II. Each group exchanged tasks with other groups, followed by dividing LKS 5 on straight-changing irregular motion. The teacher appoints several students to do a demonstration about straight-changing irregular motion. The teacher guides students to graph the s-t and v-t relationship from the demonstration results and guides students to find the understanding of the acceleration of the v-t relationship graph and to graph the a-t relationship. Furthermore, the teacher asks students to present the results of their group discussions, and asks other groups to respond. The teacher gives reinforcement to students. At the end of the core activity the teacher together with the students conclude the results of group work.

3.3.3 Observation of Cycle III (meeting 1)

The results of observation in cycle III (meeting 1) are as follows: (a) Students enthusiastically exchange assignments with other groups, the class atmosphere becomes lively. Good cooperation between group members has been seen; (b) During group discussion, students are eager to answer questions in LKS 5; (c) By the time of the question and answer session independently in the group, students have started to get used to it, and have no difficulty in conducting independent question and answer with their friends. The results of observations of students' activities at meeting 1 are presented in the following Table 7.

Table 7 Data Based Observation of Cycle 3

No	Descriptors	Percentage (%)
1	The involvement in discussion	88
2	Group Collaboratives	86
3	Students' Responsibility in Group	87
	Percentage of Rate	**87**

The results of observations of the implementation of teaching and learning activities by the teacher are recorded as follows: (1) the teacher is good at managing the class and arouse the activities of students to participate in learning; (2) the teacher has begun to pay attention to students who are passive in group activities so that discussion in the group comes alive; (3) students have been directed to the subject matter that will be sought for answers or found a solution; and (4) the teacher has given students the freedom to discuss, ask questions, or express opinions.

3.3.4 Planning Research Cycle III (meeting 2)

Some of the activities carried out at this stage include: preparing Learning Implementation Plans (RPP), preparing worksheets about irregularly moving concept maps of irregular change, Student Observation Activity Sheets, observation sheets of learning implementation by teachers, student learning motivation questionnaire sheets, lattice and card test questions.

3.3.5 Implementation of Cycle II Research (meeting 2)

Learning begins with greetings, then the teacher conveys the learning objectives. After that, students' group in accordance with their respective groups as in the first meeting. Each group exchanged assignments with other groups about the tasks that had been done at home and completed LKS 6 on the map of the concept of straight motion changing irregularly.

Students seem to have no difficulty in completing the worksheet. Then one group representative is appointed to present, while another group responds. The teacher reinforces the results of discussion and presentation of students. At the end of the core activity the teacher together with the students conclude the results of group work.

3.3.6 Observation of the End of Cycle III (meeting 2)

The results of the observations of the collaborators are as follows: (a) in the initial activity the students seemed enthusiastic about exchanging assignments with other groups, the class atmosphere became lively, all students were actively involved; (b) during group work, students are eager to answer questions in LKS 6 and cooperation among group members is greatly increased, shown in the following Table 8.

Table 8 Group Work Achievement of Cycle 3

No	Descriptors	Percentage (%)
1	The involvement in discussion	92
2	Group Collaboratives	91
3	Students' Responsibility in Group	92
	Percentage of Rate	**91**

The learning scenario is done by 100%. (d) The results of the learning outcomes test in the third cycle showed that 28 students were complete, and there were still 4 incomplete people with an average value of 76.3, classical completeness reaching 87.5%. When compared with learning outcomes in the pre cycle, cycle I and cycle II there is an increase in student learning outcomes, as in the following Table 9.

Table 9 Students' Learning Outcomes for Cycle 3

KKM	Success Indicators (%)	Learning Mastery (%)			
		Pre-Cycles	Cycle I	Cycle II	Cycle III
75	85	46,9	78,1	81,3	87,5

Based on the results of collaborator observations, the learning activity of students in meetings 1 and 2 in cycle III was 89% with a very high category.

3.3.7 Cycle Reflection Phase III

Based on the results of research in cycle III through both test results, collaborator observation results, questionnaire learning activities and teacher's monitoring during the research activities, all components showed a significant increase. Weaknesses found in cycle II can be corrected in cycle III. Implementation of learning at each meeting 100%. Time management is more effective, this is seen in the implementation of learning that is not rushed and clarity at each step of learning. The development of student learning outcomes has progressed compared with the second cycle, which initially 81.3% of students had completely increased to 87.5% at the end of the third cycle.

This data shows that teachers are increasingly skilled at implementing the chosen learning strategies and students are better prepared to learn. Thus, completeness has reached more than 85% of students completed with an average value of 76.3. Based on an analysis of the process and results of activities at the end of cycle III, it was determined that the research activities had reached the indicators of success determined and the study ended.

4. DISCUSSIONS

This action research found that the application of concept maps in learning can improve students' learning activities and learning outcomes. This can be seen in: (a) the enthusiasm of students following the learning; (b) students can identify and interpret the concepts and principles of science properly; (c) when discussing students can work together in groups; (d) students begin dare to ask questions and care about the group; and (e) the ability of students while doing learning has increased in each aspect and achieve the indicators of success that are set.

The learning outcomes of students on straight motion material are greatly improved and the results of independent tests have passed the established indicators of success. The final results in the form of an independent test showed that students who completed learning reached 87.5% with an average value of 76.3. The results of the questionnaire showed students 'positive responses to learning increased with an average percentage of all descriptors on the questionnaire students' responses to learning reached 89%. This means that students' interest in applying concept maps in learning is very high.

As explained at the beginning, learning outcomes are described as written statements about what is expected, known, and / or can be done by students at the end of the learning period [20]. Learning outcomes in the form of verbal information that is the ability to express knowledge in the form of language, both oral and written [21], [22]. While the indicator of increasing activity of learning is more directed to the maximum involvement of students in all learning. Student participation is the main indicator in measuring the success of student learning activities [23], [24]. One important factor that supports the high activity and learning outcomes is the application of concept maps.

Concept maps are able to present a schematic chart to illustrate a person's conceptual understanding in a series of statements. In addition to describing important concepts, concept maps also connect existing concepts. The concept maps are a good way to get new ideas and easy ways to get information from the mind [14], [15]. By using concept maps, the natural workings of the brain can be involved from the start. This means that to recall further information will be easier. One statement in Ausubel theory is that the most important factor influencing learning is that early knowledge is known to students [16], [17]. So, for learning to be meaningful, then new concepts must be linked to concepts that exist in the cognitive structure of students.

In connection with this study, research conducted by Rina Rahayu Ningsih found that the learning process, the application of the 5E learning cycle equipped with a concept map can improve the quality of the process and learning outcomes of chemistry subject matter solubility and solubility results [25]. The learning process in question is the activeness of students during the learning process, while the intended learning outcome is student learning completeness on cognitive learning achievement.

In addition to cognitive learning achievement, learning outcomes assessed are affective aspects or students 'attitudes towards learning and students' psychomotor skills in carrying out practical activities in the laboratory. The assessment of affective and psychomotor aspects is carried out to provide information to the teacher regarding student attitudes and assessment of student skills during the learning process.

By applying the concept map learning strategy students find it easier to understand the material provided during the lesson because the concept map provides concrete visual assistance to help organize information before the formation is learned [7], [26]. Thus, the concept map is able to facilitate the response of holistic dimensions of students in learning. For whatever reason, the balance in achieving learning outcomes from all dimensions of the individual, is an important and major goal that is pursued by all teachers [27], [28].

5. CONCLUSION

The application of concept maps in learning can improve the activities and learning outcomes of natural science in straight-motion material for grade VII D students of SMP Negeri 1 Maesan in semester 1 of the 2016/2017 school year. Mastery learning outcomes of students achieve a significant level of success, which is equal to 87.5% of students with an average value of 76.3.

Based on the process, implementation, and results of classroom action research that has been carried out, it is recommended that the application of concept maps in learning can be used for other competencies that have the same characteristics as the research activities that have been carried out so that learning becomes interesting.

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