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The Development of Cooperative Learning Model Team Assisted Individualization with SETS Vision to Increase Science Process Skills

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Abstract

This study aims to increase the science process skills and cognitive learning outcomes of students by applying the development of Team Assisted Individualization (TAI) cooperative learning model with SETS vision. The development of this Team Assisted Individualization (TAI) cooperative learning model with SETS vision is a research and development (R&D). Increasing of science process skills students are explored through observation sheets, then the increasement is analyzed using N-gain. The results showed that Team Assisted Individualization (TAI) cooperative learning model with SETS vision could improve the science process skills of students with the acquisition of N-gain of 0.72 (high) in the experimental class 1 and 0.76 (high) in the experimental class 2. Cognitive learning outcomes of students have increased by 0.54 (moderate) in the experimental classes 1 and 2 with classical completeness of 86.1% and 88.89%. Based on the questionnaire responses, it can be concluded that the implementation of the Team Assisted Individualization (TAI) cooperative learning model with SETS vision effectively increases the science process skills of students.

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INTRODUCTION

Natural Sciences (IPA) is a method of finding out about nature systematically and mastering the collection of knowledge in the form of facts, concepts, principles, discovery processes and have a scientific attitude (BSNP, 2006). Learning science is essentially built on three aspects, namely scientific products, processes, and attitudes. Good products are produced from good process skills (Erina & Kuswanto, 2015). Therefore, science learning can be implemented if science process skills are applied to students (Ulmiah et al., 2016).

Science process skills are a set of skills used by scientists in conducting scientific investigations (Kemendikbud, 2013). Science process skills consist of basic skills and integrated skills. Process skills need to be developed in science learning because they are able to bridge the achievement of science learning objectives through direct experience through scientific inquiry (Susilawati & Sridana, 2015). The science process skills have been in principle already in the students. The role of the teacher in learning must be able to develop these skills, one of which is by conducting learning activities that involve students actively in learning.

Field study results conducted at Senior High School (SMA) Negeri 9 Semarang, showed that (1) students still consider chemistry as a difficult lesson, in accordance with Ristiyani & Badriah (2016) that chemistry subject matter in high school contains many concepts that are quite difficult to understand students, (2) the teacher has delivered chemistry subject matter by utilizing the existing facilities, but the learning conditions are still less effective because there are still many students who are not active during learning and tend to be ashamed to ask the teacher when experiencing difficulties in understanding the material, and (3) the ability of students is to provide concrete examples for the material that has been given and learned, and their ability to apply the concept of material taught to solve problems in everyday life is still considered low. This is caused that chemistry learning is only able to learn concepts, principles, theories on memory levels and have not directed students to be directly involved in scientific activities that can increase their knowledge of the concepts of the material being taught. Therefore, a learning model that can solve the problem is needed. One of them is Team Assisted Individualization (TAI) cooperative learning with SETS vision.

Cooperative learning is a learning approach that focuses on the use of small groups of students to work together in maximizing learning conditions to achieve learning goals (Sugiyanto, 2009). Through cooperative learning, students will find it easier to comprehensively find difficult concepts if they discuss with other students about the problems at hand (Kusuma & Aisyah, 2012). Team Assisted Individualization (TAI) is a learning model that combines cooperative learning and individual learning (Sutriningsih, 2015). In the Team Assisted Individualization (TAI) learning there is a student who is better able to act as an assistant in charge of helping individually other students who are less capable in a group. Team Assisted Individualization (TAI) learning will motivate students to help each other group members so as to create enthusiasm in the competition system by prioritizing individual roles without sacrificing cooperative aspects (Kolifah et al., 2013).

SETS (Science, Environment, Technology, and Society) vision provides opportunities for students to acquire knowledge as well as the ability to think and act based on the results of a comprehensive analysis and synthesis by taking into account aspects of science, environment, technology, and society as an integral entity (Binadja, 2006). The application of the Team Assisted Individualization (TAI) cooperative learning model with SETS vision is expected to help students to be more actively in learning activities and easily understand the competencies being studied and then can solve these problems. Students are also expected not only to memorize concepts, but also to relate the material learned with technology, society, and the environment so that their science process skills will also increase.

Based on the problems described above, the objectives of this study are to analyze (1) the validity of the Team Assisted Individualization (TAI) cooperative learning model with SETS vision used in the learning process, (2) the Team Assisted Individualization (TAI) cooperative learning model with SETS vision developed can increase science process skills and cognitive learning outcomes of students, (3) the response of students in the learning process using the Team Assisted Individualization (TAI) cooperative learning model with SETS vision.

METHODS

This research is a type of research and development. This study uses two experimental groups. Development research method is a research method used to produce a particular product, and test the effectiveness of the product (Sugiyono, 2011). The study was conducted from April 27 to May 30 2015 with research subjects in class XI MIA 4 and XI MIA 5 at SMA Negeri 9 Semarang. This research and development aims to produce a valid and effective Team Assisted Individualization (TAI) cooperative learning model with SETS vision so that it can be used as a reference in learning activities. The research activity begins with a needs analysis of the problems found in learning activities through observation. Based on direct the observations made on learning activities in class XI MIA 4 and XI MIA 5 SMA 9 Semarang can be seen that the active participation of students is still lacking because teachers tend to use the lecturing method. Practicum activities are also rarely carried out due to limited facilities and time.

The next stage of development is to design the Team Assisted Individualization (TAI) learning with SETS vision syntax, then to compile learning tools in the form of syllabus, lesson plans, teaching materials and evaluations with SETS visioned and oriented science process skills, validation sheets, observation sheets, and response questionnaires. A set of coginitive test questions to determine the increase in student learning outcomes. Validation sheets are used to assess content validity carried out by experts on the instruments that have been made. Observation sheets are used to find out aspects of science process skills of students. The response questionnaire sheet provides to find out the students' response to the teaching materials used in the learning process. The next stage is expert validation, small group trials, and field trials.

This research is said to be successful if it meets the following criteria: (1) Teaching materials that have been developed obtaining the average score of the validator in the category of feasible or valid; (2) students' cognitive learning outcomes reach KKM $\geq$ 75 with classical completeness reaching 75%; (3) The percentage of science process skills of students with minimum criteria of "high" $\geq$ 70%; (4) Increasement of science process skills and learning outcomes of students classically meet the minimum criteria of "medium" based on the value of N-gain obtained; (5) A minimum of 70% of the total number of students give a positive response to the learning done.

RESULTS AND DISCUSSION

This research begins with identifying and gathering information about various initial conditions of the learning process that take place in the school. These initial conditions include the learning methods used and the characteristics of students in chemistry learning. The next step is to compile and develop various research tools needed, then validate the instruments by experts. At this stage teaching materials and other supporting instruments that have been designed and will be tested are validated in content and construct by experts. This stage aims to validate the learning tools developed before being tested.

Inputs and suggestions from the validators are used as a reference in improving research instruments in order to obtain valid instruments. The instruments produced after going through increasements according to input from the experts used in the small group trial stage. The results of the overall validation of the research tool can be presented in Table 1.

Table 1. Summary of Overall Validation of Research Instrument

Instrument	Validator I	Validator II	Total Score	Average	Criteria
Silabus	4,5	4,6	8,9	4,45	Very good
RPP	4,7	4,6	8,7	4,35	Very good
Teaching materials	4,3	4,6	8,9	4,45	Very good
Test of Learning Outcomes	4,7	4,6	7,4	3,7	Very good
Student response sheet	4,5	4,3	7,8	3,9	Very good

Based on Table 1 shows that the developed device has valid criteria and can be used even though it needs to be improved according to the suggestions of each validator. This is because in its preparation, the learning model developed is based on an adequate theory (content validity) and all components of the learning model relate to each other consistently (construct validity). In accordance with Rochmad (2012), the indicators used to state that the learning model developed is valid. It is based on the curriculum or learning model developed based on strong theoretical rationale. In addition, the developed learning model shows internal consistency between the components of the model. After the research instrument was revised and approved by the supervisor, a small group trial was conducted on students who were not used as research subjects. Small group trials are conducted to find out and look for deficiencies, weaknesses, obstacles and obstacles that might occur during the learning process.

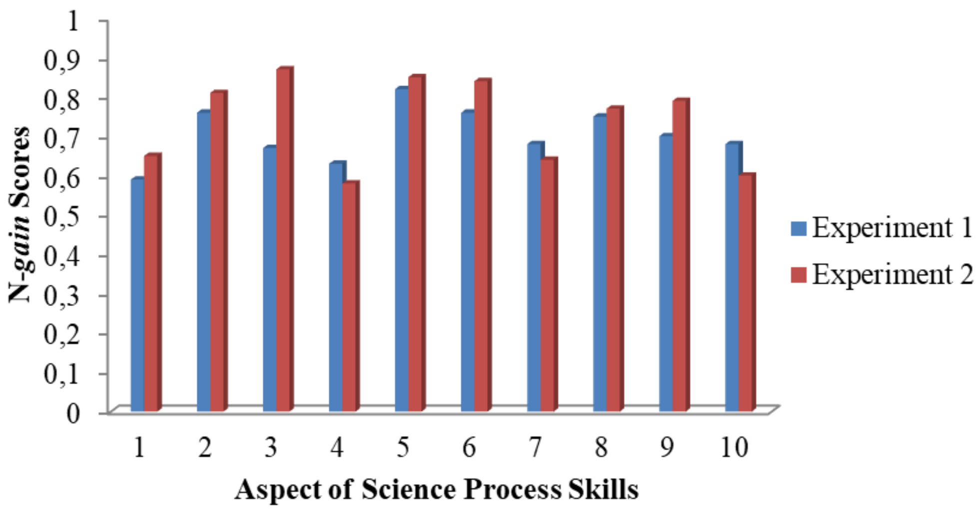
Aspects of the science process skills of the students are analyzed in this study. They include (1) identifying variables, (2) classifications, (3) asking questions, (4) formulating hypotheses, (5) conducting experiments, (6) observing, (7) compiling observational data, (8) analyzing data, (9) formulating conclusions, and (10) communicating observations. Assessment of science process skills in the learning process of Team Assisted Individualization (TAI) cooperative learning model with SETS vision on colloidal material was carried out through observations by observers from 1st meeting to 3rd meeting and learning outcomes test.

Observations were made on 2 experimental classes where each class consisted of 36 students divided into 6 groups. The development of science process skills of students was observed through observation of science process skills of students during the learning process using the Team Assisted Individualization (TAI) cooperative learning model with SETS vision to determine the increasement of science process skills in each experimental class. The improvement of science process skills in the two experimental classes was carried out by analyzing the N-gain scores obtained. The magnitude of the increasement in scientific process skills of students as a whole from the 1st observation to the 3rd observation can be seen in Table 2.

The development of Team Assisted Individualization (TAI) cooperative learning model with SETS vision can effectively increase the science process skills of students with the acquisition of N-gain in the experimental class 1 by 0.72 and the experimental class 2 by 0.76, both of which fall into the high category. Increasement of science process skills in the two experimental classes was caused by the use of Team Assisted Individualization (TAI) cooperative learning model with SETS vision on learning activities giving students the opportunity to be more active in learning independently, according to Rahmawati et al. (2015) that the Team Assisted Individualization (TAI) learning model trains students to appear confident and more active in front of the class. Team Assisted Individualization (TAI) learning with SETS vision can train students to be more motivated because students can construct their knowledge individually and also students get direct guidance from peers who are more able in terms of their academic abilities. This study also conducted a value analysis on each aspect of science process skills. The results of the N-gain score achieved in each aspect of the science process skills can be seen in Figure 1.

Table 2. Analysis Results of Science Process Skills

Class	Observation	Average Value of KPS	N-gain	Description
Experiment 1	1	21,64	0,72	The N-gain score in the experimental class 1 entered into the high category
	2	23,97		
	3	27,86		
Experiment 2	1	21,14	0,76	The N-gain score in the experimental class 2 entered into the high category
	2	23,81		
	3	28,03		



Information:

1. Identifying Variable
2. Classifications
3. Asking Questions
4. Formulating hypotheses
5. Conducting Experiments
6. Observing
7. Compiling Observational Data
8. Analyzing Data
9. Formulating Conclusions
10. Communicating Observations

Figure 1. Score Results on Each Aspects of Science Process Skills

From Figure 1 above, it can be seen that in the experimental class 1 the highest N-gain score is achieved in the aspect of conducting an experiment with a N-gain achievement score of 0.82 (high). This is because the experimental activities using the Team Assisted Individualization (TAI) cooperative learning model with SETS vision are different from the experimental activities that were used previously by students. SETS vision learning connects the theories learned with their application in the form of technology, their impact on society, and the environment is real and contextual (Nugraha et al., 2014). Learning feels more fun and students who are still not familiar with the experimental activities in this learning, the longer students become interested in being active of conducting experimental activities. Experimental activities are very important to do because according to Prasetyo et al. (2015), without practicum activities, students' skills in applying concepts into problems, explaining problems, formulating hypotheses and arguments, and making conclusions are still low.

In Figure 1 it can also be seen that the experimental class 2 has the highest increase in science process skills in the aspect of asking questions with an N-gain of 0.87 (high). This is because in the Team Assisted Individualization (TAI) cooperative learning model with SETS vision there is a communicative student who has a higher academic ability who acts as an assistant so that it can help explain individually to other students who have difficulty understanding the material taught in a group. Students are given the opportunity to discuss and interact with each other. The existence of peers in charge of helping other students explain the material being taught, making students feel comfortable and not ashamed to ask friends who acted as assistants when experiencing difficulties in understanding the material being taught. This is consistent with the statement of Huda et al. (2015) with the existence of peer tutors who are less active to be active, because they are not ashamed to ask questions and can freely express their opinions to their peer tutors.

Cognitive learning outcome tests are used to determine the increase in mastery of subject matter before and after getting learning by using Team Assisted Individualization (TAI) cooperative learning model with SETS vision. Cognitive learning outcomes of students were tested with 30 items of pretest and posttest questions. After the pretest and posttest were conducted related to the ability to understand the concept of colloidal material using the Team Assisted Individualization (TAI) cooperative learning model with SETS vision, a score was obtained from each student. Pretest data provides an overview of the students' initial abilities before learning. Description of the results of the pretest and posttest data given the treatment shown in Table 3.

Table 3. Pretest and Posttest Scores of Cognitive Learning Outcomes

Class	Mean Pretest Value	Mean Posttest Value	t_{count}	t_{table}	α	Criteria
Experiment 1	64,6	83,8	13,73	1,690	0,05	Significant
Experiment 2	64,7	83,9	14,08			

From Table 3 it can be seen that the mean pretest values of experimental class 1 and 2 are 64.6 and 64.7. The pretest value of experimental class 1 ranged between 46.7 and 80 while the pretest value of experimental class 2 ranged between 50 and 80. The mean posttest values of experimental class 1 and 2 were 83.8 and 83.9. The posttest value of experimental classes 1 and 2 ranged between 66.7 and 96.7. Increased data is obtained from the difference between the posttest and pretest results got from students. Based on data from cognitive learning test results can be seen that the increase (gain) achieved is 0.54. The implementation of Team Assisted Individualization (TAI) cooperative learning model with SETS vision that is used can increase student learning outcomes by increasing learning outcomes in the form of normalization gain in the medium category, in accordance with Nugraheni et al. (2013) which states SETS vision learning can increase learning outcomes.

t-test analysis is conducted to determine whether there is a significant difference between pretest and posttest scores. To test the hypothesis, hypothesis testing is Ho with the following test criteria:

- Ho is rejected if t count <t table → there is no significant change in student scores after certain treatments.
- Ho is accepted if t count> t table → there is a significant change in student scores after certain treatments.

From the calculation results obtained tcount experimental class 1 and 2 are 1.73 and 14.08. Known table with the number of data = 36 (dp = N - 1 = 35) is 1.690. Based on the results of calculations, it can be seen that the value of t test the average test between the pretest and posttest values, after there was treatment of Team Assisted Individualization (TAI) cooperative learning model with SETS vision, greater than the ttable value of 13.73 > 1.690 in the experimental class 1, and 14.08 > 1.690 in experimental class 2. Thus, Ho was accepted because there was a significant change between the pretest and posttest scores, after being given treatment with Team Assisted Individualization (TAI) cooperative learning model with SETS vision. Increased learning outcomes are also indicated by the percentage of learning completeness which can be seen in Table4.

Table 4. Percentage of Individual Completeness

	Number of Students Complete	Number of Students Not Complete	Percentage of Completeness (%)
Experiment 1	31	5	86.1
Experiment 2	32	4	88.89

Based on the percentage of individual completeness in experimental class 1 and experiment 2, it can be stated that from each of the 36 students who participated in learning on colloidal material with the application of Team Assisted Individualization (TAI) cooperative learning model with SETS vision obtained results as many as 31 students in the experimental class 1 and 32 students in the experimental class 2 were declared complete with the acquisition of $\geq$ 75 in accordance with the KKM set in the school, while as many as 5 students in the experimental class 1 and 4 students in the experimental class 2 were declared incomplete with the acquisition value $\leq$ 75. The results of the percentage of classical learning of students in the experimental class 1 was 86.1% and in the experimental class 2 was 88.89% so it can be concluded that the learning outcomes in the two experimental classes were declared complete. In accordance with the criteria of classical learning completeness, learning is declared complete if $\geq$ 80% of students complete classically.

In the Team Assisted Individualization (TAI) cooperative learning model with SETS vision, students who are weak are helped by students who have more abilities in the academic field, so that students who are weak in academic will find it easier to understand the material being taught. SETS visionary learning raises issues that occur in the community in daily life. The teacher starts by raising the issue from the science side of colloidal material, then the students are asked to develop it into the form of technology, the impact on the environment, and the advantages and disadvantages for the community. This is in line with McCare's opinion that learning will stimulate students to be more active when issues are used as a stimulus (Salila et al., 2015).

Increased learning outcomes also occur because of the direct involvement of students during the learning process. This is consistent with Agustanti's (2012) statement that the principle of learning is to experience itself, meaning that students who are directly involved and conduct their own learning processes will get optimal learning outcomes. In the Team Assisted Individualization (TAI) learning with SETS vision, the teacher is also very influential in the achievement of students' cognitive learning outcomes. Without careful preparation and interesting discussion material prepared by the teacher, students will quickly feel bored and uncomfortable so that they are less active in learning (Afriawan et al., 2012).

The response of students in participating in learning becomes an important part to be considered to support the learning process of the students. Analysis of students' responses in this study was carried out using students' questionnaire responses to find out the students' responses to the Team Assisted Individualization (TAI) cooperative learning model with SETS vision used during the learning process. The response of the students in the experimental group 1 during 4 students (11.1%) included learning using Team Assisted Individualization (TAI) with SETS vision included in the strongly agreed category. 28 people included in the agreed category, and 4 people included in the disagree category. In the experimental group 2, as many as 2 people (5.6%) respondents included in the category of strongly agree, 30 people included in the agreed category, and 4 people included in the category of disagree.

Data analysis resulted in the average response of students as a whole in the criteria of both experimental class 1 and 2 which amounted to 77.8% and 83.3%. Based on the results of the analysis showed that after learning activities using the Team Assisted Individualization (TAI) learning model with SETS vision, students became more active, communicative, and motivated. This is consistent with the research of Gull & Shehzad (2015) that cooperative learning can increase students' motivation. Questionnaire responses of students also showed that Team Assisted Individualization (TAI) cooperative learning with SETS vision made students able to work together, share knowledge with other friends, in accordance with the results of Altun (2015) research that cooperative learning can increase students' social skills. The Team Assisted Individualization (TAI) cooperative learning model with SETS vision can facilitate students in understanding colloidal material and increase student learning outcomes in accordance with Sulistyaningsih et al. (2015) research that the application of Team Assisted Individualization (TAI) methods can increase students' learning activities and achievements.

CONCLUSION

Based on the results of the study it can be concluded that the validity of the Team Assisted Individualization (TAI) cooperative learning model with SETS vision was developed valid, this is consistent with the results of two validators which show that the syllabus reaches a score of 4.5 (valid), RPP with a score of 4.7 (valid), validation of teaching materials with a score of 4.3 (valid), and a 4.7 (valid) test question. The application of the Team Assisted Individualization (TAI) cooperative learning model with SETS vision can improve the science process skills of students in both experimental classes with N-gain gains of 0.72 (high) in the experimental class 1 and 0.75 (high). The percentage of students whose science process skills fall into the good category is 78% in the experimental class 1 and 81% in the experimental class 2. The Team Assisted Individualization (TAI) cooperative learning model with SETS vision developed in learning can effectively increase the learning outcomes of students in both experimental classes. This is according to the results of the effectiveness test shows that the N-gain value is 0.54 (medium) in both experimental classes. Other effectiveness is shown through the percentage of students who complete learning with KKM> 75 reaching 86.1% in the experimental class 1 and 88.89% in the experimental class 2. Students give a positive response to the implementation of the Team Assisted Individualization (TAI) cooperative learning model with SETS vision with a percentage of 7.,8% in the experimental class 1 and 86.7% in the experimental class 2.

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