



Development of cooperative learning by utilizing circular design on the subject of energy at SMP Negeri 13 Manado

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Abstract

This research aims to develop cooperative learning that is integrated or executed using a circular design approach on the subject of energy at SMP Negeri 13 Manado. The method used in this research is research and development (R & D) following the research development stages of the four-d-models define, design, develop, and disseminate. The research results show that (1) The quality of the product produced is in accordance with theory and its internal consistency (valid) based on validation from material and media experts; (2) Products that have been created and developed provide good results for their users (effective), namely they can increase the effectiveness of science learning; and (3) Cooperative learning products using circular design in energy materials are developed that are easy to use (practical) based on students' positive responses.

Keywords: Cooperative learning, circular design, research and development methods

Introduction

Humans are social creatures, and live to support each other. Likewise in the world of education. The social aspect of education is an essential thing that is needed by everyone without exception. The life of an individual or group can be assessed for quality and skill in the way they work in a group. The implementation of the Independent Learning Curriculum is realized as an effort to improve the quality of education in Indonesia, where the existing orientation and provides opportunities for students to explore and discuss in learning activities. With the implementation of the Independent Learning Curriculum, the learning process in schools has changed. This is in line with the development of science and technology which is increasingly advanced day by day.

However, this also has an impact, namely that learning currently focuses on technology and automation. This results in the use of technology in extracting or searching for information tending to be used as a solution in the classroom. The impact of incorrect use of technology is that, when students are faced with problem solving carried out in groups, students experience problems in taking their roles in the group. This is also reinforced by the current conditions where students misuse existing technology. Learning activities in schools are more directed towards individual learning because students can directly search for information themselves, which results in students' ability to adapt to a group in teaching and learning activities being problematic.

Based on observations through observations of learning activities in grade 8 students at SMP Negeri 13 Manado, it was observed that as a result of errors in the use of technology, students experienced difficulty in taking their role in the discussion process in learning and were unable to contribute well, and had a tendency to be careless in making decisions in in groups which has an impact on the quality of learning in the classroom. These problems have an impact on decreasing student learning outcomes. Researchers think that learning is needed that invites students to study in

groups, so that later students will be able to take their role in learning. This is based on the opinion of Gillies (2020) ^[12], namely "Instructors play a critical role in promoting dialogic interaction in their students". Teachers have an important role in promoting dialogic interaction in their students.

Learning activities at SMP Negeri 13 Manado have implemented Cooperative Learning which directs students to study in groups, but it has not been effective. Based on the results of observations through observations and interviews with grade 8 students and teachers at SMP Negeri 13 Manado, it was found that there were several learning activities that were not optimal, resulting in the quality of the application of Cooperative Learning to students being ineffective. Teachers still go through several phases in the syntax of the cooperative learning model used and apply inappropriate approaches so that learning does not run well. Teachers have difficulty directing students to work together in groups, so that only a few students are actively involved in the learning process.

The Cooperative Learning Model is a learning model that prioritizes cooperation between students, so that there is positive interaction in solving a problem. Lie (2008) believes that cooperative learning is a teaching system that provides students with the opportunity to collaborate with other students in structured tasks. Lie's opinion is strengthened by the statement made by Etin Sobayarin and Raharjo (2007), which states that: Cooperative learning implies a joint attitude or behavior in working or helping others in an orderly cooperative structure in a group, consisting of two people or more where the success of work is greatly influenced by the involvement of each member of the group itself. Cooperative learning can also be interpreted as a shared task structure in an atmosphere of togetherness among fellow group members.

In implementing Cooperative Learning, a medium is needed that students can use to make it easier to discuss or work in groups. In this case, Circular Design, which is usually used as a strategy in business/economics, can be utilized in Cooperative Learning. Elmansy (2023) states that the

Circular Design process involves 4 stages, namely Understand, Define, Make, and Release. Researchers think that these 4 stages can also be developed and integrated with the Cooperative Learning learning model, which is very suitable for Natural Sciences lessons. In developing science learning, teachers must first understand the characteristics of the lesson. Science lessons themselves are a combination or blend of physics, biology and chemistry, so group discussions are needed to discuss a problem, so a learning plan is needed that is appropriate and can be developed. Based on the description above, research was carried out which aims to develop cooperative learning which will be integrated or executed using a circular design approach which will be designed and developed which is expected to solve problems in schools.

Method

The type of research that will be used is development research or research and development. The method used in this research is research and development (R & D) following the stages of research and development of four-d-models (Model 4d) according to Thiagarajan, and Semmel (Palilungan, 2014) ^[19]. The 4-d model consists of four development stages, namely define (definition or tracking), design (design), develop (development) and disseminate (dissemination or dissemination). At the define stage, researchers carry out the following activities: initial analysis, instructional indicator analysis, concept analysis, and technology analysis. The design stage is the realization of the previous initial analysis stage. The researcher carried out the following activities, selecting the format and initial design. The development stages carried out by researchers are as follows: expert appraisal (expert validation) and development testing. The dissemination stage is carried out by researchers by distributing the final product in journal form, along with collecting positive response data which will be filled in by users, namely students. Next, a trial of the product being developed is carried out including trial design and trial subjects (validation subjects and trial subjects).

The data collection technique in this research follows the 4D procedural stages. Data collection at the define stage takes the form of interviews and observations. Data collection at the design stage takes the form of searching for sources and references that can be used as products. Data collection at the develop stage is material and media validation (validity aspect) and product testing (effectiveness aspect). Meanwhile, data collection at the dissemination stage takes the form of giving questionnaires to students which will later be used as practical test results. Data analysis techniques to determine aspects of validity, effectiveness, and practicality are as follows: validity analysis (valid criteria test), effectiveness analysis (paired sample t-test statistical test, normality test, and homogeneity test), and practicality analysis.

Results and Discussion

A. Results

The research description follows research procedures in the three aspects tested, namely validity, practicality and effectiveness.

1. Product Design

From the results of interviews with one of the science subject teachers at SMP Negeri 13 Manado, the researcher

summarized the following information: (1) Implementation of learning in schools often uses conventional models; (2) The learning attitudes produced by schools tend to focus on individual rather than group work; (3) The cooperative attitude of students in group work and outside the classroom has not been fully reflected; (4) Minimal use of external learning instruments to support learning in schools; and (5) Never heard of circular design and circular learning at all.

In determining the material, the researcher linked science lessons and determined that energy was a topic that had extensive discussion so that it could be used as a topic of discussion in cooperative learning lessons. The indicators that need to be considered according to the interview are that the internet is used as a learning medium and energy material is discussed in a complex manner.

Next, the researchers began designing instruments that would be used in the classroom, consisting of teaching modules, learning videos, as well as designing circular learning sheets that would be used in cooperative learning lessons. Next, the initial product is given to a team of experts (material experts and media experts) to determine whether the product is suitable for use and testing or not. Based on the assessment of the expert team, the product can be used with notes to revise several parts of the product. Next, the researcher continued the research at the develop stage, namely by conducting product trials to examine the effectiveness of the product, after that the disseminate stage by distributing positive response sheets to students.

2. Valid Aspect Testing

a. Material Expert Validator

This validation is carried out by material experts consisting of two validators with a value range for expert assessment scores of 1-5. The results obtained showed that the learning design in terms of the material aspect was declared valid. Because the score reached the very good category, the learning design was declared valid.

b. Media Expert Validator

This validation is carried out by media experts consisting of one validator with a value range for expert assessment scores of 1-5. Because the score reached the very good category, the learning design was declared valid. Next, the researcher calculated the total average of the results of the validity questionnaire conducted by material and media expert validators. Because the score reached the very good category, the learning media design was declared very valid and can be used.

3. Effective Aspect Testing

a. Prerequisite Test Paired Sample t-test

1. Sampling

Paired Sample t-test uses one class group. Determination of this group is carried out during the data collection process, as well as after the product is ready for testing. There is no more in-depth comparison with the control class because the aim of the research is to see improvements in student learning outcomes without having to compare them, but will still be tested statistically.

2. Normality Test

Next, the researcher carried out a normality test on the pre-test and post-test data for the experimental class and the post-test data for the control class. The Sig value in the

Shapiro-Wilk Test on pre-test data is 0.208 and on post-test data is 0.181, so it can be said that the pre-test and post-test data are normally distributed because the Sig value is > 0.05.

3. Homogeneity Test

The homogeneity test can be carried out if the data group is in a normal distribution. Data is said to be homogeneous if the sig value is > 0.05. Based on the significance value of the average student learning outcomes, the data is homogeneous seen from the Sig value. $0.807 > 0.05$, so that the prerequisites for paired sample t-test testing have been met and can be continued.

b. Hypothesis Testing and Paired Sample t-test

Hypothesis testing in this research uses a paired sample t-test, which is an analysis by comparing the difference between two means of two paired samples with the prerequisite of data that is normally distributed and homogeneous. The difference in paired groups seen from the mean is 64.250 with a standard deviation of 18.736. This indicates that there are differences between student learning outcomes after receiving treatment.

The Sig (2-tailed) significance value of the experimental class students' learning outcomes obtained was smaller than 0.001. Based on the statistical hypothesis test decision, H_0 is rejected and H_a is accepted, there is a significant difference in the average learning outcomes taught using cooperative learning based on circular design. The t_{count} value is 26.563. To find the t_{table} value, refer to the formula $\alpha/2$; (df), α is the level of significance, in this study it is 0.05, while df is degrees of freedom or degrees of freedom in this study, namely $60-1=59$, so t_{table} is seen in the table distribution 0.025;59, which is 2.00100, $t_{table} = 2.00100$. Thus t_{count} is $26.563 > t_{table} 2.00100$, then based on the basis of decision making through a comparison of t_{count} and t_{table} values, it can be concluded that H_0 is rejected and H_a is accepted, which means there is a difference in the average student learning outcomes after being given treatment using cooperative-based learning circular design.

Next, a compare mean test was carried out to see whether there was an increase in student learning outcomes after treatment. The average pre-test score was 48.33 and the average post-test score was 83.17. Thus, there is an increase in student learning outcomes using cooperative learning based on circular design. As a reference for whether the product being developed is truly effective, researchers compared the post-test results from the comparison class 8B. The average value of the experiment was 83.17 and the average value of the control class was 71.00. Thus, there are differences in student learning outcomes using cooperative learning based on circular design.

Practical Aspect Testing

The decision on the practicality of the product was taken from the results of the students' positive responses in the questionnaire distribution. The questionnaire was filled out by 30 students as respondents, to see and analyze their responses to the products that had been designed and developed. From the total average results obtained, it was found that cooperative learning products based on circular design were practical.

Discussion

From the results of research that has been tested and carried out at SMP N 13 Manado, namely the validity, effectiveness and practicality of the products that researchers have developed. A summary of the data is shown in Table 1.

Table 1: Summary of research results and data analysis

Valid	Circular design-based cooperative learning learning seen from the results of the validator assessment of media experts and material experts is 4.47.
Effective	The learning design is effective because it has fulfilled the research hypothesis of testing effectiveness through learning outcomes tests and statistical data from the Paired Sample t-test.
Practical	Cooperative learning based on circular design is very practical as seen from the percentage of teacher and student responses reaching 89.97%.

Next, the researcher linked aspects of validity, effectiveness and practicality in further literature studies to find a common thread between developing cooperative learning products and the 3 aspects tested. As educators, teachers are required to be able to innovate in learning. Therefore, in the learning process it is not enough to just apply the learning model, but there must be innovation. Currently, the role of appropriate technology is really needed to connect teachers and students so they can communicate and meet face to face even in different locations. This aims to achieve the educational goals and learning objectives expected by Ekayogi (2023). Learning models play a significant role in the teaching and learning process. Students' ability to absorb learning material can be influenced by choosing an appropriate learning model, so as to achieve the learning objectives that have been set. There are various learning models that can be alternative choices for teachers to increase the effectiveness and optimality of learning activities in the classroom. Therefore, teachers need to design and implement teaching and learning activities that encourage students to actively build their own knowledge. Success in the learning process is influenced by two main factors, namely internal factors related to individual student characteristics such as ability, interest, motivation and active learning, as well as external factors such as the learning model applied. One example of a learning model, namely cooperative learning, emphasizes cooperation between students to achieve learning goals. With this approach, the teacher's role changes from the center of learning to managing students in small groups. More importantly, this model helps teachers to achieve learning goals that involve social dimensions and human relationships. Cooperative learning can be an alternative because many opinions state that active learning, including cooperative learning, can increase learning effectiveness (Tabrani, 2023) [27]. In essence, cooperative learning is the same as group work. Therefore, many teachers say that there is nothing strange in cooperative learning because they assume that they are used to carrying out cooperative learning in the form of group learning. Rusman (2018) [20] said that cooperative learning is a grouping technique in which students work towards learning goals together in small groups which generally consist of 4-5 people. The use of small groups in learning allows students to work together to maximize their learning and the learning of other members in the group. Sukmawati (2022) [25] believes that there are three objectives of

cooperative learning that can be developed, namely academic learning outcomes, acceptance of diversity and development of social skills. Another important goal of cooperative learning is to teach students cooperation and collaboration skills.

Cooperative learning is learning that utilizes study groups in studying subject matter to improve cooperation and collaboration skills over diversity, as well as improving learning outcomes in terms of students' academic abilities. In developing cooperative learning, the thing that needs to be considered is defining variables and then describing the variables into more detailed indicators. After that, prepare the product details or design, then carry out trials. After the trial, validity and reliability were analyzed. This also has similarities with the criteria for a good assessment instrument according to Aisah (2020)^[4] such as 1) valid; 2) reliable; 3) objective; and 4) practical and economical. In this circular design-based cooperative learning research, a special effectiveness aspect was added to measure the effectiveness of student learning through statistical tests of student learning outcomes. In this way, the products that researchers develop can be assessed based on their validity, effectiveness and practicality.

Conclusion

1. The quality of the product produced is in accordance with theory and its internal consistency (valid) based on validation from material and media experts.
2. Products that have been created and developed provide good results for their users (effective), namely they can increase the effectiveness of science learning.
3. The cooperative learning product using circular design in energy material at SMP N 13 Manado was developed to be easy to use (practical) based on students' positive responses.

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