REACT Strategy Aided by Cabri 3D to Improve Students' Mathematical Connection Ability

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ABSTRACT

The ability of mathematical connection is very important to be developed in a mathematics learning process. This study aims to describe the process and outcomes of the development for REACT strategy aided by Cabri 3D to improve mathematic connection ability in good quality, to describe the effectiveness of the REACT strategy aided by Cabri 3D to improve as well as describe mathematical connection ability after learning with REACT strategy aided by Cabri 3D. The instructional material developed in this research were lesson plans, student worksheets, and achievement tests. The materials were developed using the ADDIE models. The research subject for the trial and implementation classes is the students of STKIP Taman Siswa Bima. This shows that learning tools meet the validity, practicality, and effectiveness criteria. The instruction training effectively can train the students' mathematical connection ability on transformation. There is a difference in mathematical connection ability among students with high, average, and low mathematical connection ability in identifying mathematic ideas related to daily life.

Keywords: *REACT Strategy, Cabri 3D, Mathematical Connection Ability.*

1. INTRODUCTION

Mathematical connection skills are very important for a student to have. because by having the ability to connect mathematics students can connect mathematics with other subject matter and everyday life. Therefore, mathematical connections are important to develop. In line with that, Rohendi & Dulpaja [1] said that mathematical connection will be greatly needed by students, especially to solve the problems that need the relation between mathematical concepts with other concepts in mathematics and other disciplines or everyday life. Mathematical connection skills are needed by students to solve mathematical problems, especially solving problems related to mathematical concepts with other concepts in mathematics and other disciplines or in everyday life. NCTM [2] also mentions the importance of mathematical connections for students, namely "... to help students build a disposition to use connections in solving mathematical problems, rather than see mathematics as a set of disconnected, isolated concepts and skills".

students still see mathematics as an unconnected collection of separate concepts and skills. therefore, with the ability to connect mathematics can help students in solving math problems. students will learn to remember too many separate mathematical concepts and procedures without a mathematical connection, Jaijan & Lolpha [3] said that "mathematical connections are the linkage through activities to other concepts. Sawyer [4] said, "Making connections was fundamental to mathematics education influenced their teaching practice in several important ways. The effectiveness of their practice was evidenced by examples of students in classes taught by these teachers who demonstrated the ability to make connections between mathematical knowledge and other forms of disciplinary knowledge and between mathematical knowledge and real-life"

To build mathematical understanding, it is important for students and teachers to make connections in learning mathematics. Mousley [5]. Students are not alone able to connect mathematical concepts because the mathematical connection ability of students is influenced by effective teaching practice by teachers that enable students to demonstrate the ability to make connections between mathematical knowledge and knowledge of other forms and between mathematical knowledge and daily life. Thus the ability of a mathematical connection

needs to be trained to the student. Johnson and Johnson (in Walmsley & Muniz) [6] said that if mathematics instruction is to help students understand the connections among various mathematical facts and procedures and be able to apply formal mathematical knowledge flexibly and meaningfully, cooperative learning must be employed in mathematics classes.

Cooperative learning should be applied in the classroom if the learning of mathematics is to help students understand the relationship between mathematical facts and procedures and be able to apply the knowledge of mathematics flexibly and meaningfully, then. Johnson & Johnson [7] said that "in cooperative learning situations there is a positive interdependence among students' goal attainments; students perceive that they can reach their learning goals if and only if the other students in the learning group also reach their goals". In the learning model, we need a strategy that can support the success of the learning. David (in Sanjaya) [8], strategy is a plan, method, or series of activities designed to achieve an educational goal. One of the learning strategies that meet these criteria is the REACT strategy. REACT strategy is a learning strategy that contains five components of learning strategy developed by CORD (Center for Occupational Research and Development) in America. Crawford [9] mentions the five REACT strategy components of "Relating, Experiencing, Applying, Cooperating, and Transferring".

At the relating stage, according to Satriani, Emilia, & Gunawan [10], "relating is connects new information to life experiences or prior knowledge that students bring to the classroom", which means that relationships are connecting new information with life experiences or knowledge that students had previously in the class. Where this definition is closely related to the connection of mathematic according to NCTM that in the connection of mathematics includes recognizing and applying mathematics outside the context of mathematics (daily life).

The next stage is experiencing, which has been explained previously according to Crawford that students learn by experiencing directly through exploration, discovery, and creative activities. Where experience is things that students must experience in connecting mathematics as previously mentioned from Ellis [11] that "Math connection is designed to provide students with experience. Based on this opinion, it is explained that the relating stage includes mathematical connections, namely students connect new information with life experience or previous knowledge of students.

Along with the rapid development of science and technology and being able to encourage renewal efforts in the utilization of technological results in the learning process, making the computer gets very big attention. The use of computers as a medium of learning has benefits in the presentation of information, simulations, exercises, and games. Based on the results of research Joubert [12] computers have a very important role in the process of learning mathematics. Therefore, the use of computers is very beneficial to the development in the world of education. NCTM said that "Teachers should use technology to enhance their students' learning opportunities by selecting or creating mathematical tasks that take advantage of what technology can do efficiently and well—graphing, visualizing, and computing". Teachers should use technology to improve student's learning opportunities by choosing or making math tasks that utilize technology efficiently including graphics, visualization, and calculations.

One of the computer application programs that will be used as a learning medium on the material wake-up space is Cabri 3D. This program is designed to support the learning process of three-dimensional geometry. Through this program, students can explore, observe, and make wake-up geometry that can be seen from various directions. Accascina & Rogara [13] said that "Cabri 3D is a potentially very useful software for learning and teaching 3D geometry. The dynamic nature of the digital diagrams produced with it provides a useful aid for helping students to better develop concept images of geometric concepts". Cabri 3D is software that is potentially very useful for learning and teaching 3D geometry, Rososzczuk [14].

Based on what has been described, the purpose of this research is to describe the process and the result of the development of learning tools of mathematics of good quality, effectiveness REACT strategy aided by Cabri 3D to train students 'mathematical connection ability on transformation material and students' mathematical connection ability after applying the REACT cooperative learning strategy with the help of Cabri 3D on transformation material.

2. METHODS

This is descriptive research with a qualitative and quantitative approach. This research is done in STKIP Taman Siswa Bima. Learning tools will be developed in the form of a lesson Plan (RPS), Module, and Learning Results Test (THB). While the quantitative approach to obtain data learning results as well as to measure the validity, reliability, and sensitivity of test items. Development of learning device in this research using development model according to ADDIE model. ADDIE provides a five-phase development model, including: Analysis, Design, Development, Implementation, and Evaluation.

The research instruments used to collect data are the lesson plan validation sheet, teacher's observation sheet in managing learning in the class, student activity observation sheet, student response questionnaire,

module validation sheet, THB validation sheet and interview guide. Data collection methods used in this study are the method of observation, questionnaires, THB, and interviews.

Data analysis of the validity of the device, namely (1) the data from the validator's assessment was analyzed descriptively based on suggestions and comments from the validator for each aspect of each developed device. Learning tools that are said to be valid are at least 3 aspects or each criterion is in the minimally good category. (2) THB analysis is a matter of description that will be analyzed for validity, reliability, and sensitivity. The formula for calculating the validity of THB validity is as follows.

1. *Validity vormula*

$$r_{XYj} = \frac{n\sum_{i=1}^{n} XijYi - (\sum_{i=1}^{n} Xij)(\sum_{i=1}^{n} Yi)}{\sqrt{\{n\sum_{i=1}^{n} Xij^2 - (\sum_{i=1}^{n} Xij)^2\}\{n\sum_{i=1}^{n} Yi^2 - (\sum_{i=1}^{n} Yi)^2\}}}$$

2. *Reliability formula*

$$r_{11} = \left(\frac{N}{N-1}\right)\left(1 - \frac{\sum_{i=1}^{n} {\sigma_i}^2}{{\sigma_t}^2}\right) \ ,$$

3. *Sensitivity formula*

$$S = \frac{\sum_{i=1}^{n} S_{es} - \sum_{i=1}^{n} S_{eb}}{n(S_{max} - S_{min})}$$

The analysis of practicality data used is (1) data on the ability of teachers to manage learning. The teacher's ability to manage learning is said to be good if every aspect gets a score of 3. (2) student activity data. during learning student activities are assessed based on time for each activity. Student activities are said to be effective if students carry out learning activities at each stage in the lesson plan according to the ideal time with a tolerance of 10%. The percentage of time used by students in carrying out activities is calculated by the formula:

$$\%\ activity = \frac{time\ students\ spent\ in\ each\ stage}{all\ the\ time\ spent\ in\ a\ meeting} \times 100\%$$

The effectiveness of the data analysis use is (1) at least 80% of students get a score of more than 75, so it is said to be classically complete (2) aspects of student response. Student responses are said to be positive if more than 75% of students give positive responses to each criterion. The percentage of each student's response is calculated by the formula:

$$PRS = \frac{N_y}{N} \times 100\%$$

The method used to determine the effectiveness of learning using the REACT strategy aided by Cabri 3D, descriptive analysis was carried out at the implementation stage. The data analyzed include the ability of teachers in managing learning, student activities, student learning outcomes, and student responses. Then the data has been collected, analyzed in accordance with the indicators of the effectiveness of learning proposed by Slavin which describes that a lesson is said to be effective when it has to consider aspects: *Quality of Instruction, Appropriate levels of instruction, Incentive,* and *Time*.

To know the students' mathematical connection ability after cooperative learning strategy REACT with help of Cabri 3D, given posttest then conducted the interview. Data analysis of interview results is done during and after data collection.

3. RESULTS AND DISCUSSION

The following will describe the process and result of the development of the cooperative learning tool of REACT strategy with the help of Cabri 3D to improve mathematical connection ability on transformation materials in this research using ADDIE development model consisting of the following five phases.

a) Analysis

In this phase, a study of mathematics curriculum, analysis of student abilities, analysis of student characteristics, material analysis, and task analysis. Task analysis is used to identify, detail, and systematically organize the main parts of the transformation material.

b) Design

In the design phase, cooperative learning with REACT strategy aided by Cabri 3D tools designed on transformation materials include Learning Implementation Plan (RPS), Module, Learning Outcome Test (THB). In addition, a research instrument was also designed which included device validation sheets, teacher observation sheets in managing learning, student activity observation sheets, and student response questionnaires.

c) Development

In the development phase, the cooperative learning strategy of REACT strategy with the help of 3D Cabri called *Draft I* was produced.

d) Implementation

In the implementation phase, validation of learning tools, revisions, and Draft I trials is conducted to produce a good learning tool (Final Draft) that meets the valid, practical, effective criteria.

1) THB validation results

Validation results indicate that every item in THB is valid. These results can be seen in

Table 1. Coefficient of validity

No	Coefficient of Validity	Interpretation
1	0,81	Very High
2	0,76	High
3	0,77	High

The result of the reliability of THB is categorized high with a reliability value of 0.67. while the THB sensitive results can be seen in Table 2.

Table 2. Sensitivity of validity

No	Sensitivity of Validity	Interpretation
1	0,59	Sensitive
2	0,67	Sensitive
3	0,63	Sensitive

Based on Table 2, each question meets the sensitive criteria, namely question number 1 is sensitive at 0.81 in the very high category, question number 2 is 0.76 in the high category, while question number 3 is 0.77 in the high category

2) Readability Test

The results of the legibility test in this study that the designed device can be read clearly, and can be understood by teacher. While for LKS and THB also can be understood, student.

3) Trials

a. The results of teacher ability analysis to manage learning

The results of the teacher's ability in learning are categorized as good with observer ratings for each aspect of at least 3. This shows that the teacher's ability to manage to learn is categorized as good.

b. Results of student activity analysis

The results of student analysis in the test class show that students have effective activities, this can be seen from the results of observing student activities in learning with a time tolerance of 10%.

c. Results of student response analysis

The results of the student response analysis show a positive response, this can be seen based on the percentage of student responses to each aspect above 80%.

d. Student Learning Complete

The results of students' learning mastery showed the percentage of learning completeness classical reached 87.5%.

e. Evaluation

In this phase, an implementation or implementation of learning tools has been developed to see the effectiveness of cooperative learning strategies REACT with the help of 3D Cabri to trace students' mathematical abilities on transformation materials. And to see students' mathematical ability after the learning. At this stage learning device that have met both categories. In class implementation, the teacher's ability to manage learning is categorized as good, student activities in effective learning are shown by the observations that each aspect meets the criteria with a time tolerance of 10%. Positive student response, this is shown in every aspect of the student's positive response to learning above 80%. To complete student learning is also achieved, where students who complete in learning reached 95.8% of all students in class implementation.

In this research, learning activities are based on REACT strategy aided by Cabri 3D to improve mathematical connection ability. In the early learning activities in the classroom, the teacher conveys the learning objectives, applies the relating stage, which is linking the students' initial knowledge with the material to be studied. At this stage, the teacher reminds the prerequisite material. In line with the opinion of NCTM states the importance of mathematical connection for students, namely "… to help students build a disposition to use the connection in solving mathematical problems, rather than see mathematics as a set of disconnected, isolated concepts and skills".

Mathematical connection skills are used to help students develop a tendency to make connections in solving mathematical problems, rather than viewing mathematics as a collection of separate concepts. students have to learn and remember too many separate concepts without a mathematical connection. This is also in accordance with the constructivist view of learning mathematics, namely that new information must be linked to other information so that it integrates with the schemata owned by students so that understanding of complex information or material occurs Hudojo [15]. This is in line with Ausubel's statement in his book Educational Psychology: A Cognitive view (in Dahar [16]) which says that the most important factor influencing learning is what students already know.

The teacher organizes students into study groups (cooperating). At the beginning of this activity, the teacher mentions the name of students in each group and gives directions to more according to their groups. The teacher has no difficulty asking students to sit in groups

because the teacher immediately determines the position of each group. Thus students swiftly go directly to the positions that have been determined by the teacher. With the existence of study groups, students will have the opportunity to get better learning outcomes. According to Arends [17], students who cannot get help from students who can, while students who can already have the opportunity to improve their academic abilities through their role as tutors for their friends.

Next, the teacher distributes the module and gives directions on how to do it. The module contains the REACT Strategy which consists of five stages, namely relating, experiencing, applying, cooperating, transferring. The stages of the REACT strategy are not carried out sequentially, because the cooperating stage is carried out together with other stages. At the relating stage, students in the groups discuss several formulas. Furthermore, in the experiencing stage, students are allowed to conduct experiments to find the formula with the help of a Cabri 3D. The teacher asks a student to open the experience that has been shared. Then students are asked to follow the instructions in the module on how to use the Cabri 3D.

Then in the applying stage, the teacher asks students to apply the concepts that have been obtained in the previous stage, namely discussing problems in the module by discussing groups. Next in the transferring stage, the teacher directs students to use the knowledge they have gained in a new context. During the module work, the teacher goes around to see student activities and guides students when students ask questions or experience difficulties.

4. CONCLUSION

This study has produced cooperatively with REACT strategy aided by Cabri 3D learning tools to improve mathematical connection ability on Transformation. Learning using cooperative learning with REACT strategy aided by Cabri 3D tools effectively improved students' mathematical connection ability on the material transformation. There are differences in students' mathematical connection abilities based on the level of low mathematical ability, moderate mathematical ability, high mathematical ability and mathematics in identifying mathematical ideas related to everyday life. Students with moderate and low math skills can identify several mathematical ideas in solving problems related to daily life and can apply mathematical ideas in solving problems related to everyday life but not complete.

AUTHORS' CONTRIBUTION

All authors conceived and designed this study. All authors contributed to the process of revising the manuscript, and at the end all authors have approved the final version of this manuscript.

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