CORE (Connecting, Organizing, Reflecting & Extending) learning model to improve the ability of mathematical connections

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Abstract. Mathematics is a unity of knowledge whose parts are interconnected. The fact is exactly what inspired the mathematical connection. With mathematical connection, students will better understand the meaning behind what he is learning and being able to look at the topics of mathematics as a whole. However, based on the results of research that has been done often mention that most students can make a list of mathematical concepts that have relevance to real-world problems, but not many students were able to explain why the concept is used. In this article, the author argues that the mathematical connection capabilities should be practiced in school and the CORE learning model can become one of the alternatives that can be used. Systematically, This article will review the literature regarding how the CORE learning model can help students in improving the ability of mathematical connections. Connecting, organizing, reflecting and extending the stages in the application of learning models CORE. The stage circuit a positive impact on the development of the students in understanding mathematics. Each stage through which can help train students in the mathematical connection capabilities. Thus, this article suggests the CORE learning model that can be used to help improve students' mathematical connections.

1. Introduction
Various approaches, strategies and learning models being developed to experts in an effort to improve students' abilities in mathematics. The approach, strategy or model of learning that been expected to benefit efforts to improve the mathematics learning process to improve students' mathematical abilities. In fact, none of the approaches, strategies or learning model that is suitable for fixing all the problems in the learning process and applies to all students in a class. Therefore, the use of the approach, strategy or model of learning must be heterogenous so that all kinds of needs and problems can be met and minimized. The accuracy in the use of the approach, strategy or model of learning will at least be able to provide the opportunity for students to practice capabilities, so it can reach the standard of students' mathematical abilities to achieve the learning objectives peak of mathematics is problem-solving. One alternative learning model that can be used is the CORE learning model.

CORE is an abbreviation of the four words that have a unitary function in the learning process, namely, Connecting (linking the old information with new information or between concepts), Organizing (organize the information obtained), Reflecting (rethink the information that has been obtained), and Extending (expand knowledge) [1]. These elements are used to connect the old information with new information, organize a number of material vary; reflects everything that the students learn; and developing a learning environment [2]. CORE learning model applied by Miller & Calfee in 2004 in Science learning combined with methods of reading and writing [3].
A mathematical connection is an important process that must be possessed by students in learning mathematics [5] because mathematics is a knowledge unity whose parts are interconnected. Mathematical connections are the relationships between mathematical topics, the relationship between mathematics with other disciplines, and the relevance of mathematics to the real world or in daily life. So the mathematical connection capability is essential for students because it will help students understand math concepts and solve problems [6]. Mathematical connection capabilities need to be trained to the students in the school because most students are often able to apply mathematical concepts associated with the real problem, but only a few students were able to explain why the concept is used [7]. The CORE learning model can be used as an alternative to practicing students' mathematical connection abilities. Here will be described systematically, by reviewing the literature on how the CORE learning model can help students develop and improve mathematical connections.

2. CORE Learning Model

The CORE learning model is one model of learning-oriented constructivist learning theory. Geary [8] revealed that the main assumptions in the constructivist are active students in developing knowledge for themselves. In line with this, Slavin [9] states that the constructivist theory students have to find themselves and transform complex information, check the new information with the old rules and revise them if these rules are not appropriate anymore. Besides related to constructivism learning theory. The CORE learning model is closely related to learning theories expressed by Jean Piaget. Piaget's theory of cognitive processes emphasize that the process used when constructing knowledge of children associated with the scheme, assimilation and accommodation, the organization.

In the scheme, Piaget [10] says that when a child is trying to build an understanding of the world, the developing brain creates a schema. So that the scheme is an action or mental representations that organize knowledge. To explain how children use and adjust their schemes, Piaget revealed that the two concepts of assimilation and accommodation. Assimilation occurs when children enter new information into their existing schemes. Accommodation occurs when children adjust their schemes to get information and new experiences. To understand the knowledge, children cognitively arrange their experiences in organizational processes. Organizations in Piaget's theory is a grouping of experiences and thoughts to a higher level. So it can be said that the organization is related to constructing knowledge. And in the process of equilibration, Piaget proposed a mechanism that explains how children move from one stage to the next stage of thinking. The shift occurs when children experience cognitive conflict, or disequilibrium, in trying to understand the world. Finally, they resolve conflict and achieve a balance or equilibrium of thought.

The Learning model developed by Miller & Calfee [3] consists of four stages, namely connecting, organizing, reflecting, and extending. Stages in the CORE study model is cyclical, as illustrated in the following figure 1.

![Figure 1. Stages in the CORE study model [10]](image-url)
The image above shows the stages or phases of The CORE learning model. The activities carried out in the stages described by Table 1 below:

Table 1. Event Stages Model CORE

| Stages                  | Activity                                                                 |
|-------------------------|--------------------------------------------------------------------------|
| Connecting Knowledge    | • students to recall [11] or enable knowledge that students knew before [4] |
|                         | • relate to what is being or will be studied [12]                        |
|                         | • can be done with a class discussion method [3]                          |
| Organizing Information  | • students organize knowledge from the previous stage, can be exaggerated [3] that the principles of students study are simpler and more obvious limitations [12], can be done by collecting facts and establishing the organization of information/knowledge of old into new forms [11] |
|                         | • can be done in groups or individuals [3].                             |
|                         | • This stage produces a schema of knowledge that can be illustrated in charts, tables or maps concepts. |
| Reflecting on Learning  | • students review the organizational structure of the knowledge that the students from the previous stage [4] |
|                         | • done to improve knowledge of possible misunderstandings and strengthen knowledge and can be done by groups [3] can be done in a way to explain or criticize the content, structure or strategy that has the student made previously [12]. |
| Extending the Experience | • students gain the opportunity to expand on its existing knowledge [12] |
|                         | • can be done by applying this knowledge to solve a new problem that is relevant [4]. |

3. Mathematical connections
The idea of mathematical connections have long been investigated by WA Brownell 1930s, but at that time the idea of mathematical connections are limited to connections on the arithmetic [13]. Inspired by the mathematical connection because mathematics is not partitioned in a variety of mutually exclusive topics, but the math is one unit. In addition it also can not separate mathematics from knowledge than mathematics and the problems that occur in life. Without the mathematical connection then students should learn and remember too many concepts and mathematical procedures apart from each other [6]. The concept of fractions, percentages, ratios, and linear comparison is one example of topics that can be linked.

Generally, Coxford [14] suggests that the mathematical connection capabilities include:
1) connecting the conceptual and procedural knowledge,
2) using maths on other topics (other curriculum areas),
3) using mathematics in life activities,
4) seeing mathematics as integrated and whole,
5) applying mathematical thinking skills and create a model to solve problems in other subjects, such as music, art, psychology, science, and business,
6) using connections between topics in mathematics, and
7) knowing different representations for the same concept.

Of the seven who have been exposed connection capability, we can conclude that in fact there is three verbs indicator on the ability of the intended connection. Verbs such indicators are to
see/recognize, connect, and use/apply. Meanwhile, four components that can be connected mathematically namely: conceptual and procedural knowledge, topics in mathematics, topics/subjects beyond mathematics and daily life activities.

The teaching program from pre-kindergarten through 12th grade in connection according to the NCTM standards [6] should enable all students to:

1. recognize and use connections among mathematical ideas;
2. understand how mathematical ideas are interrelated and build upon one another to produce a coherent whole;
3. recognize and apply mathematics in contexts outside of mathematics.

Indicators according to the mathematical connection capabilities Sugiman [15] are: connections between mathematical topics that relate between concepts or principles in the same topic, connections between topics in mathematics that link material in a particular topic with material in other topics, and connections between matter and science other than mathematics.

Meanwhile, Jihad [16] suggested that the mathematical connections are arranged in the relevant indicators, including; (1) find the relationship of various representations of concepts and procedures, (2) understand the relationship between mathematical topics, (3) applying mathematics in other fields or in everyday life, (4) understand the representation of the equivalent of a concept, (5) make contact one procedure with other procedures in the representation equivalent, (6) apply mathematical relationships between topics and between different mathematical topics with topics outside mathematics.

Based on the description above, it can be concluded that the mathematical connections are the relationships between mathematical topics, the relationship between mathematics with other disciplines, and relevance of mathematics to the real world or in daily life.

4. Discussion

The following Table 2 is some research on the use of the model articles CORE to improve students' mathematical connections.

| Author | Year | Subject |
|--------|------|---------|
| [17] Setyawan A A | 2013 | High School Student |
| [18] Agustianti R, Amelia R | 2018 | High School Student |
| [19] Yulianto A R, Rochmad, Dwidayati N K | 2018 | Elementary School Student |
| [20] Azizah L, Mariani S, Rochmad | 2012 | High School Student |
| [21] Aryati T A, Santika T, Kartika H | 2017 | Junior School Student |
| [22] Wicaksana I N J, Wirya N, Margunayasa I G | 2014 | Elementary School Student |

Based on the above article, the results of which have research shows that CORE learning model positive effect on students' mathematical connection capability, so it can be used as an alternative in helping students develop and improve connections.

4.1 Mathematically Connection Capability Indicators

Based on the exposure of the previous description, the mathematical connection is understood as the relationships between mathematical topics, the relationship between mathematics with other disciplines, and relevance of mathematics to the real world or in daily life. Thus, it can be concluded that the aspects of the mathematical connection capability consist of aspects of internal connection and external connection aspect. Aspects of internal connections consist of the relationships between mathematics
with himself. While the external aspect consists of the relationships between mathematics with subjects other than himself and the relationships between mathematics with students' daily lives.

Aspects of the mathematical connection can then be elaborated back into grains indicator to measure the ability of students' mathematical connections. Recognizing the concepts and principles of mathematics; recognizing the concept of other subjects; and using the concepts, principles and procedures or arithmetic operations are indicators that may be a reference to determine or measure the extent of students' mathematical connection capabilities.

4.2 CORE Learning Model as an Alternative to Improve Ability Mathematical Connections
Connecting, organizing, reflecting, and extending the elements in the CORE learning model [3] cyclical, wherein each of the stages can not be passed without passing through or leaving the previous stage. The elements of each stage circuit are complementary or falsify the previous stage. If the stages are done correctly can help train students in the mathematical connection capabilities.

At this stage of connecting students will the recall of knowledge/information/topics that they already know about the topic being or will they learn [4]. Recalling and associate previously learned knowledge with the knowledge to be learned is the key mathematical connections. By constantly recalling previous knowledge related to the topic being or will be studied, forcing students to not forget the knowledge they have learned previously. If students are accustomed to doing so before starting to learn something new, it is not possible ability to connect students will be honed and increasing. So that the connecting stage is a stage that is instrumental in improving students' mathematical connection capabilities.

The knowledge that students remember back on stage connecting previously may be excessive. At the stage of organizing knowledge-knowledge is managed again by students to information that students can relevant to what they are being studied. At this stage the students to explain or criticize reflecting the content, structure, and strategies of the knowledge they have acquired in the previous stage [12]. Students will precipitate what he had learned as a new knowledge structure which is enrichment or revisions and prior knowledge. So at this stage, the students are allowed to rectify and improve misunderstanding that perhaps they did before. So the organizing stage and reflecting also instrumental in improving the ability of the student connections, connections that they understand precise limits.

On extending stage, students are allowed to use the knowledge that has been synthesized at earlier stages and applied to something new [4]. This stage is the stage of determining whether knowledge that students can understand well or not. Extending this stage also allows students to improve their external connections, ie associating knowledge they have learned with knowledge/subjects other than mathematics and real-life students.

Based on the exposure of the above discussion, it can be concluded that the CORE learning model can be used as an alternative to improve students' mathematical connections that can be described by the following scheme.

![CORE models as an alternative to improve the ability of students' mathematical connection](image)
4.3 CORE Model Implementation in Learning

As has been mentioned earlier that the CORE learning model can be used as an alternative to improve the ability of students' mathematical connections. In its application must be certain that every step of performing well, so the ability of students' mathematical connection can be trained well too. Here's an example of the implementation of the CORE model of learning that may be a reference for teachers or others who want to use the model of CORE, which is described in Table 3.

| **Table 3. Application of Model CORE in Learning** |
|-----------------------------------------------|
| **Step** | **Activity** |
| Preliminary | Apperception & Motivation: |
|  | ▪ The teacher gives an introduction about the importance of studying the topics they will learn on that day by giving a few examples of applications or benefits of the topics studied by students' daily lives. |
|  | ▪ **Connecting:** The teacher recalls previous topics related to the topics to be studied to provide questions to stimulate memories of students, then connect with the topics they will learn. |
| Main | ▪ **Organizing:** Students summarize and organize what is obtained at the stage of connecting and write it down on a table by the teacher on the worksheet. |
|  | ▪ **Reflecting:** Students are allowed to reflect with rechecking they wrote at the stage of organizing worksheets and write the results of these reflections with their language on the worksheet. |
|  | ▪ **Extending:** Students apply/apply concepts learned by solving a relevant problem. |
| Closing | Teachers guide students to make inferences about learning activities that have been carried out. |
|  | Teachers confirm of what has been learned. |

In the preliminary activities, teachers must ensure that students have understood the material preconditions because it will affect the success of learning on that day. At the CORE learning model, the connecting stage is not necessarily done on the core activities of learning. Because in apperception activities students also recall the material preconditions related to that will be studied on that day, with the prerequisite material connecting with what will be learned also been included to stage the connecting. The series of these stages can be repeated to adjust to many of the concepts that will be taught. The example above is just an example of the application of the general CORE will be more detailed and more if combined with material / specific topics that will be taught.

5. Conclusion

Students can make a list of mathematical concepts that have relevance to the real problems, not necessarily able to explain why the concept is used. Therefore, the mathematical connection must be trained to students at school. Due to the mathematical connection, students will better understand the meaning behind what he is learning and being able to look at the topics of mathematics as a whole. A series of stages in the CORE learning model positive impact on the development of students' mathematical connection capabilities. So as CORE learning model is one alternative that can be applied to teachers in the classroom to practice students' mathematical connection capabilities. With good connection skills, students will more easily understand the benefits of mathematics and be able to see mathematics as a whole that is interconnected.
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