# *Systematic Literature Review*: Mathematical Critical Thinking Ability Viewed From Adversity Quotient through CORE Learning Model based on Game Based Learning

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Abstract

In the 21st century, there are several capabilities that must be possessed in order to be able to compete along with the times and technology. In the field of education, especially mathematics, the ability to think critically is a must-have ability. Critical thinking ability can be viewed from the Adversity Quotient (AQ). AQ is an individual ability that is expected to change view of a difficulty as a new opportunity to achieve the desired success. Education as a facility of improving critical thinking ability in terms of AQ, learning is its activity. In learning there is a learning model that is used, namely CORE learning model (Connecting, Organizing, Reflecting, Extending) based Game Based Learning (GBL). The purpose of writing this is to describe the effectiveness of Mathematical Critical Thinking Ability in terms of AQ in CORE Learning Model based GBL. This research used Systematic Literature Review (SLR) method in articles or journals published in 2013-2023. There are 15 national or international articles obtained from the Google Scholar and Scopus databases. The results showed that CORE Learning Model based GBL can effectively improve critical thinking ability.

Keywords: Critical thinking, CORE, AQ, GBL



## 1. Introduction

Along with increasing time, the era is growing. The development of the times is followed by the development of knowledge and technology and also accompanied by the development of Human Resources, so that later they can compete with the world globally. One facility that can support the development of Human Resources is through education. Education plays substantial role in ensuring survival and improving the quality of human resources (Konita et al., 2019). Through education various competencies that must be possessed in the 21st century will be fulfilled, there are various competencies that must be possessed in order to survive and compete in this times, one of them competencies is critical thinking ability.

Critical thinking ability can be developed in the field of education, especially in Mathematics. The current focus on learning mathematics requires more conceptual understanding and the ability to provide justification than just applying mathematical rules, indicating that mathematics has a potential role for the development of thinking, including critical thinking (As'ari et al., 2017). In our daily lives, critical thinking ability have become one of the tools to solve several problems, its because critical thinking ability involve logical reasoning, interpreting, analyzing and evaluating information to enable one to make reliable and valid decisions (Widana, 2018). Mathematics is the basis of other sciences. Mathematics is a universal science that has an important role in various disciplines and promotes human thinking which is taught to equip students with the ability to think logically, analytically,

systematically, critically, and creatively and to work together (Maula, 2020). Students need to have mathematical critical thinking ability in solving problems that occur in everyday life. With the ability to think critically, students can survive and be able to solve problems in order to face increased technological developments which have now reached the 4.0 revolution era (Tresnawati et al., 2017). Development of critical thinking indicators based on the theory are to analyze and evaluate arguments and evidence, clarify, make judgments, make explanations, and identify assumptions (Dhayanti & Johar, 2018).

The results of the 2018 PISA study released by the OECD in the field of mathematics state that Indonesia ranks 72 out of 78 participating countries with a score of 379 with an average OECD score of 478. PISA type questions are questions that have standardized high-level thinking skills that can raise to students' critical thinking ability (Saputra, 2020). From that things, so it can be concluded that students' critical thinking ability in Indonesia are still relatively low. The level of a person's critical thinking ability is certainly different, and a person's critical thinking ability must continue to experience improvement in order to be able to compete with developments in knowledge and technology.

Critical thinking especially in the field of mathematics really needs to be done, supported by the individual's ability to overcome an existing difficulty by changing his perspective on a difficulty as a new opportunity to achieve the desired success. one of the things related to this is adversity quotient. Adversity quotient provides a role that can influence the achievement of students' mathematical critical thinking ability (Supardi, 2015). With the existence of adversity quoutient can raise fighting power, and not to give up when facing a difficulty in learning, especially in the field of mathematics. There are several facility to develop critical thinking ability one of them is through education. In education there are a series of activities, one of them is learning. Learning is one of the efforts in education that will be carried out directly to develop critical thinking ability.

According to Shomad (2014), In a learning activities there are several learning model that is carried out, one of them is CORE Learning Model (Connecting, Organizing, Reflecting, Extending). Learning Model Connecting, Organizing, Reflecting, Extending (CORE) is a learning model that encourages students to think about connecting, organizing, exploring, managing, and developing information. By connecting old information obtained by students with new information related to a concept in a learning, students will be able to organize their ideas to understand the learning material discussed. In organizing ideas to understand the material, students carry out activities to rethink and explore information that has been obtained, so that later they will be able to develop, expand, and use and find an understanding of the material in the learning being studied. According to research Nasution (2017) the use of inappropriate learning methods will have a major impact on the success of the learning process. This large impact will lead to a low level of student motivation. Until now the application of conventional methods is still widely used by educators who tend to be boring (Diana, 2022). One of learning methods that can be used is learning model based of Game Based Learning or GBL.

The characteristics of GBL as a learning method is integrating the ongoing learning process by playing (Maulidina et al., 2018). GBL is a form of teaching activity in which students play a more dominant role with the help of games to achieve learning objectives (Candra & Rahayu, 2021). GBL will make students play a more active role in learning. Interactive and more interesting learning will make students feel directly how the learning process takes place, where students will not be bored. GBL is an idea in conveying learning,

using the CORE learning model, students will be able to use the understanding that has been obtained and can apply it directly, so that in this way, existing knowledge will be more developed, not only fixated on what they have learned, but developed through application to direct learning with the help of GBL.

Based on the description above, the objective of this research is to describe the results of related studies Mathematical Critical Thinking Ability Viewed From Adversity Quotient through CORE Learning Model based on Game Based Learning.

## 2. Research methods

This article used Systematic Literature Review (SLR) method. SLR as a process that aims to identify, review, evaluate and interpret parts of existing research. In this research, the researcher conducted a series of review processes and identified several articles that were arranged according to the steps (Triandini et al., 2019).

In this SLR research there are 5 stages, in the first stage, formulating the problem. At this stage the author writes the formulation of the problem which will be discussed in the article in depth. Formulate the problem by making questions based on the needs of the topic to be chosen by the author, ie : Is Mathematical Critical Thinking Ability Viewed From Adversity Quotient through CORE (Connecting, Organizing, Reflecting, Extending) Learning Model based on Game Based Learning is effectively used?.

The second stage is to search for literature. After formulating the topic and formulation of the problem to be raised or researched, the next step is to search for articles or journals that are relevant or known as a search process. The research data used are secondary data or data obtained from previous studies or previous research. The data obtained comes from articles or journals both nationally and internationally. The literature search process is carried out by accessing data on *Google Scolar* and *Scopus.* The search is carried out using keywords "Critical thinking ability", "Adversity Quotient*",* "CORE Learning Model", and "Game Based Learning*".* The next stage is the third stage, they are, determining the inclusion and exclusion criteria. Determination of inclusion and exclusion criteria is used to determine eligibility in the literature which will later be used in research using this SLR method. Articles or journals that meet the inclusion criteria will be included in the research phase. Table 1 describes the inclusion and exclusion criteria used in this research.

2.1 Table

**Table 2. 1**. Inclusion and Exclusion Criteria

| Inclusion | Exclusion |
|---|---|
| National or international articles or journals that are relevant to Mathematical Critical Thinking Ability Viewed From Adversity Quotient through CORE Learning Model based on Game Based Learning. | National or international articles or journals that are irrelevant to Mathematical Critical Thinking Ability Viewed From Adversity Quotient through CORE Learning Model based on Game Based Learning.. |
| Articles or national or international journals that are appropriate to the research topic. | Articles or national or international journals that are not in accordance with the research topic. |
| Articles published in 2013-2023 are used as a | Articles published before 2013 are used as a |

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|---|---|
| reference for discussion. | reference for discussion. |
| The language used is Indonesian or English. | The language used is other than Indonesian or English. |

The fourth stage is selecting the results of the literature from articles and journals that meet the criteria. The fifth stage, making research conclusions, at this stage the author makes a conclusion that is related to a brief statement related to the results of the analysis description which comes from facts or logical relationships and contains answers to the questions posed in the problem formulation section.

## 3. Discussion

Retrieved 15 articles that are relevant to the keywords. Then, the author examines articles or journals that are relevant to Mathematical Critical Thinking Ability Viewed From Adversity Quotient through CORE (Connecting, Organizing, Reflecting, Extending) Learning Model based on Game Based Learning.

3.1 Table

**Table 3. 1** Related Research Mathematical Critical Thinking Ability Viewed From Adversity Quotient through CORE Learning Model based on Game Based Learning.

| Source | Author, Year | Journal/Proceedings, Publication Category | Research result |
|---|---|---|---|
| Google Scholar | (Siregar et al., 2018) | *Jurnal Penelitian dan Pembelajaran Matematika* | The critical thinking ability of students who get treated with the CORE learning model are more high than students who get the direct learning model. |
| Google Scholar | (Konita et al., 2019) | PRISMA, Prosiding Seminar Nasional Matematika | CORE learning is appropriate for learning mathematics, where learning mathematics begins by remembering previous concepts related to the new concepts being observed. |
| Google Scholar | (Friscillia et al., 2021) | Journal of Educational Review and Research | Students who use CORE learning model have mathematical critical thinking ability higher than students who use direct learning models in class. |
| Google Scholar | (Ayudia & Mariani, 2022) | Jurnal Ilmiah Pendidikan | The application of an effective CORE learning model can improve students' critical thinking ability and already meet the effectiveness criteria of achieving classical mastery. |
| Google Scholar | (Rahayu & Alyani, 2020) | Jurnal Pendidikan Matematika | Adverse quotient has a positive effect on the achievement of students' mathematical critical thinking, and |

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| | | | there is a significant relationship between AQ and critical thinking, so there is an explanation about the characteristic of AQ. |
| Google Scholar | (Kusumawardani & Sulaiman, 2021) | Jurnal Pendidikan Matematika | students' critical thinking profile in understanding the problem is climber and camper student do all indicators of critical thinking in the clarification phase. Quitter student is only able mentioning known and asked information. |
| Google Scholar | (Didik Sugeng Pambudi et al., 2022) | Jurnal Nasional Pendidikan Matematika | Students with a high AQ category have a tendency to have very high and high critical thinking ability. Students in the moderate AQ category have a tendency to have high and medium critical thinking ability, and students in the low AQ category have a very low tendency to think critically. |
| Google Scholar | (Astiantari et al., 2022) | Jurnal Program Studi Pendidikan Matematika | Adversity Quotient influences students' mathematical critical thinking ability based on Adversity Quotient criteria. |
| Google Scholar | (Hidayat & Sari, 2019) | Jurnal Elemen | Adversity Quotient provides a role that can influence the achievement of students' mathematical critical thinking ability. The influence of AQ is 61% and the remaining 39% is influenced by other factors. |
| Google Scholar | (Ulfa et al., 2022) | Jurnal BASICEDU: Research & Learning in Elementary Education | Game Based Learning is effective to apply. In the research, it was found that GBL can improve students' mathematical abilities. |
| Google Scholar | (Wijaya & Andriyono, 2020) | Journal Informatic Technology And Communication | Learning by using educational games provides more interest in learning mathematics, and makes students better understand mathematics learning material. |
| Google Scholar | (Maula, 2020) | Jurnal PETIK | Game Based Learning has a significant impact on the learning process because it can increase student motivation and performance by increasing their interest in modeled learning. In learning games can increase students' learning motivation. |
| Scopus | (Mao et al., 2022) | Journal of Educational Computing Research | The type of game, critical thinking construct, culture, year of publication and type of publication significantly moderate the GBL effect. GBL has a |

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|---|---|---|---|
| | | | large and significant positive effect on students' critical thinking. |
| Scopus | (Chang & Yeh, 2021) | Technology, Pedagogy and Education | Games improve critical thinking skills mathematically, while Socrates can lead to knowledge sharing and critical thinking. |
| Scopus | (Pei Hwa, 2018) | Source: Journal of Educational Technology & Society | Digital and gamified learning lends a creative dimension to an otherwise lackluster classroom environment. Digital Game Based Learning is more effective in acquiring mathematical critical thinking skills than traditional learning. |

Based on the results of the research that has been carried out as listed in the table above, show that the critical thinking ability of students who get treated with the CORE learning model are higher than students who get the direct learning model. (Siregar et al., 2018). CORE learning is appropriate for learning mathematics, where learning mathematics begins by remembering previous concepts related to the new concepts being observed (Konita et al., 2019), students' critical thinking ability is classified as higher than students who use direct learning models in class (Friscillia et al., 2021), effective can improve students' critical thinking ability and already meet the effectiveness criteria of achieving classical mastery (Ayudia & Mariani, 2022).

Adverse quotient has a positive effect on the achievement of students' mathematical critical thinking, and there is a significant relationship between AQ and critical thinking, so there is an explanation about the characteristic of AQ (Rahayu & Alyani, 2020), of the three types of AQ students' critical thinking profile in understanding the problem is climber and camper student do all indicators of critical thinking in the clarification phase. Quitter student is only able mentioning known and asked information (Kusumawardani & Sulaiman, 2021), students with a high AQ category have a tendency to have very high and high critical thinking ability. Students in the moderate AQ category have a tendency to have high and medium critical thinking ability, and students in the low AQ category have a very low tendency to think critically (Didik Sugeng Pambudi et al., 2022), Adversity Quotient influences students' mathematical critical thinking ability based on Adversity Quotient criteria (Astiantari et al., 2022). Adversity Quotient provides a role that can influence the achievement of students' mathematical critical thinking ability. The influence of AQ is 61% and the remaining 39% is influenced by other factors (Hidayat & Sari, 2019).

Game Based Learning is effective to apply and can improve students' mathematical abilities (Ulfa et al., 2022), learning by using educational games provides more interest in learning mathematics, and makes students better understand mathematics learning material (Wijaya & Andriyono, 2020), has a significant impact on the learning process because it can increase student motivation and performance by increasing their interest in modeled learning. With using games in learning can increase students' learning motivation (Maula, 2020), had a large, significant positive effect on students' critical thinking (Mao et al., 2022), Games improve critical thinking skills mathematically (Chang & Yeh, 2021), digital game-based learning is more effective than traditional class based learning (Pei Hwa, 2018).

## 4. Conclusion

Based on the discussion that has been described, it can be concluded that learning CORE (Connecting, Organizing, Reflecting, Extending) in mathematics learning will improve the ability to think critically mathematically compared to students who get direct learning. CORE learning is in accordance with mathematical concepts ranging from Connecting, Organizing, Reflecting, to Extending. CORE learning model based of game will increase students' interest and make a greater contribution to improving mathematical critical thinking skills, which is accompanied by an Adversity Quotient which will later have an effect when students face difficulties, where later with a high Adversity Quotient will be able to face difficulties in learning well, and the higher the Adversity Quotient, the higher the mathematical critical thinking ability. Therefore, the CORE Learning Model based of Game Based Learning is effective for improving students' mathematical critical thinking skills.

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