# Literature Study: Improving Critical Thinking Ability Through a Challenge Based Learning Model with a STEM Nuance with the Help of Kahoot!

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### Abstract

Critical thinking ability is one of the 4C abilities demanded in the 21st century. Critical thinking abilities help students effectively address social, scientific and practical problems in the future. Therefore, in the 21st century, students' critical thinking abilities are really needed. This research aims to examine improving critical thinking abilities with the Challenge Based Learning model with STEM nuances assisted by Kahoot! against the literature study method. This research was carried out by studying literature from several national and international articles. The Challenge Based Learning model can improve critical thinking abilities because it makes students actively learn, because students think about how to solve the problems they face. Based on previous research, aspects of STEM are also good for improving students' critical thinking abilities because students think from different perspectives so that students are used to thinking critically. Kahoot! will present challenging situations during learning so as to improve students' critical thinking abilities. The results show that critical thinking abilities can be improved through the CBL model with STEM nuances assisted by Kahoot!

Keywords: Challenge Based Learning, Critical Thinking Abilities, Kahoot!, STEM

#### 1. Introduction

21st century abilities consist of 4 abilities or what are usually called 4C abilities, which include critical thinking, creative, collaborative, communicative and high-level thinking (HOTS) (Arnyana, 2019). Critical thinking abilities are part of the 4C abilities which are one part of the abilities demanded in the 21st century. Critical thinking abilities play a role in equipping students to handle social, scientific and practical problems effectively in the future (Novitasari et al., 2022).

However, Indonesian students' critical thinking abilities are still low, as shown by Indonesia's PISA ranking, which is far behind other countries. Meanwhile, from data from the Program for International Student Assessment (PISA) initiated by the Organization for Economic Co-operation and Development (OECD) in 2018, Indonesia is ranked 73rd out of 79 countries with an average score of 386 from the OECD average. amounting to 489 (Schleicher, 2019). Indonesia's average score is still below average and Indonesia's ranking is still below other countries (Firman & Rahayu, 2020). Critical thinking abilities are very necessary for students. Because with these abilities students can solve all the problems they face in learning (Ulum et al., 2020).

Based on research conducted by (Rafi et al., 2020) that the STEM approach is very suitable to be used to improve students' critical thinking abilities because this approach combines several branches such as Science, Technology, Engineering, and



Mathematics can improve students' critical thinking abilities because students think from different points of view so that students get used to thinking critically. Science, Technology, Engineering, and Mathematics (STEM) is also one of the steps that educators can use to improve students' critical thinking abilities.

One learning model that can be implemented in order to improve students' critical thinking abilities is Challenge Based Learning (CBL). The Challenge Based Learning model can improve critical thinking abilities because it makes students actively learn, because students think about how to solve the problems they face. CBL can improve critical thinking because it encourages students to be active in learning activities, students think about how to solve the problems they face, advanced thinking called critical thinking occurs in the problem solving process (Nawawi, 2016).

In facing the era of industrial revolution 4.0, teachers can take advantage of technology. One of the uses of technology in the educational sector is Kahoot!. Kahoot! is a web-tool application that can be used to create interesting guizzes, discussions and surveys. In education, Kahoot! can be used in the classroom to make learning more interesting and fun. The Kahoot application as a learning technology platform combines learning evaluation experiences using interactive games and is equipped with a student activity monitoring system. Kahoot! will present challenging situations during learning so that it can improve students' critical thinking abilities (Nasution, 2019).

Therefore, combining Challenge Based Learning, STEM and Kahoot! which is applied has the same thing in helping students to develop their critical thinking skills. Based on this background, this article aims to examine improving critical thinking skills with the Challenge Based Learning model with STEM nuances assisted by Kahoot! with the literature study method.

#### 2. Method

The method used in this research is a literature review study, which is a study carried out to analyze literature selected from several sources so that it becomes a conclusion and becomes a new idea. The journals used in this study are journals that discuss topics using the keywords Challenge Based Learning, STEM, Kahoot!, and critical thinking abilities. After selecting according to keywords consisting of 8 national articles searched with RnD research designs, guantitative and gualitative, in the period 2016-2022.

#### 3. **Results and Discussion**

# 3.1. Critical Thinking Ability

Critical thinking according to Mukhlisuddin (Mukhlisuddin, 2016) s the ability to think at a complex level and use analysis and evaluation processes. Critical thinking involves inductive thinking abilities such as recognizing relationships, analyzing openended problems (with many possible solutions), determining cause and effect, making conclusions and taking into account relevant data.

Indicators of critical thinking abilities include the following (NCTM, 2011). 1) Understand problems and be diligent in solving problems 2) Can think abstractly and quantitatively 3) Create mathematical models, and 4) Look for and use structures and frameworks. From the description above, it can be concluded that critical thinking



abilities are the ability to carry out analysis, create and use criteria objectively and carry out evaluations objectively(Mukhlisuddin, 2016).

According to Perkins and Murphy (2006) critical thinking is divided into 4 stages, namely clarification, assessment, inference, strategy/tactics. The clarification stage is the stage of stating, clarifying, describing or defining the problem. The next stage is the assessment, presenting the facts of the argument or connecting the problem with other problems. Next is the conclusion stage, students can draw appropriate conclusions by deduction and induction, generalizing, explaining and making hypotheses. Finally, the strategy/tactics stage is the proposing stage, evaluating a number of possible actions.

# 3.2. Challenge Based Learning

Challenge Based Learning (CBL) is learning with a multidisciplinary approach that encourages students to utilize technology used in everyday life to solve real world problems (Maisaroh et al., 2022). CBL provides an effective and efficient learning framework for solving real-world problems collaboratively and directly asking all participants to identify Big Ideas, ask questions, discover and solve challenges, provide understanding of knowledge, and develop 21st century abilities (Nichols et al., 2016). his learning model combines aspects such as problem-based learning, project-based learning, and contextual-based learning to answer real-world problems. The challenges given in the CBL model also help students to construct the knowledge they obtain into a solution (Nawawi, 2016).

The CBL learning framework is divided into three interconnected phases, namely Engage, Investigate, and Act (Nichols et al., 2016). From the first stage to the next stage, the CBL model is connected to preparing student activities. The first phase begins with Engage which contains a big idea that explains an overview of the material studied in general so that it can be explored in depth by students. The teacher asks contextual guestions at the essential guestion stage to generalize the big idea. Then students are given a challenge to learn and develop solutions to the challenges given. Entering the second phase, namely investigate, students are given Guiding Questions, Guiding Activities and Resources, and Analysis. Students are asked guiding guestions to direct them to knowledge to develop solutions. Then, students are given guided activities and guided resources containing the material studied to develop solutions to challenges. The final phase in the CBL model is act. Students create solutions, test and refine the solutions obtained at the solutions stage. This solution is immediately implemented into the real world at the implementation stage. The final stage of the act phase provides an opportunity to assess the solution and make adjustments to that knowledge.

# 3.3. STEM

STEM is an abbreviation for science, technology, engineering, and mathematics. STEM education is an educational concept that integrates several types of knowledge in the form of science, technology, engineering or mathematics in the implementation of the learning process (Suardi, 2020). The goal of STEM learning is to master 21st century competencies, students have literacy about STEM, are active and interested in the learning process, and are able to make connections. These four aspects are



needed to create a cohesive and active learning system to solve problems (Ai Mulyani, 2018).

#### Kahoot! 3.4.

Kahoot! is an online application that can develop and present questions in a "game-show" format (Mertayasa et al., 2022). Meanwhile, according to Graham, (2015) Kahoot! is an online learning media that contains free or unpaid questions that are applied in the learning process in order to evaluate student learning outcomes. Kahoot! contains questions in a game-show display that can be used for free or free of charge. The question display in this application can be equipped with images or videos that can clarify the question. Operation of the Kahoot! This is very easy to do, Kahoot! can be accessed via applications or websites, making it practical to use (Damayanti & Dewi, 2021).

### Critical Thinking Ability through CBL with STEM using Kahoot! 3.5.

Using keywords Challenge Based Learning, STEM, Kahoot!, and critical thinking abilities. Based on keywords, 8 articles were found that met the review criteria.

Researcher	Research Result
Ash-Showy et al., 2022	Teaching materials with a Challenge Based Learning model that integrates STEM are suitable for use in learning activities.
Mertayasa et al., 2022	Learning with HOTS-based gamification-Kahoot media influences the mastery of science concepts and critical thinking skills in Class V students of Gugus Laksamana, Jembrana District.
Zulfa et al., 2022	STEM integrated science learning tools are effective in improving critical thinking skills because the average of the experimental class is higher than the control class.
Ulum et al., 2020	Kahoot as a digital game based learning media can improve students' critical thinking skills.
Suardi, 2020	After implementing the STEM learning unit, students' critical thinking abilities increased, their creative thinking abilities also increased, and students' collaboration abilities also increased.
Nawawi, 2016	The CBL learning model can empower critical thinking because it makes students active in learning, because students think about how to solve the problems they face, in the problem solving process a high level thinking process occurs, namely critical thinking.
Ardiansyah et al., 2022	This research using literature studies shows the positive influence of implementing Challenge Based Learning in developing 4C skills. Collaborative learning in the Challenge Based Learning model provides students with the opportunity to develop collaborative skills, critical thinking abilities and creativity.
Sardi, 2022	The use of the CBL learning model can improve students' critical thinking abilities, marked by an increase in the average value of students' critical thinking abilities in cycle I, namely 65.97, increasing to 75.84 in cycle II.

Table 1 Critical Thinking Ability through CBL with STEM using Kaboot



The Challenge Based Learning model can empower students' critical thinking abilities, because students think about how to solve the problems they face, in the problem solving process a high level thinking process occurs, namely critical thinking (Nawawi, 2016) This is in accordance with research by Hanson and Wolfability (2000) that students' critical thinking abilities can be empowered with CBL learning model activities, namely by providing organized and systematic questions in assessing a topic, thereby leading students to independent and trustworthy conclusions.

STEM which is integrative allows the application of various supporting learning models (Ash-Showy, 2022). Integrating STEM in learning based on previous research can train students to think critically (Zulfa et al., 2022). With integrated STEM learning, it is possible for critical thinking abilities to become sharper because students' abilities and abilities in cognitive and psychomotor aspects are carried out more optimally.

Based on Ulum's (2020) research here was an increase in each indicator of the critical thinking process so that there was an increase in students' critical thinking abilities using Kahoot! This is because there is an increase in students' ability to make reasons based on convincing facts by providing reasons for each step of the solution. So using Kahoot! can improve students' critical thinking abilities.

### 4. Conclusion

It can be concluded that with the Challenge Based Learning model with STEM nuances assisted by Kahoot! can be a solution to improve students' critical thinking abilities. The Challenge Based Learning model can make students think about how to solve the problems they face. STEM is good for improving students' critical thinking abilities because students think from different points of view so that students are used to thinking critically. Kahoot! will present challenging situations during learning so as to improve students' critical thinking abilities. Further suggestions, a Challenge Based Learning model textbook with a STEM nuance can be developed with the help of Kahoot! on students' critical thinking abilities.

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