Scafolding as An Alternative Way to Develop The Ability of Critical Thinking in The Life of Digital Era

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Abstract. Critical thinking skills are one of the must-have abilities students in the 21st century must have. Critical thinking is one of the high-level thinking according to (Zembal-Saul et al., 2002) high order thinking is a combination of critical thinking, creative thinking, and basic knowledge thinking. Critical thinking means putting yourself in an active quest to understand what is going on by using reasoning procedures, evaluating evidence, and carefully weighing the thought process itself. In fact, students still have difficulty thinking critically of mathematics. This paper examines scaffolding as one of the efforts to improve critical thinking skills. Scaffolding can be given to students in the form of modeling certain behaviors (modeling of desired behaviors), presenting explanations (offering explanations), inviting student participation (inviting student participation), verifying and clarifying student understandings, and inviting students to contribute clues. In principle scaffolding is given then the provision of scaffolding is reduced and ultimately eliminated after the student has gained understanding.

Keywords: Critical thinking, scaffolding, mathematics

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INTRODUCTION

Mathematics is one of the disciplines aimed at improving students' thinking to be able to contribute to the resolution of problems of daily life (Ralmugiz & Merliza, 2020) including in the world of work and even in the development of science at this time (Masamah, 2017). Therefore, it is important to pay attention to the series of learning processes in order to achieve learning goals (Sutiarso, 2009) which in them facilitate the skills needed by students in this instructive era.

Critical thinking is an ability that must be possessed by students. It is inaccordance with thegovernment's ideals contained in permendikbud No. 20 of 2016 (No, 22 C.E.). When the child is cultured to think critically, then he will always review, assess, research thingsthat need tobe studied. Critical thinking skills are skills that must be owned and developed by everyone. Students also need to have these critical thinking skills in order to be used in making decisions in everyday life. A person who has the ability to think critically will be able to examine the problems faced, find and choose the right solution, logical, and useful. In the learning environment, students must be accustomed to developing critical thinking skills in solving problems so that problem-solving skills will develop as well. The only obstacle to critical thinking is that the changes that occur today have not only touched social life, but also have propagated into the pattern of piker. In school, for example, educators still tend to feel powerful, therefore students must obey all what is taught by the teacher. The relationship between teacher and student is more dominant monologue and one-way. The space of creativity, freedom, and innovation for learners has not got a place, even though all these things are much needed capital to deal with complex and rapid changes in adulthood. There are several ways of thinking that inhibit piola critical thinking. These obstacles are a negative result of the development of science and technology, namely a self-centered way of thinking, a pattern of thinking that ignores universal values, the habit of thinking without testing, the absolute interests of groups or collectives, and the worship of technology.

A person who has the ability to think critically will be able to examine the problems faced, find and choose the right solution, logical, and useful. So, if a problem arises then he will immediately find the best solution. For that, every student should have good critical thinking skills. But the current facts show that the discovery of low critical thinking skills of students is seen from the quality of questions and answers of students at the time of the learning process. Students are less able to use reason in achieving the information they receive (Tarigan et al., 2016).

The weight of one's critical thinking is revealed in various intellectual virtues such as intellectual humility, courage, autonomy, integrity based on the ability of reason in dealing with the reality of life, honing

themselves continuously and being the basis in providing an assessment of the various realities that are carried out by communication technology, so, maximum development and manneruity. In the utilization of the five intellectual virtues will guarantee the sustainability of humanity, the sustainability of humanity will be seen in learning in school, in work and in everyday life.

Critical thinking has benefits in many areas. For critical thinking students develop the ability to understand, construct and form better arguments. Critical thinking enhances the ability to solve problems and communicate ideas clearly and effectively in working on mathematical problems. This pattern of thinking can also reduce errors in personal decision making.

Based on this information, as an educator it is necessary to be able to design a learning that can support students' critical thinking skills. According to (Trilling & Fadel, 2009) the skills that should be possessed by someone in the 21st century include problem solving, communication, creative, innovative, expertise in utilizing IT, leadership and socialization intelligence. To facilitate learning with these skills requires teacher expertise to provide constructive learning. This is in line with the paradigm of learning mathematics based on the 2013 curriculum from teaching to learning, from teacher-centered to student-centered approach (No, 22 C.E.).

RESULTS AND DISCUSSION

1. Definition of Critical Thinking

Definition of critical thinking (Larsson, 2017) is to think reasonably and reflectively by pressing on decision-making about what to believe or do. According to critical thinking is based on certain skills, such as observing, inferring, generalizing, reasoning, evaluating reasoning, and the like. In line with Ennis, Ellie (Moon, 2007) critical thinking is a thinking activity that aims to challenge ideas. This is done in the thought process by evaluating by considering different perspectives and has the potential to add value in achieving a new level of curiosity (the addition can be a new question, finding a new answer or asking many other questions). According to Beyer (Mergler, 2008) Critical thinking is the ability (1) to determine the credibility of a source, (2) distinguish between relevant from irrelevant, (3) distinguish facts from judgments, (4) identify and evaluate unspoken assumptions, (5) identify existing biases, (6) identify viewpoints, and (7) evaluate evidence offered to support recognition.

A person who has critical thinking always: (1) ensures the trueness of an expression both real and questionable; (2) distinguish relevant information from irrelevant; (3) Determine the accuracy of a fact of a statement; (4) seeking a logical explanation of an expression; (5) use sources that have credibility and mention them; (6) pay attention to the situation and the overall condition; (7) distinguish between opinions that are not and can be accounted for; (8) identify all points of view in finding alternatives in explaining an argument; (9) Be open-minded and open-minded; (10) take a position when there is sufficient evidence to do something; (11) determine the strength of the argument; and (12) behave systematically and regularly with parts of the whole problem.

2. Critical Thinking in math learning

Mathematics is a discipline that studies organized patterns, structures, regularities that start from undefined element elements and then defined element elements, continuing to blossom into axioms all the way to theorems (Goguen, 1998) In mate-matika, a truth is proven by examining the consistency of a concept with previous concepts that were considered true. Mathematical proof is done deductively and logically. To prove deductively in mathematics requires several abilities including: the ability to understand problems, analyze the consistency with the theory that has been owned, analyze the needs of theory in solving problems, do the reflection of problem solving done, identify different points of view in breaking down a problem to be proven and conclude what is done (Goguen, 1998) Some of the skills needed in mathematics seem to be externally that critical thinking is needed in learning mathematics. So as a math educator who wants to improve the math skills of students is needed to improve the critical thinking skills of students.

The learning process that bares critical thinking skills can be achieved by learning students to be able to structure arguments, solve problems, individual work, and group work (Anderson et al., 2001) Other activities that support include identifying, justifying concepts and presenting supporting evidence. Chukwuyenum also said critical thinking requires the activity of gathering, interpreting, analyzing and evaluating information for the purpose of arriving at a reliable and valid conclusion (Chukwuyenum, 2013).

(Goguen, 1998) also said that to improve

critical thinking skills can be done with 4 stages, namely (1) the preparation stage: habituation to understand a problem, (2) the incubation stage: thinking about how to solve the problem, (3) the illumination stage: ideas that lead to solving a problem, (4) The verification stage: checking the answer again. The stages of the stages carried out by some of the researchers above are generally covered in scaffolding learning.

3. Scaffolding

The term scaffolding was introduced by Wood and is conceptually appropriate for Vygotskys' Development Zone is proc-simal and is a structured pedagogical tool that aims to support student learning (Anghileri, 2006). In reviewing the last decade of research, Van de Pol, Volman and Beishuizen suggested six instruction-onal practices typically used in scaffolding: providing feedback, hinting, instructing, explaining, modeling and questioning (de Pol et al., 2010).

According to Stone (Stylianou et al., 2010) scaffolding learning is a mechanism for observing the process by which students are helped to learn to understand their potential. Practically speaking it refers to "the provision of increased guidance and support or assisting the development of learners' competencies" (Stylianou et al., 2010), and is based on an unassuming transitional situation between teacher and student ideas. However, understanding the intricacies of an ongoing situation is a complex process that disseminates sensitivity to the goals that the student must achieve arises in learning activities (Stylianou et al., 2010).

4. Scaffolding in improving critical thinking skills

Many research backgrounds on scaffolding have been drawn from studies not specifically related to math classes. Rogoff's socio-cultural approach has been helpful in analyzing an activity in three different interdependent areas, but each can be made a focus for studies that can inform classroom practice. In the same way, the following discussion will propose a level of scaffolding that can be found explicitly supporting the ability of critical thinking in the study of mathematics with various contributions to practice. (de Pol et al., 2010) posits three levels of Scaffolding as a series of effective teaching strategies that may or may not be seen in the classroom. The most basic level is environmental environtment provisions,Level 2 is explaining, reviewing and restructuring,and level 3 is development conceptual thinking.

To build critical thinking skills students need scaffolding procedures as follows:

1. Provisions:structuring a learning environment that supports the occurrence of interactions that hone students' critical thinking skills
2. Explaining;showing the basic concepts of unknown material.
3. Reviewing; When students engage with assignments, they are not always able to identify the aspects that are most important with regard to implicit mathematical ideas or problems to be solved. A response for teachers is to refocus their caution and give them further opportunities for the development of their own understanding rather than relying on the teacher. Review five types of interaction classifications:
   a. get students to see, touch and speak what they see and think.
   b. get students to explain and justify.
   c. interpret the student's actions and speak.
   d. use do-rong/ questions/ and investigate and
   e. parallel modeling / parallel modeling.
4. Restructuring:Through restructuring, the teacher's intention/goal is more progressive for advance modifications that will make ideas more accessible, not

Only build contact with existing student understanding but take forward meaning. This differs from reviewing where teacher-student interaction is intended to encourage reflection, clarify but not change existing student understanding.

Development conceptual thinking:teaching interactions that explicitly address the conceptual development of thinking by creating opportunities to express understanding to students and teachers together.

From each stage of scaffolding above it is very clear that every action can explicitly support the ability to think critically because in the process of scaffolding thinking requires students to observe, conclude, generalize, reason, evaluate reasoning. The emergence of observing and evaluating activities will arise during the reviewing process, especially when the teacher asks questions to investigate.

According to Despina, A (Stylianou et al., 2010) there are four categories used in scaffolding, namely transactive instruction,

facilitative speech, didactic and rektid. Speech that has the portion most often spoken by teachers in doing scaffolding is a transactive instruction that is Socratic. Transactive speech according to Despina, A et al (Stylianou et al., 2010) can build the practice of argumentation that is necessary to solve a problem. We see argumentation as a higher mental function developed first when socializing between each person and then internalized as part of one's personal language. Socratic questions can: (1) raise basic issues; (2) investigate deeply; (3) help students to meet their thought structure; (4) help students develop sensitivity to clarification, accuracy, and relevance; (5) help students to arrive at consideration through their own reasoning; (6) and helps students analyze claims, evidence, conclusions, issues, assumptions, implications, consequences, concepts, and opinions. Some questions that are considered effective enough to improve critical thinking skills mentioned by Adinda can be: "Is there another solution?", "what if?", "what is wrong?", "what are you doing?".

The question is, "Is there another solution? This is done after the solution of the problem is found and checked, with the aim of finding other problem-solving alternatives to train students to be open as there is in the critical thinking characteristics. The question "what if?" is done after the solution is obtained and the teacher modifies the problem. The question "what's wrong?" is uttered by the teacher when the teacher provides an illustration that contains problems and solutions that contain errors both conceptually and in calculation. With this question students are required to analyze more deeply about the basic concepts possessed to solve this problem so that the ability to think critically can be improved. The question "what are you doing?" is given so that students can sharpen and strengthen the arguments expressed.

In the restructuring and development stage students are required to seek a logical explanation of an expression, use sources that have credibility and mention it, pay attention to the situation and conditions, distinguish between opinions that are not and can be accounted for, identify all points of view in finding alternatives in explaining an argument, behaving and thinking openly and determining the strength of argument. Based on this explanation it is very clear that scaffolding is able to support students' thinking skills. Some studies that support this statement are done by several researchers including: Beyer (Redhana, 2015) and (Kurniasih, 2012) Beyer's research shows that Socratic questions are a scaffolding strategy to improve students' critical thinking skills. Scaffolding in the form of Socratic questions and open-ended questions is proven to be effective at improving students' critical thinking skills due to students' epistemo-logi readiness to questions and the search for knowledge.

According to (Kurniasih, 2012) Scaffolding in an effort to improve critical thinking can be given to students who model behavior (modelingof desired behaviors), present explanations (offeringexplanations),invite student participation(invitingstudent participation),verify and clarifystudent understandings, and invite students to provide pointing /key (invitingstudents to contribute clues). (Kurniasih, 2012) applies the technique by modeling the behavior of using the type of speaking in class, providing explanations in an explicit that is familiar to students in order to understand the material of building space, encouraging students to actively participate in arguments, invite students to provide instructions or keywords of the given problems, and verify and clarify.

Although in addition to scaffolding there are still several learning models developed to improve critical thinking skills such as Bacracharya (2010) and Buhaerah (2015), but according to the author there are still many shortcomings. Developed the ABC model which stands for Anticipation, Building Knowladge and Consolidation. Develops a learning model consisting of 3 phases namely phase 1 (identifying and justifying concepts), phase 2 (solving problems), and phase 3 (identifying and analyzing algorithms).

In addition to developing models to develop critical thinking skills, there are also researchers who apply critical thinking training, namely (Chukwuyenum, 2013). He applies critical thinking training with components: (1) Interpretation; (2) Analysis; (3) Evaluation; (4) Inferential; (5) Explanatory and (6) Self-Regulation. Of some of the previously mentioned, the authors point to some of the shortcomings that are followed up, among others: Bacracharya Research (2010), teachers do not give students full confidence to convey their ideas and ask questions. There is still too much intervention from teachers in terms of providing solutions to a given problem. In providing the conclusion of a solution, the teacher quickly perfects the results of the student's work. According to the author, teachers should give the widest freedom to

students to argue in solving a given problem. The best teacher only acts as a moderator and triggers concerns over the student's arguments. At the time of being a doubter, teachers can use transactive speech or instructions so that with these transactive instructions there is a scaffolding process of developing the student's argumentation structure (Nugroho, 2017)

In buhaerah research (2015), teachers do not explain the basic concepts of the material to be explained, so students lack a solid foundation in arguing to reduce the ability of students to decide a solution of existing problems. According to the author, preferably in understanding basic concepts, especially about the definition in the dimateri that teaches need to be explained in detail the meaning so that students have a strong capital to build critical thinking. In addition, in Buhaurah's research, students only learn with their peers, whereas according to Vygotsky (Kozulin, 2003) child development can be shaped by this is a joint activity between children and adults and peers, so it is still very necessary the role of teachers in planting basic concepts of the material taught.

CONCLUSION

Based on the exposure of theories and the results of some of these studies, it can be drawn a conclusion that critical thinking is a capable that must be owned by every student in accordance with the government mandate given to every educational institution so that students can face an increasingly complex life with problems that must be pursued. Scaffolding is one of the alternatives that are good enough to support critical thinking skills.

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