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ReCLif: PROBLEM-BASED LEARNING MODEL TO IMPROVE CRITICAL THINKING FOR BEGINNER LEARNERS

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Abstract. *Indonesia's SDGs Roadmap 2030 underlines the importance of critical thinking skills to achieve sustainable development goals. Complex problem-based learning models can be cognitively burdensome for novice learners. Another factor is the lack of opportunities for students to apply their knowledge in real situations and solve complex problems. This research aims to develop and test the effectiveness of the ReCLif model more effective to problem-based learning for beginner learners. The ReCLif model is designed to the cognitive level of novice learners. This research uses research and development methods from Plomp and Nieveen. The research results the development of the ReCLif model learning syntax is an integration of complex thinking teaching and learning strategies with 3C3R design problems and 4C/ID instructional design with three learning stages (1) exploring real life; (2) using complex thinking skills; and (3) creating solutions for life situations. The results of the quade rank analysis of covariance test, obtained a Sig value. (0.000) <0.05 (α), then H0 is rejected and the research hypothesis is accepted. This means that there are significant differences in critical thinking skills in students between classes given learning using the ReCLif model and control model. The results of the Bonferroni Dunn test show that the corrected mean value for the ReCLif model is 80.46, the TPS model is 71.27 and the CTL model is 70.57. It can be concluded that there is a significant difference in the mean value of critical thinking skills between the ReCLif learning model and the CTL and TPS models.*

Keywords: *ReCLif, Critical Thinking, 3C3R Design Problems, 4C/ID, Cognitif Load Theory*

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1. INTRODUCTION

In this globalization era, developing individual potential becomes increasingly crucial. Indonesia's 2030 SDGs Roadmap underlines the importance of improving the quality of education to achieve sustainable development goals. One important indicator is the development of 21st century skills, such as critical thinking, which equips the younger generation to face the complex modern world [1].

Previous research show that many students still experience difficulties in developing critical thinking skills, especially in the context of science learning. The results of the PISA study [2] show that Indonesian students' critical thinking abilities are still below the international average. One factor that contributes to this problem is the lack of opportunities for students to apply their knowledge in real situations and solve complex problems [3].

Critical thinking is an essential competency that must be has by every individual, especially novice learners. As emphasized by [4], critical thinking is not only important for academic success, but also for everyday life. Beginner learners who have critical thinking skills will be better prepared to face future challenges, such as making wise decisions, adapting to change, and collaborating with others [5]. Unfortunately, traditional teaching methods are often less effective in developing critical thinking skills.

Traditional teaching methods, which often center on the teacher as the primary source of knowledge and emphasize memorizing facts, have long been the standard in education. Although this approach is effective in transferring information, it has limitations in developing critical thinking skills. Research shows that traditional learning models tend to hinder students' ability to analyze information in depth, evaluate arguments critically, and solve complex problems. This is in line with the findings of [6] which shows that a learning approach that is too structured and relies on direct instruction can limit students' cognitive development.

In the other hand, traditional methods often provide less opportunities for students to develop metacognitive skills. Metacognition or self-awareness of one's own thought processes, is an important component in critical thinking. However, in highly structured learning environments, students are rarely invited to reflect on their thought processes or develop effective learning strategies. This is reinforced by [7] research which shows that one of the factors that most influences learning outcomes is effective learning strategies.

Problem-based learning is a pedagogical approach that places students at the center of learning by giving them tasks to solve authentic problems. Problem-based learning encourages students to work collaboratively in small groups to analyze problems, search for relevant information, evaluate various solutions, and make decisions. Research shows that problem-based learning has great potential in developing students' critical thinking skills. Current research shows that problem-based learning is effective in developing relevant 21st century skills, such as critical thinking, creativity, and collaboration. For example, [8] found that students involved in problem-based learning projects showed significant improvements in critical thinking and complex problem-solving skills compared to a control group.

Although problem-based learning is often associated with face-to-face learning, research shows that problem-based learning approaches can also be implemented effectively in online learning environments. [9] found that students who took part in online learning with a problem-based approach showed significant improvements in critical thinking abilities and problem solving skills. Problem-based learning is in line with the development of 21st century skills needed in the world of work. [10] found that problem-based learning can help students develop the critical thinking, creativity and collaboration skills needed to face future challenges.

One of the main advantages of the problem-based learning approach is its ability to motivate students. When students are involved in solving problems that are relevant to real life, they tend to be more motivated to learn and retain the knowledge they gain. Recent research shows that problem-based learning can increase students' intrinsic motivation and their engagement in learning. For example, [11] found that students engaged in problem-based learning reported higher levels of interest and engagement compared to students in traditional learning.

This purpose of this research is to introduce ReCLif, a learning model developed with an innovative problem-based approach and specifically designed to improve critical thinking skills in novice learners. Problem-based learning has long been recognized as an effective approach in developing critical thinking skills. However, previous research shows that problem-based learning can pose a significant cognitive load for novice learners, especially when they are faced with problems that are too complex or abstract [12]. Excessive cognitive load can hinder concept understanding and reduce learning motivation for novice learners.

According to [5] cognitive load is felt by novice learners. [13] explain that novice learners are students who have never received a problem-based learning scheme before, so they have not yet understood and familiarized themselves with the nature of complex learning tasks. [14] explains that students who understand and can adapt to learning materials and tasks will quickly process information in short-term memory, so they can adapt to the way the brain works which can help them learn more effectively, so in its sustainability problem-based learning should offers students the opportunity to engage with real-world issues.

2. RESEARCH METHODS

The ReCLif model implemented in class X of Madrasah Aliyah Negeri (MAN) 2 Pontianak City. This research involved 3 classes with a total of 104 students in Biodiversity and Global Warming subjects. This research uses a research and development design that refers to the [15] model consisting of three stages, namely (1) preliminary research; (2) development phase; and (3) an assessment phase to evaluate the effectiveness of the ReCLif learning model in improving students' critical thinking skills.

The research instruments used include essay tests to measure critical thinking skills. The research instrument used in this research has gone through the validation and reliability stages. The results of the construct validity test show that the ReCLif model, teaching modules, student worksheets, and critical thinking skills instruments have a very good level of validity with a percentage above 90%. Specifically for the critical thinking skills instrument, of the 12 questions, 6 questions were declared valid. Reliability testing of learning tools and critical thinking skills instruments using Cronbach's alpha produced a value of >0.50 which indicates high reliability. The results of the normality test using Kolmogorov Smirnov and homogeneity using Levene's test showed that the data were not normally distributed and homogeneous (Table 1), data analysis was carried out using the non-parametric statistical test Quade Rank ANCOVA and the Bunferroni Dunn post hoc test.

Tabel 1. Normality and Homogeneity Test of Critical Thinking Result

No.	Statistical Assumption Test	*Sig (2-tailed)*		Description
		Pretest	Posttest	
1	Kolmogorov Smirnov Test	0.003	0.000	Not normally distributed
2	Levene’s Test	0.578	0.002	Not homogen

3. RESULTS AND DISCUSSION

This research aims to develop and evaluate the effectiveness of the ReCLif model in improving the critical thinking skills of class X high school students on biodiversity and global warming. The ReCLif model offers a unique approach by presenting problem contexts that are authentic and relevant to students' daily lives, such as the impact of climate change on biodiversity in the surrounding environment. In contrast to conventional problem-based learning models which often use artificial scenarios, ReCLif encourages students to carry out direct observations and interviews and interact with the surrounding community to collect the data needed to solve problems.

The development of the ReCLif model in the preliminary study focused on needs analysis (1) analysis of critical thinking empowerment by teachers; (2) analysis of students' mastery of critical thinking skills; and (3) analysis of literature studies related to theoretical and empirical studies of development research. Based on the results of filling out a questionnaire on empowering critical thinking in biology learning in class by 12 teachers, it was found that 56% of teachers still had not empowered critical thinking skills and had not innovated in learning, including using problem-based learning models in biology learning. Initial analysis was carried out to determine the description of the mastery of critical thinking skills of class X students from 8 high schools in Pontianak City. The results of the study showed that the average score for students' mastery of critical thinking skills was 47.58 with moderate qualifications.

The literature study analysis aims to collect information related to the rationality of developing the ReCLif model. This literature study examines the conceptual basis and supporting learning theories. The foundation of the development concept includes complex thinking teaching and learning strategies, 3C3R design problems, and 4C/ID instructional design. Supporting learning theories include cognitive learning theory,

behaviourism, meaningful learning, cognitive constructivism, constructivism, social constructivism, information processing, social learning, and experiential learning.

The development of the ReCLif model syntax was carried out by integrating components of complex thinking teaching and learning strategies with 3C3R design problems and 4C/ID instructional design to produce learning stages. Next, the learning stages that have been formed will be conceptually synthesized through theoretical support to produce learning activities that can empower critical thinking skills.

The development of the ReCLif learning model syntax produces three stages along with learning activities. The development of the ReCLif model syntax obtained by integrating the components of complex thinking teaching and learning strategies, 3C3R Design Problem, and 4C/ID instructional design. Apart from being supported by conceptual theory, syntax development is also supported by theories that can empower critical thinking skills. The first stage is exploring real life, having learning activities, namely (1) reading the material contained in the student worksheet (LKPD); (2) identify problems; and (3) collecting information through observation and interviews. At this stage the teacher builds learning in accordance with real life realities by integrating critical issues so that it is hoped that the knowledge within students can develop through learning events in everyday life. The learning developed by the teacher has paid attention to aspects of the content and context of problem design. In constructing problems the teacher refers to facts and pays attention to critical issues, so that through these problems students are expected to be able to build contextual knowledge together with dominant knowledge.

The second stage learning activities by using complex thinking skills are (1) evaluating evidence; (2) consider alternative problem solving solutions and their implications. At this stage, various kinds of complex thinking skills are used by group members in order to contribute to successful problem solving. By evaluating evidence, students are expected to be able to use critical thinking to question sources of information that have been obtained, check the validity of evidence, identify bias or errors in arguments, and interpret relevant data to solve problems. A good critical thinker must be able to question the information they receive, assessing its reliability and relevance through evaluating evidence [16].

The next activity is to consider alternative problem solving solutions and their implications. In this activity, students and their groups are expected to conduct problem-based discussions to analyse problems from various points of view, generate creative ideas, consider the implications of each solution including short-term and long-term consequences, understand the potential risks and benefits of each alternative solution. According to [17] through the process of evaluating alternative solutions, students can develop critical thinking skills in analysing the social impact of solutions.

The third stage of creating a solution for life situation, has learning activities, namely (1) selecting and implementing the best solution; and (2) reflecting through presentations. At this stage, the application of students' knowledge and skills will produce problem solving which is expected to provide solutions that can have a good impact on life. The activity of selecting and implementing the best solution expects students to critically, through communication and collaboration skills, be able to make decisions from several proposed alternative solutions to be used as the best solution that can be implemented to have a good impact on life. According to [18], finding a solution indicates that learning activities involving simple to complex thinking skills have gone well during learning. The activity of reflecting through presentations is where students evaluate the learning experiences they have gone through as well as solving the resulting problems and their impact on life. It is hoped that in this activity, apart from students having communication and collaboration skills, students also have the ability to reflect critically on themselves to assess their strengths and weaknesses in carrying out the problem solving process.

4. CONCLUSIONS

The ReCLif learning model is a problem-based learning approach designed to develop critical thinking skills in beginner students. This model emphasizes active, collaborative and reflective learning by considering students' cognitive load during the learning process. ReCLif's key features include authentic problem solving, project-based learning, and metacognitive reflection. Through the implementation of ReCLif, students are invited to identify problems, collect information, analyze data, evaluate various solutions, and communicate results effectively. The research results show that the application of the ReCLif model significantly improves students' critical thinking abilities, especially in terms of analysis, evaluation and problem solving.

These findings have very important implications for educational practice. The ReCLif model offers an attractive alternative to traditional, more passive learning methods. By equipping students with strong critical thinking skills, this model not only helps them achieve academic success, but also prepares them to face increasingly complex real-world challenges. Therefore, educators are strongly encouraged to consider

adopting the ReCLif model in their learning practices. In this way, we can create a generation of students who not only have extensive knowledge, but are also able to think critically and creatively to solve complex problems.

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