

STUDENTS CRITICAL THINKING SKILLS USING THE LOCAL WISDOM-BASED 7E LEARNING CYCLE MODEL

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ABSTRACT

This study identifies challenges in physics learning in class X IPA MAN 1 Padang, such as students' lack of concentration, inadequate mastery of basic concepts, and a teacher-centered approach. The integration of local wisdom in physics learning is often overlooked, resulting in students losing experiences in their surroundings. The low critical thinking skills, especially in quizzes and semester exams, have serious consequences. This research evaluates the effectiveness of the Learning Cycle 7E model integrated with local wisdom compared to Discovery Learning. A quasi-experimental study involves all class X IPA students at MAN 1 Padang using cluster random sampling. The results show that the integrated Learning Cycle 7E is more effective, with an average critical thinking score of 92.94 in KD 3.9, while in Discovery Learning, the t-test result is 3.97 compared to the table t-value of 1.67. In conclusion, the Learning Cycle 7E model integrated with local wisdom is more effective in enhancing students' critical thinking skills.

Keywords: Critical Thinking Skill ; Learning Cycle 7E; Local Wisdom.

INTRODUCTION

Critical thinking skills are one of the essential skills that students must possess. In the 21st century, having critical thinking skills is crucial in high school education (Pratiwi, 2021:139). In physics education, critical thinking skills are necessary because the goal of physics education is to make students understand and master scientific concepts that have relevance to solving everyday life problems (Hatibe, 2021:58).

However in reality, students critical thinking skills in the field of physics at the high school level are still relatively low. Various studies, including those by Munandar (2018), Parwati (2020), and Lestari (2019), have shown that high school students' critical thinking skills are generally low. Many students at MAN 1 Padang have not been able to achieve the minimum passing grade (KKM) in physics learning. Analysis of the final semester exam questions in physics at MAN 1 Padang revealed that three out of six questions were categorized as critical thinking questions. Research conducted by physics educators at MAN 1 Padang on May 5, 2023, indicated that many students answered critical thinking questions incorrectly, leading to a high number of students

failing the semester exam in physics. As a result, the critical thinking skills of students at MAN 1 Padang are still low.

The low critical thinking skills can be attributed to various factors, including factors related to teachers and students. Regarding students, the current generation, often referred to as Gen Z and living in the era of the fourth industrial revolution, is highly influenced by rapid technological advancements and tends to be more interested in social media and other distractions than in learning (Erlina et al., 2019). Students often do not bring prior knowledge to the classroom, making it difficult for them to connect concepts and requiring them to rely heavily on teachers for explanations (Benyamin, 2021) (Afriani, 2018). On the teachers' side, there is often a lack of pedagogical skills in physics teaching, leading to teacher-centered approaches where the focus and primary source of knowledge are the teachers themselves. However, the 2013 curriculum emphasizes student-centered learning (Munandar, 2018). Teachers tend to stick to one teaching model throughout a semester (Siddin, 2021).

If the issue of low critical thinking skills among students is not addressed, it can lead to difficulties in understanding the material, problem-solving, making rational decisions, and interpreting the answers to physics problems (Sundari, 2021) (Munandar, 2018). The negative consequences of weak critical thinking skills include the inability of students to identify incorrect assumptions and missing data when solving problems. Students may perform physics calculations but struggle to understand the significance of their answers (Hatibe, 2021). In the classroom, there is often a lack of active engagement in learning due to an imbalance between students' abilities and teachers' teaching methods in achieving physics learning objectives (Nasihah, 2019).

In improving students' critical thinking skills, many things have been done by previous researchers and the government. Solving the problem of low critical thinking skills of students has been addressed in previous studies through developing and applying Inquiry, PBL, Problem solving learning models as well as contextual teaching and learning approaches in physics learning and using various cooperative learning models in various types applied to high schools (Handayani, 2022) (Lestari., 2019) (Parwati., 2020). The 2013 curriculum is designed to be student centered learning so that it can influence 21st century skills which include critical thinking skills. (Ariani and Ratnawulan, 2022).

One previous approach to addressing critical thinking skills is the implementation of the Learning Cycle 7E model. The use of the Learning Cycle 7E model is not only intended to enhance students' critical thinking skills in physics but also to improve their learning outcomes, religious character, science knowledge competency, conceptual understanding, science process skills, and more. Research by Yusrianto has shown that the Learning Cycle 7E model improved students' learning outcomes more than the Group Investigation model (Nasir, 2017).

Based on the previously mentioned aspects, this research aims to address critical thinking skills by applying the Learning Cycle 7E model integrated with local wisdom in

class X at MAN 1 Padang. This approach allows students to apply scientific concepts they have learned to solve real-world problems and apply them in their daily lives, with the hope that using the Learning Cycle 7E model integrated with local wisdom will enhance the learning process. Interviews conducted on January 16, 2023, with physics teacher at MAN 1 Padang revealed that local wisdom had not been integrated into physics education, and the school had only been using the Discovery Learning model.

The incorporation of local wisdom education allows students to better understand and relate the material to their surrounding environment. According to Wati, as quoted by Maryam (2022), learning physics based on local wisdom can enhance students' abilities to investigate and explain scientific concepts within the context of local wisdom. This is supported by the National Education System Law No. 20 of 2003 in Chapter X, Article 36(3), which states that the curriculum should be designed in accordance with the national education framework, taking into account aspects such as the "diversity of regional and environmental potentials," which can be interpreted as local wisdom present in the region and environment that can be related to learning materials (Sholekah, 2020: 4). In this research, the local wisdom used is paragliding in Padang, applied to the topic of Work and Energy. The objective of this research is to determine whether the application of the integrated Learning Cycle 7E model with local wisdom can provide better critical thinking skills compared to Discovery Learning.

METHODOLOGY

This research is of the Quasi-Experimental type. According to Soutfer and Campbell, as cited by Dicky Hastjarjo, quasi-experimentation is defined as an experiment that includes treatment, impact measurement, experimental units, but does not employ random assignment to create comparisons to conclude changes caused by treatment. The comparison process relies on non-equivalent comparison groups that differ in many aspects, not solely based on treatment (Hastjarjo, 2008). The research design for this quasi-experiment is the Randomized Control Group Posttest Only design. In this design, subjects are selected from a predetermined population and randomly divided into two groups: the control group and the experimental group. The experimental group is treated with "Physics learning using the integrated Learning Cycle 7E model with local wisdom".

Table 3.1 Randomized Control Group Posttest Only design

Class	Treatment	Posttest
Control Class	-	T
Experimental Class	X	T

Note:

X : Treatment using Learning Cycle 7E learning model Integrated with local wisdom

T : Critical thinking skills test in experimental and control classes

The population in this study were students of class X at MAN 1 Padang, class X IPA consisted of 3 classes. The sampling technique in this study was carried out in cluster random sampling. Tests of normality, homogeneity, similarity of means using spss where the results of Kolmogrov Smirnov calculations obtained with Kolmogrov Smirnov Z Asymp. Sig 0.200; 0.200; 0.196 > 0.05. So the data is normally distributed. Based on trimmed mean calculation results obtained with a Sig.0.058> 0.05 value for all variables in the population. So it can be concluded that the variance of all variables is homogeneous or the data is homogeneously distributed. The Anova test results obtained a Sig. value of 0.344> 0.05 so that the data has an average similarity. So that random classes were taken, the sample classes X IPA 2 and X IPA 3 were obtained. The independent variable in this study is the application of the Learning Cycle 7E model Integrated with local wisdom. The dependent variable in this study is the critical thinking skills of students. The control variables in this study are the same material used in accordance with the 2013 curriculum, teachers, learning strategies and the amount of time used are the same and the number and type of questions tested in the two classes are the same.

The instruments used in this study were critical thinking skills tests in the form of written essay tests and lesson plans. After the lesson plan was completed by the author, the next step was to validate the lesson plan which was carried out by a lecturer from the Department of Physics Education (Dewi Juita, M.Pd) and a physics teacher from MAN 1 Padang (Dra. Asnita Luthan, M.P.Fis). The results of the analysis of the lesson plan instrument obtained 84% with the valid category. After making the test grids and answers by the author, the test was validated by lecturers from the Department of Physics Education of UIN Imam Bonjol Padang (Pipi Deswita, M.Pd, Zulpadrianto, M.Si) and physics teacher (Dra. Asnita Luthan, M.P.Fis). The results of the analysis of the test question grids and answer keys with a percentage of validity of 82 valid categories on KD 3.9 Work and Energy questions. After that, the test was carried out to classes outside the sample, the results of which were tested for differentiation, difficulty index, and reliability. The data analysis technique used is the normality test and homogeneity test using SPSS 25. After that, do the hypothesis test using Microsoft Excel.

This research was conducted over four sessions with the following steps: collecting previous semester scores in physics to measure students critical thinking levels before applying the treatment. The treatment involved implementing the Learning Cycle 7E Integrated with Local Wisdom teaching model in the experimental group and providing Discovery Learning in the control group. A posttest was then administered to measure students critical thinking levels and conclusions were drawn for both the experimental and control groups. The final step involved administering a posttest to both groups to determine the difference in students critical thinking skills. This posttest consisted of essay questions in line with the research instrument. After completing the research, data analysis was conducted using data analysis techniques, followed by

hypothesis testing. Finally, all the data was described in the research results and conclusions.

RESULT AND DISCUSSION

The research was conducted in classrooms at MAN 1 Padang, involving two classes sample (Class X IPA 2 and X IPA 3), which were the experimental and control classes using the Randomized Control Group Posttest Only design. The data in this research were limited to the cognitive aspect. Assessment of the cognitive aspect used a critical thinking skills test in physics for students, obtained from the final test on the topic of Work and Energy in KD 3.9.

1. Research Results

Activities in experiments using the Learning Cycle model integrated with local wisdom in class X IPA 2 on KD 3.9 Work and Energy, namely Elicit: In the elicit phase, teachers display images so that students get the initial concepts of physics and are motivated to find answers from these images that can improve students' critical thinking indicators, namely simple explanations, Engage: In this phase students are stimulated by images and can express their opinions because teachers free students to express opinions. So that it can improve critical thinking indicators, namely simple explanations, Explore (Investigate): In this phase students do the practicum well with the LKPD(Student Worksheet) guide given by the teacher. Where learners make previous knowledge to experiment with new knowledge guided by teacher. Learners are able to work together with a group of friends to unite arguments so as to gain new knowledge so as to increase critical thinking indicators, namely strategies and tactics and build basic skills.

Furthermore, Explain: Learners summarize their findings so that learners have the courage to explain to the class the results of the discussion that has been carried out. Learners also ask other groups if there is something they do not understand. In this phase learners improve critical thinking indicators, namely further explanation and conclusion, Elaborate: With this phase learners gain knowledge related to examples of problems in the material taught by teacher, and understand symbols, definitions, physics concepts. Learners are able to solve problems given by educators because educators provide quiz questions so that students understand more. It is in this phase that indicators of building basic skills and further explanation can increase, Evaluate: Learners get evaluation results related to what they have learned. The critical thinking indicator that increases is further explanation. Extend: In this phase learners ask about what they have not understood and know the learning with everyday life. So that students understand more about the material they are learning at that time. Learners increase critical thinking indicators, namely strategies and tactics in this phase.

Implementation of learning in the control class, Syntax of the discovery learning model during research activities conducted in class X IPA 3 on kd 3.9 Work and Energy: Stimulation: At this stage students are stimulated by activities carried out by educators

in front so that they foster curiosity and a sense of confusion that indicators of simple explanations increase, Problem Identification (Problem Statement): Learners identify problems about what they have seen so that learners are confident to summarize assumptions. Learners are free to identify existing problems related to the material that seeks to find their own answers that affect the indicators of building basic skills, Data Collection: Learners collect as much information as possible by using relevant sources, literature, observing objects, conducting trials that increase indicators of strategy and tactics, Data Processing: Learners can interpret the data obtained themselves so that they can think about the answers to existing assumptions, Verification: At this stage learners can carry out careful checks to prove the data or results that have been determined, linked to the results of data processing, the indicator of further explanation increases, Conclusion (Generalization): Learners can draw conclusions from the proof stage, increasing the indicator of concluding.

The results of students' critical thinking skills were obtained through tests given after the completion of one kd or subject matter of learning material for the two sample classes. Each sample class received the same treatment with different materials and times. The test results will be averaged based on the similarity of the treatment obtained from the two treatments given to each sample class. How to get data on the assessment of students' critical thinking skills is by giving a test in the form of essay questions totaling 10 items.

For the results of the posttest of students' critical thinking skills on Kd 3.9 about Work and Energy where eksperimental in class X IPA 2 and control in class X IPA 3 are found in table 4.1 as follows:

Table 4.1 Posttest Results of Critical Thinking Skills on KD 3.9

No	Indicators of Critical Thinking Skills	Question number	Average Percentage of Students' Score	
			Experimental Class (X IPA 2)	Control Class (X IPA 3)
1.	Elementary Clarification	1, 9	86,47	79,85
2.	Building basic skills	2, 3	92,50	91,32
3.	Inference	4, 6	91,47	85,88
4.	Advanced Clarification	5, 7	96,92	87,64
5.	Strategy and tactics	8, 10	96,91	81,21
Total score of all indicators			464,27	425,93
Average Value Per Class			92,8542	85,186
Average Percentage of Critical Thinking Skills			92,85%	85,19%
Category			Excellent	Good

Clarified in the form of a bar chart of the results of critical thinking skills that trigger in table 4.1 as follows:

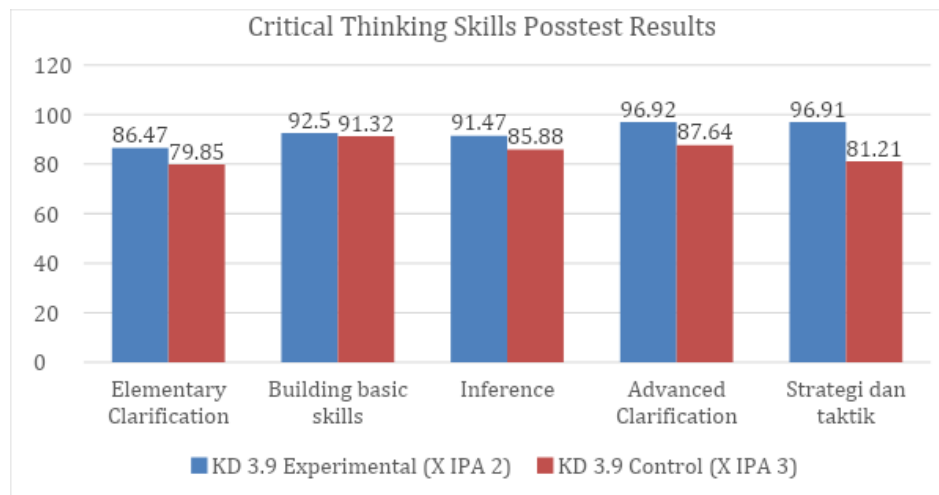


Figure 4.1 Bar Diagram of Critical Thinking Skills Results

The data table 4.1 above shows, if the overall average value of students' critical thinking skills in the knowledge aspect through learning treatment using the Learning Cycle 7E model integrated with local wisdom obtained a percentage value of 92.85 better than the Discovery Learning treatment with a value of 85.19.

To test the hypothesis, the normality test and variance homogeneity test were conducted on the sample class. The sample normality test aims to see whether the sample is normally distributed or not. The normality test was carried out using the Kolmogorov Smirnov Test with the help of the SPSS 25 application, based on the one-sample kolmogorov-smirnov test table above, the experimental class and control class obtained the results of Asymp. Sig. 0.200 and 0.055, meaning that the significance value of the experimental class and control class is > 0.05 so that it is stated that the two sample classes are normally distributed. Homogeneity test is conducted to see whether the sample class has a homogeneous variant or not. This homogeneity test uses the Levene Test with the help of the SPSS 25 application with the criteria: if the sig value. $\text{Levene} > 0.05$ then the data is homogeneous and vice versa. The results of the homogeneity test conducted are listed in the value of Levene Statistics Sig. 0.681 in treatment class XA. This shows the value of $\text{Sig. } 0.681 > 0.05$ then the variance of all variables is homogeneous.

Hypothesis testing was conducted to test the hypothesis on the two correlated sample classes. Hypothesis testing is carried out by fulfilling the conditions namely the sample class must be normally distributed, have a homogeneous variance. Based on the normality test, both sample classes are normally distributed and have homogeneous variances. Hypothesis testing is done to test the hypothesis whether it is accepted or rejected. Hypothesis testing is done with the help of Microsoft Excel application by calculating using the t-test in the form of t-test: two samples assuming equal variances. The testing criteria for the hypothesis are, if the sig value < 0.05 and the tcount $>$ ttable value then H_0 is rejected and H_1 is accepted and vice versa.

The data taken for the hypothesis is the value of the posttest results of students on KD 3.9 Work and Energy material (class X IPA 2 as the experimental class and class X IPA 3 as the control class). Based on the results of the t-test output two samples assuming equal variances on critical thinking skills, the average value of the experimental class is 92.94 and the control class is 85 with a P value ($T \leq t$) one tail on KD 3.9 is 0.01 so that the Sig value is <0.05 and the t stat value (t_{count}) $3.97 > t_{Critical}$ one-tail (t_{table}) 1.67. So according to the basis for decision making in the t-test: two samples assuming equal variances, it can be concluded that in the KD 3.9 material H_1 is accepted and H_0 is rejected so that the application of the Learning Cycle 7E model integrated with local wisdom is better than Discovery Learning on critical thinking skills of class X IPA students at MAN 1 Padang.

2. Research Discussion

Based on the results of research conducted by the author, it can be seen that learning with the Learning Cycle 7E model integrated with local wisdom provides a better average critical thinking skills than Discovery Learning in class X IPA 2 and X IPA 3 at MAN 1 Padang. The results of data description and analysis obtained critical thinking skills of students with the Learning Cycle 7E model integrated with local wisdom are better than Discovery Learning. Assessment of critical thinking skills is done by giving essay questions totaling 10 items. Each question represents an indicator of critical thinking.

According to Ennis (1996) cited by Mariati, (2021) Critical thinking can be seen from several indicators, indicators of critical thinking skills are five groups, namely: 1) Providing simple explanations (such as: focusing questions, analyzing questions, asking and answering questions about an explanation), 2) Building basic skills (such as: considering whether a source is reliable or not, observing and considering an observation report), 3) Concluding (such as: deducing and considering the results of induction, inducing and considering the results of induction, making and determining the value of considerations), 4) Providing advanced explanations (such as: defining terms and considering definitions and three dimensions, identifying assumptions) and 5) Organizing strategies and tactics (such as: determining actions, interacting with others). Critical thinking skills are included in the 21st century skills that students and educators must have (Siddin, 2021).

Based on the evaluation that has been given to students using critical thinking indicators, students obtained higher posttest results in the experimental class than the control class. Students' critical thinking skills can increase by using the Learning Cycle 7E model integrated with local wisdom because both classes are active in learning, focused and happy to work in groups in discussions which means that students are really directly involved in learning.

The advantages of the Learning Cycle 7E model that are felt in research include: Can foster the enthusiasm for learning of students because students are actively

involved in learning, Generate the courage of students in expressing opinions without fear of being wrong, Help develop students' scientific attitudes and make learning more useful and meaningful for students, Can build students' knowledge in their own minds and use it in solving problems, The creation of innovative, creative, conducive and fun learning for students and educators so as not to get bored in which all the people in the class take part in participating in the process of learning activities, Increase the curiosity of students, Students can experiment in finding a concept and thinking and searching for themselves, and can validate material from educators after students get their own information.

The average value of critical thinking skills test results in physics learning using the Learning Cycle 7E model Integrated with local wisdom and Discovery Learning on kd 3.9 Work and Energy of the experimental class (X IPA 2) was 92.85 and the control class (X IPA 3) was 85.19. The results of class critical thinking skills indicators using Learning Cycle integrated with local wisdom and Discovery Learning both get good results. There are several indicators that have a high value, namely in kd 3.9 material work and energy whose indicators of building basic skills get very good scores, namely in the experimental class (92.50) and the control class (91.32). While the indicator provides the lowest simple explanation of the 5 existing indicators, namely the experimental (86.47) and control classes (79.85).

Based on the results of the t-test output two samples assuming equal variances on critical thinking skills, the average value of the experimental class is 92.94 and the control class is 85 with a P value ($T \leq t$) one tail on KD 3.9 is 0.01 so that the Sig value is <0.05 and the t stat value (t_{count}) $3.97 > t_{Critical}$ one-tail (t_{table}) 1.67. So according to the basis for decision making in the t-test: two samples assuming equal variances, it can be concluded that in the KD 3.9 material H_1 is accepted and H_0 is rejected so that the application of the Learning Cycle 7E model integrated with local wisdom is better than Discovery Learning on critical thinking skills of class X IPA students at MAN 1 Padang.

The high average critical thinking skills of students using the Learning Cycle 7E model integrated with local wisdom is due to students being more critical in the initial findings of the material so that they can discuss finding answers to questions or problems related to the material being taught. In physics learning through learning using the Learning Cycle 7E model integrated with local wisdom, students' critical thinking skills increase. When viewed from the results of the posttest critical thinking skills learning using Discovery Learning also get good results. So that educators are free to choose or vary the learning model used in teaching in the classroom.

The results of this study are relevant to previous research conducted by Dewi, Made Paramita, et al; Amalia, et al; Syahidah, Miftah Karimah, et al; Dewi, Ni Puti Sri Ratna, et al showed satisfactory results in each variable that increased using the Learning Cycle 7E model even integrated with local wisdom. (Kamalia & Kustijono, 2018; Lucyana, 2019; Made Paramita Dewi¹, I. B. Surya Manuaba², 2018; Suardana et al., 2018; Syahidah et al., 2017). Nasir's research results also state that the Learning

Cycle 7E model is better than the Group Investigation model so that it can improve students' critical thinking skills. (Nasir, 2017)

CONCLUSION

Based on the average value and hypothesis testing by conducting a t test on kd 3.9, the t stat value (tcount) is $3.97 > t$ Critical one-tail (ttable) 1.67. So according to the basis for decision making in the t-test: two samples assuming equal variances, it can be concluded that in the material KD 3. H1 is accepted and H0 is rejected so that the application of the Learning Cycle 7E model integrated with local wisdom is better than Discovery Learning on critical thinking skills of class X IPA students at MAN 1 Padang. The critical thinking skills of students using the Learning Cycle 7E model integrated with local wisdom are X IPA 2 (92.85%). The results of critical thinking skills indicators of classes using Learning Cycle integrated local wisdom and Discovery Learning both get good results. Indicators of critical thinking skills of students who are still low, namely providing simple explanations on kd 3.9.

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