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THE EFFECT OF THE ECIRR LEARNING MODEL ON STUDENTS' CRITICAL THINKING ABILITY IN CLASS LEARNING ACTIVITIES

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Abstrak: *Penelitian ini bertujuan untuk mengetahui bagaimana model pembelajaran ECIRR (elicit, confront, identify, solve, reinforcement) mempengaruhi kemampuan berpikir kritis siswa terhadap konten gelombang berjalan dan gelombang diam. Desain penelitian kuasi-eksperimental dengan desain kelompok kontrol non-ekuivalen adalah metodologi yang digunakan. Teknik purposive sampling digunakan untuk mengumpulkan sampel. Dengan tingkat signifikansi 5% (α = 0,05) digunakan uji Mann-Whitney U untuk uji hipotesis. Dapat disimpulkan bahwa model pembelajaran ECIRR berdampak terhadap kemampuan berpikir kritis siswa jika temuan uji hipotesis H0 ditolak. Berdasarkan hasil uji N-Gain, N-Gain kelas eksperimen yang berada pada kategori sedang mengalami peningkatan lebih besar dibandingkan N-Gain kelas kontrol yang berada pada kategori rendah. Menurut tanggapan siswa terhadap model pembelajaran ECIRR, mayoritas siswa menyatakan merasa tertarik.*
Kata kunci: model pembelajaran ecirr, kemampuan berpikir kritis, siswa

Abstract: This study's goal was to find out how the ECIRR (elicit, confront, identify, resolve, and reinforce) learning model affected students' ability to think critically about running wave and stationary wave content. A quasi-experimental research design with a non-equivalent control group design was the methodology employed. The technique of purposive sampling was used to collect samples. With a significance level of 5% (α = 0.05), the Mann-Whitney U test is used for the hypothesis test. It can be concluded that the ECIRR learning model has an impact on students' critical thinking abilities if the findings of the hypothesis test H0 are rejected. According to the N-Gain test results, the experimental class's N-Gain, which is in the medium category, increased more than the control class's N-Gain, which is in the low category. According to student responses to the ECIRR learning model, the majority of pupils reported feeling interested.
Keywords: ecirr learning models, critical thinking skills, students

Introduction

Every aspect of life must change to keep up with the times. In the area of education, there is no exception. Students must be highly qualified and competitive in order to serve as the primary initiators in all development areas, according to the educational paradigm of today. The employment of a curriculum that adheres to the 21st century education paradigm, with its emphasis on students' need for the capacity to think and learn, must come after this. The government itself has now implemented the 2013 curriculum, which, if examined from the perspective of content standards, process standards, and assessment standards, includes 21st century skills. This active participation and interaction between students and teachers can improve one of the skills that are needed in the 21st century, namely the ability to think critically (Astuti, 2023).

According to the Division of Assessment and Teaching of 21st Century talents, one of the four categories of 21st century talents is the capacity for critical thought. The fundamental competencies of this critical thinking skill, interpretation, analysis, assessment, inference, explanation (explanation), and self-regulation, are crucial for students to possess. Today's pupils in Indonesia must also possess the ability to think critically (R. Diani, 2019). The scope of learning in the science and technology subject group includes critical scientific thinking, according to Regulation of the Minister of National Education Number 22 of 2006.

The value of teaching critical thinking to kids is negatively correlated to reality. One of them is physics-related. One of the disciplines that helps students develop their critical thinking abilities is physics. That's because physics has a well-defined existence and a measurable quantity. Physics is a subject that is not only about understanding concepts, principles, and facts (Facione, 2015). However, students are also required to have direct experience of how these concepts, principles, and facts occur. With this, students will actively participate in learning and construct and develop their own understanding. As a result, physics may be one of the disciplines that helps pupils enhance their critical thinking abilities. However, in practice, students still have a limited understanding of physics. The outcomes of the science assessments in the Program for International Student Assessment (PISA) activities demonstrate this: The average science score for Indonesian students is 396 out of 489 average scores, placing them 70th out of 79 participating countries.

Additionally, it was determined that 29% of high school students had low critical thinking skills based on the findings of earlier research. Students are not used to honing their critical thinking abilities because of cognitive C4–C6. According to the results of the preliminary survey, learning is still done in a teacher-centred way, with lectures being the mode of choice. The teacher explains the material through PPT, and students only listen to the material explained. This type of learning method makes pupils less engaged in their education, which has an effect on each student's capacity for critical thought (Idris, 2021). Developing students' critical thinking abilities demands a learning model that encourages them to create their own knowledge, even if this is one of the ways to improve students' grasp of physics subjects. In order for students to actively investigate and use science to solve an issue, it is also critical to implement an interactive learning paradigm. The ECIRR model (elicit, confront, identify, resolve, and reinforce) is one that can be applied. The constructivism learning theory, in which pupils create their own prior knowledge, is adhered to by the ECIRR approach (Jusman, 2012).

Five syntaxes make up the ECIRR paradigm, which is known by its acronym: elicit, confront, identify, resolve, and reinforce. The following explanation of the five syntaxes' representation of learning stages is provided: The elicit stage is first. When presented with a problem by the teacher that probes their past knowledge, students are encouraged to think (L. Kurniawati, 2020). The confrontation stage comes next. At this point, the instructor offers debunking inquiries to disprove students' initial beliefs and concept-changing techniques to alter students' beliefs through disequilibrium. Third, identify the stage. Students will be asked to explain the initial conceptions they put forward along with their beliefs or disbelief in their answers at the elicit stage, which can be seen by comparing students' answers at the elicit and comfort stages. Fourth, the resolution stage at this stage, the teacher helps improve student concepts that are still wrong with new concepts found through problems, experiments, or demonstrations that lead to problem solving (Mokodenseho, 2023). The last is the reinforcement stage. The teacher provides reinforcement and reviews students' conceptions at the end of the lesson. Students learning with the ECIRR model are required to construct their own knowledge, not just receive knowledge from the teacher. The ECIRR model also encourages students to defend their ideas, improve concepts, and explain the concepts they have. The ECIRR model is anticipated to be able to motivate students to engage in critical thought when learning a new idea. There is a lot of research on the ECIRR learning model, although most of it focuses on how to use it to lessen students' misconceptions (Nugroho, 2023).

The 4C abilities, including critical thinking, are ones that students must master in the 21st century learning system. The importance of this mastery is that critical thinking skills hone students' abilities to analyse and make patterns from data or problems they have so that they can help in the process of solving them. However, with only 29%, students' critical thinking abilities in physics are still quite low. These kids' poor critical thinking abilities will make it challenging for them to acquire physics information, which will ultimately result in poor student learning results, particularly under the KKM. Additionally, students who have completed their education won't be as competitive in the future. In light of these issues, initiatives must be made to enhance students' capacity for critical thought when studying physics in senior high schools (Parinussa, 2023). The learning process, which does not currently assist the advancement of students' critical thinking skills, is one of many elements that influence students' critical thinking abilities, which are still poor. In this instance, the teacher continues to employ a teacher-centred learning approach, preventing the pupils from participating actively in their education and from engaging in independent exploration. Teachers have also not planned lessons to develop pupils' critical thinking abilities. Using the ECIRR learning model is one option that can be found (A. C. Prastiwi, 2018).

Then, two classes the control class and the experimental class were used to conduct a physics lesson on the topic of traveling waves and stationary waves. A pre-test is administered to both the control class and the experimental class prior to the start of the learning process to assess the students' first critical thinking abilities. The ECIRR learning paradigm was used in the experimental class once the results were obtained to help students develop their critical thinking abilities (Redhana, 2019). The teacher's preferred learning model is applied in the control group. A post-test was then administered to both the control class and the experimental class to assess the students' final critical thinking abilities (M. Wayudi, 2020). The results revealed that the experimental class, which used the ECIRR learning model, had students' final critical thinking abilities improve more than the control class.

Method

This study employed a quasi-experimental research design. In this research method, there are control and experimental groups, but the control group cannot fully control outside factors that influence how the research is carried out. The experimental and control groups were not chosen at random when the non-equivalent control group design was utilized for the study. The purpose of this study's design is to compare the critical thinking abilities of students before and after treatment. Students in class XI made up the population in this study. Purposive sampling, a non-probability sampling approach, was used to select the sample for this investigation. As a result, the class was selected as the experimental class, whereas the other class was selected as the control class. The data that has been obtained is then processed and analysed so that the results can be used to answer research questions and test research hypotheses. Before that, the data was tested first with statistical preliminary tests, namely normality and homogeneity tests. After that, it continued with hypothesis testing and data analysis from student response questionnaires. This data analysis uses IBM SPSS Statistics.

Findings and Discussion

The results of the first ability test scores (pre-test) and the results of the final ability test scores (post-test) are used to determine the students' critical thinking abilities. The same test instrument is used to measure initial and final ability tests based on different parts of critical thinking abilities. The validity, reliability, discriminatory power, and level of difficulty of the critical thinking ability test employed in this study have all been tested and tried out. All 10 questions produced meaningful results and were practicable to use, according to the results of the instrument's testing. The pre-test then uses the questions. The average pre-test scores for the experimental class and control class indicate that pupils' critical thinking abilities are still not very high. The achievement of an average pre-test score in the experimental class of 39 and in the control class of 39.35 out of a possible 100 serves as proof of this. This is consistent with research showing that students still have limited critical thinking abilities.

Initial critical thinking abilities among students are still comparatively weak in the five areas of elementary clarification, fundamental support, inference, advance clarification, and strategy and tactics. In the experimental class, starting student ability was 42.28%, compared to 40.44% in the control group for the component of elementary elucidation. Students have not been able to formulate queries and answers about the concept of stationary waves or regarding the variables influencing the speed of wave propagation in this regard. The average beginning ability of pupils in the control class was 46.32%, but it was 44.85% in the experimental class, when it came to basic support. Students' poor critical thinking abilities in the area of fundamental support are due to their inability to rationally select the variables that influence the speed of wave propagation. In both the control class and the experimental class, the first critical thinking abilities of the students were 46.49% in the area of inference. Because students have not been able to infer and consider the results of inferences regarding the application of free-end stationary waves in daily life, they have low critical thinking skills in the inference aspect. They have also not been able to deduce and consider the results of inductions regarding the relationship between frequency and wavelength in fixed-end stationary waves. In the area of advance clarification, students' initial critical thinking abilities in the control class were 48.03% and in the experimental class were 45.09%. Students' inability to define concepts and take into account the definition of free-end stationary waves is the reason of their poor critical thinking abilities in the area of advance clarification.

Although students' initial critical thinking skills in terms of strategy and tactics in the control class were 16.47% and 17.42%, respectively, the low critical thinking skills of students in terms of strategy and tactics are due to their inability to choose solutions to problems involving moving waves in practical situations, interact with other people to solve problems regarding the physical magnitude of fixed-end stationary waves in real cases, and decide actions to determine the truth or opinion regarding the occurrence of free-end stationary waves in everyday life. Based on the results of direct observation, the teacher's method of teaching is to use the lecture method so that students only listen and only focus on mathematical calculations. This causes students to only focus on memorizing formulas and not understand the concept of material, which results in their inability to deal with conceptual questions in the realm of higher-order thinking. This is also supported by research that has been done before showing that one of the reasons for the low critical thinking ability of students is the learning model used in class, which has not accustomed students to dealing with problems in cognitive domains C4–C6.

Both the experimental class and the control class saw a considerable improvement in the students' overall critical thinking abilities. In comparison to the control class that received treatment using a scientific method, the experimental class that underwent treatment utilizing the ECIRR learning model (Elicit, Confront, Identify, Resolve, Reinforce) received higher post-test average scores. The experimental class scored an average of 69.35 on the post-test, compared to the control class's average of 54.82. The experimental class scored the highest at intervals between 78 and 89, while the control class scored the highest at intervals between 68 and 78, with a 14.53-point difference between the two classes' results. This is due to the fact that the experimental class received instruction using the ECIRR learning model (Elicit, Confront, Identify, Resolve, Reinforce), which allows students to build their own understanding of the material being studied, weigh and maintain their understanding so they can solve the given problem, and thus properly develop their critical thinking skills. In addition, students can also be more confident in constructing their own understanding at the confront and identify stages. That is because at the confront stage, students will get another view of the understanding they have formed, and later in the identify stage, they will reconsider their initial understanding and be trained to solve their own erroneous understandings about the material being studied. At the end of the reinforcement stage, students are given reinforcement regarding the material being studied so that their understanding will be remembered more in the long term. This is consistent with research that states that the identify and reinforce stages can form students' long-term memory.

Both the experimental class and the control class's final critical thinking skills have improved in every way. In the area of elementary clarification, students' critical thinking abilities in the control class were 42.65% lower than those in the experimental class, which were 52.57% higher. This gain can be attributed to students' increased ability to inquire about stationary wave definitions and the variables influencing wave propagation speed and receive responses in return. Students' critical thinking abilities in the experimental class were 88.97% higher than those in the control class in the area of basic support, which was measured at 86.76%. This significant increase occurred because students were able to provide reasons for choosing the factors that affect wave propagation speed. Final scores for students' critical thinking skills in the area of inference in the control class were 63.23%, whereas they were 73.16% in the experimental class. This substantial improvement resulted from students' ability to infer and take into account the conclusions of inferences regarding the relationship between frequency and wavelength quantities on fixed-end stationary waves as well as the application of free-end stationary waves in daily life. Then, in terms of final critical thinking abilities in the area of advance clarification, the experimental class scored 90.19%, compared to the control class's 56.86%. This significant increase occurred because students were able to define terms and consider the definition of free-end stationary waves. Lastly, students' final critical thinking skills in aspects of strategy and tactics in the control class were 51.40% and those in the experimental class were 68.36%. This significant increase occurred because students have been able to decide actions to solve problems regarding traveling waves in real life, interact with other people to solve problems regarding the physical quantities of stationary wave ends in real cases, and decide actions to determine the truth of an opinion about events involving stationary waves in everyday life.

The control class and the experimental class both showed an improvement in critical thinking abilities, as seen by the post-test average scores. The average N-Gain value reveals this. In comparison to the control class, the experimental class has a higher average N-Gain value. The average N-Gain value fell into the medium range for the experimental class, scoring 0.49, and the low category for the control class, scoring 0.25. The experimental class grew by 0.78 points whereas the control class increased by 0.18 points in terms of elementary clarity. Because the ECIRR learning model was used, specifically at the elicit stage, the increase in the experimental class was higher. In order to enhance their capacity to ask and respond to questions, students are required to recall the content they have learned and recognize the challenges that are being presented. This is also consistent with research by Lia Kurniawati et al. (2020), which found that students can learn to make assumptions about a given topic during the elicit stage.

The control class grew by 0.47 and the experimental class by 0.50 in terms of basic support. Due to the application of the ECIRR learning model, the rise in the experimental class was larger, namely at the confront and identify stages. At the confront stage, students are given refutation questions related to their initial answers, and at the identify stage, students are asked to reiterate answers regarding their initial conceptions after receiving a rebuttal question. These two stages are able to develop students' ability to provide logical reasons for the problem given after getting a rebuttal question. This is also consistent with previous research, which states that the confront and identify stages are able to help students give reasons in good and logical language based on known facts.

In terms of inference, the control class increased by 0.29, while the experimental class increased by 0.46. In terms of strategy and tactics, the control class increased by 0.41, while the experimental class increased by 0.60. Due to the adoption of the ECIRR learning model, namely during the resolve stage, the growth in the experimental class in both aspects was higher. Students are asked to fix issues using the provided instructions at this stage. This is able to develop students' ability to solve problems, decide actions to determine the truth with concepts that are correct, and interact with fellow students in the process of solving problems, which can finally provide conclusions in the form of deduction or induction. This is consistent with other research, which indicates that at the resolve stage, pupils are able to record problem-solving techniques and gain the capacity to make judgments based on concepts that are accurate about the knowledge they possess. The control class grew by 0.08 and the experimental class by 0.55 in terms of advance clarity. Due to the application of the ECIRR learning paradigm, namely during the reinforce stage, the growth in the experimental class was greater. Students' ability to create and consider definitions is being developed at this point because they already have an idea that is distinct from the first concept. Research from the past demonstrates that during the reinforcement stage, students use the knowledge they have learned to solve issues in a variety of settings.

The post-test statistical hypothesis test revealed that H1 had been accepted and H0 had been rejected. This statistical hypothesis test indicates that there is a difference between the experimental class and the control class in terms of the overall average of students' critical thinking abilities. With a difference in average score of 14.53, students' critical thinking abilities on average were greater in the experimental class than in the control class. The different approaches taken with these two classes account for the ultimate score discrepancy. The control class learned using a scientific approach, while the experimental class employed the ECIRR learning paradigm (elicit, confront, identify, resolve, and reinforce). Other studies that claim that the ECIRR (Elicit, Confront, Identify, Resolve, Reinforce) learning model can enhance students' mathematical critical thinking abilities support the findings of this study.

The majority of students in the experimental class were eager to feel smarter and learn more about the subject matter by using the ECIRR (Elicit, Confront, Identify, Resolve, Reinforce) learning model to study the information for traveling waves and stationary waves. Almost all students responded favourably to the application of the ECIRR (Elicit, Confront, Identify, Resolve, and Reinforce) learning model in learning materials for traveling waves and stationary waves, as evidenced by the average percentage of student response questionnaires to the application of the ECIRR (Elicit, Confront, Identify, Resolve, and Reinforce) learning model of 81.26%.

Conclusion

According to the results of hypothesis testing using the Mann-Whitney test, which obtained a sig. (2-tailed) value of 0.00, there is an effect of using the ECIRR learning model (Elicit, Confront, Identify, Resolve, Reinforce) on students' critical thinking skills in traveling wave and stationary wave material. The experimental class's post-test average score was higher than the control class'. The control class scored on average 54.82 points, compared to the experimental class's 69.35 points. Students that receive treatment using the ECIRR learning model in the experimental class show an improvement in their critical thinking abilities, which is equal to 0.49, which is in the medium category. Improvements in elementary clarification aspects of 0.78, basic support aspects of 0.50, inference aspects of 0.46, advance clarification aspects of 0.55, and strategy and tactics aspects of 0.60 Almost all students are interested in using the ECIRR learning model for moving wave and stationary wave material, with an average percentage of student responses to the use of the ECIRR learning model of 81.26%. The implementation of the ECIRR learning model requires a relatively long time, so it is recommended that teachers be able to use learning time effectively. In the initial syntax of the ECIRR model (elicit stage), the average student is still passive; therefore, it is necessary to have high teacher creativity in stimulating students to want to actively argue. Implementation of the ECIRR learning model is better done with physics learning materials that are balanced between concepts and mathematics.

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