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Guided Inquiry Learning Model Integrated with Peer Instruction: Its Impact on Grade Xi Students' Critical Thinking Skills in Thermochemistry

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Abstract: This study examines the effectiveness of a guided inquiry learning model integrated with peer instruction in improving students' critical thinking skills. An experimental method employing a randomized control group pretest–posttest design was implemented in two Grade XI MIPA classes at SMAN 2 Tambang. The research instruments consisted of pretest and posttest assessments comprising 25 items developed based on 11 indicators of critical thinking skills. Data were analyzed using inferential statistics. Prior to hypothesis testing, assumptions of normality and homogeneity were examined using the Liliefors and Levene's tests, respectively. Hypothesis testing was conducted using an independent samples t-test to determine differences in critical thinking skills between the experimental group, which received guided inquiry instruction integrated with peer instruction, and the control group, which was taught using a conventional guided inquiry learning model. The significance level was set at α = 0.05. The results indicate that the mean gain in critical thinking skills in the experimental group (54.58) was higher than that of the control group (48.98). The hypothesis testing yielded a t-value of 10.56, exceeding the critical t-value of 1.987 at the 0.05 significance level, indicating a statistically significant difference between the two groups. These findings demonstrate that the guided inquiry learning model integrated with peer instruction is effective in enhancing students' critical thinking skills in thermochemistry. Therefore, this model is recommended for chemistry teachers to improve student engagement and foster higher-order thinking skills in chemistry learning.

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Introduction

Critical thinking skills are essential because they enable individuals to analyze information logically, assess the validity of an argument, and make informed decisions based on evidence and rational reasoning (Puling et al., 2024). In an educational context, critical thinking helps students not only understand concepts in depth but also relate knowledge to real-world situations, solve problems systematically, and resist accepting information without consideration (Husna et al., 2025). This ability is also a key provision in facing the challenges of the 21st century, which is characterized by rapid developments in science and technology, enabling individuals to be reflective, adaptive, and responsible in both academic and social life. Critical thinking skills are part of cognitive abilities, namely, the ability to analyze and understand explanations of acquired knowledge (Nugraha, 2018).

In chemistry learning, critical thinking skills not only play a role in deepening conceptual understanding but are also crucial in developing analytical, evaluative, and solution-oriented mindsets that provide the foundation for solving real-world problems

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(Rahim, 2023). This aligns with the direction of the Independent Curriculum, which emphasizes the importance of developing higher-order thinking skills (HOTS). HOTS-based learning serves to stimulate students to develop critical, creative, and analytical thinking skills through a contextual approach relevant to real-life realities (Gunartha, 2024).

However, in reality, many students in Indonesia, particularly in chemistry, have not demonstrated adequate skills in these areas. Results from national assessments and international studies by Wadhwa, (2018) revealed that most students experience difficulties when working on problems that require the ability to analyze and evaluate information. One cause is the still-dominant teaching method of one-way lectures, where students are merely passive listeners and not actively involved in the scientific thinking process. The findings of Falentina et al., (2020) also, strengthen this condition, which shows that the increase in critical thinking skills after conventional learning was only 8.55%, and most students were not able to achieve a minimum score of 75 in the critical thinking test.

At the high school level, chemistry is a subject that tends to be less popular among most students. Thermochemistry, in particular, is considered difficult to understand. This perception diminishes students' interest in the subject and reinforces their belief that thermochemistry is indeed difficult to learn (K. M. Dewi et al., 2018). Thermochemistry requires conceptual understanding and mathematical skills simultaneously (Aprialisa & Mahdian, 2017). Interviews with chemistry teachers at SMA Negeri 2 Tambang, Kampar Regency, revealed that many students still experience learning difficulties in thermochemistry. This difficulty stems from the material's rich concepts and the complexity of calculations, leading most students to quickly become bored and less interested in learning chemistry. The average student score for thermochemistry is still below the established Subject Level Completion Criteria (KKTP), which is 80. Only about 48% of students successfully achieved completion, while 52% have not yet met this standard. Students' difficulty in achieving grades above the minimum competency standard (KKTP) is due to a lack of curiosity during the learning process. This is evident in their limited ability to explain the material simply. The questions they ask are also basic and indecisive.

During the question-and-answer session, students simply asked and answered questions without attempting to analyze or critically respond to their peers' arguments. Interviews revealed that students did demonstrate signs of critical thinking skills, but these were still at a basic level, limited to providing simple explanations. This situation warrants immediate remedial action by designing more effective and targeted learning.

The implementation of a guided inquiry learning model can be an alternative to help improve students' critical thinking skills. This model provides students with the opportunity to investigate a problem step by step, with focused teacher guidance. This approach allows students to build understanding based on direct learning experiences. Many students actively participate in discussions, not just one or two who dare to ask questions or express opinions (Solikah & Novita, 2022).

The guided inquiry model is also considered more appropriate than other forms of inquiry because students receive guidance from the teacher throughout the learning process but are still given the freedom to investigate, discover, and formulate their own understanding. This way, the learning process becomes more lively, engaging, and able to help students actively develop critical thinking skills. Barriers to the learning process, such as minimal interaction, are often the cause of low student learning outcomes (Amijaya et al., 2018).

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Several previous studies have shown that the guided inquiry learning model has a positive effect on improving students' critical thinking skills. A study conducted by Falentina et al., (2020) found that the implementation of this model can increase students' critical thinking skills by up to 18.75%. Furthermore, studies by Nurdiyah & Yonata, (2022) and Firmanda & Novita, (2022) also indicates that the guided inquiry approach not only encourages active student involvement in the learning process by more than 90%.

Several previous studies have demonstrated that the use of guided inquiry learning models has a positive impact on improving students' critical thinking skills. However, research by Kurniawati & Diantoro, (2014) and Hidayatussani et al., (2020) indicates that even the implementation of guided inquiry still faces obstacles. One such obstacle is the uneven involvement of students in learning activities. This low participation impacts students' difficulty in understanding concepts deeply and honing their critical thinking skills. The relationship between Guided Inquiry (GI) and Peer Instruction (PI) lies in their complementary abilities in facilitating students' critical thinking processes. GI provides a systematic framework for scientific inquiry through the stages of orientation, problem formulation, hypothesis development, data collection, testing, and conclusion drawing under teacher guidance. However, various studies show that the implementation of GI often faces obstacles in the form of uneven student participation, where discussions and high-level cognitive activities tend to be dominated by certain students (Hidayatussani et al., 2020). This situation means that not all students experience optimal critical thinking, even though the learning model used is inquiry-based.

The integration of PI into GI creates synergy by ensuring individual cognitive engagement before group interaction occurs. In PI, students are presented with conceptual questions (concept tests) that must be answered independently before discussing with peers. This stage forces each student to develop a prior understanding and take a position on the problem being studied, thereby reducing the tendency for passive students to simply follow the opinions of their peers (Handriyati et al., 2022). PI strengthens the early stages of GI by instilling individual responsibility for thinking, which lays the foundation for deeper inquiry. Therefore, the combination of GI and PI produces more effective learning in developing critical thinking skills across the board than either approach alone.

This process is further strengthened by the discussion pattern inherent in peer instruction, which begins with individual thinking, followed by pair discussions, and then continues into group discussions. Through this gradual discussion process, students have more time to think critically, evaluate ideas, and deepen their understanding. Moreover, all students become more actively engaged in learning as their curiosity increases. Therefore, the integration of guided inquiry and peer instruction helps students build initial understanding, test its validity, and refine it through interaction with their peers.

These findings align with interviews with chemistry teachers at SMA Negeri 2 Tambang, Kampar Regency. Although learning is conducted by dividing students into groups for discussion, learning activities are still dominated by one or two members of the group, while other members tend to be passive and simply contribute to the group's work. When the teacher asks questions in class, only a few students are willing to answer. The majority of students tend to remain silent, resulting in low class interaction. This condition shows that a learning method is needed that can increase the active involvement of all group members, discuss, exchange opinions, be able to trigger curiosity, increase active participation, and guide students in understanding concepts through a critical thinking process from the beginning of learning.

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To address this issue, it is necessary to integrate guided inquiry learning with other learning methods to be more effective and optimize students' critical thinking skills. One learning method that has the potential to foster student engagement in learning is peer instruction. With the integration of peer instruction, students are given the opportunity to discuss and clarify their understanding through conceptual questions, which fosters mutually supportive collaboration in developing critical thinking skills.

Research conducted by Saputra et al., (2023) shows that peer instruction is more effective than traditional classroom discussions because it encourages each student to think independently before discussing with peers. This results in more focused arguments and reduces the tendency for students to simply follow the dominant opinion. Conversely, many classroom discussions lack independent opinions or initial answers, leading to a tendency to follow the dominant opinion, resulting in less cognitive conflict. A learning process rich in peer discussion can develop critical thinking skills and deepen conceptual mastery in students (Widiastuti & Kania, 2022).

The peer instruction method can be a solution to address low student engagement in the learning process and simultaneously improve students' critical thinking skills. Through peer discussions guided by conceptual questions (concept tests), students are encouraged to think critically and express opinions based on their scientific understanding. When this method is combined with the Guided Inquiry model, it can create a more interactive learning environment, encourage two-way communication, and focus on student engagement at every stage of the learning process.

This study aims to examine the effectiveness of implementing a guided inquiry learning model integrated with peer instruction in improving the critical thinking skills of eleventh-grade students in thermochemistry. Specifically, this study compares the improvement in critical thinking skills between students learning using a guided inquiry model integrated with peer instruction and students learning without this integration. This study was conducted to obtain empirical evidence regarding the role of integrated peer instruction in optimizing student engagement and developing critical thinking skills more equitably in chemistry learning.

The novelty of this study lies in the systematic integration of the peer instruction method into the guided inquiry model as a solution to the limitations of conventional guided inquiry, which still shows unequal student participation. Through stages of independent thinking, pair discussions, and group discussions, each student is encouraged to actively build understanding, present arguments, and critically reflect on concepts. In addition, the application of this model to abstract and complex thermochemical materials provides a new contribution by showing that the integration of peer instruction is effective in improving critical thinking skills in chemical materials that require conceptual understanding and analytical skills simultaneously.

Research Method

This research is an experimental study with a Quasi-Experimental design involving two classes, namely the experimental class and the control class. The experimental class implemented a guided inquiry learning model integrated with peer instruction, while the control class used a guided inquiry model without peer instruction integration. Both classes were given a pretest and posttest on thermochemistry material with the same number of questions and time. The difference in pretest and posttest scores was used to determine the improvement in students' critical thinking skills after the treatment. This research was

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conducted in the eleven grade students of SMAN 2 Tambang, located on Jalan Bupati, Kualu Village, Tambang District, Kampar Regency, Riau Province. The population in this study was all eleven grade students of Mathematics and Natural Sciences at SMAN 2 Tambang in the 2025/2026 academic year, divided into four classes: XI.1, XI.2, XI.3, and XI.4, which constituted the study's target population. The sample in this study was class XI.1 as the experimental class and class XI.2 as the control class. The research instrument was a measuring tool used by the researcher in data collection to ensure systematicity. The instrument used in this study was a student critical thinking ability test sheet. Before used, the students' critical thinking ability test sheet was validated by two expert validators. The validation results showed that the instrument was suitable for use.

The data analysis technique in this study employed inferential statistics, which process data from the research sample and then draw conclusions or estimate the conditions of the broader population. The primary purpose of using inferential statistics is to test the research hypothesis. Prior to hypothesis testing, normality and homogeneity tests were conducted as prerequisites for analysis. The normality test in this study was conducted using the Liliefors normality test by SPSS. This test is used to determine whether two samples come from populations with the same or different distributions. Data are normally distributed if Lmax ≤ Ltable with a test criterion of $\alpha = 0.05$. The homogeneity test is used to determine whether two or more groups of sample data have the same variance and ability (homogeneous). The homogeneity test in this study was conducted using Levene's homogeneity test by SPSS. This test is used to determine whether two samples come from populations with homogeneous variances. Data are homogeneous if $L_{max} \leq L_{table}$ with a test criterion of $\alpha = 0.05$.

Hypothesis testing was conducted using a t-test formula to determine whether the average critical thinking skills of students in the experimental class using the peer-instruction integrated guided inquiry learning model were higher than those in the control class using the non-integrated guided inquiry learning model. The null hypothesis (H_0) is symbolized by there being no significant difference or increase in students' critical thinking skills after the implementation of the peer instruction integrated guided inquiry learning model on thermochemistry material in class XI of SMAN 2 Tambang. The alternative hypothesis (Ha) is symbolized by there being a significant increase in students' critical thinking skills after learning using the peer instruction integrated guided inquiry model on thermochemistry material in class XI of SMAN 2 Tambang. The alternative hypothesis (Ha) is accepted if the t count value < t table, with degrees of freedom (dk) of n1 + n2 – 2 and a significance level (α) = 0.05. If the t count value < t table with other degrees of t value, then the null hypothesis (H_0) is accepted, the alternative hypothesis (Ha) is rejected.

Results and Discussion

Research data testing can be conducted after the prerequisite data analysis tests have been conducted, including normality tests, homogeneity tests, and hypothesis testing. The processing of research data is described as follows:

Results of the Normality Test for Pretest-Posttest Differences

The results of the normality test for the difference in pretest and posttest scores for the experimental and control classes indicate that both classes are normally distributed. The results of the normality test for the difference in pretest and posttest scores are presented in Table 1.

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Table 1. Results of the Normality Test for Pretest-Posttest Differences

Class	N	$\overline{X}$	L_{max}	L_{table}	Description
XI.1	45	54,58	0,1221	0,1321	Normally Distributed
XI.2	45	48,98	0,1156	0,1321	Normally Distributed

Table 1 shows the results of the normality test for the difference in pretest-posttest scores for the experimental and control classes. The pretest and posttest data for the experimental and control classes were normally distributed, as Lmax ≤ Ltable was obtained, which meets the Lilliefors normality test requirement. For normally distributed data, Lmax ≤ Ltable was obtained for the experimental class (0.1221 ≤ 0.132077) and Lmax ≤ Ltable (0.1156 ≤ 0.132077).

Homogeneity Test

The homogeneity test was conducted on a sample of student pretest scores that were normally distributed. The homogeneity test, as a prerequisite for the research, used the normally distributed pretest scores of classes XI.1 and XI.2. Based on the analysis, classes XI.1 and XI.2 showed a homogeneous class pair. After the homogeneity test, class XI.1 was designated as the experimental class and XI.2 as the control class.

Table 2. Results of the Homogeneity Test Analysis of Pretest Values

Class	**N**	**∑X**	$\overline{X}$	F_{table}	F_{count}	F_{table}	F_{count}
XI.1	45	25,07	1.128	1,666	1,064	1,987	-0,92
XI.2	45	26,40	1.188				

Source: Processed Data 2025

Table 2 shows the results of the homogeneity analysis of pretest scores from two classes, namely Class XI.1 and XI.2, which had F count < F table, namely 1.064 < 1.666. Based on the calculation, the t count value lies between -t table and t table, namely -1.987 < -0.92 < 1.987, indicating that both samples can be considered homogeneous.

Hypothesis Test

The hypothesis test uses a right-tailed t-test. The data used for hypothesis testing in this study is the difference between posttest and pretest scores, as this difference indicates a significant increase in students' critical thinking skills before and after learning thermochemistry material with the application of the guided inquiry learning model integrated with peer instruction and the application of guided inquiry. The results of the hypothesis testing analysis are presented in Table 3.

Table 3. Results of Hypothesis Test Analysis

Class	**N**	**∑X**	$\overline{X}$	t_{table}	t_{count}	**Description**
Experiment	45	2.456	54,58	1,987	10,56	Hypothesis accepted
Control	45	2.204	48,98			

Source: Processed Data 2025

Table 3 shows the results of the improvement in critical thinking skills. The calculation obtained t = 10.53, while the t table obtained with a probability of 1 - α with α = 0.05 and df = 88 is 1.987. It can be seen that t = t table, namely 10.56 > 1.987, which means Ha is accepted and H0 is rejected. Thus, there is an increase in students' critical thinking skills after implementing the guided inquiry learning model integrated with peer instruction on thermochemistry material for class XI SMAN 2 Tambang.

The increase in critical thinking skills is known based on the difference between posttest and pretest scores analyzed through hypothesis testing. The analysis results show that the t value of 10.56 > t table of 1.987 with degrees of freedom (df) = 88. The t value > t table, indicating that Ha is accepted and H0 is rejected. This statement shows that there is an

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increase in students' critical thinking skills using the peer instruction integrated guided inquiry learning model which is greater than the increase in students' critical thinking skills using the guided inquiry learning model alone.

Furthermore, the improvement in students' critical thinking skills can also be seen from the average pretest-posttest difference between students. The average score for the experimental class was 54.58, while the average score for the control class was 48.98. The difference in average scores between the two classes was 5.6. The critical thinking skills of the experimental class were higher than those of the control class. Therefore, it can be concluded that the implementation of the guided inquiry learning model integrated with peer instruction can improve students' critical thinking skills in thermochemistry for grade XI students at SMAN 2 Tambang.

The improvement in critical thinking skills in the experimental class was higher than in the control class. The difference in results between the experimental and control classes was due to the integration of the peer instruction method into the guided inquiry model in the experimental class, while the control class only implemented guided inquiry without integration of this method. In the control class, students continued to follow the six stages of inquiry: (1) orientation, (2) formulating problems or questions, (3) formulating hypotheses, (4) collecting data, (5) testing hypotheses, and (6) drawing conclusions. However, the problem-solving and discussion process was carried out directly in groups by students seeking information related to the given problem together without going through several stages such as individual thinking, pair discussion, and group discussion, which are stages of the peer instruction method. Discussions in the control class were more dominated by several active students, while other students tended to be passive and only followed the results of the group discussion.

The absence of a gradual clarification process limits interaction between students, resulting in less than optimal opportunities to express opinions, respond to peers' arguments, and refine their own understanding. This aligns with research by Shandra & Movitaria, (2022), who stated that the implementation of the guided inquiry model does not make all students active in learning activities. Many students remain passive, both in completing worksheets and during group discussions. This condition results in learning activities being dominated by only a few active students, while others tend to follow along without participating. Furthermore, research conducted by (Sunti et al., 2022), which compared the Think Pair Share learning model with guided inquiry, showed that in the guided inquiry model, discussion activities tended to be dominated by a few students who were more active in solving problems, while others remained passive. This condition was evident throughout the learning process, where student involvement was uneven in each group activity.

In contrast to the control class, students in the experimental class implementing the guided inquiry model integrated with peer instruction demonstrated more active, focused, and reflective engagement. In this learning, students not only follow the six stages of guided inquiry, but also undergo a gradual discussion process, starting from individual thinking, discussing in pairs, to discussing in groups. Students are given the opportunity to solve problems independently first, with the aim that all students can express their own ideas in solving the problem before finally discussing in pairs and groups that make all students have the same responsibility in solving the problem and are given the opportunity to think independently first before exchanging opinions.

This allows students more time to think and makes them more active as their curiosity grows. This gradual discussion pattern helps each student build initial understanding, then

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test and refine it through interactions with peers. Therefore, the peer instruction method encourages students to express opinions, respond to peers' arguments, and provide logical reasons for their chosen answers. This process of mutual clarification and exchange of opinions helps strengthen their ability to analyze information, assess evidence, and draw conclusions, which are the core of critical thinking. This aligns with research by Julianti et al., (2019) that found that the use of a guided inquiry model integrating peer instruction can improve students' argumentation skills in terms of making statements, presenting data, and making connections.

The combination of the guided inquiry model and the peer instruction method creates a more collaborative learning environment in the experimental class and supports the development of critical thinking skills. Students not only understand concepts but are also given more time to think, respond, work independently, and exchange ideas with others to solve problems. Through the question-and-answer process and peer discussion, students are encouraged to think reflectively and logically in solving the problems they face. This is what causes the increase in critical thinking skills of students in the experimental class to be more significant compared to the control class. These results indicate that the integration of peer instruction in guided inquiry is effective in creating meaningful learning interactions and fostering critical thinking skills in students. This is in line with the results of research by Dewi et al., (2020) which stated that the implementation of the guided inquiry model integrated with peer instruction in the experimental class has a positive effect in the form of increased critical thinking skills in students.

In the first stage of learning, the orientation phase, students are introduced to contextual problems through a presented discourse. This presentation of problems motivates students to think critically in devising answers to the questions posed. Next, they are given conceptual questions to answer individually, followed by comparing and discussing their answers in pairs to identify differing perspectives. This activity trains students to understand the core of the issues presented and focus on important points (an indicator of critical thinking skills: focusing on questions). During pair discussions, they challenge each other's reasoning for their answers, assess the strengths and weaknesses of arguments (an indicator of critical thinking skills: analyzing arguments), and practice providing logically reasoned responses (an indicator of critical thinking skills: asking and answering questions).

Through this process, students are encouraged to make decisions about the answers they deem most appropriate (an indicator of critical thinking skills: determining actions). Thus, the orientation phase not only introduces the problem but also fosters critical thinking skills from the beginning of the lesson. This is in line with the findings of Sarifah & Nurita, (2023) and Syaifuddin & Martini, (2025) which show that at the orientation stage the teacher presents problems in the LKPD which will increase critical thinking indicators by providing simple explanations, namely focusing on questions, analyzing arguments, and asking and answering questions.

The peer-instructed, guided inquiry learning model significantly impacts students' critical thin king skills. After the material presented to students at each meeting was completed in the two classes, a posttest was administered. The purpose of the posttest was to determine whether it had an impact on students' knowledge after receiving the material. Students' posttest scores were then compared with their pretest scores. The test used was a T-test using the pretest-posttest difference data.

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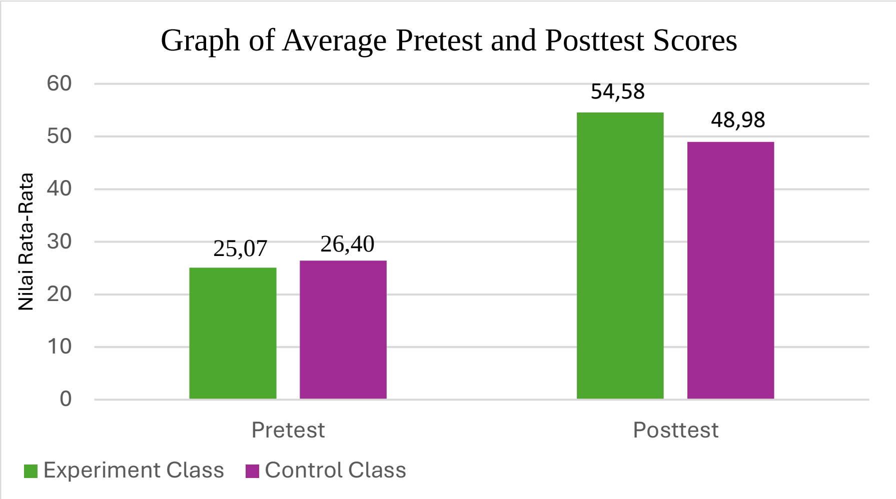

Figure 1. Graph of the average pretest and posttest scores of the experimental and control classes

The graph in Figure 1 shows an increase in critical thinking skills after the implementation of the peer-instructed, guided inquiry model in the experimental class. This improvement in critical thinking skills was due to students' improved conceptual understanding and learning outcomes. This is because the model combines the positive aspects of integrated peer-instruction learning. A positive aspect of integrating peer instruction is that students go through a gradual discussion process, starting with individual thinking, pair discussions, and group discussions. This encourages each student to understand the material, express their opinions, and reassess their understanding through interactions with their peers.

The findings of this study also have conceptual implications for understanding the mechanisms by which critical thinking skills develop in chemistry learning. The results indicate that improvements in critical thinking skills are influenced not only by investigative learning models but also by the sequence and structure of cognitive interactions experienced by students during the learning process. According to Dewi et al., (2020) the integration of peer instruction in guided inquiry confirms that critical thinking skills develop optimally when students are given the opportunity to test their own understanding, compare it with the views of others, and reconstruct concepts through scientific dialogue. This reinforces the view that critical thinking is the result of a reflective and dialogical process, not simply an individual activity (Fithriyah & Isma, 2024).

Furthermore, this study extends the conceptual framework of Higher Order Thinking Skills (HOTS) by showing that the integration of peer instruction serves as a bridge between lower-order and higher-order cognitive activities (Julianti, Azhar, Nasir, et al., 2019). The independent thinking stage encourages initial understanding and simple analysis, while peer discussion triggers argument evaluation and concept synthesis. Thus, this finding confirms Fanani, (2018) research findings that HOTS can be developed gradually through systematic and structured learning design, as suggested in the revised Bloom's taxonomy framework and 21st-century learning.

This research contributes to collaborative learning models in science, particularly in the context of chemistry learning, which is abstract and mathematical. The integration of peer instruction into guided inquiry creates learning conditions that encourage productive cognitive conflict, where differences in answers and arguments between students trigger

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higher-order thinking processes. This finding aligns with cognitive conflict theory, which states that differences in understanding can be an effective means to deepen conceptual mastery and critical thinking skills (Pahriah & Hendrawani, 2019).

Furthermore, the results of this study emphasize that the teacher's role in inquiry learning needs to be positioned as a facilitator of cognitive dialogue, not merely a provider of procedural guidance. Teachers not only direct the inquiry process but also play a role in designing conceptual questions, facilitating discussions, and ensuring that each student is involved in the process of scientific thinking and argumentation. Conceptually, this shifts the paradigm of inquiry from merely an activity of discovering concepts to a structured social-cognitive process, which significantly supports the development of critical thinking skills.

Conclusion

Based on the results of the analysis and discussion, it can be concluded that the implementation of the integrated guided inquiry learning model peer instruction is effective in improving students' critical thinking skills in thermochemistry material for class XI of SMAN 2 Tambang. This is indicated by the results of the t-test which obtained a t-value of 10.56 which is greater than the t-table of 1.987 at a significance level of 0.05. This learning model places students as the center of learning activities through the process of independent concept discovery with teacher guidance and gradual discussions that include individual thinking, pair discussions, and group discussions, thus encouraging conceptual understanding, courage to express opinions, and reflection on the understanding they have.

Recommendation

Based on the conclusions obtained, the researcher recommends that the integrated peer instruct ion guided inquiry learning model can be used as an alternative to be applied in the general learning process and specifically in chemistry learning to improve students' critical thinking skills. Based on the findings of this study, chemistry teachers are advised to implement a guided inquiry learning model integrated with peer instruction as an alternative learning strategy to improve students' critical thinking skills, particularly in complex and abstract chemistry topics such as thermochemistry. This model encourages the active involvement of all students through independent thinking, pair discussions, and group discussions, thereby reducing the dominance of certain students and creating equitable learning participation in the classroom.

Furthermore, teachers need to design conceptual questions that require analysis and evaluation, and manage learning time effectively at each stage of the activity. Teachers are expected to act as active facilitators by monitoring discussions, providing conceptual reinforcement, and encouraging passive students to engage in the learning process. Through continuous reflection and evaluation of learning, teachers can adjust learning strategies so that the integration of peer instruction within guided inquiry can be optimally applied to various other chemistry topics.

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