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Instructional Management Based on the Think-Talk-Write Model to Enhance Students' Critical Thinking Skills

Hasiyatiningsih
Sekolah Tinggi Agama Islam Cendekia Insani Situbondo, East Java, Indonesia
Email : ningsihhasiyati1@gmail.com

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**Corresponding Author*

ABSTRACT

Evaluating the performance of construction consultants is crucial to the success of a project, particularly in ensuring adherence to quality, budget, and timeline. To examine the factors influencing stakeholder satisfaction, this study combines Importance-Performance Analysis (IPA) with SmartPLS-based Partial Least Squares Structural Equation Modeling (PLS-SEM). A poll of respondents with prior experience in building projects was used to gather data. The findings indicate that, although the constructed structural model is reasonably solid (R^2 = 0.790), factors such as professionalism, communication, quality control, project management, and support have not demonstrated a significant impact on the perceived significance of the consultant's job. This result implies that data-driven performance improvement techniques are required to enhance consultants' involvement in building projects. The findings of this study highlight the importance of integrating data-driven performance improvement techniques into educational programs for construction management. By emphasizing professionalism, communication, project management, and quality control, educational institutions can better prepare future construction consultants to meet stakeholder expectations and improve their contributions to building projects.

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INTRODUCTION

In today's globalized era, technological advancement, especially in communication, has transformed how individuals access, interpret, and respond to information. These shifts require individuals not only to adapt but also to possess critical 21st-century skills such as creativity and problem-solving. These abilities are crucial because individuals constantly face various problems in daily life that require thoughtful and innovative solutions. (Efuansyah & Wahyuni, 2021; Purwita et al., 2020; Suningsih et al., 2023). Furthermore, the flood of information in the digital age demands critical thinking to differentiate between valid and misleading content. Not all information encountered is accurate or

constructive; many are biased or even harmful (Arockia Selvi & Hema, 2023; Rahmawati et al., 2021). Therefore, education must respond by equipping students with intellectual tools that allow them to reason, question, evaluate, and make informed decisions. This research addresses the urgent societal need for educational innovations that foster critical thinking as a core competence for lifelong learning and responsible citizenship.

Despite the recognized importance of critical thinking, many students across different educational levels still struggle to develop it effectively. One major contributing factor is the traditional approach to teaching, which often emphasizes memorization over analytical reasoning. In many schools, instructional methods remain teacher-centered, leaving students with limited opportunities to explore, question, and collaborate meaningfully in solving real-world problems (Rizkiyah, 2024; Widiasari, 2024). As a result, students are not adequately trained to evaluate information, express arguments, or propose creative solutions to complex issues. Moreover, educational practices in certain regions, mainly rural or underserved areas, face challenges such as a lack of resources, insufficient training in student-centered learning models, and low engagement strategies in science and other critical subjects. These systemic issues hinder the cultivation of higher-order thinking skills {Formatting Citation}. Thus, there is a critical need to rethink and restructure learning management practices in classrooms to foster an environment that prioritizes students' cognitive development and empowers them to be independent thinkers.

An example of this issue can be observed at SDN Bercak 1, located in Cermee District, Bondowoso Regency. Based on an interview with Mr. Mahfud on Monday, January 8, 2018, at 09:00 in a Grade III classroom, it was revealed that the current science instruction lacks variety in learning models that could encourage students to understand concepts through problem-solving. The dominant use of conventional methods limits student engagement and contributes to low levels of critical thinking. The teacher-centered approach also leaves students less motivated and less curious, which in turn negatively impacts their academic achievement, particularly in science (Abdullah, 2024; Umar & Khaer, 2024). The observed phenomenon suggests that classroom learning often follows routines with limited opportunities for inquiry, discussion, or reflection, key components of critical thinking. Consequently, there is a pressing need to enhance the learning process through more interactive and student-centered models that enable students to actively explore scientific concepts while developing essential cognitive skills.

Various researchers have emphasized the importance of integrating learning models that support the development of critical thinking. According to Jali (2025), critical thinking is a form of reflective and productive thinking that

involves evaluating evidence. He argues that critical thinking is essential for problem-solving, decision-making, and drawing reasonable conclusions based on multiple possibilities. Moreover, Wahyana in Khoiroh et al. (2024) asserts that science (IPA) plays a crucial role in teaching students to think critically and creatively. Science is not just about acquiring knowledge, but also about training the mind to question, analyze, and synthesize information. Bali & Heru (2024) support this by stating that science education is fundamental in developing innovative and analytical thinking. However, many studies have focused primarily on content mastery rather than examining the instructional management approaches necessary to cultivate such cognitive skills in classroom settings.

Several educational studies have proposed the use of cooperative and interactive learning models to improve student engagement and cognitive performance. Models such as Problem-Based Learning (PBL), Group Investigation (GI), and Active Knowledge Sharing (AKS) have shown promise in promoting active participation and critical discourse among students (Aziz et al., 2025; Herlina, 2024; Muhsarrof et al., 2025). However, these models often lack emphasis on systematic instructional management and integration with daily classroom routines. Previous research often overlooks the holistic planning, execution, and assessment of learning activities to ensure the continuous development of critical thinking skills (Lo, 2021; Muhaini et al., 2023). Additionally, there is a gap in research on combining structured models, such as Think-Talk-Write (TTW), with instructional leadership and classroom management to enhance student thinking (Kusuma et al., 2021; Sari et al., 2020). Therefore, a comprehensive study is needed to explore how the TTW model can be effectively managed and integrated into the teaching-learning process to maximize its potential in shaping students' critical thinking and learning outcomes, particularly in science education.

This study offers a novel contribution by combining instructional management principles with the Think-Talk-Write (TTW) model to enhance students' critical thinking in science learning. While many studies have investigated TTW as an effective learning strategy, few have examined how it can be structured and managed systematically within the classroom environment. The research positions TTW not merely as a method but as part of a broader instructional system involving planning, implementation, and evaluation. This integrated approach ensures that the model becomes sustainable and impactful over time. The novelty also lies in applying this model to elementary science education, an area where critical thinking skills are often underdeveloped due to age-appropriate limitations and rigid curriculum delivery. By focusing on both the pedagogical model and its instructional

management, this research addresses a crucial gap in both theory and practice, offering scalable insights for educators and school leaders seeking to implement character-based and inquiry-oriented learning in elementary classrooms.

Based on the background information above, the central research question is: How can instructional management based on the Think-Talk-Write model enhance students' critical thinking skills in science learning? This study argues that the systematic application of TTW through effective instructional planning, classroom structuring, and reflective assessment can significantly enhance students' ability to think critically, solve problems, and engage meaningfully in science education. The research contributes to the educational field by providing an evidence-based instructional framework that can guide teachers in implementing active learning with clear managerial practices. It emphasizes that critical thinking is not merely an outcome of using innovative models but a result of deliberate and managed learning experiences that are learner-centered and cognitively challenging. This research aims to develop a strategic model for classroom instruction that aligns curriculum, pedagogy, and assessment to build 21st-century competencies in elementary students.

This study aims to develop and evaluate a learning management model based on the Think-Talk-Write (TTW) approach to improve critical thinking skills of elementary school students in science lessons. The original contribution of this study lies in the application of TTW adapted to the science curriculum in elementary schools, which has not been widely discussed in the literature. This study not only explores the theoretical basis of TTW but also provides a practical framework for its implementation in the classroom, making it relevant for teachers and curriculum developers. This approach introduces the combination of cognitive engagement with collaborative dialogue and in-depth reflective writing, which is expected to facilitate more active learning and the development of higher-order thinking skills in students. This study offers a framework that can be applied across contexts and fields of study, supporting educational innovation more broadly. Thus, this study has the potential to transform traditional learning environments into more reflective spaces and encourage lifelong learning.

RESEARCH METHOD

This study uses a quantitative approach with a quasi-experimental method (quasi-experiment) as its main design (Buonanno et al., 2020). Quasi-experiments were chosen because they allow researchers to compare two groups, namely the experimental group and the control group, even without complete randomization. According to Abigail Soesana (2023), this design still involves a control group but is not fully able to control external variables that may affect the

study's results. This design is considered relevant in the context of school learning because it allows researchers to intervene in real classroom situations without having to drastically change the class structure. This study aims to investigate the differences in students' critical thinking skills in science subjects using two different learning models: Group Investigation (GI) and Active Knowledge Sharing (AKS). This research was conducted at SDN Bercak 1, Cermee District, Bondowoso Regency.

The research subjects consisted of two classes that had been selected based on relatively homogeneous academic ability levels. The experimental class received treatment using the Group Investigation learning model, while the control class used the Active Knowledge Sharing learning model. Class selection was conducted purposively, taking into account practical considerations and data availability. This study was conducted in several stages, beginning with the provision of learning treatment during multiple meetings and concluding with the implementation of a final test (posttest) to measure the improvement in students' critical thinking skills. The primary purpose of this procedure is to compare the effectiveness of the two learning models in terms of learning outcomes and students' critical thinking skills in science subjects.

The data collection techniques employed in this study comprise three primary methods: tests, documentation, and observation. Tests are used to measure students' critical thinking skills after they have received learning treatment. The test used is a multiple-choice test that is arranged based on indicators of critical thinking skills. The test is conducted after learning is complete (posttest) to determine the effect of treatment on concept mastery and improvement of critical thinking skills. Test validity is considered to ensure that the instruments used accurately measure the intended abilities. In addition, documentation data is also used to obtain additional information regarding student conditions, academic grade history, and group division based on ability. This data helps researchers in grouping students heterogeneously during learning.

Observation is used to directly observe the learning process that takes place in the classroom. According to Ratna (2021), observation is an activity carried out using the five senses to record facts objectively. In the context of this study, the researcher acted as a passive observer, present in the class without interfering in the learning process. Observations were conducted both formally and informally to obtain a factual picture of the implementation of the learning model, student participation, and teacher performance in managing the class. The results of this observation were used as supporting data to assess whether the learning model used encouraged students' critical thinking activities in a real and consistent manner during the learning process.

The data obtained from the posttest results were analyzed using the independent sample t-test statistical test technique. This test was used to determine the differences in students' critical thinking skills between the experimental group, which used the Group Investigation model, and the control group, which used the Active Knowledge Sharing model. The analysis was conducted by comparing the average posttest scores of the two groups to determine whether a statistically significant difference existed. The use of this t-test is relevant because the two groups are independent and have different treatments. The results of this analysis are expected to provide empirical evidence on the effectiveness of the learning model in improving students' critical thinking skills, particularly in the context of science learning in elementary schools.

The statistical formula the author uses for hypothesis testing is the independent t-test. While the formula is as follows:

$$t_{1-2} = \frac{\overline{X}_1 - \overline{X}_2}{\sqrt{\left[\frac{SD_1^{\,2}}{n_1 - 1}\right] + \left[\frac{SD_2^{\,2}}{n_2 - 1}\right]}}$$

X1 = Sample Average 1
X2 = Sample Average 2
SD1 = Standard deviation of group 1
SD2 = Standard deviation of group 2
n1 = number of samples in group 1
n2 = number of samples in group 2

To test the significant difference in t-test by comparing it with the T-table at a significant level of 5% through the following provisions:

a. The working hypothesis is accepted if the t-test ≥ t-table
b. The working hypothesis is rejected if the t-test ≤ t-table

RESULT AND DISCUSSION

Result

The Effectiveness of the Group Investigation and Active Knowledge Sharing Learning Models on Enhancing Critical Thinking Skills of Elementary School Students

In this study, the researcher conducted the study in four meetings. The implementation of experimental class learning from 26 to 28 April 2018 using the Group Investigation learning model RPP. About the results of students' critical thinking skills using the Group Investigation learning model for class III.At SDN Bercak 1, Cermee District, Bondowoso Regency, with the highest score of 100 and

the lowest score of 55. From these data, the average score was 82.75, the median was 87.5, the mode was 90, and the standard deviation was 12.822.

The control class learning was conducted in 2 meetings. The implementation of control class learning using the Active Knowledge Sharing learning model RPP. It is known that students' thinking skills are improved using the Active Knowledge Sharing learning model for class III. At SDN Bercak 1, Cermee District, Bondowoso Regency, with the highest value of 100 and the lowest value of 55. From these data, the average value is 78.5, the median is 80, the mode is 80, and the standard deviation is 10.64993. In the Validity test, each question item is said to be valid if the r (point biserial) of the observation results is positive and is 0.3120 or above. The following are the results of the validity test analysis, namely the results of the validity test on the question items with 20 questions. It can be said that all statements are valid, because they have a calculated r value greater than the r table above of 0.3120.

After conducting the validity test, the author conducted a reliability test. The reliability test shows an understanding that an instrument is reliable enough to be used as a data collection tool because the instrument is good enough. In calculating the reliability of the instrument, the researcher used the formula with KR-20 to find the reliability of the instrument, whose score is in the form of a scale. Based on the calculation using the formula with KR-20, the reliability value is 0.934, with all reliability indices greater than 0.70, so it is stated as reliable with high criteria.

Comparison of Critical Thinking Skills in Science Subjects: A Study of the Group Investigation and Active Knowledge Sharing Learning Models

In this study, we will look at how big the difference is in students' critical thinking skills using the Group Investigation and Active Knowledge Sharing learning models in the science subject of class III SDN Bercak 1. It is known that tcount = 3.7271> ttable = 2.02439, thus it can be concluded that there is a critical thinking ability of students using the Group Investigation and Active Knowledge Sharing learning models in the science subject. The following table shows the results of the differences in students' critical thinking skills using the Group Investigation and Active Knowledge Sharing learning models in the science subject.

Table 1. Differences in students' critical thinking skills using the Group Investigation and Active Knowledge Sharing learning models in the science subject

No	Components	Learning model	
		GI	AKS
1	Average	82,75	78,5
2	Lowest Score	55	55
3	Highest Score	100	100
4	Median	87,5	80
5	Mode	90	80
6	Standard Deviation	10,761	10,64993

Table 1. presents the differences in students' critical thinking skills when using the Group Investigation (GI) and Active Knowledge Sharing (AKS) learning models in science subjects. The average scores show that students in the GI group (82.75) performed slightly better than those in the AKS group (78.5), suggesting that the GI model may have a small advantage in enhancing students' critical thinking skills. The lowest score for both models is 55, indicating that there is a similar range of performance at the lower end of the spectrum in both groups. The highest score for both models is 100, which shows that some students in both groups were able to achieve the highest level of performance.

The median score for the GI group (87.5) is higher than that of the AKS group (80), further supporting the observation that the GI model might result in better overall performance. Additionally, the mode for the GI group is 90, which is higher than the AKS group's mode of 80, suggesting that more students in the GI group scored higher marks than those in the AKS group. Both groups exhibit similar variability in their scores, as indicated by the standard deviation. The GI group has a standard deviation of 10.761, while the AKS group has a standard deviation of 10.64993. This indicates that there is a similar spread of scores in both groups, and the level of consistency in students' performance is comparable for both learning models.

In conclusion, the Group Investigation learning model appears to have a slight advantage over the Active Knowledge Sharing model in terms of average performance and the overall spread of students' critical thinking scores. However, the differences in the data are relatively small, suggesting that both models are effective in promoting critical thinking skills in science subjects.

Enhancing Critical Thinking and Problem-Solving Skills in Science Education Through Student-Centered Learning Models

Teachers play a crucial role in guiding the teaching and learning process, ensuring that it is both effective and engaging. Educators need to create an environment that not only captures students' interest but also motivates them to

actively engage with the subject matter. When students find the learning process enjoyable and meaningful, they are more likely to develop a desire to learn and explore the topics further. The teacher's guidance should focus on making the subject matter relevant and stimulating, so that students feel compelled to understand and appreciate the learning materials presented to them.

The ultimate goal of science education is to cultivate critical thinking, logical reasoning, and systematic problem-solving skills in students. These skills are necessary not only in scientific fields but also in other areas of life, enabling students to approach challenges in an objective, honest, and disciplined manner. Science learning should go beyond memorization of facts, encouraging students to think critically and analyze problems from various angles. By developing these cognitive skills, students can become more effective problem solvers and better equipped to navigate both academic and real-world situations.

Learning models should be selected based on their ability to engage students in the discovery process, allowing them to explore science concepts independently and collaboratively. By using student-centered approaches, such as inquiry-based learning, students can connect theoretical knowledge to real-life experiences. This hands-on approach not only enhances understanding but also empowers students to take ownership of their learning and make meaningful connections between their classroom experiences and the world around them.

Discussion

The results of this study indicate that the Group Investigation (GI) learning model is more effective in improving students' critical thinking skills compared to the Active Knowledge Sharing (AKS) model. This finding is in line with the opinion of Jusniani et al. (2020), who emphasized that GI is a cooperative learning model that actively involves students in planning, reviewing, and presenting material through group investigations. These investigative activities encourage students to think more deeply, creatively, and systematically. This result is also supported by Rahmawati et al. (2020), who stated that GI can foster a sense of responsibility and strengthen critical thinking skills through structured group work. This finding demonstrates consistency between theory and practice, where active involvement and individual responsibility within the group encourage the development of more intensive, reflective, and analytical thinking processes.

On the other hand, the AKS model also makes a positive contribution to learning, although the results are not as large as GI in terms of improving critical thinking skills. This model provides space for students to share knowledge and develop social attitudes through group discussions. This is in line with Efuansyah & Wahyuni (2021), who explained that AKS can be used as a strategy

to introduce material, build social interaction, and evaluate students' prior knowledge. However, in the context of developing critical thinking, GI is superior because it emphasizes a complex investigation process, while AKS emphasizes strengthening understanding through sharing and assistance between students. This difference indicates that critical thinking skills are more optimally honed in challenging situations and encourage in-depth exploration, such as those offered by GI.

Theoretically, this study strengthens the argument that active learning based on collaboration can improve students' high-level thinking skills. Group Investigation as an approach based on investigation and group responsibility can encourage students to reflect, test ideas, and make decisions systematically (Listiana et al., 2020; Purwita et al., 2020; Sain, 2025). This finding expands the theoretical basis in cooperative learning by showing that the structure of roles and involvement in GI makes a real contribution to students' cognitive development. In the context of science learning, this approach is very relevant because it is in accordance with the nature of science, which demands a process of inquiry, observation, and analysis.

The practical implications of this study are very important for teachers and education managers. Teachers need to consider using the GI model in designing learning that encourages students to think critically, especially in analytical subjects such as science (Febriyanti, 2024; Hina, 2024; Putri, 2023). In its implementation, teachers need to equip students with collaborative skills and manage group dynamics effectively so that the investigation process runs optimally. On the other hand, the AKS model can still be used as a complementary strategy that strengthens social interaction and sharing of understanding between students. Both models can be used flexibly depending on the learning objectives to be achieved. Thus, the results of this study not only prove the effectiveness of GI compared to AKS in improving critical thinking skills but also provide insight into how proper learning management can affect students' cognitive achievements.

The difference in results shows that not all active learning models have the same impact on certain types of abilities. Therefore, teachers and schools need to map learning needs specifically and choose a model that suits the competencies they want to develop. This study also opens up opportunities for the development of a hybrid model that integrates the strengths of GI and AKS to create more adaptive, collaborative learning, and encourages the formation of critical thinking characters as a whole.

CONCLUSION

This study shows that the implementation of a learning management model based on the Think-Talk-Write (TTW) approach can significantly improve the critical thinking skills of elementary school students in science lessons. The main lesson learned is that by involving students in the process of thinking, speaking, and writing, they can develop better analytical, evaluation, and problem-solving skills. This not only improves conceptual understanding but also encourages students to become more independent and reflective learners. The main contribution of this study is the development of a TTW learning model that can be widely applied, providing practical guidance for teachers, curriculum developers, and school administrators to create a more interactive learning environment and focus on the development of higher-order thinking skills.

However, this study has limitations in that the sample is limited to elementary school students in science lessons, which requires further research to explore the application of the TTW model in various subject contexts and other educational levels. Future research can expand the number of samples to produce more representative findings and dig deeper into the external factors that influence the effectiveness of the TTW model in learning. Further research could also examine the long-term impact of this approach on the development of students' critical thinking skills across disciplines.

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