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Comparing team accelerated instruction and jigsaw in mathematics: Effects on students' learning interest and computational thinking skills

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ABSTRACT

Background: Enhancing students' learning interest and computational thinking skills has become a critical objective of 21st-century education. Nevertheless, conventional instructional approaches often fail to optimally develop these competencies, necessitating the implementation of more effective cooperative learning models.

Purpose: This study aims to compare the effects of the Team Accelerated Instruction (TAI) and Jigsaw learning models on students' learning interest and computational thinking skills.

Method: This study employed a quasi-experimental design using a non-equivalent control group design involving 56 tenth-grade students. Data were collected through a learning interest questionnaire and a computational thinking skills test. The data were analyzed using the Mann–Whitney U test with the assistance of SPSS version 25.

Findings: The findings revealed that the Team Accelerated Instruction (TAI) model was more effective than the Jigsaw model in enhancing both students' learning interest and computational thinking skills. The mean rank of computational thinking skills in the TAI group was 16.71, compared to 11.46 in the Jigsaw group, with a statistically significant difference ($p < .05$). Similarly, the mean rank of learning interest was higher in the TAI group (21.21) than in the Jigsaw group (15.25), and the difference was also statistically significant ($p < .05$). These findings indicate that the TAI model is more effective than the Jigsaw model in improving students' learning interest and computational thinking skills.

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INTRODUCTION

National education plays an important part in developing scholars' character and capabilities in order to produce individualities who are faithful, ethical, creative, independent, and responsible, as emphasized in the National Education System Law. In addition, the demands of 21st- century education bear scholars to master advanced- order thinking chops, collaboration, creativity, communication, and technology- grounded literacy capabilities (Putra et al., 2024). One of the essential capabilities that should be strengthened in contemporary education is computational thinking.

Computational thinking is a problem- working process that involves logical, structured, and methodical thinking in formulating results that can be enforced effectively (Dağ et al., 2023). The conception was originally vulgarized by Jeannette Wing, who explained that computational thinking is not limited to computer wisdom but represents a abecedarian skill that should be learned by all scholars across colorful disciplines (Wing, 2008). Computational thinking consists of several main confines, videlicet corruption, pattern recognition, abstraction, and algorithmic thinking (Huang et al., 2023). corruption refers to the capability to break complex problems into lower and further manageable corridor (Dian Mariani, 2020). Pattern recognition involves relating parallels or connections within problems, while abstraction emphasizes fastening on important information and ignoring inapplicable details. Algorithmic thinking refers to the capability to design methodical and successional way to break problems effectively (Lehmann, 2023).

In mathematics literacy, computational thinking is reflected in scholars' capacities to dissect problems totally, identify fine patterns, formulate logical strategies, and estimate results critically (Mendrofa, 2024). thus, learning conditioning should give openings for scholars to laboriously share in logical and problem- working processes. In the environment of this study, the factors of computational thinking are integrated into cooperative literacy conditioning through problem-working tasks, collaborative conversations, and structured literacy stages that encourage scholars to develop logical and methodical thinking chops during the literacy process.

Still, current educational practices indicate that learning perpetration in seminaries is still constantly dominated by conventional tutoring styles centered on schoolteacher explanations, performing in limited pupil participation and commerce (Alami et al., 2022). similar conditions contribute to scholars' low literacy interest and inadequate development of computational thinking chops, which immaculately should be fostered through interactive, cooperative, and exploratory literacy gests (Kurniawan, 2023; Septi Anggraeni & Octavia, 2023). original compliances conducted in class X of SMAS Hidayatul Muhtadin revealed that 32 out of 56 scholars had not yet achieved the minimal literacy completion criteria. These findings indicate that scholars' engagement and logical capacities still bear enhancement through further innovative and pupil- centered literacy approaches (I Made Ayada & I Made Tegeh, 2024).

One literacy approach considered able of addressing these challenges is collaborative literacy. Several former studies have demonstrated that collaborative literacy models can ameliorate scholars' provocation, participation, and learning issues (Suhendar et al., 2021), including the Team Accelerated Instruction (TAI) model and the Jigsaw II model. The TAI model emphasizes the integration of individual responsibility and collaborative group work in miscellaneous brigades. Through structured problem- working conditioning, peer backing, and individual responsibility, scholars are encouraged to laboriously engage in the literacy process, complete tasks singly, and bandy results collaboratively. Theoretically, these literacy processes can increase scholars' learning interest because scholars come more laboriously involved, admit peer support, and witness a further interactive literacy atmosphere. In addition, the methodical stages of TAI literacy give openings for scholars to exercise corruption, logical analysis, and successional problem- working processes that are nearly related to computational thinking chops.

On the other hand, the Jigsaw model promotes collaborative responsibility through home groups and expert groups, where scholars are needed to master specific literacy accoutrements and explain them to their peers (Felisia Reformasi Daeli, 2024; Sastramayani, 2020). This cooperative medium can strengthen scholars' communication chops, confidence, and social commerce during literacy conditioning. likewise, the process of swapping information and explaining generalities among group members may support scholars' logical thinking and pattern recognition capacities, which are important confines of computational thinking. still, the effectiveness of the Jigsaw model largely depends on scholars' understanding and participation within their groups.

Although former studies have reported positive impacts of collaborative literacy models on learning issues and provocation, utmost exploration still focuses primarily on cognitive achievement and general literacy provocation, while limited studies have exhaustively examined literacy interest and computational thinking chops contemporaneously as important capabilities in 21st- century education (Yulianti & Wulandari, 2021). former studies have also demonstrated that the Team Accelerated Instruction (TAI) and Jigsaw literacy models can ameliorate scholars' cooperative literacy, academic achievement, and classroom participation. still, studies examining the relative effectiveness of these two models in enhancing literacy interest and computational thinking chops among elderly high academy scholars remain limited. In addition, exploration that contemporaneously analyzes learning interest and computational thinking capability within a single study is still infrequently conducted.

The comparison between the TAI and Jigsaw models is theoretically important because both literacy models are grounded on collaborative literacy principles but employ different educational mechanisms that may impact scholars' learning interest and computational thinking development in different ways. The TAI model emphasizes structured individual responsibility combined with cooperative problem- working conditioning, allowing scholars to exercise logical thinking, logical logic, and methodical problem- working processes that are nearly related to computational thinking chops (Cahyaningsih, 2018). Meanwhile, the Jigsaw model prioritizes peer tutoring, information exchange, and social commerce through expert and home group conversations, which may contribute to scholars' engagement, communication chops, and abstract understanding during literacy conditioning (Wahyuni et al., 2025). thus, comparing these two models is important to identify which collaborative literacy approach more effectively supports the development of scholars' learning interest and computational thinking capabilities in mathematics learning surrounds.

This study was conducted at SMAS Hidayatul Muhtadin because primary compliances revealed that scholars' learning participation and logical capacities were still fairly low, as indicated by the large number of scholars who had n't yet achieved the minimal literacy completion criteria. These conditions make the academy environment applicable for examining the perpetration of innovative and cooperative literacy models that may ameliorate scholars' engagement and advanced- order thinking chops. thus, this study offers a donation by comparing the perpetration of the TAI and Jigsaw models in the environment of learning at SMAS Hidayatul Muhtadin.

This study also seeks to give an indispensable collaborative literacy approach that may support the development of scholars' logical capacities and learning engagement. Grounded on these considerations, the exploration questions of this study are (1) Are there differences in scholars' learning interest between classes tutored using the TAI model and those tutored using the Jigsaw model? and (2) Are there differences in scholars' computational thinking chops between classes tutored using the TAI model and those tutored using the Jigsaw model?

METHODS

This study employed a quantitative approach because the collected data were presented in numerical form and analyzed using statistical techniques. Quantitative research provides a systematic and structured procedure, enabling the research process to be conducted in a directed and measurable manner (Arditya Prayogi et al., 2024). The study applied a quasi-experimental method using an unequal control group design, since the researcher administered different learning treatments to the experimental and control groups but could not fully randomize the participants (Saifuddin, 2021).

The experimental group received instruction using the Team Accelerated Instruction (TAI) cooperative learning model, whereas the control group was taught using the Jigsaw cooperative learning model. The purpose of this design was to compare the influence of both learning models on students' learning interest and computational thinking skills.

The participants in this study were all students of grade X at SMAS Hidayatul Muhtadin, consisting of 56 students, including 30 male and 26 female students. The sample was selected using a saturation sampling technique, in which all members of the population were included as research participants (Danis & Ayu Lestari, 2024).

Class XA, consisting of 28 students, was assigned as the control group, while class XB, consisting of 28 students, served as the experimental group. The study was conducted during the mathematics learning process in the academic year in which the research took place.

Two research instruments were employed in this study. The first instrument was a learning interest questionnaire designed to measure students' interest in learning activities. The questionnaire consisted of six statement items developed based on indicators of learning interest, including attention, participation, curiosity, enjoyment, learning motivation, and engagement during classroom activities. The instrument used a Likert scale scoring system ranging from strongly disagree to strongly agree. Prior to implementation, the questionnaire was reviewed through expert judgment to ensure content validity and was tested for reliability using Cronbach's Alpha.

The second instrument was a computational thinking assessment sheet used to measure students' abilities in solving mathematical problems systematically. The assessment indicators included decomposition, pattern recognition, abstraction, and algorithmic thinking (Richardo et al., 2025). The scoring procedure was carried out using an assessment rubric adjusted to the level of students' responses, allowing objective evaluation of computational thinking performance.

The research procedures were conducted in several stages. Initially, both groups were given a pretest to identify students' initial learning interest and computational thinking abilities. Subsequently, the experimental group received instruction using the Team Accelerated Instruction (TAI) model, which emphasized cooperative teamwork, peer assistance, and individual responsibility in completing learning tasks. Meanwhile, the control group was taught using the Jigsaw learning model, where students learned through group discussions and information exchange among group members.

The treatment was conducted over several learning sessions covering the same mathematics topics in both classes. At the end of the treatment, students in both groups completed a posttest using the same instruments administered during the pretest stage.

The collected data were analyzed through descriptive and inferential statistical techniques using SPSS version 25 software (Sahrul et al., 2025). Descriptive statistics included the calculation of minimum scores, maximum scores, means, and standard deviations to describe the characteristics of the data.

Before hypothesis testing, prerequisite analyses were conducted through normality and homogeneity tests to determine the suitability of parametric statistical procedures (Nurhaswinda et al., 2026). If the data did not meet the normality assumptions, hypothesis testing was conducted using the non-parametric Mann–Whitney U test to compare differences between the two groups (Birahi et al., 2022). All statistical decisions were made using a significance level of 0.05. A significance value below 0.05 indicated a statistically significant difference between the experimental and control groups.

RESULT AND DISCUSSION

Results

Differences in Students' Learning Interest between the TAI and Jigsaw Models

Tabel 1

Descriptive Statistics Results of Learning Interest

	N	Min	Max	Sum	Mean		Std Deviation
	Statistic	**Statistic**	**Statistic**	**Statistic**	**Statistic**	**Std. Error**	**Statistic**
Jigsaw	28	12	18	427	15.25	0.462	2.444
TAI	28	18	24	594	21.21	0.455	2.409

According to the information in Table 1, the Jigsaw group received scores varying from 12 to 18, averaging at 15.25 (SD = 2.444). On the other hand, the TAI group scored between 18 and 24, with an average score of 21.21 (SD = 2.409). The descriptive analysis shows that students who were instructed through the TAI model had higher Learning Interest scores compared to those in the Jigsaw group.

Tabel 2

Normality Results of Learning Interest

		Shapiro-Wilk		
Variable	**Group**	**Statistic**	**df**	**Sig.**
Learning Interest	Jigsaw	0.824	28	0.000
	TAI	0.837	28	0.001

Table 2 shows that the significance values for the Learning Interest variable in each group were under 0.05, suggesting that the data distribution is not normal.

Tabel 3

Homogeneity Test Results of Learning Interest

Variable	Levene Statistic	df1	df2	Sig.
Learning Interest	0.025	1	54	0.876

The outcomes of Levene's Test shown in Table 3 reveal that the significance value exceeded 0.05. This implies that the variance among the Jigsaw and TAI groups was consistent, indicating that the data variation between the groups was quite alike.

Tabel 4

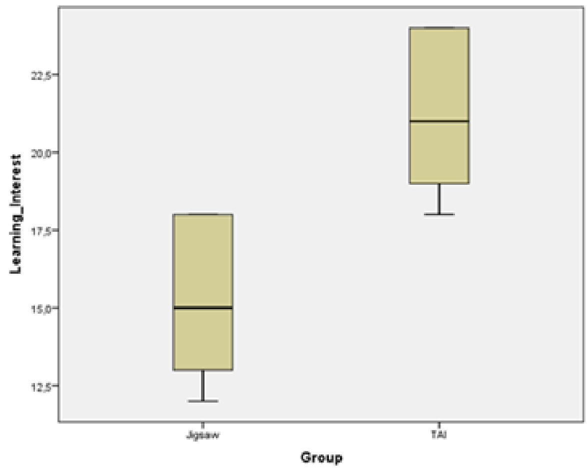
Mann-Whitney U Test of Learning Interest

	Learning_Interest
Mann-Whitney U	25.000
Z	-6.095
Asymp. Sig. (2-tailed)	0.000

Table 4 presents a notable distinction between the Jigsaw group and the TAI group regarding the Learning Interest variable. The significance level was recorded at 0.000 ($p < 0.05$) with $Z = -6.095$. These results suggest that the learning model had a considerable impact on students' Learning Interest.

Figure 1

Boxplot Diagram of Learning Interest



The boxplot diagram illustrates that the TAI group achieved higher median scores than the Jigsaw group in the Learning Interest variable.

Differences in Students' Computational Thinking Skills between the TAI and Jigsaw Models

Tabel 5

Descriptive Statistics Results of Computational Thinking

	N	Min	Max	Sum	Mean	Std Deviation
Jigsaw	28	6	16	321	11.46	2.531
TAI	28	12	20	468	16.71	2.492

Table 5 illustrates that every group included 28 participants. The Jigsaw category received scores that varied from 6 to 16, accumulating a total score of 321 and an average score of 11.46 (SD = 2.531). In contrast, the TAI group scored between 12 and 20, achieving a total score of 468 and an average score of 16.71 (SD = 2.492). These results suggest that the TAI group exhibited superior Computational Thinking skills compared to the Jigsaw group.

Tabel 6

Normality Results of Computational Thinking

		Shapiro-Wilk		
Variable	**Group**	**Statistic**	**df**	**Sig.**
Computational Thinking	Jigsaw	0.959	28	0.338
	TAI	0.917	28	0.030

Table 6 shows that the variable related to Computational Thinking in the TAI group did not follow a normal distribution (p = 0.030), while the Jigsaw group exhibited a normal distribution (p = 0.338). Because some datasets failed to satisfy the normality assumption, non-parametric analysis was utilized.

Tabel 7

Homogeneity Test Results of Computational Thinking

Variable	Levene Statistic	df1	df2	Sig.
Computational Thinking	0.077	1	54	0.782

The findings from Levene's Test presented in Table 7 show that the significance level exceeded 0.05. This suggests that the variance for the Jigsaw and TAI groups was consistent, indicating that the variability of data among the groups was approximately alike.

Tabel 8

Mann-Whitney U Test of Computational Thinking

	Computational_Thinking
Mann-Whitney U	53.500
Z	-5.583
Asymp. Sig. (2-tailed)	0.000

Table 8 shows a significant difference between the Jigsaw and TAI groups for the Computational Thinking variable. The significance value was 0.000 (p < 0.05) with Z = -5.583. These findings indicate that the learning model significantly influenced students' Computational Thinking skills. The boxplot diagram illustrates that the TAI group achieved higher median scores than the Jigsaw group in the Computational Thinking variable (Figure 2).

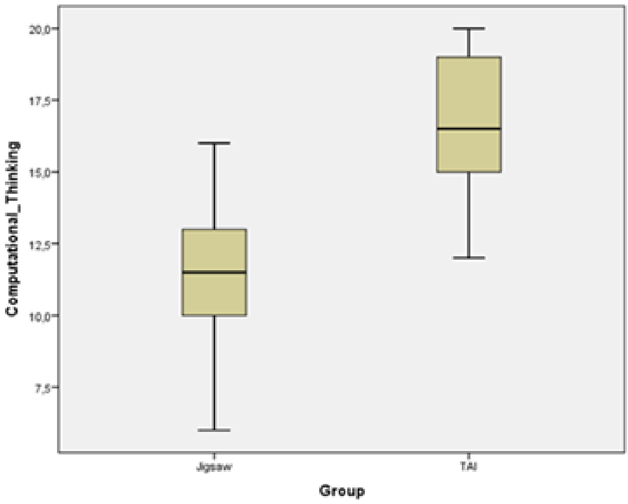
Discussion

The findings indicate that the Team Assisted Individualization (TAI) model was more effective than the Jigsaw model in improving students' Learning Interest and

Computational Thinking skills (Zhan et al., 2024). The descriptive statistics and Mann–Whitney U test confirmed significant differences between the two groups, with the TAI group consistently achieving higher mean scores (Tai et al., 2022).

Figure 2

Boxplot Diagram of Computational Thinking



These findings are consistent with previous studies reporting that TAI enhances students' motivation, participation, and learning outcomes because it integrates cooperative learning with individual accountability (Tinungki et al., 2024). Students are encouraged to prepare learning materials independently before participating in group discussions, thereby increasing engagement and responsibility in the learning process. In addition, the reward system implemented in TAI contributes to stronger learning motivation and active participation.

From the perspective of Computational Thinking, the structured learning stages and repeated problem-solving activities in TAI support students in developing systematic and analytical thinking skills (Lee et al., 2024). The model encourages learners to solve problems collaboratively while maintaining individual responsibility for task completion. In contrast, the Jigsaw model relies heavily on peer explanation and information sharing (Jeppu et al., 2023). Consequently, when group members have limited understanding of the material, the effectiveness of learning may decrease.

Although the study demonstrated positive findings, several limitations should be acknowledged. First, the participants were limited to tenth-grade students from a single school, restricting the generalizability of the findings. Second, the study only examined Learning Interest and Computational Thinking variables, whereas other factors such as motivation, learning style, and environmental support may also influence learning outcomes. Third, the Learning Interest questionnaire relied on students' self-perceptions, which may introduce response bias.

CONCLUSION

Based on the results of the data analysis and discussion, it can be concluded that the Team Accelerated Instruction (TAI) learning model demonstrated a greater contribution to improving students' learning interest and computational thinking skills compared to the Jigsaw learning model. Students who participated in learning through the TAI model showed better engagement in classroom activities and stronger abilities in solving problems systematically and analytically.

The findings of this study provide theoretical implications by strengthening the view that cooperative learning models emphasizing individual responsibility and collaborative interaction can support the development of higher-order thinking skills and learning motivation. In addition, this study contributes to the development of constructivist learning theory, particularly in the context of computational thinking and student-centered learning approaches.

Practically, the results suggest that the TAI learning model can be used as an alternative instructional strategy for mathematics learning in senior high schools to foster students' active participation, increase learning interest, and improve computational thinking skills. Therefore, educators are encouraged to implement innovative and collaborative learning models that facilitate meaningful learning experiences and active student involvement in the classroom.

Future research should engage a more representative and larger sample in terms of levels of education as well as characteristics of schools so that the results may be more generalizable. Second, future researchers can incorporate other variables such as learning motivation, learning styles, or cognitive learning outcomes in order to provide a broader view of the impact of the two models. Third, utilize mixed methods for offering quantitative and qualitative means to more deeply investigate the learning trajectory. Fourth, more future research can develop or combine the TAI model about digital learning technology to know the potential for achieving better learning outcomes.

DECLARATIONS

Author Contribution

Darmaji, Contributed to the conceptualization of the study, research methodology, data collection, formal analysis, visualization, and preparation of the original manuscript draft; **Widayat, E.**, contributed to the development of the research design, data analysis, interpretation of findings, manuscript review, and editing process. He also was involved in data validation, supervision, and manuscript refinement to ensure the accuracy and quality of the study results; **Sucipto**. contributed to supervision, validation of research data, evaluation of the research process, and critical review of the manuscript.

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Conflict of Interest

The authors declare no conflict of interest.

Declaration of AI Use

No generative AI tools were used in the preparation of this manuscript

Additional Information

Not applicable.

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