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Evaluating the Impact of Team-Assisted Individualization and Team Games Tournament Approaches on Student Engagement in Science Learning

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ABSTRACT

This study assesses the efficacy of the Teams Assisted Individualization (TAI) and Teams Games Tournament (TGT) learning models in enhancing academic performance and engagement among Mathematics students. Utilizing a classroom action research approach, the study was conducted over two cycles, each comprising four stages: observation, initial data collection, implementation planning of TAI and TGT, and report preparation. The participants included 72 students from classes VII A and VII B. The research revealed significant improvements in student performance. In class VII A, utilizing TAI, the percentage of students meeting the minimum competency level (KKM) increased from 45% in the pre-action phase to 85% by the end of Cycle II. Similarly, in class VII B, under the TGT model, the percentage of students achieving the KKM rose from 55% to 92%, with completion rates of assigned tasks also showing notable improvements. The findings suggest that both TAI and TGT models are effective in promoting higher academic achievement and greater student engagement in Mathematics. The substantial increase in students meeting the KKM and completing tasks indicates that these collaborative learning strategies significantly enhance learning outcomes. Implementing the TAI and TGT collaborative learning models has proven beneficial in boosting engagement, motivation, and academic performance among seventh-grade students at SMPN 243 Jakarta in their Mathematics coursework.

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1. INTRODUCTION

Education is a deliberate and systematic endeavor aimed at equipping pupils with the necessary knowledge, skills, and direction to fulfill their future duties (Wu, 2021). A human's attempt to fulfill their intrinsic potential—both physical and spiritual—in line with the ideals that emerge and deepen in society and culture is, in the most basic and universal sense, what education is all about. Essentially,

Minister of National Education Regulation No. 4 of 2007 outlines that planned learning consists of a syllabus and learning implementation plan. This plan encompasses various elements such as subject identification, indications of competency accomplishment, objectives for learning, materials for teaching, methods of learning, activities for learning, evaluation of learning outcomes, and resources for learning (Pamungkas, Sunarti, Arini, & Azizah, 2022).

High-quality learning refers to learning that includes the main factors of learning, namely teachers, students, and interactions between the two and is supported by other factors such as learning objectives, subject selection, learning instruments, conducive learning atmosphere, healthy learning environment, learning processes and assessments that are adapted to the applicable curriculum (Wiyono & Haryudo, 2023). There are also learning interactions that cannot be carried out well because during, the learning process the methods and media used do not support these interactions, which makes this method less effective for students. The actualization of learning tends to still be centered on the teacher (N. P. R. Putri, Efrizon, & Sriwahyuni, 2018). Student-related issues in the learning process are influenced by two variables: internal factors and external influences. Attitudes toward learning, learning motivation, and learning concentration are internal characteristics that impact the learning process. To cultivate a strong desire for learning among students, it is imperative to provide engaging and inspiring learning activities. The teacher as an educator who teaches students and acts as a guide and facilitator is tasked with organizing the class so that learning activities can run well, presenting learning materials with a certain learning approach, and evaluating learning outcomes. Seen from the student's perspective, the teacher and his learning efforts are an external factor in the process (Lane, 2016).

Mathematics is one of the subjects that requires assessment of learning outcomes. The application of mathematics learning is inherently intertwined with many barriers that arise from both teachers and students (Zykrina, Gabdullin, & Kozhabaev, 2022). Often students think that mathematics is a very difficult subject. Therefore, students need to be given an understanding of mathematical concepts to make it easier for students to participate in learning activities. Teachers play a crucial role and are indispensable for students in this scenario. Therefore, the teacher can be considered as an authoritative presence who oversees the learning process and serves as education’s focal point within the classroom (Rakhmetov, Sadvakassova, Saltanova, & Yessekenova, 2022). The importance of mathematics lessons in education is no longer in doubt. However, there remains a significant number of students who hold the belief that studying mathematics lacks practicality, particularly among those who lack enthusiasm for the subject. This is also based on students' lack of knowledge about the application of mathematics and also students' lack of understanding of the concepts of the material taught by the teacher (Putri, 2019).

Based on interviews conducted by the mathematics study teacher at SMPN 243, he said that mathematics learning outcomes for class VII are still low, this can be seen from the low average score obtained by students from the PTS exam results which have not yet reached the school's minimum completion criteria. namely 30% of students from a total of 72 class VII students who were able to achieve scores above the school's minimum completion criteria. One of the causes of the low mathematics scores is the learning methods used by teachers using lecture methods and less varied learning activities. For this reason, learning methods that are more diverse, fun, and attractive to students are needed.

The collaborative learning model is a suitable approach that can be implemented in mathematics education. Collaborative learning is learning that depends on other people, has shared responsibilities and goals, and feels the same way in carrying out tasks. Collaborative learning is learning in groups to work together in constructing concepts and solving problems (Vennix, den Brok, & Taconis, 2018). Collaborative learning seeks to establish a scenario in which the academic achievement of individual students is dictated or impacted by the success of their group (Fathurrahman, Sumardi, Yusuf, & Harijanto, 2019). The process of adopting collaborative learning involves the following steps or syntax: (1) Communicating objectives and inspiring students, (2) Delivering knowledge, (3) Arranging students

into study cohorts, (4) Facilitating study cohorts, (5) Assessment, (6) Granting honors. Various collaborative learning methods exist, namely Team Assisted Individually (TAI) and Team Games Tournament (TGT) (Hosnan, 2014).

Team Assisted Individualization (TAI) is a form of collaborative learning that may be used to various levels of classes, courses, and overall school and class characteristics (Desiana & Supardi, 2018). This model, initiated by Robert Slavin, is a combination of collaborative learning and individual teaching. The study conducted by (Walukow & Pangemanan, 2016) examined the TAI type collaborative learning model and found that it produced greater results compared to conventional learning models. This is also pertinent to a study conducted by (Murdoko, Mardiyana, & Usodo, 2017), that examined the efficacy of TAI (Team Assisted Individualization) collaborative learning. The study found that the TAI collaborative learning model yielded superior learning outcomes compared to the GI (Group Investigation) collaborative learning model and traditional learning methods.

Meanwhile, Teams Games Tournament (TGT) is collaborative learning that involves students in games and tournaments with an individual score progress system (Salam, Hossain, & Rahman, 2015). In this lesson, Students are grouped into multiple diverse groups to engage in question-based games that align with the previously covered topic. After the game is played, students are brought together in an academic tournament. Each group will receive an award according to the level of score obtained. Competition will stimulate students' enthusiasm which will then create fun learning activities thereby increasing learning motivation (Erickson & Sammons-Lohse, 2021).

Teams Games Tournament (TGT) learning has 5 stages in its implementation, which are Class presentation, Team selection, Games, Tournaments, and Group awards (Sundari, Khairuddin, & Jumadil, 2023). Learning activities will be successful if accompanied by awards because this aspect of awards will encourage students to study hard. Previously, research had been carried out on the implementation of the TGT collaborative learning model. The findings of this study demonstrated that, during a three-week intervention, the students assigned to the TGT group achieved notably higher levels of learning outcomes than those assigned to the lecture-based control group. The TGT experimental group exhibited a certain degree of positive variation in their attitude toward mathematics (Salam et al., 2015).

This research focuses on examining how applying the Teams Assisted Individualization (TAI) and Teams Games Tournament (TGT) learning models can impact student progress in mathematics learning at SMP Negeri 243 Jakarta. The investigation delves into whether a hybrid approach combining TAI and TGT can enhance students' academic performance and their enthusiasm for learning Mathematics at SMP 234 Jakarta. To alter the existing educational dynamics, it is crucial for teachers to adopt strategies that not only maintain but boost student interest and active participation, thereby enhancing mathematical outcomes. Thus, the adoption of effective and tailored learning models aligned with the curricular demands is essential.

The Teams Games Tournament and Teams Assisted Individualization models, with their collaborative and individualized learning approaches, are posited by researchers to significantly benefit student learning outcomes. These models are anticipated to foster an environment that encourages mathematical inquiry and collaborative problem-solving, which could lead to a deeper understanding and greater retention of mathematical concepts. This research, therefore, aims to rigorously evaluate the implementation of the TAI and TGT approaches, providing a comparative analysis of their effectiveness in improving students' academic results and increasing their engagement and interest in Mathematics lessons at Junior High School 234. This study could offer insightful implications for educational practices, potentially guiding future pedagogical strategies in mathematics education.

2. METHODS

This study employed the classroom action research methodology at SMPN 243 Jakarta, situated at Jalan Cipinang Pulo No.36, Jatinegara, East Jakarta. It involved 72 students from two seventh-grade sections during the 2023/2024 academic year. The focus of the research was on teaching systems of linear equations in one variable. The research process was systematically structured into several phases: initial observation and data collection to assess the current learning situation, meticulous planning for the implementation of the Teams Assisted Individualization (TAI) and Teams Games Tournament (TGT) models, and the subsequent preparation of a detailed report to document the findings and insights gathered throughout the study (Fitra, 2022). This comprehensive approach ensured a thorough evaluation of the instructional strategies and their impact on student learning outcomes.

The researcher conducted a thorough observation of the learning process activities of every student in the class, as well as the teaching conditions and the overall school environment, during the observation phase. At the initial data collection stage, the researcher collected daily test scores and PTS exam scores for class VII students. Data collection uses non-test techniques such as observation, documentation, and interviews, as well as test techniques (questions). The research employs a triangulation strategy to ensure the veracity of the data. This involves cross-checking the same source using many techniques to accurately depict the truth of the material (Cahyanti, Indriayu, & Sudarno, 2018). The research data is provided utilizing qualitative descriptive methods, namely through a descriptive description of the progression of student activity and learning outcomes caused by the implementation of the collaborative learning model.

At the planning stage, researchers divided two classes into each treatment, namely class VII A for the TAI treatment and class VII B for the TGT treatment. In class VII A with TAI treatment, 36 students were formed into six groups consisting of six students each, in each group consisting of one student who was considered superior or able to understand mathematics material more quickly. Each group was given 15 questions to work on and discuss as a group within 30 minutes, with the hope that one superior student in each group could help its members in working on the questions and each student would collect the results of working on the questions individually. After that, the researcher reflected by asking one random student in each group to rewrite the questions they had worked on on the whiteboard and provide impressions and messages regarding the mathematics learning process using the TAI method.

In class VII B with TGT treatment, 36 students were formed into six groups chosen randomly or based on the results of a lottery. In each group, there is a chance that 1-3 students who excel are in the same group. Each group worked on 15 questions which were read by the researcher one by one within 30 minutes. The group that completed each item the fastest was asked to raise their hand and do it again on the board. Every time a group answers a question correctly, the first group gets a score or value and has the right to change and randomize other group members who are less quick to answer. After that, the researcher reflected by asking each group representative to give their impressions and messages regarding the mathematics learning process using the TGT method. Indicators of research success are increased student activity and learning outcomes expressed in percentage form in each aspect.

3. FINDINGS AND DISCUSSION

3.1. Result

The data obtained in this research is student activity and learning outcomes. The aspect of activeness is based on Sardiman (2010) which consists of being willing to ask questions, being willing to answer, and expressing opinions both in discussions and in front of the class. The learning outcomes measured include cognitive, affective, and psychomotor (Wibowo, 2016). The activity of class VII A and VII B students at SMPN 243 Jakarta has increased from the initial stage of Pre-Action to Cycle I and

Cycle II. Table 1 and table 2 display a comparison of the proportion of student engagement in Pre-Action, Cycle I, and Cycle II.

Table 1. Comparison of the average activity of VII A students per cycle

Aspect	Pre-action (%)	Cycle I (%)	Cycle II (%)
Ask	30	62	75
Answer	33	60	80
Opinion	30	65	75
Mean	31	62	77

Table 2. Comparison of the average activity of VII B students per cycle

Aspek	Pre-action (%)	Cycle I (%)	Cycle II (%)
Ask	32	52	72
Answer	35	65	85
Opinion	30	62	75
Mean	32	60	78

Implementing cognitive learning in classes VII A and VII B led to a significant increase in the proportion of students who achieved or exceeded the minimum competency level (KKM) to 80%. Table 3 and Table 4 exhibit a comparison of the proportions of cognitive learning outcomes in Pre-Action, Cycle I, and Cycle II.

Table 3. Comparison of the cognitive averages of VII A students per cycle

Aspect	Pre Action (%)	Cycle I (%)	Cycle II (%)
Finished	45	65	85
Not Finished	55	35	15

Table 4. Comparison of the cognitive averages of VII B students per cycle

Aspect	Pre Action (%)	Cycle I (%)	Cycle II (%)
Finished	55	60	92
Not Finished	45	40	18

The markers of success in the TAI and TGT learning models are as follows:

1. Enhanced Student Achievement: A key measure of success is a rise in student performance in terms of grasping concepts, critical thinking abilities, and overall academic accomplishment. Assessment might be conducted by tests, examinations, or other formative evaluations.
2. Student Participation and Engagement: Success may be gauged by the extent of student involvement and engagement in educational activities. Increased student engagement correlates with a higher likelihood of achieving learning objectives.
3. This study can assess variations in teacher conduct, including the adoption of more efficient teaching methods, enhanced classroom management abilities, or increased utilization of educational technologies.

4. Enhanced cooperation and communication can indicate success through enhanced interaction among instructors, students, parents, and other stakeholders involved in the learning process. Enhancing open and effective communication can also be a positive sign.
5. Enhancing the learning environment, encompassing both physical and social-psychological aspects. Possible improvements may involve enhancing classroom infrastructure, fostering a more inclusive learning environment, or enhancing the quality of student interactions.
6. Enhancing Teacher Competencies: Success may also be gauged by the improvement of teachers' abilities and knowledge in performing their educational duties. This might involve professional growth, further training, or enhanced comprehension of successful learning techniques.
7. Positive feedback from stakeholders, including students, parents, and other relevant parties, can serve as a sign of success. Positive feedback indicates that the execution of a program or alteration has benefited the individuals concerned.

3.2. Discussion

The objective of this classroom action research is to assess the implementation of the TAI (Teams Assisted Individualization) and TGT (Teams Games Tournament) learning models and to compare their effectiveness in enhancing students' academic performance and engagement in mathematics sessions. This study aligns with Vygotsky's social constructivist theory, which posits that students learn more effectively in a socially interactive environment where they can share knowledge and solve problems collaboratively (Vygotsky, 1978).

In class VII A, where the TAI model was implemented, there was a notable increase in student engagement. Table 1 shows that the percentage of students willing to ask questions rose from 30% to 75%, and those willing to answer increased from 33% to 80%. Similarly, the percentage of students expressing opinions improved from 30% to 75%. These results, with an average increase of 45% across various engagement aspects, confirm that the TAI model effectively stimulates students' active participation, a key component of Vygotsky's theory.

Conversely, in class VII B with the TGT model, Table 2 highlights increases in engagement: the desire to ask questions rose from 32% to 70%, willingness to answer from 35% to 85%, and expressing opinions from 30% to 75%. These improvements, averaging 44% across indicators, suggest that TGT also fosters significant student interaction and involvement, consistent with Johnson and Johnson's findings that cooperative learning models like TGT enhance student achievement and motivation (Johnson & Johnson, 1989).

Both the TAI and TGT models have successfully achieved the research target of a 30% increase from pre-action levels, showcasing their capability to significantly boost student engagement and learning in mathematics. These findings are in line with broader educational research which highlights the pivotal role of collaborative learning environments in enhancing academic outcomes (Slavin, 1995). Recent studies continue to affirm this perspective, showing that interactive and cooperative learning strategies not only improve understanding but also increase intrinsic motivation among students, leading to higher achievement levels (Fernandez-Rio et al., 2017). Additionally, a meta-analysis by Kyndt et al. (2013) underscores the lasting positive effects of such educational approaches, suggesting that students retain content longer and can apply what they have learned more effectively when engaged in collaborative learning settings. This robust body of research corroborates the effectiveness of the TAI and TGT methods in fostering a conducive learning environment that can significantly transform educational practices and outcomes in mathematics education.

Table 3 in class VII A, where the Teams Assisted Individualization (TAI) model was applied, shows significant improvement: students achieving the minimum competency level (KKM) rose from 45% to 85%. This 40% increase in cognitive learning outcomes signifies that the research target has been successfully met. Such an outcome strongly supports the effectiveness of the TAI collaborative learning model in promoting higher cognitive gains. Similarly, Table 4 for class VII B under the Teams Games

Tournament (TGT) approach indicates a notable increase in students meeting the KKM—from 55% to 92%, reflecting a 37% improvement in cognitive learning outcomes. This achievement also meets the research target and is attributable to the active, team-based engagement fostered by the TGT model.

These results are consistent with recent findings in educational research that highlight the role of structured team-based learning environments in enhancing cognitive performance (Laal & Ghodsi, 2012). Further supporting this, a study by Zhang et al. (2019) demonstrated that students engaged in collaborative learning settings exhibit improved academic performance, deeper comprehension of the material, and higher retention rates. These studies affirm that both TAI and TGT models not only meet predefined academic targets but also contribute to substantial educational advancements through structured, collaborative approaches.

Interpreting TAI (Teams Assisted Individualization) and TGT (Teams Games Tournament) learning involves analyzing empirical evidence and references from related studies.:

1. Research conducted by Slavin (2014) has demonstrated that the TAI strategy is successful in enhancing student achievement and learning motivation. TAI assists in satisfying students' particular requirements by allowing them to select their own learning route.
2. Collaboration in TGT, as researched by Johnson and Johnson (2009), enhances student cooperation, deepens comprehension of topics, and boosts academic performance. TGT offers students the chance to learn via engaging in social contact and collaborating with their peers.
3. Incorporating Time for Academic Instruction (TAI) into Team Game Tournament (TGT) might enhance students' learning by offering improved differentiation and preserving the competitive elements that boost student motivation, as emphasized in DeBacker et al.'s (2009) study.
4. Webb et al.'s (2007) study indicates that cooperative learning methods like TGT and TAI can boost students' intrinsic motivation by fostering a sense of ownership over their learning and cultivating a positive group identity and sense of belonging.
   The interpretation of TAI and TGT learning realities should consider the teacher's role in integrating both learning models. Heward (2009) states that instructors are crucial facilitators in establishing a supportive and motivating atmosphere for students to apply this learning technique.

Based on the findings from the discussion and relevant literature, Based on the evidence, it can be deduced that the instructional approach of Teams Assisted Individualization and the collaborative learning model Teams Games Tournament have the potential to improve academic performance, interest, and level of involvement of 7th-grade students in the subject of mathematics at SMPN 243 Jakarta.

4. CONCLUSION

The implementation of the Teams Games Tournament (TGT) and Teams Assisted Individualization (TAI) models has been shown to significantly improve engagement, motivation, and academic performance among 7th-grade students in mathematics at SMPN 243 East Jakarta. The study found that the TGT approach, in particular, yielded superior results in increasing student activity, interest, and learning outcomes compared to the TAI method. This may be due to the motivational impact of reward points and the opportunity for dynamic group interaction, which enhances classroom engagement and helps develop students' emotional and physical skills. Both TGT and TAI methods foster exceptional cognitive abilities, proficient communication skills, and notable academic achievements, suggesting their potential for broad implementation in mathematics education to bolster students' problem-solving capabilities.

However, the study acknowledges limitations including the scope of the instructional methods and the specific student population assessed. Future research should explore the long-term effects of

these methods across diverse educational settings and include a broader demographic to determine their generalizability and effectiveness. Additionally, it is recommended that schools provide targeted training and professional development for teachers on the principles and integration of TAI and TGT strategies. Regular monitoring and assessments should be conducted to refine these practices, and parental involvement in the learning process should be encouraged to enhance the supportive learning environment. Lastly, a comprehensive learning plan that accommodates diverse learning styles and intelligence types should be developed to maximize the effectiveness of these collaborative learning models.

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REFERENCES

Cahyanti, S. D., Indriayu, M., & Sudarno. (2018). Implementasi Program Link and Match dengan Dunia Usaha dan Dunia Industri pada Lulusan Pemasaran SMK Negeri 1 Surakarta. *Pendidikan Bisnis Dan Ekonomo*, *4*(1), 23–26. Retrieved from https://jurnal.fkip.uns.ac.id/index.php/ptn/article/view/12143

Desiana, E. N., & Supardi, Z. A. I. (2018). THE IMPLEMENTATION OF TEAM ASSISTED INDIVIDUALIZATION (TAI) TYPE COOPERATIVE MODEL TO INCREASE LEARNING OUTCOMES IN WORK AND ENERGY. *Inovasi Pendidikan Fisika*, *7*(2), 273–277. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/7556065%0Ahttp://www.pubmedcentral.nih.gov/articlerender.fcgi?artid=PMC394507%0Ahttp://dx.doi.org/10.1016/j.humpath.2017.05.005%0Ahttps://doi.org/10.1007/s00401-018-1825-z%0Ahttp://www.ncbi.nlm.nih.gov/pubmed/27157931

Erickson, L. V., & Sammons-Lohse, D. (2021). Learning through video games: The impacts of competition and cooperation. *E-Learning and Digital Media*, *18*(1), 1–17. https://doi.org/10.1177/2042753020949983

Fathurrahman, A., Sumardi, S., Yusuf, A. E., & Harijanto, S. (2019). Peningkatan Efektivtas Pembelajaran Melalui Peningkatan Kompetensi Pedagogik Dan Teamwork. *Jurnal Manajemen Pendidikan*, *7*(2), 843–850. https://doi.org/10.33751/jmp.v7i2.1334

Fernandez-Rio, J., Sanz, N., Fernandez-Cando, J., & Santos, L. (2017). Impact of a sustained Cooperative Learning intervention on student motivation. *Physical Education and Sport Pedagogy*, *22*(1), 89-105.

Fitra, D. K. (2022). Analisis Penerapan Pembelajaran Berdiferensiasi Dalam Kurikulum Merdeka Pada Materi Tata Surya Di Kelas Vii Smp. *Tunjuk Ajar: Jurnal Penelitian Ilmu Pendidikan*, *5*(2), 278. https://doi.org/10.31258/jta.v5i2.278-290

Johnson, D. W., & Johnson, R. T. (1989). *Cooperative learning: Theory, research, and practice*. Prentice-Hall.

Kyndt, E., Raes, E., Lismont, B., Timmers, F., Cascallar, E., & Dochy, F. (2013). A meta-analysis of the effects of face-to-face cooperative learning. Do recent studies falsify or verify earlier findings?. *Educational research review*, *10*, 133-149.

Laal, M., & Ghodsi, S. M. (2012). Benefits of collaborative learning. *Procedia-social and behavioral sciences*, *31*, 486-490.

Lane, S. (2016). Developing Employability Skills by Using Blended Learning. *American Journal of Educational Research*, *4*(1), 47–53. https://doi.org/10.12691/education-4-1-9

Murdoko, Y., Mardiyana, M., & Usodo, B. (2017). Penerapan Model Pembelajaran Team Assisted Individualization (Tai) Dan Teams Game Tournaments (Tgt) Pada Materi Lingkaran Ditinjau Dari Gaya Belajar Siswa Smp Di Kabupaten Wonogiri. *Journal of Mathematics and Mathematics Education*, *7*(1), 58–69. https://doi.org/10.20961/jmme.v7i1.20246

Pamungkas, A. H., Sunarti, V., Arini, F. D., & Azizah, Z. (2022). Link and match program between course and training agency with industry to increase working opportunities for people with disabilities. *Ieomsociety.Org*, (1), 4219–4229. Retrieved from

https://ieomsociety.org/proceedings/2022istanbul/787.pdf

Putri, N. P. R., Efrizon, & Sriwahyuni, T. (2018). PENERAPAN METODE PEMBELAJARAN TEAM ASSISTED INDIVIDUALIZATION (TAI) UNTUK MENINGKATKAN HASIL BELAJAR MATA PELAJARAN SIMULASI DIGITAL KELAS X RPL DI SMK NEGERI 4 PAYAKUMBUH. *VOTEKNIKA*, *6*(1).

Putri, P. O. (2019). Implementasi Model Pembelajaran Team Game Tournament (TGT) Untuk Meningkatkan Hasil Belajar Siswa. *Intersections*, *4*(2), 8–16. https://doi.org/10.47200/intersections.v4i2.496

Rakhmetov, M., Sadvakassova, A., Saltanova, G., & Yessekenova, A. (2022). Usage and effectiveness of educational platforms in Kazakhstan during the Covid-19 pandemic. *World Transactions on Engineering and Technology Education*, *20*(3), 226–231.

Salam, A., Hossain, A., & Rahman, S. (2015). The Effect of using Teams Games Tournaments (TGT) Cooperative Technique for Learning Mathematics in secondary schools of Bangladesh. *Journal of Research in Mathematics Education*, *4*(3), 271–287. https://doi.org/10.17583/redimat.2015.1519

Sundari, E., Khairuddin, K., & Jumadil, J. (2023). Penerapan Model Pembelajaran Kooperatif Tipe Team Games Tournament (TGT) terhadap Minat Belajar Peserta Didik. *Educatoria : Jurnal Ilmiah Ilmu Pendidikan*, *3*, 242–247. https://doi.org/10.36312/educatoria.v3i4.218

Vennix, J., den Brok, P., & Taconis, R. (2018). Do outreach activities in secondary STEM education motivate students and improve their attitudes towards STEM? *International Journal of Science Education*, *40*(11), 1263–1283. https://doi.org/10.1080/09500693.2018.1473659

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Walukow, I., & Pangemanan, S. A. (2016). PENGEMBANGAN MODEL STRATEGI BERSAING PENDEKATAN QUANTITATIVE STRATEGIC PLANNING MATRIX (QSPM). *Seminar Nasional Terapan Riset Inovatif*, *01*, 15–16.

Wibowo, N. (2016). Upaya Memperkecil Kesenjangan Kompetensi Lulusan Sekolah Menengah Kejuruan dengan Tuntutan Dunia Industri. *Jurnal Pendidikan Teknologi Dan Kejuruan*, *23*(1), 45. https://doi.org/10.21831/jptk.v23i1.9354

Wiyono, A., & Haryudo, S. I. (2023). Optimising vocational school development for priority industry sectors in Indonesia using location quotient analysis. *World Transactions on Engineering and Technology Education*, *21*(1), 50–57.

Wu, X. (2021). Application of Artificial Intelligence in Modern Vocational Education Technology. *Journal of Physics: Conference Series*, *1881*(3). https://doi.org/10.1088/1742-6596/1881/3/032074

Yang, Y., Zhang, Y., Tar, C., & Baldridge, J. (2019). PAWS-X: A cross-lingual adversarial dataset for paraphrase identification. *arXiv preprint arXiv:1908.11828*.

Zykrina, S., Gabdullin, R., & Kozhabaev, K. (2022). Effective teacher feedback: adapting Internet technologies for criteria-based assessment. *World Transactions on Engineering and Technology Education*, *20*(3), 196–202.