

Teams Games Tournament Learning Model; Efforts in Improving Students' Way of Thinking

Febriyanti Ghayatul Qushwa^{1(✉)}, Anis Sulala²

¹Universitas Nurul Jadid Probolinggo, East Java, Indonesia

²Universitas Nurul Jadid Probolinggo, East Java, Indonesia

(✉)Correspondence to: qushwa23@gmail.com

Received: May 2023

Accepted: June 2023

Published: July 2023

DOI: <https://doi.org/10.71392/ejip.v2i2.77>

Abstract: The aims of this study was to explore the effectiveness of the Teams Games Tournament (TGT) learning model in increasing students' cognitive engagement and reducing boredom during classroom learning. Using the Classroom Action Research (CAR) methodology, this study involved 24 female students from class VIII B Regular. Data collection used pre-test and post-test assessments to evaluate learning progress. The intervention followed four procedural stages: planning, action implementation, observation/evaluation, and reflection. Initial findings revealed suboptimal student performance, with only 8.3% achieving the learning mastery standard (mean score: 56.91). After implementing the TGT model in the second cycle, significant improvements were observed. The students' average score increased to 80.25, and 70.83% of students met the learning mastery threshold. These results demonstrate the capacity of the TGT model to stimulate active student participation, encourage cooperative learning, and improve critical thinking skills. This study underscores the importance of implementing a student-centered pedagogical approach to maximize educational outcomes and engagement, especially in a complex subject such as Tajwid Science. This study provides valuable insights for educators seeking to develop interactive and inclusive classroom environments. While the results are promising, further research is recommended to examine the adaptability of the TGT model across different subject areas and student demographics.

Keywords – *Teams Games Tournament Learning Model, How to Think for Students*

Abstrak – Tujuan penelitian ini untuk mengeksplorasi efektivitas model pembelajaran Teams Games Tournament (TGT) dalam meningkatkan keterlibatan kognitif siswa dan mengurangi kebosanan selama pembelajaran di kelas. Dengan menggunakan metodologi Penelitian Tindakan Kelas (PTK), penelitian ini melibatkan 24 siswi dari kelas VIII B Reguler. Pengumpulan data menggunakan penilaian pra-tes dan pasca-tes untuk mengevaluasi perkembangan pembelajaran. Intervensi mengikuti empat tahap prosedural:

perencanaan, implementasi tindakan, observasi/evaluasi, dan refleksi. Temuan awal mengungkapkan kinerja siswa yang kurang optimal, dengan hanya 8,3% yang mencapai standar penguasaan pembelajaran (skor rata-rata: 56,91). Setelah menerapkan model TGT pada siklus kedua, peningkatan yang signifikan diamati. Skor rata-rata siswa meningkat menjadi 80,25, dan 70,83% siswa memenuhi ambang batas penguasaan pembelajaran. Hasil ini menunjukkan kapasitas model TGT untuk merangsang partisipasi siswa aktif, mendorong pembelajaran kooperatif, dan meningkatkan keterampilan berpikir kritis. Studi ini menggarisbawahi pentingnya penerapan pendekatan pedagogis yang berpusat pada siswa untuk memaksimalkan hasil dan keterlibatan pendidikan, khususnya dalam mata pelajaran yang kompleks seperti Ilmu Tajwid. Penelitian ini memberikan wawasan berharga bagi para pendidik yang ingin mengembangkan lingkungan kelas yang interaktif dan inklusif. Meskipun hasilnya menjanjikan, penelitian lebih lanjut direkomendasikan untuk memeriksa kemampuan adaptasi model TGT di berbagai mata pelajaran dan demografi siswa.

Kata Kunci – Model Pembelajaran Teams Games Tournament, Cara Berfikir Siswa

INTRODUCTION

Learning is the effort of a person or group of people to produce *goals* in the form of an *attitude* that is insightful on knowledge, values, skills, and positive thinking based on experience (Herbert et al., 2020; Toh & Kirschner, 2020). Through learning one is able to know an unknown knowledge, become able, even proficient. In this case, education in schools is a means to channel belajar activities (Hewett, Zeng, & Pletcher, 2020; Wei et al., 2020). The existence of education is a law of quality for the next generation of the nation in inheriting religious values, culture, thoughts, and expertise in order to be ready to face and bring the Indonesian nation towards a better future (Carpenter et al., 2020; Khotimah et al., 2021).

What should be noted, a learning also depends on the teacher's ability to develop a learning model that aims to increase the intensity of student participation in the classroom (Tantri et al., 2023). That is why, a teacher should be able to choose the right learning model to use and implement in the classroom so that learning objectives can be achieved and able to improve students' reasoning, and way of thinking (Williams, Pill, & Hewitt, 2021).

As the learning process progresses, the teacher acts as a subject and the student becomes an active, dynamic and interactive object. In this case, students become objects that become components of learning that require main attention because students play an important role for the progress of a community order (Ishaq et al., 2021). Thus, independence will be formed in students in getting used to being involved in an activity both within the family and community.

Not only prioritizing attention to students, a teacher must also pay attention to the development of students' thinking ability. This is because the ability of students to think is needed in various lives (Hsieh, 2020). Therefore, the ability to think should be honed from an early age either at school, at home or in the community. Related to learning, thinking is one way to understand a learning. This is what needs to be emphasized that the ability to think critically, logically, systematically, analytically, creatively, and cooperatively can make a learning of higher quality.

Ironically, facts on the ground show that the development of students' thinking skills is often hampered by problems. For example, the problem in MTs N 1 Probolinggo is that students feel bored and saturated in the learning process. This is due to the method presented by the teacher. In this case, the majority of teachers still use conventional learning models centered on teacher activity (*Teacher Centered Learning*) (Zamroni et al., 2021). This means that learning is still one-way so that students have little opportunity to explore ideas and abilities in themselves. In its implementation, students become passive objects who only listen to the teacher in delivering the material. As a result, both student involvement, cooperation in groups, and teaching and learning activities become inefficient, causing low learning achievement (Astuti & Kristin, 2017).

In overcoming the problems as mentioned above, an innovative learning model is needed. *Teams Games Tournament* (TGT) can be a learning model as a solution to improve the way students think in MTs N 1 Probolinggo. The TGT learning model can help the learning process in the classroom to take place optimal. This learning model includes cooperative type learning in which learners are gathered in study groups so that learning is student-centered (Wang & Jian, 2022; Staneva et al., 2023).

The existence of learning innovations carried out by teachers is expected to make students more active in the classroom. Especially if the learning model applied is cooperative learning such as *Teams Games Tournament* (TGT). So, the cooperative learning model can be one way so that students are no longer saturated and bored, but active and participatory. This is in line with Faizah's opinion (in Ulfa et al.) which states that TGT learning is included in effective cooperative learning to improve the thinking ability of participants. In addition, the *Teams Games Tournament* learning model can make students feel happy and enthusiastic because of the challenging games in the learning.

On the other hand, teachers should give certain stimuli such as yell or clapping so that the specific skills possessed by students are better trained through the TGT learning model so that the learning achievements obtained will increase. These various foundations are what make researchers strive to apply the *Teams Games Tournament* learning model in MTs N 1 Probolinggo class VIII B Regular.

To obtain comprehensive analysis results, researchers seek to review other studies relevant to this research topic. For example, research conducted by Hakim and Syofyan states that the TGT cooperative learning model can motivate learners in learning. In line with the study, Damayanti and Apriyanto also stated that the learning outcomes of students in mathematical learning have increased with the application of the Teams Games Tournament (TGT) type cooperative learning model.

The two studies both show that the TGT model has a positive impact on student motivation and learning outcomes. In this case, the author also examines the TGT learning model. The difference is that the researcher's focus is on using the TGT model as a means of improving the way of thinking of female students. This is because the TGT model is included in the cooperative learning model (Gupta et al., 2023). Through cooperative learning, students are required to be able to solve problems faced with their peers, so as to help students to be more active in the classroom. This is what the novelty of the research is all about.

In addition, the implementation of teaching and learning activities in conventional MTs N 1 Probolinggo often does not trigger the critical attitude of female students. Because, conventional learning is only in the form of conveying information through lectures so that it refers more to the activeness of the teacher, while students only listen, copy, and answer questions. In this case, the teacher is only limited to giving examples of questions and exercises that are routine in nature and do not utilize the critical thinking power of female students. After that, the teacher evaluates the learning outcomes through the assessment of the questions that have been answered (Walker et al., 2020). TGT's cooperative learning model which is group work in the form of academic games played by one group of students with another group (Jauza Nareswari et al., 2024). There is no distinction of social or intellectual status in the score achievement in the group because the implementation of academic games is carried out in teams. So, the TGT model makes learners as peer tutors but in the form of games or tournaments. In this case, the researcher wants to focus on the object of MTs N 1 Probolinggo students. Thus, all objects are female and have their own characteristics.

Research on the *Teams Games Tournament* (TGT) learning model is important to study because the learning model has a function to improve the way students think in MTs 1 Probolinggo. That way, students will become a learning center (*Student Centered Learning*) so that students' thinking skills become more honed during classroom learning. Furthermore, TGT learning which is classified as cooperative learning can hone students' social skills in group activities so as to improve student learning achievement. When learning is centered on female students, it shows the activeness of female students so that it can improve student

learning outcomes. Because, when female students are active, it means a lot of new knowledge they absorb.

RESEARCH METHOD

The focus of this research is an effort to improve the thinking ability of students through the Teams Games Tournament learning model by applying a qualitative research approach of the Class Action Research (PTK) type. Class Action Research (PTK) was chosen to establish the rationality of an action, understand the action in depth, and improve a learning practice (Silva, Farias, & Mesquita, 2024). In carrying out this study, researchers applied two cycles, namely cycles 1 and 2 to determine the differences in students' thinking levels before and after using the *Teams Games Tournament* (TGT) learning model. In each cycle carried out there are four stages, namely action planning, action implementation, observation / evaluation, and reflection.

This research was carried out at MTs N 1 Probolinggo class VIII B Regular with a total of 24 students. To be precise, the learning model of the *Teams Games Tournament* is carried out on the subject of Tajwid Science. The data listed were obtained from the results of observations and evaluation records in the pre-cycle as well as the results of giving tests in cycle 1 and cycle 1 to students of class VIII B Regular with a total of 24 people.

FINDINGS AND DISCUSSION

Teams Gamestournament Learning Model

An expert named Johnson Smith suggests that a cooperative learning model can foster five important things from a learner: *first*, positive independence; *second*, triggering interactions between learners directly; *third*, individual and group accountability; *fourth*, interpersonal and small group skills; *fifth*, group processing skills (Liyanage et al., 2022). The TGT learning model is a model that can trigger students to be more enthusiastic about learning, and this learning model really needs to be applied because it can grow the character of students to do work together and improve the learning outcomes of *Teams Games Tournament* (TGT) students are also classified as cooperative learning that is not difficult to do, games or tournaments in TGT can involve all students without must distinguish statuses, as well as teach female students to become peer tutors through the element of the game. This TGT learning aims to improve the thinking of students, especially during learning. With this learning model, students are more active in a more lively classroom atmosphere and students are not impressed as spectators. However, students can also review the lessons or materials that have been explained and shape themselves so that students can bring out the talents that exist in the student. Therefore, the cooperation

between students and teachers can build interactions in the classroom to be more active and fun (Fitri et al., 2025).

The procedure in the TGT learning model is that the teacher first transfers knowledge, in *this case, the* teacher as a center of learning, namely as a teacher in learning that directs students. *Second*, the students are divided into heterogeneous groups, meaning that the teacher spreads to students who have *high thinking*, (*is a way of thinking critical students in solving problems. normal thinking (thinking critically in normal levels), and low thinking (thinking abnormally or slow in thinking)*). *Third*, students are instructed to advance to the tournament table with a representative system that has the same intellectuals. *Fourth*, after the game was ended, the female student was asked to return to the original place. *Fifth*, the teacher provides *punishment* for the losing student, which must re-deliver the material that has been taught and give *rewards* to the student who determines the champion in the form of praise and grade prizes. Below is table 1 of the *Teams Games Tournament* TGT learning procedure:

Table 1. Prsedur Model Pembelajaran Teams Games Tournament

Sintak Model Pembelajaran <i>Teams Games Tournament</i> (TGT)	
Langkah-langkah	Aktivitas Guru
Presentasi Kelas	Guru menyampaikan informasi yang diperlukan dalam pembelajaran, menyampaikan kompetensi yang ingin dicapai, memotivasi siswa dalam belajar.
<i>Teams</i>	Guru membagi kelas menjadi beberapa kelompok belajar yang bersifat heterogen.
<i>Games</i>	Guru membimbing siswa untuk menjawab pertanyaan dalam <i>games</i> .
<i>Tournament</i>	Guru mengadakan kompetisi antar kelompok dan memberikan evaluasi untuk mengetahui hasil belajar siswa.
Rekondisi Tim	Guru memberikan penghargaan kepada kelompok belajar atas usaha dan hasil belajar yang telah dicapai.

(Sumber: diadaptasi dari Rusman, 2016:225)

Based on the table above, it can be concluded that teachers are intensely implementing systematically, namely class presentations, Teams, Games, Tournaments, and Team Reconditioning. So that in the final stage students can carry out fun lessons in the form of rewards / awards.

Learning model of teams games tournament in improving the way students think in mts n 1 probolinggo

Pre-cycle

The difficulty of learning tajwid knowledge which has many kinds is often complained by MTsN 1 Probolinggo students. This difficulty can be

caused by the teacher's inaccuracy in choosing a learning model in improving the thinking of students. In fact, the conditions in the classroom during the learning of tajwid science take place, students seem to be more busy by themselves, so students are not very active in learning in class. At the time of learning, there were still students who just sat and were silent because some students thought that the subject of tajwid science was a boring lesson so that learning outcomes were not optimal (Tang & Hare, 2020). The lack of maximum learning outcomes can be seen when students are unable to answer practice questions properly.

Cycle 1

In cycle 1 (before the TGT learning model was applied), students did not have the opportunity to actively participate or have discussions between friends in learning Tajwid Science. That is what causes a sense of saturation in female students when listening to the material, so that the student's learning achievement is unstable or ups and downs (Hambali, Rozi, & Farida, 2021). From the review, researchers visited MTS N 1 Probolinggo on Tuesday, November 23, 2021 to meet teachers of tajwid science subjects. After meeting the tajwid science subject teachers, an agreement was obtained to conduct a trial of the TGT learning model on Tuesdays at 3-4 at 08.30 to 09.30 WIB and Thursday (November 25, 2021) at 7-8 at 11.00 to 12.00 WIB. The implementers of the TGT learning model are the researchers themselves while the teachers of the Tajwib Science subjects are the observers. In this case, the task of the observer is to pay attention to, review, and assess the activities of researchers and students during the TGT learning model. Of course, researchers have received student data from teachers of Tajwid Science subjects in preparation for the implementation of the TGT learning model. From the student's data, researchers began to form study groups in TGT learning.



Figure 1. Formation of a Study Group

As shown in Figure 1, researchers divided the regular class VIII students into several groups which is the first step in the TGT learning model. In order to make the formation of the study group more accurate, the researcher gave a pre-test when the Tajwid Science lesson began to sort the results of the scores from the highest to the lowest. From the sequencing of these grades, the students were divided into 6 study groups in the order of namely the group of students with high academic ability I, high II, medium I, medium II, low I, low II. Then, these groups are spread out to become heterogeneous groups of academic abilities so that there is no inequality in learning outcomes.

The distribution of group members is carried out by placing a female student with high academic ability I, a student with high academic ability II, a student with medium academic ability I, a student with medium academic ability II, a student with low academic ability I, and a student with low academic ability II into one study group. In addition to forming heterogeneous study groups, the results of the pre-test assessment of Tajwid Science subjects are used to find out the basic knowledge and thinking ability of students before the TGT learning model is implemented. The following is a table of pre-test results before the TGT learning model is applied:

Table 2. Student Learning Outcomes Before TGT Implementation

Student Criteria	Schoolgirl Code	Gender	Initial Test Scores
Students with high academic ability I	NNASA	P	76
	GO	P	76
	ADN	P	73
	SAN	P	73
High academic ability student II	EYES	P	72
	NN	P	72
	SN	P	72
	MONKEY	P	72
Students with moderate academic ability I	KNA	P	70
	MRL	P	70
	UDH	P	70
	VNL	P	70
Students with moderate academic ability II	SB	P	68
	NEW	P	68
	RW	P	68
	DHA	P	68
Students with low academic ability I	CS	P	59
	YAN	P	59
	UNK	P	59
	AT	P	59

Students with low academic ability II	UB AS SM KH	P P P P	57 57 57 57
No	Information	Result	
1	Total <i>pre-test</i> participants	24	schoolgirls
2	Total <i>pre test</i> scores	1366	
3	<i>Average pre test</i> score	56,91	
4	Total female students who achieved learning completion	2	schoolgirls
5	Percentage of learning completion	8,3%	
6	Total female students who did not reach learning completion	22	schoolgirls
7	Percentage of learning incompleteness	91,7%	

By reviewing the table of pre-test results of tajwid science subjects class VIII B Regular MTsN 1 Probolinggo before the TGT learning model was applied, it can be seen that the learning outcomes of Tajwid Science subjects have not exceeded the established learning completion standard, which is 75%. This is evidenced by the results of the calculation of the total average score of 56.91 students obtained from the calculation = 56.91, while the students who achieved learning completion were only 2 people or 8.3% obtained from the calculation. $\frac{\sum \text{skor yang diperoleh siswi}}{\sum \text{seluruh siswa}} = \frac{1366}{24} \times \frac{\sum \text{siswi yang tuntas}}{\sum \text{seluruh siswa}} \times 100\% = \frac{2}{24} \times 100\% = 8,3\%$

Cycle II

On Thursday, November 25, 2021, researchers returned to MTsN 1 Probolinggo class VIII B Regular to start implementing the TGT (*Teams Games Tournament*) learning model and providing post tests on Tajwid Science subjects. The procedure for implementing the TGT learning model in MTsN 1 Probolinggo class VIII B Regular is by determining the TGT components. The *first* component is a class presentation (class presentation) to introduce the material to be used in TGT through lesson discussions (*off learning*) which is collaborated with audio-visual presentations. The goal is to attract the sympathy of female students to give their full attention during the lesson. *The second is* the grouping of female students based on study groups that have been created at previous meetings (Cycle 1). *Third,* the implementation of a game that contains several basic questions that must

be answered by students to test students' knowledge during presentations in class with their team.



Figure 2. The teacher asks a question to the female student for the team to answer

Shown in Figure 2, the game is played on a table with three female students as representatives of three different groups. In this game, a female student must pick up a numbered card and answer the questions listed on the card. At the event, the teacher appointed students from each group to be at the tournament table. Two female students with high academic ability are at table 1, two students with moderate academic ability at table 2, and 2 students with low academic ability at table 3, as is true in each group. The mixing of academic abilities in each group is the same as the individual progress score system, so that each female student of all ability levels can participate to the maximum to collect scores for their team. *The four* tournaments build structures as the game progresses. At this stage, the teacher gives a presentation assignment in front of the class to show the results of answering questions with the group on the activity sheet.

After the tournament was held, researchers again gave a test (post test) to find out the learning outcomes of each student. The following is a table of post-TGT test results:

Table 3. Student Learning Outcomes After TGT

Student Criteria	Schoolgirl Code	Gender	Initial Test Scores
Students with high academic ability I	ANA	P	95
	AND	P	95
	ANK	P	95
	DAM	P	95
High academic	DW	P	92
	DMPP	P	87
	IN	P	92

ability student II	FK	P	87
Students with moderate academic ability I	IJT	P	85
	IDP	P	85
	JNI	P	81
	LITTLE	P	80
Students with moderate academic ability II	KMH	P	78
	NWJ	P	75
	NAA	P	76
	NNN	P	75
Students with low academic ability I	NK	P	75
	NPD	P	74
	PDA	P	74
	Go out	P	70
Students with low academic ability II	SNM	P	65
	SRH	P	65
	TS	P	65
	TAF	P	65

No	Information	Result
1	Total <i>post test</i> participants	24 schoolgirls
2	Total <i>post test</i> values	1926
3	<i>Average post test score</i>	80,25
4	Total female students who achieved learning completion	17 schoolgirls
5	Percentage of learning completion	70,83%
6	Total female students who did not reach learning completion	7 schoolgirls
7	Percentage of learning incompleteness	29,16%

By reviewing the post test results after the TGT learning model was applied to Tajwid Science subjects in VIII B Regular MTsN 1 Probolinggo, it was seen that the learning outcomes had reached the set, which was 75%. This is evidenced by the total average score of students of 80.25 obtained from the calculation = 80.25 and students who achieved learning completion of 17 people or 70.83% obtained from the calculation. The increase in learning outcomes shows that the thinking ability of female students is also increasing. $\frac{\sum \text{skor yang diperoleh siswi}}{\sum \text{seluruh siswa}} \times 100\% = \frac{\sum \text{siswi yang tuntas}}{\sum \text{seluruh siswa}} \times 100\% = \frac{17}{24} \times 100\% = 70,83\%$.

This study contributes to educational practice by demonstrating the effectiveness of the Teams Games Tournament (TGT) learning model in enhancing students' critical thinking and engagement. It provides empirical evidence that cooperative learning frameworks like TGT can significantly improve academic performance and reduce classroom boredom, particularly in challenging subjects such as Tajwid Science. The research offers a practical instructional strategy for educators seeking to promote student-centered learning and active participation. Additionally, the study highlights the potential of structured peer collaboration to foster social skills and academic accountability, offering valuable guidance for future classroom applications and further educational research.

CONCLUSION

This study revealed that the application of the Teams Games Tournament (TGT) learning model significantly enhanced students' critical thinking and learning outcomes in Tajwid Science at MTs N 1 Probolinggo. The most important finding is that structured cooperative learning, when implemented effectively, transforms passive learning environments into active, student-centered experiences, leading to a substantial improvement in both cognitive engagement and academic achievement. The implication of this research is the validation of TGT as a viable alternative to conventional teacher-centered approaches, particularly in contexts where student motivation and participation are low. Scientifically, the study contributes empirical evidence to the field of cooperative learning, confirming its role in fostering student collaboration, accountability, and critical thinking. Practically, it provides a replicable instructional model for educators to enhance classroom interaction and student performance. However, the study has limitations, particularly the small sample size and focus on a single subject and gender group, which may affect generalizability. Future research is recommended to examine the adaptability and effectiveness of the TGT model across diverse subjects, educational levels, and mixed-gender settings to validate and expand its applicability. This study serves as a foundation for further exploration into innovative pedagogical strategies aimed at improving student learning and engagement.

REFERENCES

- Astuti, W., & Kristin, F. (2017). Penerapan Model Pembelajaran Teams Games Tournament untuk Meningkatkan Keaktifan dan Hasil Belajar IPA. *Ilmiah Sekolah Dasar*, 1(3), 155–162.
- Carpenter, D., Geden, M., Rowe, J., Azevedo, R., & Lester, J. (2020). Automated analysis of middle school students' written reflections

- during game-based learning. *Lecture Notes in Computer Science (Including Subseries Lecture Notes in Artificial Intelligence and Lecture Notes in Bioinformatics)*, pp. 67–78. https://doi.org/10.1007/978-3-030-52237-7_6
- Fitri, A. H., Alnedral, Gusril, Nurhastuti, & Syafruddin. (2025). Design of Cooperative Learning Model of Teams Games Tournaments Type to Improve Basic Movement Skills of Students with Mild Intellectual Disabilities in Special Schools. *Annals of Applied Sport Science*, 13(Special-Issue), 183–186. Retrieved from <https://www.scopus.com/inward/record.uri?partnerID=HzOxMe3b&scp=105004287578&origin=inward>
- Gupta, A., Carpenter, D., Min, W., Rowe, J., Azevedo, R., & Lester, J. (2023). Detecting and Mitigating Encoded Bias in Deep Learning-Based Stealth Assessment Models for Reflection-Enriched Game-Based Learning Environments. *International Journal of Artificial Intelligence in Education*, 34(3), 1138–1165. <https://doi.org/10.1007/s40593-023-00379-6>
- Hambali, H., Rozi, F., & Farida, N. (2021). Pengelolaan Pembelajaran Ilmu Tajwid Melalui Media Audio Visual. *NATURALISTIC: Jurnal Kajian Penelitian Pendidikan Dan Pembelajaran*, 5(2), 872–881. <https://doi.org/10.35568/naturalistic.v5i2.1180>
- Herbert, I. P., Rothwell, A. T., Glover, J. L., & Lambert, S. A. (2020). Graduate employability, employment prospects and work-readiness in the changing field of professional work. *International Journal of Management Education*, 18(2). <https://doi.org/10.1016/j.ijme.2020.100378>
- Hewett, K. J. E., Zeng, G., & Pletcher, B. C. (2020). The Acquisition of 21st-Century Skills Through Video Games: Minecraft Design Process Models and Their Web of Class Roles. *Simulation and Gaming*, 51(3), 336–364. <https://doi.org/10.1177/1046878120904976>
- Hsieh, H. C. L. (2020). Integration of environmental sustainability issues into the “game design theory and practice” design course. *Sustainability (Switzerland)*, 12(16). <https://doi.org/10.3390/SU12166334>
- Ishaq, K., Rosdi, F., Zin, N. A. M., & Abid, A. (2021). Heuristics and Think-aloud Method for Evaluating the Usability of Game-based Language Learning. *International Journal of Advanced Computer Science and Applications*, 12(11), 311–324. <https://doi.org/10.14569/IJACSA.2021.0121136>
- Jauza Nareswari, T., Wahyu Wijaya, H., & Candra Eka Setiawan, N. (2024). Development of STEAM-2C: Integrated Acid-Base Digital Book Based on Malang Local Wisdom. *E3S Web of Conferences*, Vol. 481. <https://doi.org/10.1051/e3sconf/202448104003>
- Khotimah, R. P., Adnan, M., Ahmad, C. N. C., & Murtiyasa, B. (2021). Science, Mathematics, Engineering, and Mathematics (STEM)

- Education in Indonesia: A Literature Review. *Journal of Physics: Conference Series*, Vol. 1776. <https://doi.org/10.1088/1742-6596/1776/1/012028>
- Liyanage, C., Kavinda, U. A. D. S., Dasanayaka, D. S., Shehara, P. G. J., & De Silva, D. I. (2022). Interactive Mobile Application for Initial Skills Development of Primary Students in Sri Lanka. *4th International Conference on Advancements in Computing, ICAC 2022 - Proceeding*, pp. 358–362. <https://doi.org/10.1109/ICAC57685.2022.10025350>
- Silva, R., Farias, C., & Mesquita, I. (2024). "It's Good to Have a Voice": What Do Students Think about the Impact of a Flexible Curricular Implementation of Student-Centered Pedagogies on Their Own Learning Experiences? *Education Sciences*, 14(10). <https://doi.org/10.3390/educsci14101074>
- Staneva, A., Ivanova, T., Rasheva-Yordanova, K., & Borissova, D. (2023). Gamification in Education: Building an Escape Room using VR Technologies. *2023 46th ICT and Electronics Convention, MIPRO 2023 - Proceedings*, pp. 678–683. <https://doi.org/10.23919/MIPRO57284.2023.10159923>
- Tang, Y., & Hare, R. (2020). Random forest-based adaptive narrative game for personalized learning. *ASEE Annual Conference and Exposition, Conference Proceedings*, Vol. 2020-June. Retrieved from <https://www.scopus.com/inward/record.uri?partnerID=HzOxMe3b&scp=85095746486&origin=inward>
- Tantri, A., Aprial, B. M., Mashud, Kristiyandaru, A., Kahri, M., Basuki, S., ... Suryadi, D. (2023). Modification of interactive multimedia with the ARA MODEL: study of development of football learning models in pandemic times. *Retos*, 50, 1289–1298. <https://doi.org/10.47197/retos.v50.100587>
- Toh, W., & Kirschner, D. (2020). Self-directed learning in video games, affordances and pedagogical implications for teaching and learning. *Computers and Education*, 154. <https://doi.org/10.1016/j.compedu.2020.103912>
- Walker, E., Desjardins, J., & Przestrzelski, B. (2020). Re-designing the senior design classroom experience with game-based learning. *Advances in Engineering Education*, 8(1), 1–22. Retrieved from <https://www.scopus.com/inward/record.uri?partnerID=HzOxMe3b&scp=85084917420&origin=inward>
- Wang, T. N., & Jian, Y. C. (2022). A Systematic Review of Eye-Tracking Studies on Text-Diagram Science Reading. *Bulletin of Educational Psychology*, 53(4), 773–800. [https://doi.org/10.6251/BEP.202206_53\(4\).0001](https://doi.org/10.6251/BEP.202206_53(4).0001)
- Wei, H., Li, H., Xia, M., Wang, Y., & Qu, H. (2020). Predicting student performance in interactive online question pools using mouse

interaction features. *ACM International Conference Proceeding Series*, pp. 645–654. <https://doi.org/10.1145/3375462.3375521>

Williams, J., Pill, S., & Hewitt, M. (2021). 'I think everyone is on board with changing how we do things, but we are yet to find a best fit model': A figurational study of assessing games and sport in physical education. *Sport, Education and Society*, 26(3), 253–266. <https://doi.org/10.1080/13573322.2020.1716212>

Zamroni, Rofiki, M., Rozi, F., Muali, C., K, I. H., Majid, T., ... Ita, C. (2021). E-Leadership in Education in Improving Teacher Competence in Industrial Revolution 4 . 0. *Turkish Online Journal of Qualitative Inquiry (TOJQI)*, 12(4), 1650–1654.