

EMPOWERING JUNIOR HIGH SCHOOL STUDENTS' COLLABORATION SKILLS THROUGH SCIENCE LEARNING USING THE *SECRET MISSION* GAME

Rahma Fika Kurnia^{1*}, Imraatul Mufidah², Dyne Rizki Puspitasari²

¹ PPG Prajabatan-Pendidikan IPA, Universitas Negeri Malang

Jl. Semarang No. 5 Kota Malang, Jawa Timur, Indonesia

² SMP Laboratorium Universitas Negeri Malang

Jl. Simpang Bogor No. T-7, Kota Malang, Jawa Timur, Indonesia

*Corresponding author, email: rahmafika369@gmail.com

doi: 10.17977/um084v4i12026p174-183

Keywords

Collaboration Skills,
Game-Based Learning,
Lesson Study,
Science Learning,
Secret.Mission Game

Subject

Science Education,
Educational Technology,
Game-Based Learning,
Collaborative Learning

Article History

Submitted: May 16, 2025

Revised: April 6, 2026

Accepted: May 5, 2026

Published: May 6, 2026

Abstract

This study aimed to empower the collaboration skills of Class VII B students at SMP Laboratorium UM through the implementation of the Game-Based Learning model using the Secret.Mission game in science learning on the topic of Physical and Chemical Changes. The study was motivated by the low level of students' collaboration skills, as indicated by previous classroom assignments that were mostly completed individually rather than collaboratively in groups. The study employed the Lesson Study approach, which consisted of three stages: Plan, Do, and See. During the planning stage, the Lesson Study team collaboratively designed learning modules, game scenarios, instructional media, and observation instruments. In the implementation stage, students participated in the Secret.Mission game through group-based missions requiring communication, teamwork, and problem-solving skills. Observation results showed that most students actively engaged in collaborative activities during the learning process. The findings revealed that the implementation of the Secret.Mission game successfully empowered students' collaboration skills, as reflected in several indicators, including accepting assigned group membership (90%), respecting differences of opinion (84%), actively contributing (75%), accepting group agreements (78%), and helping peers experiencing difficulties (66%). Therefore, the Secret.Mission game can serve as an innovative and interactive learning strategy to strengthen collaboration skills in junior high school science learning.

1. Introduction

Collaboration skills are among the essential 21st-century competencies in the learning process. According to Zubaidah (2019), students today are no longer expected to excel only in mathematics, reading, and writing, but also need to develop higher-order thinking skills and other competencies commonly referred to as 21st-century skills. Riaz and Din (2023) stated that collaboration and teamwork have become necessities and major trends in the 21st century, serving as important skills in all areas of life. Collaboration skills can be defined as behavioral skills in which a group of individuals work together and function as a team to achieve specific goals (Perumal, 2024). In the educational context, these skills not only encourage active student participation but also improve learning outcomes through peer interaction and discussion.

However, several studies have shown that students' collaboration skills remain relatively low. Ramírez et al. (2023) reported that affinity-based groups demonstrated higher levels of friendship, but lower levels of cooperation compared to control groups. Furthermore, Zha et al. (2025) found that when team tasks and individual tasks were assigned simultaneously, the completion rate of team tasks was consistently lower than that of individual tasks. This condition

negatively affects students' conceptual understanding, particularly in topics requiring in-depth discussion.

A similar problem was identified in Class VII B of SMP Laboratorium Universitas Negeri Malang. Based on the author's experiences during the Teaching Practicum Program (PPL I and PPL II), students' collaboration skills were still low. This issue was evident from several assignments given by the teacher during classroom meetings. Tasks that were intended to be completed collaboratively were instead completed individually by most students. Further observations revealed that several students were not chosen by their peers to join study groups. This finding indicates that students' sense of empathy and concern for one another remains low. The lack of social awareness and willingness to cooperate demonstrates that social interaction and collaborative skills have not yet been optimally developed in the classroom learning process. Therefore, the researcher proposed an innovative and enjoyable learning model that could increase students' interest in working collaboratively. One of the learning approaches considered suitable is the Game-Based Learning approach.

Game-Based Learning has increasingly attracted attention because of its positive effects on cognitive processes and student engagement (Leitner et al., 2023). Monalisa (2023) defined Game-Based Learning as a game-oriented learning model that integrates games into education to enhance learning activities. This model is designed to create a more interactive, engaging, and enjoyable learning environment for students. Research conducted by Lopez-Fernandez et al. (2023) demonstrated that Game-Based Learning in face-to-face settings can improve several aspects of the learning experience, including enjoyment gained through gameplay. Similarly, Puga (2022) explained that Game-Based Learning can promote teamwork and collaboration among students. In addition, Katual et al. (2023) revealed that integrating educational games into learning significantly enhances students' critical thinking and problem-solving skills, especially when combined with challenge-based approaches. The game implemented in this study was the *Secret Mission* game.

The *Secret Mission* game is a game-based learning activity that integrates hidden missions or secret tasks for each group member. Each student is assigned a specific responsibility known only to themselves and must accomplish it for the success of the group. This mechanism encourages students to actively communicate, collaborate, and support one another in completing the tasks. The stages of the Game-Based Learning model using the *Secret Mission* game are as follows: (1) students are instructed to form groups and directed to the game arena; (2) each group discusses and determines which clue will be taken; (3) the explorer and navigator representatives from each group stand in designated places determined by the teacher, while the navigator covers the explorer's eyes to prevent cheating; (4) the teacher starts a stopwatch and gives five minutes for the explorer and navigator to retrieve the agreed clue and return to their teammates; (5) the retrieved clue is discussed within the group to determine the location of the next clue; and (6) the teacher restarts the stopwatch and gives students 25 minutes to solve the problem contained in the next clue. In this game, clues serve as important learning media that bridge instructional content and gameplay activities, making the learning process more enjoyable and meaningful.

Strouse et al. (2024) suggested that printed media should be used more frequently for educational purposes. In this context, printed media are considered one of the supporting elements of Game-Based Learning, particularly when discussing types of educational games (Sousa et al., 2023). Printed media that can be used in educational games include educational game cards, board games, and printed activity sheets or puzzles (Yaman et al., 2024). The *Secret Mission* game

utilizes printed puzzle cards containing clues. Each clue indicates the location of the next clue in the form of educational game cards. These educational game cards contain practical activity instructions designed to help students' complete activity sheets collaboratively and systematically.

One advantage of Game-Based Learning is its psychological motivational aspect, which allows students to interact with educational materials in a more enjoyable and dynamic way (Lisa & Muthohar, 2024). Adipat et al. (2021) noted that learning processes associated with adventure games can improve players' general abilities to identify solutions to problems. This becomes highly relevant when applied to difficult topics such as Physical and Chemical Changes. This topic is considered challenging because misconceptions frequently occur. Students often struggle to distinguish between physical changes, which only involve changes in the form or state of matter, and chemical changes, which produce new substances. Mualifah and Rahayu (2023) reported that 26.66% of students experienced misconceptions regarding this topic.

Although Game-Based Learning offers several advantages, this approach is not without limitations. Clear articulation of research limitations contributes to improving the accuracy of study descriptions and supports the validity of interpretations of the findings (Smith et al., 2022). Limitations in educational research generally relate to the learning methods used, the participants involved, and the curriculum implemented (Aslam et al., 2024). In this study, the limitations include the implementation of Game-Based Learning through the *Secret Mission* game, the involvement of Class VII B students at SMP Laboratorium UM, and the use of the Merdeka Curriculum on the topic of Physical and Chemical Changes. Based on the explanation above, this learning model is expected to be appropriate for implementation in Class VII B of SMP Laboratorium UM, where greater interaction among students is needed to foster collaboration skills and improve conceptual understanding. Therefore, the purpose of this study is to empower junior high school students' collaboration skills through science learning using the *Secret Mission* game.

2. Method

This study employed Lesson Study as the instructional approach to obtain an in-depth understanding of students' collaboration skills in science learning through the implementation of the *Secret Mission* game based on the Game-Based Learning model. The study was conducted in February 2025 and involved a Lesson Study team consisting of science teachers, while the research participants were students of Class VII B at SMP Laboratorium UM. The collected data included students' responses to the implementation of the game-based learning model and their collaboration skills in science learning, particularly on the topic of Physical and Chemical Changes.

The learning process adopted the Lesson Study stages proposed by Lestari et al. (2023), which consist of planning (*plan*), implementation (*do*), and reflection (*see*). The first stage involved studying the curriculum and determining the learning objectives. In this stage, the teacher selected learning materials that were appropriate to students' needs and developmental levels. The teacher also identified the learning objectives and expected competencies to be achieved. Furthermore, the Game-Based Learning approach was adjusted to accommodate students' learning needs, and the *Secret Mission* game scenario was developed in accordance with the science material being taught.

The second stage focused on designing the learning process (*plan*). During this stage, the teacher selected and prepared suitable learning materials and instructional tools. Strategies for implementing Game-Based Learning were determined, and the procedures for conducting the *Secret Mission* activity in science learning were designed. In addition, the Lesson Study team

agreed on the observation techniques and instruments that would be used to measure students' collaboration skills.

The third stage was the implementation and observation of the learning process (*do*). In this stage, the model teacher implemented the *Secret Mission* game-based learning activity in Class VII B at SMP Laboratorium UM. Meanwhile, the Lesson Study (LS) team conducted observations to record students' responses and interactions throughout the learning process. The observers also focused on how students collaborated in completing the learning missions.

The fourth stage involved conducting reflection (*see*). At this stage, the model teacher and the LS team held collaborative discussions regarding the results of the learning implementation. They analyzed the effectiveness of the *Secret Mission*-based learning activity in identifying students' collaboration skills. Recommendations and improvements for optimizing the implementation of game-based learning were also formulated. Finally, the reflection results were documented for future development and improvement of the learning process.

The final stage was clinical supervision. In this stage, the supervising teacher and the LS team provided feedback regarding the implementation of the game-based learning activity. The student teacher then evaluated the effectiveness of the strategies that had been applied. The results of the supervision were subsequently used as evaluation materials to improve future learning activities.

The instrument used to measure students' collaboration skills in this learning activity consisted of five indicators adapted from Sufajar and Qosyim (2022). These indicators included students' willingness to accept assigned group membership, respect for differing opinions, active contribution to group activities, acceptance of group agreements, and willingness to help peers experiencing difficulties. These indicators were used to observe and evaluate students' collaborative behavior during the implementation of the *Secret Mission* game-based learning activities.

Table 1. Collaboration Skills Instrument

No.	Indicator	Description
1	Accepting assigned group membership	Students demonstrate openness and willingness to join and cooperate with groups assigned by the teacher voluntarily and without objection.
2	Respecting differences of opinion	Students listen attentively to their peers' opinions, avoid imposing their own views, and demonstrate tolerance toward differing perspectives.
3	Actively contributing	Students voluntarily and consistently provide ideas, assistance, or complete group tasks without being instructed.
4	Accepting group agreements	Students demonstrate commitment to rules or decisions that have been mutually agreed upon within the group.
5	Helping peers with experiencing difficulties	Students voluntarily offer assistance to peers who experience difficulties in understanding the material or completing tasks by re-explaining concepts, providing examples, or accompanying them until they gain better understanding.

Source: Adapted from Sufajar & Qosyim (2022).

3. Results and Discussion

This study collected observational data during the learning process using the Lesson Study approach. Data obtained from 32 students of Class VII B were analyzed to identify the implementation of the *Secret Mission* game in empowering junior high school students' collaboration skills. The results obtained during the planning (*plan*) stage indicated that the selected learning model was appropriate to students' needs, namely Game-Based Learning. The game used in this

learning model was *Secret Mission*, which was designed to identify students' engagement through challenges, secret missions, and practical activities that had to be completed collaboratively in groups. The Lesson Study team agreed on several techniques used during the learning process, including: (1) observation sheets to identify observers' responses toward students' collaboration skills; (2) student worksheets used during the learning activities; and (3) questionnaires to identify students' responses toward the *Secret Mission*-based learning activities. After the planning stage was completed, the implementation (*do*) stage was carried out. The observation results of students' collaboration skills are presented in Table 2.

Table 2. Observation Results of Students' Collaboration Skills

No.	Indicator	Number of Students	Percentage (%)
1	Accepting assigned group membership	29	90
2	Respecting differences of opinion	27	84
3	Actively contributing	24	75
4	Accepting group agreements	25	78
5	Helping peers experiencing difficulties	21	66

After the implementation (*do*) stage was completed, the reflection (*see*) stage was conducted. The results showed that the implementation of the *Secret Mission* game encouraged students to demonstrate their collaboration skills during the learning process. Nevertheless, several students had not fully demonstrated optimal collaboration skills. To address this issue, further evaluation is needed regarding factors influencing students' participation, such as their understanding of instructions, confidence in communication, and group dynamics. In addition, reinforcement strategies, such as providing additional guidance or adjusting the game rules, may help encourage all students to participate more actively in collaborative activities.

Collaboration skills are essential in science learning because science education does not only focus on factual knowledge and principles but also emphasizes the process of discovery (Balazinec et al., 2024). Therefore, collaboration skills enable students to work together in designing experiments, collecting and analyzing data, and solving problems critically and creatively. Through group work, students can discuss ideas, exchange opinions, and develop a deeper understanding of scientific concepts. In the context of Lesson Study, students' collaboration skills are further strengthened because this approach encourages teachers to collaboratively design, observe, and reflect on the learning process. Lesson Study emphasizes the importance of collaborative learning, both among students and among teachers, in improving the quality of science learning.

3.1. Planning Stage (Plan)

The planning activities were conducted through collaborative mentoring sessions to design the game and determine the extent to which science material could be integrated into the implementation of the *Secret Mission* game in learning activities. Fitriati et al. (2023) stated that lesson-planning skills are essential teacher competencies for carrying out instructional tasks effectively and efficiently. Discussions during the planning stage began with mapping the scope of learning materials relevant to strengthening students' collaboration skills in the classroom. At this stage, the teacher gained a comprehensive understanding of the learning flow that would be implemented. The teacher then planned the lesson in detail by using curriculum materials and designing more student-centered learning activities (Dibaba et al., 2024). The teacher formulated the learning focus by preparing lesson plans based on the *Secret Mission* strategy. During the planning stage, the Lesson Study team, consisting of the supervising lecturer, mentor teacher, and peers, collaboratively prepared teaching modules using the Game-Based Learning model. In addition, the team designed the procedures of the *Secret Mission* game in science

learning, prepared the instructional media, and agreed on the observation techniques used to measure students' collaboration skills.



Figure 1. Supervising lecturer, mentor teacher, and peers conducting a discussion.

The results of the discussion included determining the learning topic of Physical and Chemical Changes, designing the *Secret Mission* game procedures as described in the introduction section, preparing printed media in the form of clue cards and instruction cards, developing teaching modules using the Game-Based Learning model, preparing student worksheets, observation sheets to identify observers' responses toward students' collaboration skills, and questionnaires to identify students' responses toward the *Secret Mission*-based learning activities.

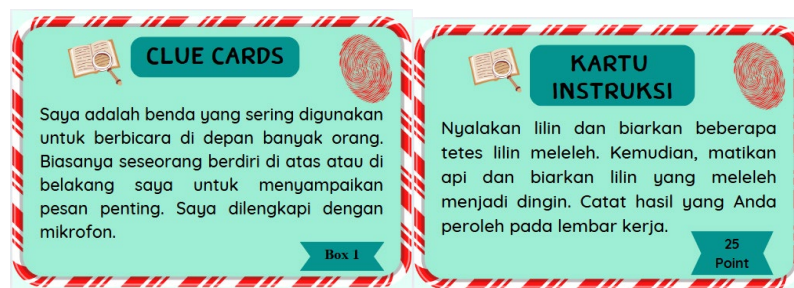


Figure 2. Printed media in the form of clue cards and instruction cards.

3.2. Implementation Stage (Do)

The implementation (*do*) stage was conducted offline with 32 students participating in the activity. During this stage, the model teacher implemented the learning design that had been previously developed, namely science learning through the *Secret Mission* game. This game-based learning activity is consistent with the findings of Yeoh et al. (2024), which demonstrated that the use of realistic contexts in game-based learning can improve students' learning outcomes and collaborative experiences. The learning activities focused on strengthening students' collaboration skills through tasks requiring teamwork, communication, and group responsibility.

Observation results showed that most students demonstrated enthusiasm and active engagement during the learning activities. Students were observed discussing, developing strategies, and independently dividing roles within their groups. These findings are consistent with the study conducted by Wu et al. (2024), which revealed that active group discussions can improve student engagement and enhance the performance of previously low-achieving students. The winning group in the game was the group led by student number 6, which achieved a score of 100, while the lowest-scoring group was led by student number 4, which achieved a score of 25. During this stage, students' collaboration skills were observed by the observers, and the results are presented in Table 2. Several field observations are illustrated in Figure 3.



Figure 3. Activities during the implementation of the *Secret Mission* game: (a) students retrieving clue cards, (b) students demonstrating collaboration skills while completing student worksheets, and (c) students confirming their answers.

3.3. Reflection Stage (See)

Reflection is a feedback stage in which all team members involved in the learning process gather to evaluate and discuss various documented events collaboratively. Phua et al. (2024) stated that structured group reflection can strengthen professional identity formation through the sharing of experiences, emotions, and meanings in educational contexts. The reflection results indicated that some students initially refused to join newly assigned groups because they felt more comfortable working with close friends. Some students also insisted on maintaining their own opinions, although they eventually accepted their peers' perspectives. Several students were still not actively contributing to group activities due to lack of confidence, insufficient understanding of their roles, or a preference for remaining passive within the group. In addition, some students demonstrated limited flexibility in adapting to group decisions. However, all students showed concern in helping peers who experienced difficulties. They voluntarily provided guidance, explained practical activities, and worked collaboratively to complete the missions.

Overall, the observers provided feedback to further improve the learning implementation, although the overall process had already been considered effective. The suggestions aimed to improve several aspects, including time management, variation of learning methods, and students' active participation, in order to make the learning process more effective, engaging, and meaningful. Reflection practices and peer assessment have been proven effective in improving independent learning engagement and students' critical thinking skills (Dutta et al., 2023).



Figure 4. Reflection session with the Lesson Study team.

3.4. Limitations of the Study

This study has several limitations that should be considered when interpreting the findings. First, the implementation of the learning activities was limited to one class, namely Class VII B at SMP Laboratorium UM, involving only 32 students. Therefore, the results may not fully

represent students with different characteristics or learning environments. Second, the study focused specifically on the topic of Physical and Chemical Changes within the Merdeka Curriculum, which may limit the applicability of the findings to other science topics or curricula. Third, the learning approach implemented in this study was restricted to the use of the *Secret Mission* game within the Game-Based Learning model. Different game designs or instructional strategies may produce different outcomes regarding students' collaboration skills.

In addition, the measurement of collaboration skills relied primarily on observation sheets and questionnaires, which may involve subjective interpretations from observers and participants. Time constraints during the implementation stage also limited opportunities for more extensive observation and repeated practice of collaborative activities. Furthermore, several students were still reluctant to actively participate in group discussions due to differences in confidence levels, communication skills, and group dynamics. These factors may have influenced the overall effectiveness of the learning process. Therefore, future studies are recommended to involve larger and more diverse participant groups, apply the learning model to different science topics, and utilize additional assessment methods to obtain more comprehensive findings regarding students' collaboration skills.

4. Conclusion

The results of this study indicate that the implementation of Lesson Study contributed to making the learning process more systematic and well-directed. In addition, the implementation of the *Secret Mission* game within the Game-Based Learning model was proven to empower students' collaboration skills in science learning. This finding was reflected in the achievement of several collaboration indicators, including accepting assigned group membership (90%), respecting differences of opinion (84%), actively contributing (75%), accepting group agreements (78%), and helping peers experiencing difficulties (66%).

However, based on the observation results, several students were still not fully engaged in the learning process as expected. Nevertheless, these issues can be improved in future learning activities by utilizing the reflection results obtained through the Lesson Study process. Based on the findings of this study, the following recommendations are proposed. First, the implementation of the *Secret Mission* game showed positive results across four collaboration indicators; therefore, it should be maintained and strengthened through consistent appreciation and reinforcement of positive values toward students. Second, the *Secret Mission* game requires teachers to design clear roles for each group member so that all students are encouraged to actively contribute rather than relying on certain members to complete the missions. Third, active teacher guidance should continue to be provided to strengthen students' empathy, ensuring that students maintain awareness of the importance of helping one another during the learning process.

References

- Adipat, S., Laksana, K., Busayanon, K., Ausawasowan, A., & Adipat, B. (2021). Engaging students in the learning process with game-based learning: The fundamental concepts. *International Journal of Technology in Education*, 4(3), 542–552. <https://doi.org/10.46328/ijte.169>
- Balazinc, M., Radanovic, I., & Bulic, M. (2024). Self-regulated learning in science classes with a discovery learning environment and collaborative discovery learning environment. *Education Sciences*, 14(6), Article 669. <https://doi.org/10.3390/educsci14060669>
- Dibaba, T. Y., Lemma, A., Faith, M., & Bekele, A. (2024). The potential of lesson study in enhancing secondary school mathematics teachers' pedagogical practices in lesson planning: Evidence from Ethiopia. *International Journal for Lesson and Learning Studies*, 13(4), 233–245. <https://doi.org/10.1108/IJLLS-01-2024-0023>

- Dutta, S., He, M., & Tsang, D. C. W. (2023). Reflection and peer assessment to promote self-directed learning in higher education. *Journal of Educational Research and Reviews*, 11(3), 35–46. <https://doi.org/10.33495/jerr.v11i3.23.111>
- Fitriati, F., Rosli, R., & Iksan, Z. H. (2023). Enhancing prospective mathematics teachers' lesson planning skills through lesson study within school university partnership program. *Journal on Mathematics Education*, 14(1), 69–84. <https://doi.org/10.22342/JME.V14I1.PP69-84>
- Katual, D., Goede, R., & Drevin, L. (2023). Game-based learning to improve critical thinking and knowledge sharing: Literature review. *67th Annual Proceedings of the International Society for the Systems Sciences (ISSS 2023)*.
- Leitner, M., Greenwald, E., Wang, N., Montgomery, R., & Merchant, C. (2023). Designing game-based learning for high school artificial intelligence education. *International Journal of Artificial Intelligence in Education*, 33(2), 384–398. <https://doi.org/10.1007/s40593-022-00327-w>
- Lestari, A. S. B. L., Wahyono, A., Akkuşci, Y. E., Purwanto, P., Anas, K., Nurmalasari, Y., Bibi, R., & Yunus, M. (2023). PLAN–DO–SEE: Lesson study-based differentiated learning in middle schools. *Delta-Phi: Jurnal Pendidikan Matematika*, 1(1), 41–45. <https://doi.org/10.61650/dpjp.v1i1.76>
- Lisa, A. A., & Muthohar, S. (2024). Strategi game based learning dalam pembelajaran PAI untuk meningkatkan keterampilan 4C + S siswa. *13(001)*, 125–138.
- Lopez-Fernandez, D., Gordillo, A., Perez, J., & Tovar, E. (2023). Learning and motivational impact of game-based learning: Comparing face-to-face and online formats on computer science education. *IEEE Transactions on Education*, 66(4), 360–368. <https://doi.org/10.1109/TE.2023.3241099>
- Monalisa, M. (2023). Pengaruh game based learning mata pelajaran matematika kurikulum merdeka terhadap motivasi dan prestasi belajar. *Padma Sari: Jurnal Ilmu Pendidikan*, 3(01), 19–29. <https://doi.org/10.53977/ps.v3i01.908>
- Mualifah, S. R. L., & Rahayu, M. (2023). Identifikasi miskonsepsi siswa kelas XI IPA MAN 2 Lamongan menggunakan instrumen tes diagnostik five tier pada konsep laju reaksi. *Berajah Journal: Jurnal Pembelajaran dan Pengembangan Diri*, 3(3), 513–526.
- Perumal, B. V. (2024). *Collaborative skills in education*.
- Phua, G. L. G., Owyong, J. L. J., Leong, I. T. Y., Goh, S., Somasundaram, N., Poon, E. Y. L., Chowdhury, A. R., Ong, S. Y. K., Lim, C., Murugam, V., Ong, E. K., Mason, S., Hill, R., & Krishna, L. K. R. (2024). A systematic scoping review of group reflection in medical education. *BMC Medical Education*, 24(1), 1–17. <https://doi.org/10.1186/s12909-024-05203-w>
- Puga, R. U. (2022). Game-based learning: A tool that enhances collaborative work: A case study of undergraduate students. *Proceedings of the European Conference on Games-Based Learning, 2022(October)*, 570–577. <https://doi.org/10.34190/ecgbl.16.1.419>
- Ramírez, D., Guzman-Lavín, E. J., Pulgar, J., & Candia, C. (2023). Affinity-based groups in secondary education: Increased stability at the expense of collaboration. *arXiv*. <https://arxiv.org/abs/2309.15212>
- Riaz, M., & Din, M. (2023). Collaboration as 21st century learning skill at undergraduate level. *SJESR*, 6(1), 93–99. [https://doi.org/10.36902/sjesr-vol6-iss1-2023\(93-99\)](https://doi.org/10.36902/sjesr-vol6-iss1-2023(93-99))
- Sousa, C., Rye, S., Sousa, M., Torres, P. J., Perim, C., Mansuklal, S. A., & Ennami, F. (2023). Playing at the school table: Systematic literature review of board, tabletop, and other analog game-based learning approaches. *Frontiers in Psychology*, 14, Article 1160591. <https://doi.org/10.3389/fpsyg.2023.1160591>
- Strouse, G. A., Opoku, A., Mourlam, D. J., Newland, L. A., Chesnut, S. R., & Williams, J. M. (2024). Educators' enacted beliefs about the use of print and digital media in early and middle childhood classrooms. *Discover Education*, 3(1). <https://doi.org/10.1007/s44217-024-00329-x>
- Sufajar, D., & Qosyim, A. (2022). Analisis keterampilan kolaborasi siswa SMP pada pembelajaran IPA di masa pandemi COVID-19. *Pensa: E-Jurnal Pendidikan Sains*, 10(2), 253–259. <https://ejournal.unesa.ac.id/index.php/pensa/article/view/45054>
- Wu, T., Tang, X., Wong, S., Chen, X., Shaffer, C. A., & Chen, Y. (2024). The impact of group discussion and formation on student performance: An experience report in a large CS1 course. *Proceedings of the 2024 ACM Technical Symposium on Computer Science Education*, 17, 1260–1266. <https://doi.org/10.1145/3641554.3701973>

- Yaman, H., Sousa, C., Neves, P. P., & Luz, F. (2024). Implementation of game-based learning in educational contexts: Challenges and intervention strategies. *Electronic Journal of E-Learning*, 22(10), 19–36. <https://doi.org/10.34190/ejel.22.10.3480>
- Yeoh, C. P., Li, C. T., & Hou, H. T. (2024). Game-based collaborative scientific inquiry learning using realistic context and inquiry process-based multidimensional scaffolding. *International Journal of Science Education*, 1–23. <https://doi.org/10.1080/09500693.2024.2354944>
- Zha, S., Tang, Y., Gong, J., & Xu, Y. (2025). COLP: Scaffolding children's online long-term collaborative learning. *arXiv*. <http://arxiv.org/abs/2502.03226>
- Zubaidah, S. (2019). *STEAM (science, technology, engineering, arts, and mathematics): Pembelajaran untuk memberdayakan keterampilan abad ke-21*.