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Problem-based learning with a digital snake-and-ladder game to improve students' learning motivation and activity in biology learning

Loly Marlina Harianja, Rahmawati Darussyamsu*), Lufri Lufri, Heffi Alberida
Universitas Negeri Padang, Padang, Indonesia

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ABSTRACT

This classroom action research aimed to improve students' learning motivation and activity in biology learning through the implementation of Problem-Based Learning (PBL) assisted by a digital snake-and-ladder game on the premise that a digital game can strengthen PBL's problem-solving stages by increasing engagement, immediate feedback, and structured participation. The study was conducted in two cycles involving 35 eleventh-grade students (Phase F.5) at SMA Negeri 12 Padang on the Coordination System topic. Data were collected using a 24-item Likert-scale learning motivation questionnaire and a structured, inter-rater 37-item learning activity observation sheet, and were analyzed descriptively using a percentage formula against a pre-established ≥80% success criterion adapted from Purwanto's (2009) categorization. The results showed that learning motivation increased from 66.24% in the Pre-Cycle to 77.14% in Cycle I and 81.14% in Cycle II. Meanwhile, learning activity increased from 65.91% to 75.87% and 83.17%, respectively, exceeding the success criterion of ≥80%. These findings indicate that PBL assisted by a digital snake-and-ladder game has strong potential to improve students' learning motivation and activity in biology learning, although, as with any classroom action research conducted without a control group, this evidence should be read as improvement within the specific classroom context rather than a definitive causal effect.

Corresponding Author:

Rahmawati Darussyamsu,
Universitas Negeri Padang
Email: rahmabio@fmipa.unp.ac.id

Introduction

Education plays a strategic role in developing high-quality human resources, as mandated by Article 31 of the 1945 Constitution of the Republic of Indonesia and Law No. 20 of 2003 on the National Education System. Education is not limited to knowledge acquisition but also aims to develop students' character, creativity, independence, and problem-solving abilities. This direction is reinforced through the implementation of the Merdeka Curriculum and the Deep Learning approach regulated by Minister of Education, Culture, Research, and Technology Regulation No. 12 of 2024, which emphasizes meaningful and student-centered learning. Biology education is expected to develop conceptual understanding alongside scientific thinking skills, problem-solving abilities, and environmental awareness (Purbayanti & Suherdiyanto, 2022). However, realizing these broader goals in practice depends on whether classroom learning can sustain students' motivation and active engagement, which remain persistent and closely related challenges in biology instruction, including at the research site examined in this study.

Biology learning still faces challenges in creating interactive and student-centered learning processes. Research conducted in Padang indicates that the use of interactive learning media in biology education requires further optimization. A needs analysis at SMAN 12 Padang showed that teachers and students require learning media that are more interactive, engaging, and easy to use, particularly for abstract biology topics (Chandrawita & Lufri, 2023). Research at SMAN 3 Padang also demonstrated that integrating learning models with instructional media can improve students' scientific argumentation skills (Hayati & Fadilah, 2023). These findings highlight the importance of developing innovative learning strategies and media to increase student engagement in biology learning.

The same problems were identified in biology learning among students of Grade XI, Phase F.5, at SMAN 12 Padang. Classroom observations indicated that learning activities remained relatively less varied and that interactive media had not been optimally utilized. Students experienced difficulties in understanding abstract topics, including bioprocesses, the respiratory system, and the circulatory system. These difficulties were reflected in low learning activity, limited attention to teacher explanations, infrequent questioning and answering, and low participation during classroom activities. The results of the Mid-Semester Summative Assessment in the 2024/2025 academic year showed that Grade XI.F.5 had the lowest mastery rate, with only 10.8% of students achieving the learning criteria and an average score of 49.8. This score remained substantially below the Learning Objective Achievement Criteria (KKTP) of 80. This achievement gap is consistent with, and plausibly reinforced by, the classroom observations of limited attention, infrequent questioning, and low participation described above, suggesting a link between low classroom activity and low academic mastery in this class, although this link was not statistically tested.

The low academic achievement was associated with students' learning motivation. A motivation questionnaire administered on October 30, 2025, revealed low participation in discussions, limited frequency of asking and answering questions, and relatively short independent study time at home, averaging approximately 30 minutes. Interviews with five students conducted on November 13, 2025, further indicated that 60% of students experienced fluctuating learning motivation, 80% were more motivated when learning took place in the classroom but lost motivation during independent study at home, and 80% experienced difficulties understanding several biology topics. Learning motivation refers to a psychological drive that directs behavior and sustains students' persistence in achieving academic goals (Schunk & DiBenedetto, 2021; Rahmi & Yuswanti, 2021). Motivation contributes to students' attention, persistence, concentration, and participation throughout the learning process (Funa & Prudente, 2021; Putri et al., 2024).

Several strategies, including interactive lectures, assignments, group discussions, projector-based instruction, and laboratory activities, had been implemented but had not optimally increased student engagement. Learning remained predominantly teacher-centered, limiting opportunities for students to express ideas, ask questions, and actively construct knowledge (Hidayat & Rahmawati, 2022; Funa & Prudente, 2021). Problem Based Learning (PBL) represents a relevant instructional model for addressing these conditions. PBL engages students with authentic problems and encourages them to identify problems, conduct investigations, analyze information, and formulate solutions (Danial, 2010; Sungur et al., 2006). The model has been reported to improve students' motivation, learning activity, problem-solving skills, and learning outcomes (Zubaidah, 2016; Fauziah et al., 2017; Nazhar et al., 2024). Mechanistically, PBL is expected to strengthen motivation and activity because its syntax requires students to repeatedly engage in problem orientation, investigation, and solution presentation, creating recurring opportunities for active participation rather than relying on students' voluntary initiative alone.

The implementation of PBL may encounter challenges when students have low confidence, limited interest in the problems presented, or insufficient independent learning and collaborative skills. Engaging and interactive instructional media can strengthen the implementation of PBL by providing a more stimulating learning experience. Game-based learning is one approach that can support this need because games can enhance students' attention, relevance, and satisfaction (Keller, 1987; Ruiz et al., 2024). Snake and ladder games have simple rules, interactive features, competitive elements, and accessible gameplay, making them suitable for adaptation as learning media (Dewi et al., 2017). Developing snake and ladder games in digital form provides opportunities to integrate learning materials, questions, challenges, and problem-solving activities into a single instructional medium. Previous studies have demonstrated that snake and ladder media can create engaging learning environments and improve students' motivation and activity (Saputra & Shofwan, 2024). The use of snake and ladder media has also been associated with learning mastery of up to 93.33% (Salam, N., & Safei, J., 2019), an 87.115% increase in learning outcomes (Widowati, 2014), and an 80.64% increase in student activity categorized as very active (Guterres et al., 2018). Nazhar et al. (2024) further reported that PBL assisted by a digital snake and ladder game improved students' learning outcomes.

Research integrating PBL with digital snake and ladder games to specifically improve students' learning motivation and activity in biology learning remains limited. Specifically, whereas Nazhar et al. (2024) examined the effect of a PBL-assisted digital snake-and-ladder game on students' learning outcomes through a single intervention, the present study differs by focusing on learning motivation and learning activity as the primary outcomes, tracked descriptively across two reflective classroom action research cycles. This research gap is particularly relevant to the conditions observed in Grade XI.F.5 at SMAN 12 Padang, where low learning achievement, motivation, and activity were accompanied by limited use of interactive learning media. PBL provides a problem-based learning structure that encourages students to investigate, collaborate, think critically, and develop solutions, while digital snake and ladder games provide an engaging, interactive, and competitive learning experience. The integration of these approaches is expected to increase student engagement and create more active and meaningful biology learning. This study therefore aims to improve students' learning motivation and activity through the implementation of Problem Based Learning assisted by a digital snake and ladder game in biology learning at SMAN 12 Padang.

Method

This study employed Classroom Action Research (CAR) using a mixed-methods approach, designed to continuously improve the quality of learning through cycles of planning, implementation, observation, and reflection (Arikunto, Suhardjono, & Supardi, 2021). The study was conducted during the second semester of the 2025/2026 academic year in Class XI Phase F.5 at SMA Negeri 12 Padang, involving 35 students. The intervention was implemented in two cycles on the Coordination System topic. Each cycle consisted of planning, implementation, observation, and reflection stages and applied the five stages of PBL proposed by Arends (2012): (1) orienting students to the problem, (2) organizing students for learning, (3) guiding individual and group investigations, (4) developing and presenting the work, and (5) analyzing and evaluating the problem-solving process. In each cycle, these stages were integrated with a digital snake-and-ladder game developed using the QuizWhizzer platform. The integration of the PBL stages with the digital snake-and-ladder game is illustrated in Figure 1. Consistent with the iterative logic of classroom action research, the reflection stage at the end of Cycle I was used systematically to identify weak indicators and aspects, which were then translated into the concrete instructional adjustments implemented in Cycle II, as detailed in the Reflection and Improvement section below.

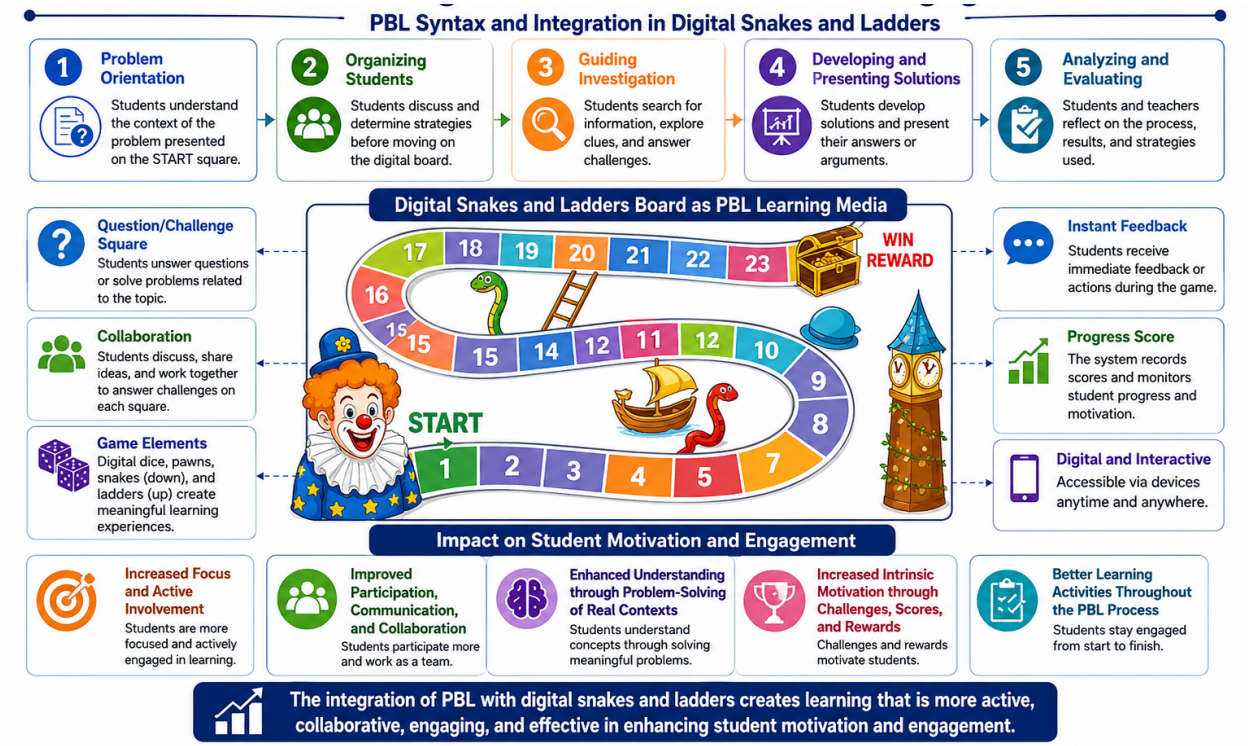

Figure 1. Integration of Problem-Based Learning (PBL) Stages with the Digital Snake-and-Ladder Game

Learning motivation data were collected using a five-point Likert-scale questionnaire consisting of 24 statements measuring six indicators of learning motivation: desire and enthusiasm for learning, persistence and resilience in completing tasks, active participation, interest in learning materials, satisfaction and self-confidence, and willingness to learn independently. Learning activity data were collected using a structured observation sheet consisting of 37 statements developed from Diedrich's eight indicators of learning activity (as cited in Helendra, Chairani, & Desniwati, 2020). These indicators were operationalized into six observed aspects: visual, oral, listening, writing, mental, and emotional activities. The observations were independently conducted by two observers using dichotomous scores (1 = observed, 0 = not observed), and inter-observer agreement was checked to support the consistency of the activity ratings.

The data were analyzed descriptively using the percentage formula $P = (f/N) \times 100\%$, where f represents the obtained score and N represents the ideal maximum score. The percentages of learning motivation and activity were then classified into five categories according to Purwanto (2009): Very Good (81–100%), Good (61–80%), Fair (41–60%), Poor (21–40%), and Very Poor (≤20%). The intervention was considered successful when the overall percentages of students' learning motivation and learning activity each reached ≥80% of the ideal score at the end of the intervention cycle, a threshold corresponding to the lower bound of the "Very Good" category in Purwanto's (2009) classification and commonly adopted as the action-research success criterion in comparable classroom studies (Wahyuni, Mustika Dewi, & Marsia, 2023).

Results and Discussions

The implementation of Problem-Based Learning (PBL) integrated with a digital snake-and-ladder game was conducted through two intervention cycles. The learning activities were designed to engage students in solving contextual problems while simultaneously providing an interactive and enjoyable learning experience. The digital game served as an instructional medium that supported the implementation of PBL syntax, particularly during problem exploration, group discussion, question-and-answer activities, and presentation. The figure 2 illustrates the digital snake-and-ladder game used during the learning intervention

Figure 2. Digital Snake-and-Ladder Game Used in the Learning Intervention

The integration of the digital snake-and-ladder game provided students with an interactive learning environment in which they were required to participate actively, respond to questions, collaborate with group members, and complete learning challenges. This approach was expected to strengthen students' motivation and learning activity throughout the intervention. The results of these two aspects are presented in the following sections**.**

Students' Learning Motivation

Students' learning motivation increased consistently across the intervention, from 66.24% in the pre-cycle to 77.14% in Cycle I and 81.14% in Cycle II. The overall improvement reached 14.90 percentage points, with the largest increase occurring between the pre-cycle and Cycle I (10.90 percentage points). The distribution of students' motivation categories also changed substantially. In the pre-cycle, 62.9% of students were in the moderate category and 34.3% were in the high category. Following Cycle I, 97.1% of students had reached the high category. By Cycle II, all students were classified as having high or very high motivation, including 8.6%

in the very-high category. While this overall increase is unambiguous, the descriptive nature of this classroom action research does not allow the relative contribution of PBL's problem-solving structure versus the digital game's engagement mechanism to be statistically disentangled; the discussion below therefore treats the improvement as an outcome of their combined implementation rather than attributing it to either component alone.

Table 1. Recapitulation of Learning Motivation Percentages by Indicator

Learning Motivation Indicator	No. of Items	Pre-Cycle (%)	Cycle I (%)	Cycle II (%)
Desire and Enthusiasm for Learning	3	67.62	78.67	85.33
Persistence and Learning Resilience	5	68.80	77.94	80.46
Participation in Learning	4	62.71	75.29	81.29
Interest in Learning Materials	4	67.57	78.14	79.14
Satisfaction and Self-Confidence	4	67.00	76.57	80.57
Willingness to Learn Independently	4	63.43	76.43	81.29
Overall Mean	24	66.24	77.14	81.14

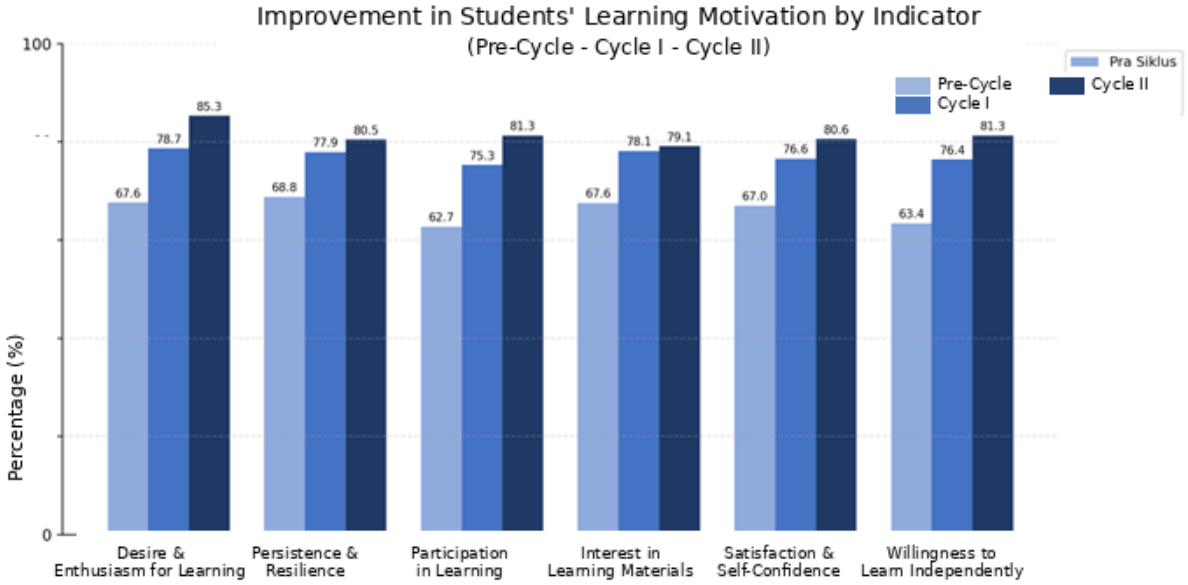

Figure 3. Graph of the Improvement in Students' Learning Motivation by Indicator

The indicator-level pattern provides a more meaningful interpretation than the overall increase alone. Participation in learning recorded the lowest initial achievement (62.71%) but showed the largest cumulative increase, reaching 81.29% in Cycle II. This 18.58-point increase indicates that the intervention was particularly effective in addressing students' initial reluctance to participate. The improvement is consistent with Alghifari, Harmanto, and Zaini (2023), who found that problem orientation and group investigation in PBL encourage active engagement and students' responsibility for their learning. Wulandari, Parenrengi, and Tune (2023) similarly reported that contextual problems in PBL can strengthen learning motivation by making learning activities more relevant to students' experiences.

The substantial improvement in participation can also be associated with the game mechanics. The digital snake-and-ladder game required students to take turns answering questions, discussing problems, and presenting group results. Participation was therefore embedded in the learning procedure rather than left entirely to students' voluntary initiative. This mechanism corresponds with Rahayu, Nugroho, and Ferdiana (2022), who found that digital game elements requiring active involvement can increase students' participation and motivation. The finding is also supported by Zebua et al. (2024), who reported that gamification in science learning can strengthen motivation through emotional engagement and enjoyment. Similar benefits of educational games have been reported by Danika, Kilat, Risna, and Novianti (2022) and Burhan, Nurwidyayanti, Asdar, Swandi, and Rahim (2024).

The improvement was not equally distributed across all indicators. Desire and enthusiasm for learning increased by 17.71 percentage points, while willingness to learn independently increased by 17.86 points. These gains suggest that the intervention affected not only students' immediate classroom engagement but also their

willingness to sustain learning-related effort. Nevertheless, interest in learning materials showed the smallest increase, from 67.57% to 79.14%. This may indicate that although the instructional format became more engaging, changing students' underlying interest in biological content requires more sustained exposure than can be achieved within two intervention cycles.

Students' Learning Activity

Learning activity demonstrated a similar upward pattern. The overall activity score increased from 65.91% in the pre-cycle to 75.87% in Cycle I and 83.17% in Cycle II. The total increase of 17.26 percentage points enabled the class to exceed the predetermined success criterion of 80% in Cycle II. This overall achievement should be interpreted with some caution, however, because two of the six activity aspects, Oral Activity (72.62%) and Mental Activity (70.57%), had not yet individually reached the ≥80% criterion by the end of Cycle II; the success of the intervention is therefore better described as met at the aggregate level rather than uniformly across all aspects of learning activity.

Table 2. Recapitulation of Learning Activity Percentages by Aspect

Learning Activity Aspect	No. of Items	Pre-Cycle (%)	Cycle I (%)	Cycle II (%)
Visual Activity	7	71.43	81.63	88.98
Oral Activity	6	49.76	62.38	72.62
Listening Activity	9	59.84	72.38	80.79
Writing Activity	6	80.48	87.14	91.43
Mental Activity	5	51.71	61.43	70.57
Emotional Activity	4	90.00	95.00	97.50
Overall Mean	37	65.91	75.87	83.17

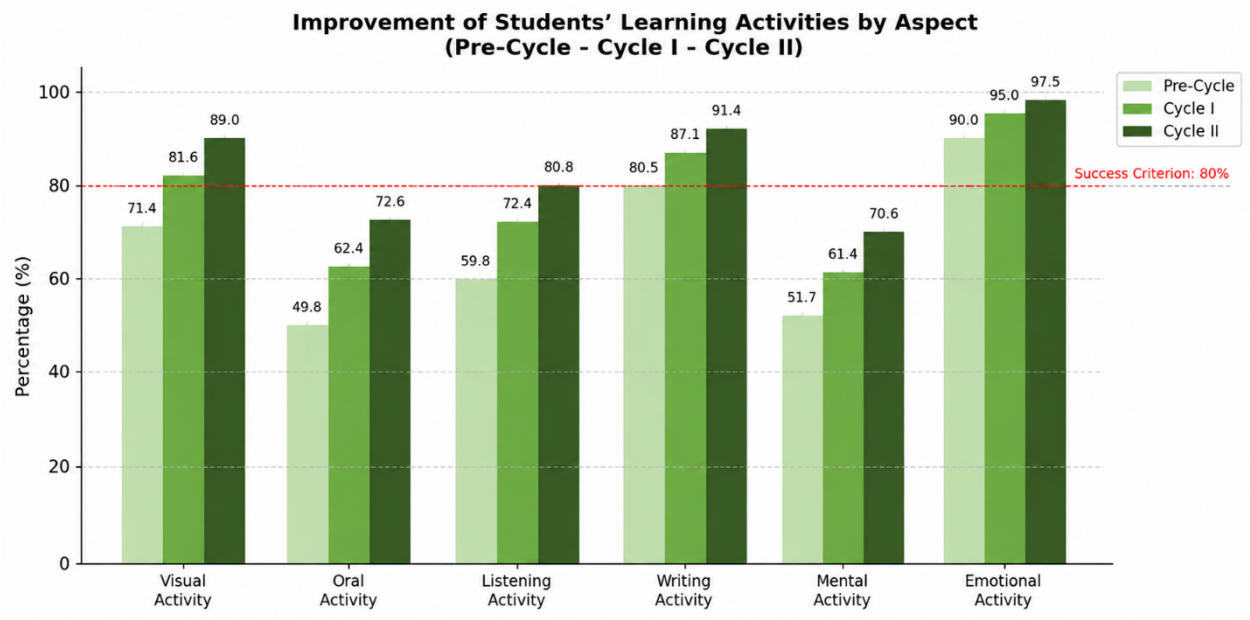

Figure 4. Graph of the Improvement in Students' Learning Activity by Aspect

The aspect-level results reveal an important distinction between general engagement and more demanding forms of participation. Emotional activity remained the highest-performing aspect throughout the intervention, increasing from 90.00% to 97.50%. Writing activity was also consistently high, reaching 91.43% in Cycle II. In contrast, oral activity remained the lowest-performing aspect despite recording the largest absolute improvement, from 49.76% to 72.62%. Mental activity followed a similar pattern, increasing from 51.71% to 70.57%.

The improvement in overall learning activity is consistent with Wahyuni, Mustika Dewi, and Marsia (2023), who found that PBL increases student activity because its learning syntax requires direct involvement in problem solving. Paratiwi and Ramadhan (2023) similarly demonstrated that PBL promotes learning activity through students' direct engagement with contextual problems. The present findings extend these results by showing that the improvement is more pronounced in observable activities such as visual attention, writing, and emotional engagement than in oral and mental activities.

The persistence of oral activity as the weakest aspect is particularly noteworthy. Although oral activity increased by 22.86 percentage points, it remained below the other activity dimensions at the end of Cycle II. This finding supports Rikawati and Sitinjak (2020), who noted that asking and answering questions can be among the most difficult forms of classroom participation to develop. The pattern suggests that an engaging learning model alone may not be sufficient to overcome students' reluctance to communicate. Structured turn-taking, explicit encouragement, role rotation, and individual reinforcement are therefore important complementary strategies.

Relationship between Motivation and Learning Activity

The parallel improvement in motivation and learning activity provides evidence of convergence between students' psychological engagement and their observable classroom behavior, although this convergence rests on the parallel trend observed across cycles rather than on a formal correlational or statistical test of association between the two variables. The weakest motivation indicator in the early stages, participation in learning, corresponded closely with the weakest activity aspect, oral activity. Both dimensions subsequently increased across the intervention. This pattern suggests that the intervention did more than improve students' perceptions of learning; it was accompanied by changes in how students participated in classroom activities.

The relationship can be understood through the complementary functions of PBL and digital game-based learning. PBL creates a cognitive and social structure in which students must investigate and solve contextual problems, while the digital game provides an engaging mechanism for interaction and participation. The game therefore functions not merely as an entertainment component but as a behavioral trigger that encourages students to act within the PBL learning process. This interpretation is consistent with the findings of Alghifari et al. (2023), Wulandari et al. (2023), and Zebua et al. (2024), which demonstrate the contribution of contextual problems, active investigation, and gamification to student engagement.

The convergence of questionnaire and observation data strengthens the interpretation because the two variables were assessed through different instruments. Motivation was measured through a 24-item Likert questionnaire, whereas learning activity was assessed using a 37-item observation instrument. The simultaneous increase in both measures reduces the likelihood that the observed improvement was attributable solely to changes in students' self-perceptions. Nevertheless, the classroom action research design does not permit the independent contribution of PBL and the digital game to be statistically separated. The findings should therefore be interpreted as evidence of improvement within the specific classroom context rather than as definitive evidence of a causal effect attributable to one component alone.

Reflection and Improvement from Cycle I to Cycle II

The improvement from Cycle I to Cycle II was closely related to the reflective process of classroom action research. Motivation increased from 77.14% to 81.14%, while learning activity increased from 75.87% to 83.17%. Arikunto, Suhardjono, and Supardi (2021) emphasize that classroom action research involves iterative cycles in which reflection on previous actions provides the basis for subsequent improvements. Kemmis, McTaggart, and Nixon (2014) similarly emphasize the importance of systematic reflection and action refinement in classroom action research.

The most substantial improvements in Cycle II occurred in the dimensions that remained relatively weak after Cycle I. Participation in learning increased by 6.00 percentage points, while oral and mental activities increased by 10.24 and 9.14 percentage points, respectively. This pattern indicates that the second cycle was not merely a repetition of the first but incorporated targeted modifications addressing the weaknesses identified during reflection. Specifically, the weak participation-in-learning and oral/mental activity indicators identified during the Cycle I reflection directly informed the structured scaffolding, the clearer game demonstration with role rotation, and the more systematic distribution of question-and-answer opportunities described below, providing an explicit link between the reflection findings and the corrective actions subsequently implemented.

Five major instructional adjustments were implemented in Cycle II. First, structured scaffolding was added to the learning module to provide clearer guidance during group investigation. Second, the digital game demonstration was improved, accompanied by clearer group-role allocation and role rotation. Third, animated videos were used as advance organizers to support students' understanding of abstract concepts related to the coordination system. Fourth, question-and-answer opportunities were distributed more systematically, supported by individual reinforcement to encourage less-active students. Fifth, learning time was reorganized to provide greater opportunities for presentation and metacognitive reflection.

The correspondence between these modifications and the subsequent data provides an important indication of instructional responsiveness. The largest improvements occurred in oral and mental activity, precisely the dimensions targeted through role rotation, structured questioning, scaffolding, and increased presentation opportunities. At the same time, activities that were already strong, particularly emotional and writing activities,

remained high. This suggests that the Cycle II modifications addressed specific weaknesses without compromising previously established strengths.

Overall, the findings indicate that PBL supported by a digital snake-and-ladder game has potential as an instructional strategy for improving students' learning motivation and activity in biology. The effectiveness of the intervention appears to derive from the interaction between PBL's problem-solving and collaborative structure and the game's capacity to create repeated, enjoyable, and structured opportunities for participation. The findings further demonstrate that digital game integration is most productive when accompanied by appropriate scaffolding, role distribution, classroom management, and reflective instructional adjustment. The intervention should therefore be understood not simply as the use of a digital game, but as an integrated pedagogical design in which game mechanics are deliberately aligned with PBL objectives and students' identified learning needs.

Conclusions

The implementation of Problem-Based Learning assisted by a digital snake-and-ladder game was effective in improving the learning motivation and activity of Class XI Phase F.5 students at SMA Negeri 12 Padang on the Coordination System topic. Learning motivation increased from 66.24% in the Pre-Cycle to 77.14% in Cycle I and 81.14% in Cycle II, while learning activity increased from 65.91% to 75.87% and 83.17%, respectively, exceeding the predetermined success criterion of ≥80%. All learning motivation indicators and learning activity aspects improved from the pre-cycle to Cycle II, although Interest in Learning Materials, Oral Activity, and Mental Activity had not yet individually reached the ≥80% criterion by the end of Cycle II. The greatest gains occurred in the aspects that were initially weakest, namely student participation and oral and mental engagement, coinciding with the targeted instructional adjustments introduced in Cycle II; because several adjustments were implemented simultaneously, however, their individual contributions cannot be statistically separated.

References

Alghifari, L. M. M., Harmanto, H., & Zaini, A. (2023). Penerapan model pembelajaran problem based learning untuk meningkatkan motivasi belajar siswa. Ainara Journal, 4(2), 76–82. https://doi.org/10.54371/ainj.v4i2.260

Anggraeni, D. P., Sari, I. K., & Pratama, Y. (2023). Pengembangan media pembelajaran game ular tangga digital berbasis QuizWhizzer untuk meningkatkan motivasi belajar biologi murid SMA. Jurnal Pendidikan Biologi Indonesia, 9(2), 112–125. https://doi.org/10.22219/jpbi.v9i2.2345

Arends, R. I. (2012). Learning to teach (9th ed.). McGraw-Hill.

Arikunto, S., Suhardjono, & Supardi. (2021). Penelitian tindakan kelas: Edisi revisi. Bumi Aksara.

Boom-Cárcamo, E., Buelvas-Gutiérrez, L., Acosta-Oñate, L., & Boom-Cárcamo, D. (2024). Gamification and problem-based learning (PBL): Development of creativity in the teaching-learning process of mathematics in university students. Thinking Skills and Creativity, 53, 101614. https://doi.org/10.1016/j.tsc.2024.101614

Burhan, B., Nurwidyayanti, N., Asdar, A., Swandi, A., & Rahim, A. (2024). Upaya meningkatkan motivasi belajar melalui pengembangan game edukasi dan animasi pembelajaran berbasis kearifan lokal masyarakat Pulau Balanglompo. Community Development Journal, 5(5), 9001–9007.

Chandrawita, R., & Lufri. (2023). Analisis kebutuhan media pembelajaran biologi digital di SMA Kota Padang. Jurnal Pendidikan Biologi Universitas Negeri Padang, 8(2), 110–122.

Danial, M. (2010). Pengaruh strategi pembelajaran PBL dan GI terhadap metakognisi dan penguasaan konsep Kimia Dasar mahasiswa Jurusan Biologi FMIPA UNM [Disertasi, Universitas Negeri Malang].

Danika, F. C., Kilat, H., Risna, M., & Novianti, P. (2022). Pengembangan game edukasi pada mata pelajaran biologi untuk siswa SMP di Kabupaten Kubu Raya. Jurnal Inovasi Pendidikan dan Pengajaran, 1(3), 154-165. DOI:10.31571/jipp.v1i3.4835

Dewi, T. L., Kurnia, D., & Panjaitan, R. L. (2017**).** Penggunaan Media Permainan Ular Tangga pada Pembelajaran PIPS untuk Meningkatkan Hasil Belajar Siswa pada Materi Pembagian Wilayah Waktu di Indonesia. *Jurnal Pena Ilmiah, 2*(1), 2091–2100. https://doi.org/10.17509/jpi.v2i1.12425

Funa, A. A., & Prudente, M. S. (2021). Effectiveness of problem-based learning in enhancing students' motivation and academic achievement: A meta-analysis. International Journal of Instruction, 14(4), 69–84. https://doi.org/10.29333/iji.14.4.5

Guterres, I. K. N. P., Sudarti, S., & Putra, P. D. A. (2018**).** Pengembangan Media Pembelajaran Ular Tangga Berbasis Android pada Pokok Bahasan Gejala Pemanasan Global untuk Pembelajaran Fisika di SMA. *Jurnal Pembelajaran Fisika, 7*(1), 54. https://doi.org/10.19184/jpf.v7i1.7225

Hayati, I., & Fadilah, M. (2023). Pengaruh Model PBL Berbantuan Media Power Point Terhadap Kemampuan Argumentasi Ilmiah Peserta Didik di SMAN 3 Padang. Jurnal Pendidikan Tambusai, 7(2), 12581–12589. https://jptam.org/index.php/jptam/article/view/

Helendra, H., Chairani, N., & Desniwati, D. (2020). Analisis aktivitas belajar siswa dalam pembelajaran biologi. Jurnal Bio Educatio, 5(1).

Kemmis, S., McTaggart, R., & Nixon, R. (2014). The action research planner: Doing critical participatory action research. Springer.

Mulyana, R., Rafni, A., Montessori, M., & Moeis, I. (2025). Strategi guru dalam meningkatkan keberanian berpendapat siswa. Journal of Education, Cultural and Politics, 5(1), 94–100. https://doi.org/10.24036/jecco.v5i1.615

Nazhar, S., Sugiarti, L., & Saputri, D. D. (2024). Penerapan Model PBL Berbantu Game Edukasi Digital Ular Tangga Sebagai Upaya Meningkatkan Hasil Belajar Siswa. *Jurnal Sitasi Ilmiah, 2*(1), 82–90. https://ejournal.unma.ac.id/index.php/si/article/view/8259/4328

Paratiwi, T., & Ramadhan, Z. H. (2023). Model pembelajaran problem based learning untuk meningkatkan aktivitas dan hasil belajar siswa pada pembelajaran IPAS kelas V sekolah dasar. Journal of Education Action Research, 7(4), 603–610.

Putri, A., Soesilawati, S. A., & Diani, N. (2024). Problem-based learning in improving student learning outcomes in biology learning. *Universal Education Journal of Teaching and Learning, 1*(2), 50–56. https://doi.org/10.63081/uejtl.v1i2.36

Purwanto, N. (2009). Prinsip-prinsip dan teknik evaluasi pengajaran. Remaja Rosdakarya.

Rahayu, F. S., Nugroho, L. E., & Ferdiana, R. (2022). E-learning gamification model using video game elements that influence engagement or addiction. Proceedings of ISITIA 2022. https://doi.org/10.1109/isitia56226.2022.9855202

Rahmi, L., & Yuswanti, D. (2021). Meningkatan Motivasi Belajar Menggunakan Model Pembelajaran Picture and Picture pada Mata Pelajaran Ilmu Pengetahuan Alam. *JuDha_PGSD: Jurnal Dharma PGSD, 1*(2), 73–85. https://ejournal.undhari.ac.id/index.php/judha/article/view/287/163

Rajab, M., Sari, I. K., & Pratama, Y. (2023). Pengembangan media ular tangga berbasis digital untuk meningkatkan partisipasi aktif siswa sekolah dasar. Jurnal PIPSI, 8(1), 45–58. https://doi.org/10.24815/pipsi.v8i1.234

Riduwan. (2013). Skala pengukuran variabel-variabel penelitian. Alfabeta.

Rikawati, K., & Sitinjak, D. (2020). Upaya meningkatkan keaktifan belajar siswa dalam pembelajaran matematika menggunakan media rainbow board di sekolah dasar [Laporan penelitian].

Salam, N., & Safei, J. (2019). Pengembangan Media Pembelajaran Permainan Ular Tangga pada Materi Sistem Saraf. *Jurnal Al-Ahya, 1*, 52–69. https://journal.uin-alauddin.ac.id/index.php/alahya/article/view/5630/pdf

Saputra, S. F., & Shofwan, I. (2024). Media Pembelajaran Interaktif Berbasis Ular Tangga Sandi di Museum Sandi Yogyakarta. Diklus: Jurnal Pendidikan Luar Sekolah, 8(2), 168–180. https://journal.uny.ac.id/index.php/jurnaldiklus/article/view/87724

Schunk, D. H., & DiBenedetto, M. K. (2021). Self-Efficacy and Human Motivation. In *Advances in Motivation Science* (Vol. 8, pp. 153–179). Elsevier. https://doi.org/10.1016/bs.adms.2020.10.001

Sungur, S., & Tekkaya, C. (2006). Effects of problem-based learning and traditional instruction on self-regulated learning. The Journal of Educational Research, 99(5), 307-317. https://doi.org/10.3200/JOER.99.5.307-320

Widowati, F. (2014). Penggunaan Media Ular Tangga untuk Meningkatkan Hasil Belajar Siswa pada Tema Hiburan. *Jurnal Penelitian Pendidikan Guru Sekolah Dasar, 2*(1), 1–10.

Wahyuni, Y. I., Mustika Dewi, R., & Marsia, Y. (2023). Peningkatan aktivitas belajar ekonomi melalui model pembelajaran problem based learning di kelas X2 SMAN 17 Surabaya. Business and Accounting Education Journal, 4(2), 172–178. https://doi.org/10.15294/baej.v4i2.69045

Wulandari, A., Parenrengi, S., & Tune, I. L. (2023). Penerapan model pembelajaran problem based learning untuk meningkatkan motivasi belajar siswa SMK. Jurnal Pendidikan dan Profesi Keguruan, 2(2), 225. https://doi.org/10.59562/progresif.v2i2.30424

Zebua, N., Malik, P. F. P., Al-Hilmiyah, N. A., Zebua, E. N. K., Pebrianti, P. E., Sari, M. S., & Rudiyanto. (2024). Analisis penggunaan metode gamifikasi untuk meningkatkan motivasi dan hasil belajar siswa pada mata pelajaran IPA-Biologi. Jurnal Cakrawala Pendidikan dan Biologi, 1(3).

Zubaidah, S. (2016). Keterampilan Abad Ke-21: Keterampilan yang Diajarkan Melalui Pembelajaran. *Seminar Nasional Pendidikan dengan Tema "Isu-Isu Strategis Pembelajaran MIPA Abad 21"*, Desember, 1–17