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Boosting elementary science engagement: A qualitative study of baamboozle-based game learning in Indonesian classrooms

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Abstract
This study explores the implementation of Baamboozle-based Game-Based Learning (GBL) to enhance student engagement in science classes at Assunniyyah Kencong Elementary School. Adopting a qualitative case study approach, the research involved 25 third-grade students and science teachers over six weeks. Data were collected through participatory observation, in-depth interviews, and documentation. Findings reveal a marked improvement in student participation, including a 45% increase in verbal engagement, a 27–38% rise in discussion involvement, and stronger collaborative skills. The most notable progress occurred in initially low-participation classrooms (38% growth). Bamboozled facilitated a differentiated learning environment that accommodated diverse learning styles. Despite technical constraints, adaptive strategies ensured pedagogical effectiveness. Innovation fosters 21st-century skills and suggests potential for broader paradigm shifts in elementary education. This study underscores the value of GBL in promoting active learning while highlighting practical considerations for its implementation.

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INTRODUCTION

Active learning is central to elementary education (Law No. 20/2003), yet student engagement remains low, particularly in science where abstract concepts require participatory methods (Putri et al., 2024). Observational data from SD Assunniyyah Kencong reveal critical gaps: only 30–65% of Grade 3 students actively participate in discussions, while 15–30% score below the Minimum Mastery Criteria (KKM) (see Table 1). Game-Based Learning (GBL) tools like Baamboozle may address this issue by fostering collaboration and motivation (Wardani & Kiptiyah, 2024), but their specific impact on verbal engagement in science lacks empirical evidence. Although national policy mandates active learning (Law No. 20/2003), classroom realities—including low test scores and passive behaviors—highlight the need for innovative solutions like GBL.

Tabel 1. *Observational Data from Assunniyyah Kencong Elementary School*

Class	Active Students (%)	Avg. Score	% Below KKM
IIIA	±30%	65	30%
IIIB	±65%	78	15%
IIIC	±50%	71	28%

Baamboozle, a Game-Based Learning (GBL) platform, offers an innovative approach to enhance elementary students' active participation in science lessons, which require hands-on involvement to grasp scientific and social concepts (Pérez et al., 2018). Through interactive activities, Baamboozle encourages students to explore topics like ecosystems and local culture, thereby increasing motivation and classroom engagement. While GBL tools like Baamboozle demonstrate potential in promoting collaboration (Fonseca et al., 2023), few studies have examined their effect on verbal participation in elementary science—a gap this study aims to address. The platform's interactive design also facilitates comprehension of abstract scientific concepts, motivating students to ask questions and experiment (Wahidah et al., 2020). Despite challenges such as limited technology access and entrenched passive learning habits, Baamboozle provides practical solutions with minimal resources, creating a dynamic learning environment that supports student engagement in science through collaboration and material exploration (Titus & Ng'ambi, 2023).

Initial observations at SD Assunniyyah Kencong on February 3, 2025, revealed that only 30% of Class IIIA students (25 students: 12 boys, 13 girls) actively participated in science lessons. Teacher records indicated an average daily test score of 65, below the KKM of 70, with 30% of students (8 students: 3 boys, 5 girls) failing to meet the standard. Comparative observations in Class IIIB (26 students: 10 boys, 16 girls) on February 24, 2025, showed higher engagement, with 65% of students actively involved in discussions and group tasks. Although this class had an average score of 78 (above the KKM), 15% of students (4 students: 1 boy, 3 girls) remained passive. Class IIIC (25 students: 13 boys, 12 girls) exhibited intermediate engagement levels on February 25, 2025, with a 71 average score and 28% (7 students: 4 boys, 3 girls) below KKM. Notably, many students relied on peers to understand material, suggesting conventional methods inadequately foster participation.

Low enthusiasm and participation in class discussions hinder students' comprehension of science concepts, as many hesitate to voice opinions or ask questions when encountering difficulties. Mr. BM, the Class IIIA teacher, noted that most students remained passive during lessons, rarely asked questions, and often waited for peers to respond. Some exhibited off-task behaviors like doodling, while others required repeated instructions to complete assignments. Mrs. OT, the Class IIIB homeroom teacher, reported that struggling students avoided asking questions or sharing ideas, instead copying peers' answers without understanding the concepts. Despite these challenges, Class IIIB showed higher engagement than other classes. In Class IIIC, Mr. FR observed

that while some students participated actively, others lacked confidence and relied heavily on peers. These findings underscore common issues: reluctance to speak up, dependence on others for answers, and limited focus—all of which necessitate innovative teaching methods like Baamboozle-based GBL to boost engagement and self-efficacy.

Prior research demonstrates that Game-Based Learning (GBL) effectively enhances student engagement and achievement in science (Nahampun et al., 2024; Paulina et al., 2023). Studies indicate that interactive game media increases student motivation and participation (Manurung et al., 2025, Sappaile, et al., 2024), with Baamboozle specifically improving interest and learning activity. Additional findings suggest GBL's potential to elevate elementary students' science performance (Simanjuntak et al., n.d.), as active participation in games correlates with stronger academic outcomes (Putri et al., 2024). Baamboozle, as an interactive digital tool, adapts to diverse learning materials and has proven effective in boosting engagement in math and science (Wardani & Kiptiyah, 2024; Nandhini & Rasyidah, 2024). Its integration into problem-based learning models also improves achievement in topics like the digestive system (Ramadhan et al., 2024). By creating a fun, interactive atmosphere, Baamboozle fosters both intrinsic (e.g., curiosity) and extrinsic (e.g., teacher-supported) motivation (Shiddiq et al., 2025; Simanjuntak et al., 2024; Widiana, 2022).

This study is grounded in Vygotsky's Social Constructivism, which underscores the role of social interaction in learning (Tamrin, et al., 2011). Baamboozle serves as a scaffold within students' Zone of Proximal Development (ZPD), enabling peer-assisted comprehension of complex concepts like ecosystems. The research contributes novel insights by examining Baamboozle-mediated GBL's impact on verbal participation (e.g., a 45% increase in unprompted responses) and peer dialogue, diverging from prior focus on cognitive outcomes. It also addresses gender disparities, such as the 19% of girls versus 11% of boys below KKM in Class IIIA, through the lens of collaborative learning. Practically, the findings guide teachers in designing effective GBL strategies. Theoretically, they enrich understanding of how GBL supports active learning (Afiyah & Sutriyani, 2024), paving the way for participatory, engaging science education at the elementary level.

METHOD

This study adopts a qualitative case study approach (Creswell, 2020) to examine how Baamboozle-mediated Game-Based Learning (GBL) fosters active participation in science education among third-grade students at SD Assunniyyah Kencong. Grounded in Vygotsky's social constructivism, the research design emphasizes peer collaboration and scaffolding within gameplay contexts.

Data collection methods include structured observations, semi-structured interviews, and documentation. Observations are conducted at 10-minute

intervals during learning sessions to capture classroom dynamics, with a coding scheme tracking student-teacher interactions, peer collaboration, and question frequency. Semi-structured interviews, comprising 10 key questions, explore teacher and student perceptions of GBL's impact on engagement, with each session lasting approximately 20–30 minutes to allow for in-depth responses. Documentation—including photographs, video recordings, and student assignments—supplements observational data by providing visual evidence of behavioral and social interactions during discussions.

Thematic analysis (Braun & Clarke, 2006) guides the inductive coding of interview transcripts and observation notes, identifying patterns in verbal participation and collaborative behaviors. To ensure methodological rigor, triangulation is employed by cross-referencing coded data with video-recorded group interactions.

Collected data is systematically categorized and synthesized into a structured narrative, with validation achieved through triangulation techniques. Active participation is operationalized through measurable indicators: (1) involvement in discussions and activities, (2) self-initiated questioning and responding, (3) collaborative engagement in group tasks, (4) sustained focus during instruction, and (5) intrinsic motivation, reflected in enthusiasm and task persistence. These indicators are analyzed holistically through observations, interviews, and documented evidence to provide a nuanced understanding of student engagement. By integrating these methods, the study aims to elucidate the effects of Baamboozle-based GBL on active learning in elementary science education, contributing empirical insights to contemporary pedagogical strategies.

RESULT AND DISCUSSION

Implementation of Game-Based Learning on IPAS Learning

The implementation of Game-Based Learning (GBL) using the Baamboozle platform in science (IPAS) lessons at Assunniyyah Kencong Elementary School follows a three-phase framework grounded in Vygotsky's social constructivism, which prioritizes social interaction as a catalyst for learning: planning, implementation, and assessment.

1. Preparation Phase

During the initial phase, researchers collaborated with third-grade teachers to conduct a needs analysis and map science topics suitable for GBL adaptation. The selected material—traditional values in Indonesia—was chosen for its demand for contextual and affective understanding. Baamboozle games were then tailored to align with learning objectives and student competencies. As noted by Mr. Bustomi, the Class IIIA homeroom teacher:

"We calibrated the difficulty of Baamboozle questions to match students' average abilities while incorporating cognitive challenges to foster development."

2. Implementation Phase

GBL was deployed across three April 2025 learning sessions per class, structured in four stages:

a. Orientation: Teachers introduced traditional values through guided discussions and visual aids.
b. Exploration: Students, grouped into teams of 5–6, explored concepts via pre-designed Baamboozle games.
c. Elaboration: Teams competed in interactive quizzes, with automated scoring fostering healthy competition.
d. Confirmation: Teachers reviewed answers, clarified misconceptions, and reinforced key concepts.

Class IIIB teacher Mrs. Okta observed:

"Baamboozle's format heightened engagement—even typically passive students contributed actively to their teams."

The game's interface (Figure 1) and sample questions (Figure 2) illustrate its integration:

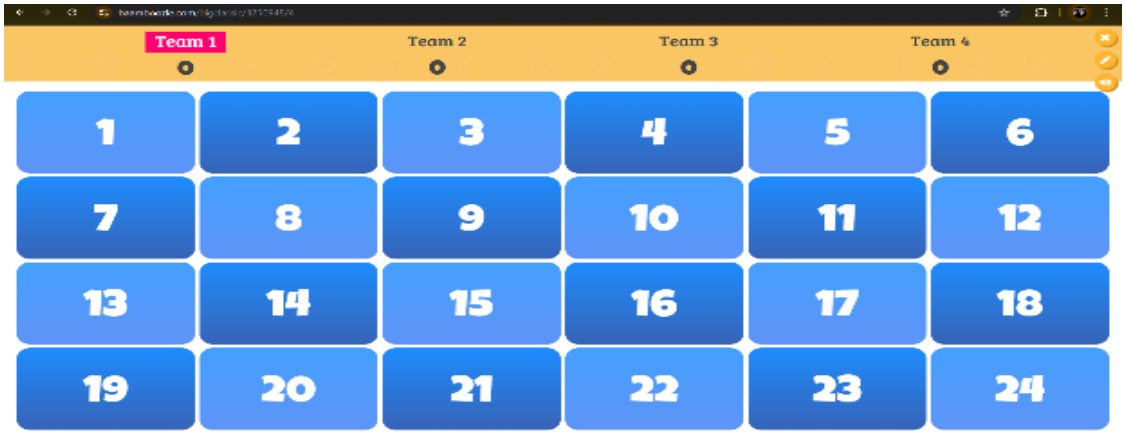

Figure 1: *Baamboozle game grid (number-based interface).*

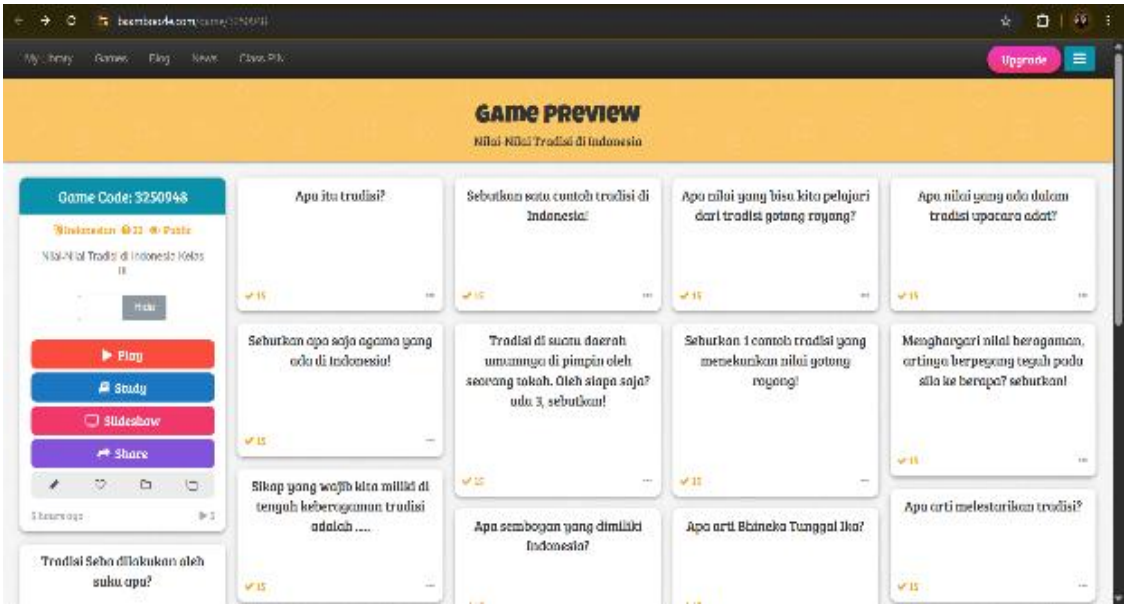

Figure 2. *Baamboozle questions (content: traditional values).*

3. Evaluation Phase

Assessment combined direct observation of student activities and post-intervention tests on traditional values. Key outcomes included:

a. A 45% increase in question-asking frequency in Class IIIA (previously the least participatory).
b. Rise in group discussion involvement: 38% (IIIA), 27% (IIIB), and 32% (IIIC).
c. Enhanced teamwork, evidenced by balanced task distribution among students of varying engagement levels.

Student Learning Activeness in Science Subjects

Observations of student learning activeness were conducted both prior to and following the implementation of Baamboozle-mediated Game-Based Learning (GBL). The evaluation employed five predefined indicators aligned with the research methodology: (1) participation in discussions and activities, (2) self-initiated questioning and responding, (3) engagement in group tasks, (4) sustained focus during lessons, and (5) learning motivation, evidenced by enthusiasm and task persistence. These metrics were systematically tracked to assess behavioral shifts during science instruction.

Initial observations revealed pronounced variations in baseline activeness across the three classrooms:

1. Class IIIA exhibited the lowest engagement, with only 30% of students actively participating. Merely four students volunteered questions or answers unprompted, while 30% scored below the Minimum Mastery Standard (KKM), averaging 65 on formative assessments.
2. Class IIIB demonstrated the highest pre-intervention engagement, with 65% of students participating actively and an average daily test score of 78. Only 15% fell below the KKM.
3. Class IIIC displayed intermediate engagement, with an average score of 71 and 28% of students not meeting the KKM. Dependence on peers for material comprehension was noted among less active learners.

Teacher interviews contextualized these findings, highlighting recurring traits among disengaged students: reluctance to speak publicly, reliance on peers for answers, distractibility, and need for repeated task instructions. As Mr. Bustomi, the Class IIIA teacher, noted:

"Student activeness fluctuates with mood and instructional timing—mornings consistently yield higher engagement than afternoons."

GBL implementation correlated with marked improvements across all classes:

1. Class IIIA's active participation surged from 30% to 68%, with previously passive students initiating questions and contributing to group discussions. Focus levels rose notably, even during afternoon sessions.
2. Class IIIB advanced from 65% to 87% activeness, with near-universal participation and enhanced collaborative behaviors.
3. Class IIIC progressed from 52% to 76%, showing increased confidence in independent work and verbal expression.

Mrs. Okta, a Class IIIB teacher, attributed this shift to Baamboozle's design:

"The platform's competitive yet collaborative framework motivated even reticent learners to engage actively."

GBL's Impact on Engagement

Game-based learning (GBL) represents an instructional approach that integrates digital and traditional gaming elements to achieve targeted educational outcomes. Grounded in the pedagogical principle that active engagement enhances learning efficacy (Maharani et al., 2024), GBL fosters problem-solving competencies and critical thinking through immersive, contextually meaningful experiences.

The integration of the Baamboozle platform into elementary science curricula follows a systematic four-phase process:

1. Needs Analysis and Planning
    a. Identification of core competencies and learning objectives aligned with the science syllabus.
    b. Strategic mapping of content adaptable to game formats, with question design tailored to students' cognitive levels.
2. Educational Game Design
    a. Development of game content on Baamboozle, incorporating scoring mechanisms and rewards to incentivize participation.
    b. Establishment of rules balancing collaborative dynamics with constructive competition.
3. Classroom Implementation
    a. Pre-game conceptual priming to ensure foundational understanding.
    b. Formation of heterogeneous ability groups to promote peer scaffolding.
    c. Teacher-facilitated gameplay with guided reflection to reinforce learning post-session.
4. Evaluation and Follow-up
    a. Multimodal assessment of participation metrics and conceptual mastery via formative tests.
    b. Analysis of student feedback to refine future GBL iterations.

Empirical studies corroborate the efficacy of this model. Wulandari & Widiansyah (2023) documented significant gains in both engagement and academic performance following Baamboozle integration, a finding consistent with this study's outcomes. As emphasized by Muzakka et al. (2025), success hinges on the deliberate alignment of game mechanics with pedagogical objectives—a principle applied here through age-appropriate design and science-specific learning goals.

Active learning in science education transcends passive knowledge reception, encompassing behaviors such as questioning, discussion, problem-solving, and opinion articulation (Widiana, 2022). This study evaluates activeness through four dimensions:

1. Verbal Participation
    a. Frequency and depth of student-generated questions.

   b. Contributions to discussions and collaborative tasks.
2. Cognitive Engagement
   a. Demonstration of solution-seeking behaviors and autonomous material exploration.
   b. Conceptual integration linking new and prior knowledge.
3. Social-Interactive Competencies
   a. Cooperative group work and peer knowledge-sharing.
   b. Effective teacher-student and peer communication.
4. Motivational Indicators
   a. Observable enthusiasm and task persistence.
   b. Intrinsic curiosity toward science content.

Research underscores the interdependence of these factors. Wulandari & Safitri (2024) identified strong correlations between activeness, intrinsic motivation, and sustained concentration—patterns mirrored in this study's findings, where Baamboozle mitigated typical afternoon engagement declines. Sativa (2024) further highlights the role of multimedia design in fostering active learning environments, a principle actualized through Baamboozle's visually stimulating interface and reward structures at SD Assunniyyah Kencong.

Differentiation and Inclusivity

The science and social studies (IPAS) curriculum in elementary education integrates fundamental scientific and social concepts to cultivate scientific literacy and societal awareness. Aligned with contemporary curricular standards, this interdisciplinary domain emphasizes the development of observational, analytical, and problem-solving skills through the study of natural and social phenomena.

1. Thematic-Integrative Approach

   IPAS instruction synthesizes scientific and social concepts within meaningful real-world contexts, highlighting the interdependence of natural phenomena and human systems. This methodology fosters a holistic comprehension of students' environments, bridging abstract theories with tangible experiences.
2. Experiential Learning Paradigm

   Instruction prioritizes hands-on and minds-on activities, engaging students in scaffolded explorations and simplified scientific investigations. These tasks are deliberately calibrated to learners' cognitive levels, enabling age-appropriate application of the scientific method.
3. Cognitive Skill Development

   The curriculum systematically nurtures higher-order thinking skills, progressing from foundational competencies (observation, classification) to advanced analytical abilities (prediction, inference formulation). This scaffolding cultivates both critical and creative thinking dispositions.
4. Values and Attitudinal Cultivation

   Beyond cognitive objectives, IPAS education instills core scientific attitudes—intellectual curiosity, empirical rigor, and environmental stewardship—while promoting respect for ecological and cultural diversity.

Recent scholarship underscores the necessity of pedagogies that accommodate diverse learning modalities. Supriana et al. (2024) posit that effective IPAS instruction demands adaptable methodologies, a criterion met by Baamboozle-mediated Game-Based Learning (GBL). This approach aligns with the subject's multidimensional nature while addressing elementary learners' needs through interactive, differentiated experiences.

Ramadhan et al. (2024) emphasize the transformative potential of interactive assessments in science education. Baamboozle's integration as a formative evaluation instrument in this study exemplifies this principle, demonstrably enhancing participation and transforming assessment into an engaging process (Febrianty et al., 2024). The platform's inherent flexibility—adjustable difficulty levels, multimodal question formats, and real-time feedback—renders it particularly efficacious for heterogeneous elementary classrooms.

Enhancing Student Learning Activeness Through Baamboozle-Mediated Game-Based Learning

1. Verbal Participation and Social Interaction

   The implementation of Baamboozle-based Game-Based Learning (GBL) yielded significant improvements in students' verbal engagement during science lessons. Most notably, Class IIIA—initially demonstrating the lowest participation levels—exhibited a marked increase in question-posing and response behaviors. Ruslandi et al. (2025) attribute this shift to Baamboozle's capacity to create a low-stakes environment where students feel empowered to contribute without fear of errors. This finding aligns with Haryanto et al. (2024), who underscore GBL's role in fostering productive peer interactions. Observations revealed that team-based gameplay mechanics prompted previously reticent students to actively exchange ideas, with Mr. Farid, Class IIIC's homeroom teacher, noting:

   "Baamboozle transformed typically silent participants into vocal contributors during group discussions."

2. Motivational and Cognitive Outcomes

   The intervention substantially enhanced intrinsic motivation, as evidenced by heightened student persistence and enthusiasm when confronting learning challenges. Baamboozle's competitive elements served as cognitive catalysts, driving deeper material engagement. Witasari (2023) corroborates this effect, demonstrating that gamified learning—when calibrated to appropriate difficulty levels—optimizes cognitive engagement. In this study, tiered question design accommodated varying ability levels, while visual aids (e.g., images of Indonesian traditional values) bolstered comprehension. As Mr. Bustomi observed:

   "Visual question formats bridged abstract concepts to concrete understanding."

3. Differentiated Learning Accommodation

   Baamboozle's flexibility effectively addressed learner diversity by:

   a. Adapting question difficulty to individual zones of proximal development (Anggraini et al., 2020)
   b. Incorporating multimodal stimuli (visual, auditory, kinesthetic) per Sappile et al. (2024)
   c. This multi-sensory approach proved particularly beneficial for students with emerging literacy skills, as Mrs. Okta emphasized:

      "Adjustable difficulty settings enabled tailored support for diverse learners."

4. Cross-Class Efficacy Analysis

   Comparative data revealed disproportionate gains in Class IIIA (38% activeness increase), consistent with Aini et al.'s (2024) findings that GBL preferentially benefits passive learners by circumventing literacy barriers through visual/group modalities. The class's pre-intervention challenges—suboptimal reading/writing skills—were mitigated by Baamboozle's emphasis on collaborative, non-textual participation.

5. Implementation Challenges and Mitigation Strategies

   Despite overall success, two key barriers emerged:

   a. Infrastructure limitations: Device scarcity and intermittent connectivity were addressed through offline mode utilization and heterogeneous grouping.
   b. Pedagogical adaptation: Teachers provided targeted scaffolding for struggling readers, while backup plans ensured continuity during technical disruptions. Mrs. Okta highlighted the efficacy of peer-assisted learning:

      "Digitally proficient students naturally mentored less-skilled peers during gameplay."

Pedagogical and Sustainability Implications

The successful implementation of Baamboozle-mediated Game-Based Learning (GBL) in enhancing student activeness yields critical insights for elementary science education. This study empirically demonstrates that thoughtfully designed digital game integration can simultaneously elevate participatory engagement while fostering 21st-century competencies—including collaborative problem-solving, peer knowledge exchange, and foundational digital literacy.

1. Strategic Recommendations for Sustainable Adoption

   To institutionalize GBL's benefits at Assunniyyah Kencong Elementary School and similar contexts, four evidence-based measures emerge as essential:

   a. Curricular Resource Development: Establishing a cross-disciplinary digital question bank would enable teachers to efficiently adapt Baamboozle's framework to diverse subjects, ensuring pedagogical consistency while reducing preparation burdens.

b. Teacher Capacity Building: As emphasized by Altinay et al. (2024), sustained professional development is paramount. Targeted training should equip educators with:
   - Competencies in GBL activity design aligned with cognitive development stages
   - Strategies for balancing game mechanics with learning objectives
   - Assessment techniques for gamified environments

c. Infrastructure Investment: Reliable access to devices and stable connectivity forms the backbone of scalable implementation. This necessitates budgetary prioritization and potential public-private partnerships to address current gaps.

d. Community of Practice Cultivation: A structured platform for teacher collaboration—sharing lesson templates, troubleshooting challenges, and refining game-based pedagogies—would accelerate iterative improvement. Mr. Bustomi's reflection encapsulates this potential:

   "Baamboozle's success has inspired me to explore additional interactive platforms across subject areas."

2. Theoretical and Practical Synergy

These recommendations operationalize broader principles of technology-enhanced learning (Altinay et al., 2024), positioning GBL not as a transient intervention but as a sustainable lever for pedagogical transformation. By institutionalizing the observed best practices—differentiated game design, peer-assisted learning, and multimodal assessment—schools can systematically bridge the theory-practice divide into active learning methodologies.

CONCLUSION

The implementation of Baamboozle-mediated Game-Based Learning (GBL) has demonstrated significant efficacy in enhancing student engagement and learning outcomes in science education at Assunniyyah Kencong Elementary School. This study provides empirical validation of Vygotsky's Social Constructivism, as evidenced by improved peer collaboration and effective scaffolding during Baamboozle activities—key mechanisms for operating within students' Zones of Proximal Development (ZPD). Notably, Class IIIA, which initially exhibited the lowest participation levels (30%), achieved the most substantial gains (68%), highlighting GBL's particular value for re-engaging disengaged learners.

While infrastructure limitations (e.g., device scarcity, connectivity issues) presented implementation challenges, adaptive strategies such as offline functionality and peer-assisted learning models proved effective workarounds. These solutions underscore the model's flexibility in resource-constrained settings.

To sustain and scale these benefits, we recommend Systematic development

of cross-curricular digital question banks to streamline GBL adoption; Ongoing teacher professional development focused on game-based pedagogy; Targeted investments in technological infrastructure to ensure equitable access; and Establishment of professional learning communities to foster collaborative innovation among educators.

Beyond immediate academic outcomes, this approach cultivates essential 21st-century competencies—including collaborative problem-solving, digital literacy, and adaptive thinking—that form the foundation for lifelong STEM engagement. The findings position Baamboozle-based GBL not merely as an instructional tool, but as a transformative framework for active learning in elementary science education.

REFERENCES

Afiyah, K. N., & Sutriyani, W. (2024). Efektivitas metode game-based learning berbantuan media flashcard pecahan terhadap hasil belajar matematika siswa. *LINEAR: Journal of Mathematics Education, 5*(2), 171–180. https://doi.org/10.32332/xmy86j91

Aini, L. N., & Purwaningsih, S. M. (2024). Pengaruh metode pembelajaran game based learning berbasis media board game ular tangga terhadap kemampuan penalaran siswa kelas xi SMK Negeri 6 Surabaya. *AVATARA: Journal Pendidikan Sejarah Volume, 15*(3), 1-12. https://ejournal.unesa.ac.id/index.php/avatara/article/view/63430

Altinay, Z., Altinay, F., Sharma, R. C., Dagli, G., Shadiev, R., Yikici, B., & Altinay, M. (2024). Capacity building for student teachers in learning, teaching artificial intelligence for quality of education. *Societies, 14*(8), 148. https://doi.org/10.3390/soc14080148

Anggraini, T. W., Febriyanti, D. P., Sakinah, A. P., Safitri, A., & Annur, S. (2020). Pengaruh metode game based learning terhadap pemahaman belajar peserta didik pada mata pelajaran IPA di MI Al Awwal Palembang. Jurnal Review Pendidikan Dan Pengajaran, 7(3), 6760–6768. https://doi.org/10.31004/jrpp.v7i3.28857

Braun, V. and Clarke, V. (2006) Using thematic analysis in psychology. *Qualitative Research in Psychology, 3*, 77-101. http://dx.doi.org/10.1191/1478088706qp063oa

Creswell, J. W. (2020). *Penelitian Kualitatif & Desain Riset*. Yogyakarta: Pustaka Pelajar

Febrianty, G.S., Ramadhan, I., & Zatalini, A. (2024). Implementation of the game based learning model using baamboozle media as an evaluation of students. *ICoCSE Proceedings, 1*, 196–202. https://jurnal.untirta.ac.id/index.php/ICoCSE/article/view/30018

Fonseca, I., Caviedes, M., Chantré, J., & Bernate, J. (2023). Gamification and game-based learning as cooperative learning tools: A systematic review. *International Journal of Emerging Technologies in Learning (IJET), 18*(21), 4–23. https://doi.org/10.3991/ijet.v18i21.40035

Haryanto, S., Zahra, R., Merakati, I., Hanafiah, H., Haryati, H., Thasimmim, S. N., & Arifianto, T. (2024). Pembelajaran berbasis game:

Pelatihan membuat media pembelajaran menarik dengan teknologi. *Community Development Journal: Jurnal Pengabdian Masyarakat*, *5*(1), 868–883. https://doi.org/10.31004/cdj.v5i1.24930

Maharani, M., Aminuyati, A., Wiyono, H., Buwono, S., & Karolina, V. (2024). Efektivitas model pembelajaran game-based learning terhadap hasil belajar peserta didik pada pembelajaran IPS kelas vii SMP Negeri 6 Pontianak. *Journal on Education*, *6*(3), 15707-15714. https://doi.org/10.31004/joe.v6i3.5403

Manurung, D. G., Butar, Z. B., Siregar, S., Butar, J. B., & Simanjuntak, N. (2025). Efektivitas penggunaan metode pembelajaran berbasis permainan untuk mengatasi kemalasan siswa SD 124398 Pematangsiantar. *Jurnal Pendidikan Tambusai*, *9*(1), 4877–4879. https://jptam.org/index.php/jptam/article/download/25191/17164/42808

Muzakka, M. N., Aulia, N., Putri, S. A., & Zulfahmi, M. N. (2025). Game based learning sebagai media pengoptimalan keterampilan 4c. 1. *Jurnal Bima: Pusat Publikasi Ilmu Pendidikan Bahasa dan Sastra*, *3*(1), 249–256. https://doi.org/10.61132/bima.v3i1.1562

Nahampun, S. H., Gurning, P. P., Nexandika, R., Zalukhu, Y. A. A., & Sianturi, M. E. (2024). Efektivitas metode pembelajaran berbasis game dalam meningkatkan motivasi belajar siswa sekolah dasar. *Sinar Dunia: Jurnal Riset Sosial Humaniora Dan Ilmu Pendidikan*, *3*(3), 63–68. https://doi.org/10.58192/sidu.v3i3.2415

Nandhini, S., & Rasyidah, R. (2024). Development of learning instruments based on game-based learning assisted by baamboozle educational game on digestive system material to improve students' learning outcomes. *Prisma Sains: Jurnal Pengkajian Ilmu dan Pembelajaran Matematika dan IPA IKIP Mataram*, *12*(3), 589–600. https://doi.org/10.33394/j-ps.v12i3.12229

Paulina, C., Rokmanah, S., & Syachruroji, A. (2023). Efektivitas penggunaan model game based learning dalam pembelajaran matematika di SD. *Jurnal Pendidikan Tambusai*, *7*(3), 31348–31354. https://doi.org/10.31004/jptam.v7i3.12114

Pérez, M. E. M, Duque, A. P. G., & García, L.C. F. (2018). Game-Based Learning: Increasing the logical-mathematical, naturalistic, and linguistic learning levels of primary school students. *Journal of New Approaches in Educational Research*, *7*(1), 31-39. https://doi.org/10.7821/naer.2018.1.248

Putri, A. H., Chahyadi, M., Sujanah, T., & Santoso, G. (2024). Efektivitas metode pembelajaran berbasis game dalam meningkatkan keterampilan pecahan pada siswa kelas 5 sekolah dasar. *Jurnal Pendidikan Transformatif*, *3*(1), 1-9. https://jupetra.org/index.php/jpt/article/view/1145

Putri, R. L., Angel, M. V. K., & Setiyawan, H. (2024). Penerapan model pembelajaran digital game based learning (DGBL) pada mata pelajaran matematika siswa kelas v. *Atmosfer: Jurnal Pendidikan,*

Bahasa, Sastra, Seni, Budaya, Dan Sosial Humaniora, *2*(3), 118–128. https://doi.org/10.59024/atmosfer.v2i3.889

Ramadhan, I., Imran, I., Syahrudin, H., Ulfah, M., Ismiyani, M., Atmaja, T. S., Dewantara, J. A., Wisely, V. O., Rokiaske, R., & Emita, E. (2024). Workshop penyusunan bahan ajar kurikulum merdeka dalam meningkatkan profesionalisme guru di sekolah perbatasan Indonesia-Malaysia. *Jurnal Pengabdian UNDIKMA 5*(2), 188–197. https://doi.org/10.33394/jpu.v5i2.9362

Ruslandi, U., Qomariyah, S., & Sumitra, M. (2025). Peran metode pembelajaran diskusi dalam menciptakan keaktifan belajar siswa di MAS Tarbiyatul Islamiyah. 2. *Katalis Pendidikan: Jurnal Ilmu Pendidikan dan Matematika, 2*(1), 79–90. https://doi.org/10.62383/katalis.v2i1.1203

Sappaile, B. I., Mahmudah, L., Gugat, R. M. D., Farlina, B. F., Mubarok, A. S., & Mardikawati, B. (2024). Dampak penggunaan pembelajaran berbasis game terhadap motivasi dan prestasi belajar. *Jurnal Review Pendidikan dan Pengajaran, 7*(1), 714–727. https://doi.org/10.31004/jrpp.v7i1.24682

Sativa, F., & Buahana, B. N. (2024). Penerapan pembelajaran STEAM dengan media loose parts untuk meningkatkan keterampilan berpikir kritis anak usia dini. *BIOCHEPHY: Journal of Science Education, 4*(2), 1093-1098. https://doi.org/10.52562/biochephy.v4i2.1367

Shiddiq, I., Sari, M., Nasution, Z. A., Purba, H. N., Kurniati, A., Junitri, A., Yanti, N., …, & Syahputri, H. (2025). Implementasi penggunaan media baamboozle untuk meningkatkan motivasi belajar matematika kelas 4 SDN 11 Panai Hulu. *Indo-MathEdu Intellectuals Journal*, *6*(1), 532–539. https://doi.org/10.54373/imeij.v6i1.2501

Simanjuntak, M. M., Saragih, A. D, Simanjuntak, C. J., Tambunan, E. P., Purba, M. S. D., Lingga, R. H., Gultom, R. V., & Simanjuntak, O. (2024). Penerapan model pembelajaran game based learning untuk meningkatkan minat belajar siswa pada mata pelajaran ipa kelas iv SD 094155 rambung merah. *Pendas: Jurnal Ilmiah Pendidikan Dasar*, *9*(4), 912–919. https://doi.org/10.23969/jp.v9i04.21375

Supriana, E., Liliani, N. T., & Luthfia, R. Z. (2024). tantangan implementasi pembelajaran berdiferensiasi: Sebuah studi literatur. *Jurnal Pembelajaran, Bimbingan, dan Pengelolaan Pendidikan*, *4*(9), 9–9. https://doi.org/10.17977/um065.v4.i5.2024.9

Tamrin, M., Sirate, S. F. S., &Yusuf, M. (2011). Teori belajar konstruktivisme Vygotsky dalam pembelajaran matematika. SIGMA: Jurnal Pendidikan Matematika, 3(1). 40-47. https://doi.org/10.26618/sigma.v3i1.7203

Titus, S., & Ng'Ambi, D. (2023). Digital gaming for cross-cultural learning: Development of a social constructivist game- based learning model at a South African university. *International Journal of Game-Based Learning*, *13*(1), 1–20.

https://doi.org/10.4018/IJGBL.331995

Wahidah, N. I., Sari, W. R., Festiana, I., & Nasir, N. (2020). Game based learning: Design a multimedia with DDD-E model for mathematics education. *International Journal of Emerging Technologies in Learning (iJET)*, *15*(21), 277–284. https://doi.org/10.3991/ijet.v15i21.16353

Wardani, M. E., & Kiptiyah, S. M. (2024). Game-Based learning model with baamboozle media based on artificial intelligence increases student engagement and learning outcomes. *Jurnal Ilmiah Sekolah Dasar*, *8*(2), 293–303. https://doi.org/10.23887/jisd.v8i2.67141

Widiana, I., W. (2022). Game based learning dan dampaknya terhadap peningkatan minat belajar dan pemahaman konsep siswa dalam pembelajaran sains di sekolah dasar. *Jurnal Edutech Undiksha*, *10*(1), 1–10. https://doi.org/10.23887/jeu.v10i1.48925

Witasari, R. (2023). Belajar dan Pembelajaran dari Perspektif Teori Kognitif, Behaviorisme Konstruktivisme dan Sosiokultural. *BASICA: Journal of Primary Education*, *3*(2), 257–268. https://doi.org/10.37680/basica.v3i2.5764

Wulandari, S. A., & Safitri, S. (2024). Penerapan Metode Game Based Learning Dalam Materi Sejarah Bandung Lautan Api Di Kelas XI IPS SMA Negeri 4 Pagar Alam. *Jurnal Inovasi Pendidikan dan Ilmu Sosial*, *2*(1), 34–41. https://ejournal.uniramalang.ac.id/index.php/jipsos/article/view/3507

Wulandari, W., & Widiansyah, A. T. (2023). Penerapan model pembelajaran games based learning untuk meningkatkan kemampuan literasi dan numerasi siswa. *Jurnal Pendidikan dan Pembelajaran IPA Indonesia*, *13*(3), 113–119. https://doi.org/10.23887/jppii.v13i3.73462