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# Development of Interactive Formative Assessment Based on Gimkit for Human Digestive System Material for Fifth Grade Elementary School Students

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## Abstract

The rapid development of information technology in the era of the Fourth Industrial Revolution has influenced various aspects of education, including assessment practices. However, the implementation of interactive formative assessment in elementary science learning remains limited and is still dominated by conventional written tests. This study aims to develop a Gimkit-based formative assessment tool for fifth-grade science learning on the topic of the human digestive system. This study employed a Research and Development (R&D) approach using the ADDIE development model, which consists of the analysis, design, development, implementation, and evaluation stages. The developed product is a formative assessment implemented through the Gimkit application using the Snowbrawl game mode. It consists of 10 multiple-choice and image-based questions designed to measure both Lower Order Thinking Skills (LOTS) and Higher Order Thinking Skills (HOTS). The visual components include illustrative images of digestive organs and an interactive game-based layout to enhance student engagement. Data were collected through observations, questionnaires, and documentation, and were analyzed using descriptive qualitative and quantitative techniques. The results of expert validation conducted by material experts, media experts, and the classroom teacher showed an average validity score of 85.72%, which was categorized as highly valid. Meanwhile, the practicality test involving students and the teacher obtained an average score of 85.92%, which was categorized as very practical. These findings indicate that the Gimkit-based formative assessment tool developed in this study is valid and practical for use in elementary science learning, particularly for the topic of the human digestive system, and has the potential to support students' engagement and learning processes.
**Keywords: formative assessment; gamification; gimkit**

## Introduction

The rapid advancement of information technology in the Fourth Industrial Revolution has transformed educational practices and increased the demand for innovative learning tools tailored for Generation Alpha students born between 2011 and 2025, who are highly familiar with digital environments (Fadlurrohim et al., 2020). Despite this digital shift, formative assessments in elementary science learning often remain conventional, relying on textbook-based exercises and written tests. Prior studies report that such traditional assessment approaches may contribute to student stress,

reduced engagement, and limited conceptual understanding, particularly in abstract science topics such as the human digestive system (Putu Agus Semara Putra Giri, 2020). Gamification-based tools have been recognized for enhancing motivation, participation, and providing immediate feedback in learning activities (Leong & Lam, 2021). Recent international studies further confirm that digital game-based platforms such as Kahoot! and Quizizz significantly improve engagement, classroom interaction, and learning outcomes (Wang & Tahir, 2020).

Among these tools, Gimkit an interactive quiz platform that integrates game mechanics offers features such as point-based rewards, strategy-oriented gameplay, and collaborative modes (Avşar et al., 2023) . These characteristics provide richer cognitive engagement compared to speed-focused platforms like Quizizz and Kahoot, which prioritize rapid responses over deeper reflection (Pham, 2023). However, recent literature indicates that while gamification research has grown substantially, it remains predominantly centered on platforms such as Kahoot and Quizizz. Empirical studies examining Gimkit, particularly as a formative assessment tool in elementary science learning, are still limited (Brillian, 2024). From a theoretical perspective, Gimkit's design aligns with constructivist learning principles, where students actively build knowledge through interactive experiences; behaviorism, where point rewards and reinforcement shape learning behavior; and game-based learning theory, which emphasizes challenge, immediate feedback, and sustained motivation as drivers of meaningful learning. These theoretical foundations strengthen the rationale for investigating Gimkit in the context of formative assessment in elementary science education. Classroom assessment practices in Indonesian elementary schools remain dominated by summative formats and conventional written tasks, which results in low student motivation and limited involvement (Yuanta et al., 2025 & Ar Rosyid & Wonorahardjo, 2024).

This contrasts with the role of formative assessment, which should be interactive, engaging, and capable of providing continuous feedback to support learning processes. Interviews with a fifth-grade science teacher at Riyadlus Sholihien Islamic Elementary School in 2025 further emphasize this gap, reporting that science learning relied heavily on teacher-centered explanations and textbook activities, leading to low student participation and difficulty understanding digestive system concepts. Based on these empirical and theoretical findings, there is a clear research gap: the use of interactive,

gamified formative assessments in elementary science learning is still limited, particularly studies examining Gimkit as a tool to support student engagement and conceptual understanding. Conventional classroom assessment practices remain teacher-centered and summative, which fails to address motivational and cognitive challenges, especially in abstract topics such as the human digestive system.

Therefore, there is a need to develop a valid, practical, and engaging Gimkit-based formative assessment tool that can enhance learning outcomes and student participation. Based on the gaps above, this study aims to answer the following research questions: (1) How valid is the Gimkit-based formative assessment tool for fifth-grade science learning on the human digestive system? (2) How practical is the tool based on teacher and student responses during implementation? (3) To what extent does the tool support students' learning processes and engagement during science lessons?

## Methods

Research and Development (R&D) serves as the primary method employed in this study. R&D is a systematic process aimed at developing educational products and evaluating their effectiveness. According to (Haviz, 2016), R&D is an innovative, productive, and meaningful research approach. In educational settings, R&D has been widely utilized to create relevant and high-quality learning products (Agus Rustamana et al., 2024), involving innovative activities focused on developing new products or services and improving existing ones (Sarpong et al., 2023). Since the 1980s, Borg and Gall formalized R&D as an educational research model, emphasizing iterative development and systematic evaluation (Gustiani, 2019)

For this study, the ADDIE model Analysis, Design, Development, Implementation, and Evaluation was chosen as the development framework, as it is frequently recommended for educational R&D due to its structured stages and opportunities for continuous refinement (Cahyadi, 2019). Each stage was carried out through field-based activities to ensure that the final product meets established quality standards. During the Analysis stage, researchers identified student needs, curriculum requirements, and classroom challenges through interviews with teachers and classroom observations. The Design stage involved planning the structure of the Gimkit-based assessment, including question types, interface layout, and gameplay flow.

The Development stage focused on producing the initial prototype and refining it based on expert evaluations. In the Implementation stage, individual trials were conducted with three students representing high, medium, and low ability levels, while small-group trials involved seven students (two high, two medium, and three low) to reflect the school's typical classroom distribution. Although the number of trial participants was limited, this approach aligns with R&D practices, which prioritize formative evaluation and usability testing to refine the product before wider dissemination. Finally, the Evaluation stageanalyzed validity scores, practicality feedback, and feasibility results to guide necessary revisions. These systematic steps ensured that the final product met the required quality standards

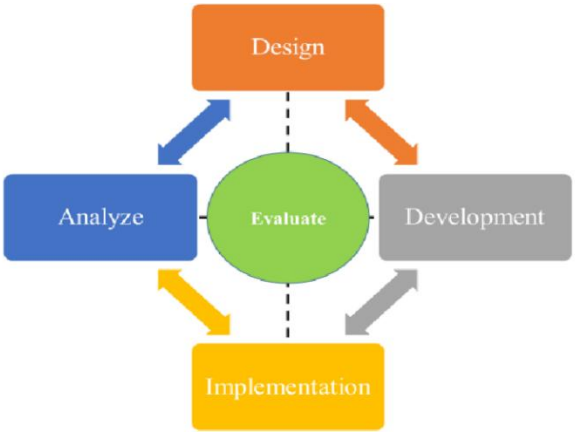



Figure 1. ADDIE Development Procedure

Source: (Robert Maribe Branch, 2009: 2)

The development process also involved multiple rounds of expert validation, individual trials, and small-group trials, followed by revisions based on feedback to ensure that the final product was valid and empirically tested. Expert validation included two university lecturers (one material expert, one media expert) and a fifth-grade teacher to ensure alignment with classroom needs. This sampling approach reflects the school context, where fifth-grade classrooms typically exhibit varied academic performance levels. Data were collected using four techniques: (1) interviews, which provided insights from teachers regarding learning conditions and media requirements; (2) questionnaires, used to gather feedback from students and experts on content quality, design, usability, and practicality; (3) observations, conducted systematically to evaluate student

engagement and media effectiveness during learning activities; and (4) document analysis, which reviewed syllabi, teaching modules, student learning outcomes, and development records.

The instruments employed included: (1) questionnaires, to assess media quality in terms of content, design, appearance, and usability based on feedback from experts and students; (2) interview guides, to collect information from teachers regarding issues faced during learning; (3) observation sheets, to document student and teacher engagement; and (4) documentation reports, which recorded the entire product development process from analysis to evaluation. Questionnaires served as the main instrument for assessing feasibility, as rating scales effectively measure perceptions, usability, and quality (Sugiyono 2022) Content validity was ensured through expert judgment (Creswell & Creswell, 2018) , while reliability was supported by consistency across multiple rounds of expert review (Cohen et al., 2017). Data analysis was conducted descriptively. Feasibility scores were calculated using the formula:

$$\text{Highest score} \times \text{Number of items} \times \text{Number of respondents}$$

Then, the respondents' evaluations and interpretations are calculated:

$$\frac{\text{Total score from collected data}}{\text{Total criterium score}} \times 100$$

Each questionnaire item was analyzed systematically to identify strengths and weaknesses of the developed Gimkit-based quiz game in terms of visual design, interactivity, usability, and effectiveness in supporting learning. As per (Riduwan, 2015), the feasibility categories are as follows:

Table 1: Feaibility categories

| Percentage | Category |
|---|---|
| 81% – 100% | Very feasible |
| 61% – 80% | Feasible |
| 41% - 60% | Fairly feasible |
| 21% – 40% | Less feasible |
| 0% – 20% | Not feasible at all |

Source:(Riduwan, 2015)

A product achieving ≥61% is considered feasible. This detailed process ensures clarity on how the instrument was selected, why the sample size was chosen, and how validity and reliability were maintained, fully addressing reviewer comments.

## Result

The science quiz game on the digestive system topic for fifth-grade students was developed through several stages of Research and Development (R&D), including needs analysis, design, development, validation, revision, testing, and implementation. The overall process is illustrated in the following figure.

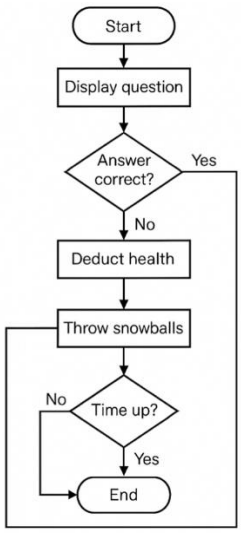



Figure 2. Flowchart of the Developed Interactive Quiz Game

Source: Personal Documents

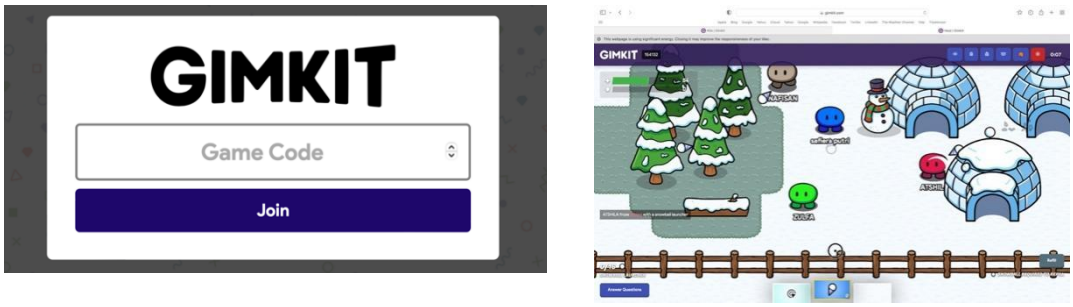
*First,* Needs Analysis

Based on the user analysis, most students in Class VC had not previously used game-based digital learning media and were more familiar with conventional learning methods. The formative assessment instrument used in this research was in the form of a fast-paced quiz in Gimkit. Questions were short multiple-choice items with limited answering time, and each correct answer gave players points to be used in the game. The quiz content was based on digestive system material, including organ functions, digestion processes, nutrient absorption, and waste elimination. This research focused on specific subtopics delivered in the first and second lessons, such as the liver's role in bile production, mechanical digestion in the mouth, the peristaltic movement of the esophagus, and the functions of the stomach and large intestine.

*Second,* Design

The design stage included planning conducted from April to May 2025, preparing ten quiz items that covered both LOTS and HOTS cognitive levels, and allocating seven

to ten minutes for gameplay. As part of the design analysis, the Snowbrawl mode in Gimkit was examined. This mode operates through a player-versus-player system, where students throw snowballs at opponents by answering questions correctly. Reloading requires answering new questions, and the number of snowballs depends on the cost setting in the game. Snowbrawl can be played individually or in teams, with each player having health and shield points that decrease when hit. When health reaches zero, the player is temporarily out and respawns after a short interval.




(a) Login/Lobby screen (b) Gameplay screen.

Figure 3. Screenshot of Gimkit Snowbrawl Mode

Table 2. Overview of the Gimkit

| Cognitive Level | Material | Question | Bloom'sTaxonomy | Answer |
|---|---|---|---|---|
| LOTS | General function of the digestive system | What is the main function of the human digestive system? | C2 – Understanding | Producing energy |
| LOTS | Mechanical digestion (mouth & stomach) | Where does mechanical digestion take place? | C1 – Remembering | Mouth and stomach |
| LOTS | Function of gastric acid (HCl) | What is the main function of stomach acid in the digestive system? | C2 – Understanding | To digest proteins in food |
| LOTS | Nutrient absorption site | Where does the absorption of nutrients such as glucose and amino acids occur? | C1 – Remembering | Small intestine |
| LOTS | Function of the large intestine | What happens during the process in the large intestine? | C2 – Understanding | Water absorption and feces formation |
| LOTS | Absorption in the small intestine | What happens to food during the digestive process in the small intestine? | C2 – Understanding | Nutrient absorption |

| Cognitive Level | Material | Question | Bloom'sTaxonomy | Answer |
|---|---|---|---|---|
| LOTS | Function of the stomach | What is the name of the organ that stores food temporarily before further digestion? | C1 – Remembering | Stomach |
| LOTS | Peristaltic movement | What is the name of the movement that swallows food due to esophageal contractions in the digestive system? | C1 – Remembering | Peristalsis |
| HOTS | Stomach function & protein digestion | After eating, someone feels nauseous. It turns out the stomach acid is insufficient. What organ is affected? | C5 – Evaluating | Stomach – Protein is difficult to digest |
| HOTS | Digestive organ & enzymes | A child has digestive problems due to a lack of amylase and trypsin. Which organ is most likely affected? | C5 – Evaluating | Pancreas – produces amylase and trypsin |

Source: Personal Documents

*Third,* Development

During the development stage, the game was created using multiple-choice and short- answer formats adjusted to reduce test anxiety. A limited trial was then conducted with selected students to evaluate clarity, usability, and difficulty. Some issues arose due to internet connectivity, which caused delays in logging in and answering questions.

*Fourth*, Validation

Validation was conducted by three experts: (1) a subject matter expert (university lecturer in science education), (2) a media expert (university lecturer in educational technology), and (3) an instructional practitioner (fifth-grade science teacher at MI Riyadlus Sholihien). The second implementation stage involved testing the revised game under expert supervision. The expert validation results obtained scores of 82.86%, 83.64%, and 90.67%, with an average of 85.72%, indicating the product is highly valid.

Table 3. Results of Expert Validation

| No | Validator | Total Score | Criteria |
|---|---|---|---|
| 1 | Subject Matter Expert | 82,86% | Highly valid |
| 2 | Media Expert | 83,64% | Highly valid |
| 3 | Subject Teacher | 90,67% | Highly valid |
| | Total | 257,17% | |

| | | |
|---|---|---|
| Avarage | 85,72% | Highly valid |

Source: Personal Documents

The practicality analysis showed a student score of 81.67% (practical) and teacher score of 89.33% (very practical), with an average of 85.5%, indicating the product is highly practical for use in fifth-grade science learning at MI Riyadlus Sholihien.

*Fifth*, Revision

Based on expert feedback, several revisions were implemented to improve the quality of the product. Before revision, the Gimkit quiz consisted mainly of text-based questions, had a relatively longer and less controlled game duration, and showed limited variation in cognitive levels. In addition, the visual appearance was considered less engaging for fifth-grade students, which could affect their learning motivation.

After revision, several improvements were applied, including the addition of supporting images and audio instructions to enhance students' visual and auditory understanding, adjusting the time limit to a fixed duration of seven minutes to maintain students' focus, and refining the question composition to better represent both LOTS and HOTS cognitive levels. These revisions resulted in improved visual appeal, more effective time management, and a more balanced assessment structure, thereby increasing student engagement and supporting more effective learning evaluation.

*Sixth*, Testing

The practicality of the product was examined through a classroom trial involving 22 students and the science teacher. Both groups assessed usability, convenience, and engagement during gameplay. Students gave a score of 81.67% (practical), while the teacher gave a score of 89.33% (very practical). The average practicality score was 85.92%, categorized as highly practical. The following is a summary of the student and teacher evaluation data:

Table 4. Teacher and Student Evaluation Results

| No | Responden | Total Score | Criteria |
|---|---|---|---|
| 1 | Teacher | 89,33% | Highly Practical |
| 2 | Student | 82,50% | Highly Practical |
| | Total | 171,83% | |
| | Avarage | 85,92% | Highly Practical |

Source: Personal Documents

*Seventh,* Implementation

The revised quiz game was implemented in a full classroom setting with 22 students. Observations showed that students were highly engaged, competitive, and

actively involved in answering questions using LOTS–HOTS reasoning. A classroom photo of students participating in the Gimkit quiz session serves as documentation of the implementation process.


Figure 4. Classroom Implementation of the Gimkit Quiz
Source: Personal Documents

*Eight,* Limitations

The main limitations identified during implementation were related to internet stability and device performance. Several students experienced delays due to weak connectivity or low-specification devices, which affected both login processes and the responsiveness of the Snowbrawl mode. These technical disruptions occasionally reduced the smoothness of gameplay and the speed at which students could answer questions. Such challenges may limit the adoption of Gimkit in schools with inadequate technological infrastructure, particularly those with limited bandwidth capacity or aging digital devices. Therefore, future development should consider providing offline-compatible versions, simplified game modes, or low-bandwidth alternatives to ensure broader accessibility and enable more equitable use across diverse school environments.

## Discussion

The results of this study provide important insights into the potential of using Gimkit Snowbrawl as a formative assessment tool in science learning, specifically on the topic of the human digestive system for fifth-grade students at MI Riyadlus Sholihien. This discussion integrates theoretical perspectives, comparative studies, and critical reflections to highlight the implications of the findings.

Previous research on gamified learning in science education has largely focused on platforms such as Quizizz and Kahoot (Pham, 2023). These studies found that such platforms improve student engagement and motivation through interactive, time-based quizzes. However, Gimkit differs by incorporating strategic gameplay elements such as resource management, player-versus-player interaction, and adaptive question difficulty. This study confirms that Gimkit offers similar benefits in engagement and learning outcomes, while adding deeper strategic engagement. These findings align with (Lieberoth, 2015) who argues that gamification is most effective when it combines competition, real-time feedback, and adaptive learning elements. Additionally, (Sailer & Homner, 2020) support that gamified tools enhance student participation when designed interactively. Previous research by (Tang & Zhang, 2019 & Hakak et al., 2019) also highlights that gamified learning can improve critical thinking and long-term learning outcomes. Further studies by (Li et al., 2022) indicate that gamification positively affects intrinsic motivation and engagement. (Zhang & Crawford, 2024) found that gamified formative assessments, such as those using Quizizz, significantly enhance students' intrinsic motivation and engagement through immediate feedback and interactive formats.

The findings suggest that Gimkit's game-based formative assessment fosters active learning and higher-order thinking, as reflected in the integration of LOTS and HOTS questions. This aligns with Bloom's Taxonomy and Constructivist Learning Theory (Vygotsky, 1980). which emphasize active, student-centered learning. Compared to traditional written tests, Gimkit offers advantages such as real-time feedback, interactive competition, and reduced test anxiety, all of which are essential in fostering intrinsic motivation (Leong & Lam, 2021) From a design perspective, the game aligns with Cognitive Load Theory by balancing intrinsic and extraneous load through paced delivery and scaffolded difficulty (Paas & Ayres, 2014). This design ensures students remain focused without experiencing cognitive overload, as supported by (Petko et al., 2020). Real-time monitoring of player responses, as noted by (Sevcenko et al., 2021) further strengthens cognitive engagement by providing instant feedback and guidance. These theoretical implications support that gamified formative assessments can deepen conceptual understanding and motivate learners intrinsically.

However, the study also highlights several challenges related to development and implementation. During the ADDIE-based development and classroom trials, limited internet stability and insufficient device specifications affected the smooth execution of Gimkit Snowbrawl. These findings confirm previous observations about infrastructural limitations in gamified learning (Pratami et al., 2023), showing that while the product is pedagogically effective, it may be less feasible in schools with restricted digital access. Flexible design with offline or low-bandwidth modes is therefore recommended to ensure equitable access.

For future research, it is recommended to compare Gimkit's effectiveness directly with other gamified platforms such as Quizizz and Kahoot (Universidad Nacional de San Agustín de Arequipa, Peru & Maraza-Quispe, 2024) to identify best practices. Longitudinal studies are needed to examine the lasting impact of gamified formative assessments on learning outcomes. Classroom implementation should also consider offline-compatible or low-bandwidth solutions to reduce technical disruptions and improve accessibility. The high validity (85.72%) and practicality (85.92%) scores obtained from expert validation and classroom evaluation support the pedagogical soundness of the product.

Expanding to different subjects and grade levels would provide broader evidence of the benefits and limitations of gamified formative assessments. Overall, this study supports the integration of gamification into formative assessment, demonstrating that Gimkit Snowbrawl can effectively engage students, foster higher-order thinking, and make formative assessment interactive and enjoyable. While infrastructural challenges remain, these tools are promising additions to modern science education when adapted to local contexts.

## Conclusion

This study successfully developed and validated a Gimkit-based formative assessment tool on the human digestive system for fifth-grade students at MI Riyadlus Sholihien using the ADDIE development model. The product achieved high validity (85.72%) and high practicality (85.92%), indicating that the developed tool is feasible and appropriate for classroom implementation. The results demonstrate that the use of Gimkit effectively enhances students' motivation, learning engagement, independent

learning, and conceptual understanding through real-time feedback, interactive gameplay, and game-based challenges.

From a theoretical perspective, this study contributes to elementary education theory, particularly in the context of constructivist learning theory, game-based learning theory, and behaviorist learning theory. The findings empirically confirm that students actively construct knowledge when they are involved in interactive and meaningful learning environments. The reward system, feedback, and strategic elements in Gimkit also support behaviorist learning theory through reinforcement mechanisms. Therefore, the findings of this study support, rather than contradict, existing learning theories that emphasize student-centered, interactive, and technology-integrated learning in elementary education.

From a practical perspective, this study provides clear evidence that Gimkit can be effectively used as a formative assessment tool in elementary science learning, especially for abstract topics such as the human digestive system. Teachers are encouraged to integrate Gimkit not only as an evaluation tool but also as a learning support medium that promotes active participation, collaboration, critical thinking, and independent learning.

For future research, further studies are recommended to: (1) examine the effectiveness of Gimkit-based formative assessment through quasi-experimental or true experimental designs to statistically measure its impact on students' learning outcomes, motivation, and higher-order thinking skills; (2) apply this assessment tool across different grade levels and various subject areas, such as mathematics and social studies, to test its broader applicability; (3) conduct large-scale trials involving multiple schools and diverse educational settings to strengthen the generalizability of the findings; and (4) investigate technical challenges in greater depth, including internet stability, device accessibility, and the digital readiness of both students and teachers. These directions are essential to support the sustainable implementation of gamification-based learning tools within the framework of Elementary Education 4.0.

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## References

Aerts, K., & Groeneveld, W. (2023). *Pro-f-quiz: Increasing the PROductivity of Feedback through activating QUIZzes* (Version 1). arXiv. https://doi.org/10.48550/ARXIV.2305.15996

Agus Rustamana, Khansa Hasna Sahl, Delia Ardianti, & Ahmad Hisyam Syauqi Solihin. (2024). Penelitian dan Pengembangan (Research & Development) dalam Pendidikan. *Jurnal Bima : Pusat Publikasi Ilmu Pendidikan Bahasa Dan Sastra*, *2*(3), 60–69. https://doi.org/10.61132/bima.v2i3.1014

Alzahrani, M. A. (2025). The Importance of Assistive Technology for Students with Disabilities in the Comprehensive Education Schools in the KSA. *Creative Education*, *16*(04), 453–476. https://doi.org/10.4236/ce.2025.164028

Ar Rosyid, H. H., & Wonorahardjo, S. (2024). Inovasi Pembelajaran IPS: Pengembangan Gimkit pada Materi Hindu Budha Kelas VII. *Journal of Innovation and Teacher Professionalism*, *3*(1), 203–210. https://doi.org/10.17977/um084v3i12025p203-210

Avşar, G., Ozan, C., & Aydin, E. (2023). The effect of reinforcement using the Gimkit game on learning the subject in nursing students. *Nurse Education in Practice*, *68*, 103595. https://doi.org/10.1016/j.nepr.2023.103595

Aziz, R., Norman, H., Nordin, N., Wahid, F. N., & Tahir, N. A. (2019). They Like to Play Games? Student Interest of Serious Game-Based Assessments for Language Literacy. *Creative Education*, *10*(12), 3175–3185. https://doi.org/10.4236/ce.2019.1012241

Azizi, M., & Prasetyo, S. (2018). Kontribusi Pengembangan Media Komik IPA Bermuatan Karakter Pada Materi Sumber Daya Alam untuk Siswa MI/SD. *Al-Bidayah: Jurnal Pendidikan Dasar Islam*, *9*(2), 185–194. https://doi.org/10.14421/al-bidayah.v9i2.25

Bai, S., Hew, K. F., & Huang, B. (2020). Does gamification improve student learning outcome? Evidence from a meta-analysis and synthesis of qualitative data in educational contexts. *Educational Research Review*, *30*, 100322. https://doi.org/10.1016/j.edurev.2020.100322

Brillian, ian. (2024). Pengaruh Penggunaan Media Pembelajaran Gimkit sebagai gamefikasi Terhadap pembelajaran Bahasa Indonesia Di Kelas 5 Sekolah Dasar. *Seminar Nasional Sosial, Sains, Pendidikan, Humaniora (Senassdra)*, 610–618.

Cahyadi, R. A. H. (2019). Pengembangan Bahan Ajar Berbasis Addie Model. *Halaqa: Islamic Education Journal*, *3*(1), 35–42. https://doi.org/10.21070/halaqa.v3i1.2124

Cohen, L., Manion, L., & Morrison, K. (2017). *Research Methods in Education* (8th ed.). Routledge. https://doi.org/10.4324/9781315456539

Creswell, J. W., & Creswell, J. D. (2018). *Research Design: Qualitative, Quantitative, and Mixed Methods Approaches*. SAGE Publications.

Eva'atussalamah, E., Fitri, A. Z., & Choiruddin, C. (2022). DEVELOPMENT OF THEMATIC E-MODULES BASED ON AL-QUR'AN VERSES TO IMPROVE STUDENT LEARNING OUTCOMES. *Al-Bidayah : Jurnal Pendidikan Dasar Islam*, *14*(2), 279–296. https://doi.org/10.14421/albidayah.v14i2.793

Fadlurrohim, I., Husein, A., Yulia, L., Wibowo, H., & Raharjo, S. T. (2020). MEMAHAMI PERKEMBANGAN ANAK GENERASI ALFA DI ERA INDUSTRI 4.0. *Focus : Jurnal Pekerjaan Sosial*, *2*(2), 178. https://doi.org/10.24198/focus.v2i2.26235

Fauzi, I. (2023). Inovasi Evaluasi Pembelajaran Sejarah Kebudayaan Islam Menggunakan Aplikasi Kahoot di MAN 2 Probolinggo. *Tarbiyatuna: Jurnal Pendidikan Islam*, *16*(1), 64–76. https://doi.org/10.54471/tarbiyatuna.v16i1.2132

Gustiani, S. (2019). *RESEARCH AND DEVELOPMENT (R&D) METHOD AS A MODEL DESIGN IN EDUCATIONAL RESEARCH AND ITS ALTERNATIVES*. *11*(2).

Hakak, S., Noor, N. F. M., Ayub, M. N., Affal, H., Hussin, N., Ahmed, E., & Imran, M. (2019). Cloud-assisted gamification for education and learning – Recent advances and challenges. *Computers & Electrical Engineering*, *74*, 22–34. https://doi.org/10.1016/j.compeleceng.2019.01.002

Hanus, M. D., & Fox, J. (2015). Assessing the effects of gamification in the classroom: A longitudinal study on intrinsic motivation, social comparison, satisfaction, effort, and academic performance. *Computers & Education*, *80*, 152–161. https://doi.org/10.1016/j.compedu.2014.08.019

Haviz, M. (2016). RESEARCH AND DEVELOPMENT; PENELITIAN DI BIDANG KEPENDIDIKAN YANG INOVATIF, PRODUKTIF DAN BERMAKNA. *Ta'dib*, *16*(1). https://doi.org/10.31958/jt.v16i1.235

Hoang, T. L. G. (2024). EFL LEARNER ENGAGEMENT IN GAMIFIED FORMATIVE ASSESSMENT: A PERCEPTION STUDY ON QUIZIZZ. *Hue University Journal of Science: Social Sciences and Humanities*, *133*(6B), 23–44. https://doi.org/10.26459/hueunijssh.v133i6a.7108

Hollman, A. K., Hollman, T. J., Shimerdla, F., Bice, M. R., & Adkins, M. (2019). Information technology pathways in education: Interventions with middle school students. *Computers & Education*, *135*, 49–60. https://doi.org/10.1016/j.compedu.2019.02.019

Kaplan, D. E. (2022). Simulation, Gaming, and Programing in Education. *Creative Education*, *13*(01), 30–37. https://doi.org/10.4236/ce.2022.131002

Leong, Y. X. E., & Lam, T. T. (2021). Game based assessment in the mathematics classroom. *International Journal on Teaching and Learning Mathematics*, *4*(1), 26–35. https://doi.org/10.18860/ijtlm.v4i1.10251

Li, X., Xia, Q., Chu, S. K. W., & Yang, Y. (2022). Using Gamification to Facilitate Students' Self-Regulation in E-Learning: A Case Study on Students' L2 English Learning. *Sustainability*, *14*(12), 7008. https://doi.org/10.3390/su14127008

Lieberoth, A. (2015). Shallow Gamification: Testing Psychological Effects of Framing an Activity as a Game. *Games and Culture*, *10*(3), 229–248. https://doi.org/10.1177/1555412014559978

Lukum, A. (2019). *PENDIDIKAN 4.0 DI ERA GENERASI Z: TANTANGAN DAN SOLUSINYA*. *2*.

Matsumoto, T. (2016). The Flipped Classroom Experience of Gamified. *Creative Education*, *07*(10), 1475–1479. https://doi.org/10.4236/ce.2016.710152

Mazon, C., Fage, C., & Sauzéon, H. (2019). Effectiveness and usability of technology-based interventions for children and adolescents with ASD: A systematic review of reliability, consistency, generalization and durability related to the effects of intervention. *Computers in Human Behavior*, *93*, 235–251. https://doi.org/10.1016/j.chb.2018.12.001

Naila, I., Kusumajanti, W., Ridlwan, M., Sutadji, E., & Mashfufah, A. (2023). ONLINE-BASED SCIENCE PROJECT LEARNING AS AN ELECTIVE INSTRUCTING MODEL TO IMPROVE THE COLLABORATIVE SKILLS OF ELEMENTARY STUDENTS. *Al-Bidayah : Jurnal Pendidikan Dasar Islam*, *15*(1), 71–96. https://doi.org/10.14421/albidayah.v15i1.1030

Paas, F., & Ayres, P. (2014). Cognitive Load Theory: A Broader View on the Role of Memory in Learning and Education. *Educational Psychology Review*, *26*(2), 191–195. https://doi.org/10.1007/s10648-014-9263-5

Petko, D., Schmid, R., & Cantieni, A. (2020). Pacing in Serious Games: Exploring the Effects of Presentation Speed on Cognitive Load, Engagement and Learning Gains. *Simulation & Gaming*, *51*(2), 258–279. https://doi.org/10.1177/1046878120902502

Pratami, I. G. A. P. S., Nitiasih, P. K., & Budiarta, L. G. R. (2023). Development of Educational Games as Learning Media for English Learning for Primary Students. *Language Circle: Journal of Language and Literature*, *17*(2), 317–324. https://doi.org/10.15294/lc.v17i2.43129

Putu Agus Semara Putra Giri. (2020). *MEREDUKSI KECEMASAN DENGAN TEKNIK DESENSITISASI SISTEMATIS*. https://doi.org/10.5281/ZENODO.3756949

Riduwan. (2015). *Metode dan Teknik Menyusun Proposal*. Alfabeta.

Sailer, M., & Homner, L. (2020). The Gamification of Learning: A Meta-analysis. *Educational Psychology Review*, *32*(1), 77–112. https://doi.org/10.1007/s10648-019-09498-w

Sarpong, D., Boakye, D., Ofosu, G., & Botchie, D. (2023). The three pointers of research and development (R&D) for growth-boosting sustainable innovation system. *Technovation*, *122*, 102581. https://doi.org/10.1016/j.technovation.2022.102581

Sevcenko, N., Ninaus, M., Wortha, F., Moeller, K., & Gerjets, P. (2021). Measuring Cognitive Load Using In-Game Metrics of a Serious Simulation Game. *Frontiers in Psychology*, *12*, 572437. https://doi.org/10.3389/fpsyg.2021.572437

Sigit Dwi Laksana, Anip Dwi Saputro, Ayok Ariyanto, & Dirga Ayu Lestari. (2024). Development of Learning Media Gamification Based on Gamimath Android in

Mathematics Learning for Elementary School. *Al-Bidayah : Jurnal Pendidikan Dasar Islam*, *16*(2), 329–348. https://doi.org/10.14421/al-bidayah.v16i2.9585

Siswoyo, A. A. (2021). DEVELOPING THEMATIC LEARNING MODULE BASED ON ETHNOSCIENCE ORIENTED OUTDOOR LEARNING STRATEGY TO IMPROVE STUDENT'S LEARNING OUTCOMES IN PRIMARY SCHOOL. *Al-Bidayah : Jurnal Pendidikan Dasar Islam*, *13*(1), 237–250. https://doi.org/10.14421/al-bidayah.v13i1.283

Sugiyono. (2022). *Metode Penelitian Kuantitatif, Kualitatif dan R&D / Sugiyono*. Alfabeta.

Tang, J., & Zhang, P. (2019). Exploring the relationships between gamification and motivational needs in technology design. *International Journal of Crowd Science*, *3*(1), 87–103. https://doi.org/10.1108/IJCS-09-2018-0025

Torres, P. L., Santos, K. E. E. D., Kowalski, R. P. G., & Behrens, M. A. (2016). Adaptive Ecosystem—Integrated Technology into the Curriculum. *Creative Education*, *07*(01), 44–54. https://doi.org/10.4236/ce.2016.71005

Universidad Nacional de San Agustín de Arequipa, Peru, & Maraza-Quispe, B. (2024). Impact of the Use of Gamified Online Tools: A Study with Kahoot and Quizizz in the Educational Context. *International Journal of Information and Education Technology*, *14*(1), 132–140. https://doi.org/10.18178/ijiet.2024.14.1.2033

Vasconcelos, F. K. A., Pagliuca, L. M. F., Carvalho, A. T. D., Oliveira, M. G. D., & Almeida, P. C. D. (2015). The Learning of Adolescent Students about the Disabled Person Using Board Game. *Open Journal of Nursing*, *05*(03), 173–180. https://doi.org/10.4236/ojn.2015.53021

Vygotsky, L. S. (1980). *Mind in Society: Development of Higher Psychological Processes* (M. Cole, V. Jolm-Steiner, S. Scribner, & E. Souberman, Eds.). Harvard University Press. https://doi.org/10.2307/j.ctvjf9vz4

Wang, A. I., & Tahir, R. (2020). The effect of using Kahoot! For learning – A literature review. *Computers & Education*, *149*, 103818. https://doi.org/10.1016/j.compedu.2020.103818

Yengin, D. (2011). DIGITAL GAME AS A NEW MEDIA AND USE OF DIGITAL GAME IN EDUCATION. *The Turkish Online Journal of Design, Art and Communication*, *1*(1). https://doi.org/10.7456/10101100/003

Yuanta, F., Suroso, N. L. D. H., Wulandari, D. A., Anggraini, D. N., Hermawan, N. S., & Yosepin Betssy Tomasoa. (2025). Pengembangan Media Pembelajaran Berbasis Gimkit Materi Perkalian Kelas V Sekolah Dasar. *Indo-MathEdu Intellectuals Journal*, *6*(1), 920–926. https://doi.org/10.54373/imeij.v6i1.2575

Yunos, S., & Din, R. (2019). The Generation Z Readiness for Industrial Revolution 4.0. *Creative Education*, *10*(12), 2993–3002. https://doi.org/10.4236/ce.2019.1012223

Yustikadewi, R., & Saputro, E. R. (2024). The Effect of Using Gimkit on the Learning Outcomes of Literature Appreciation of Grade V Elementary School Students. *DIDAKTIKA: Jurnal Pendidikan Sekolah Dasar*, *7*(1), 26–31. https://doi.org/10.21831/didaktika.v7i1.70872

Zainuddin, Z., Shujahat, M., Haruna, H., & Chu, S. K. W. (2020). The role of gamified e-quizzes on student learning and engagement: An interactive gamification solution for a formative assessment system. *Computers & Education*, *145*, 103729. https://doi.org/10.1016/j.compedu.2019.103729

Zhang, Z., & Crawford, J. (2024). EFL learners' motivation in a gamified formative assessment: The case of Quizizz. *Education and Information Technologies*, *29*(5), 6217–6239. https://doi.org/10.1007/s10639-023-12034-7