

Development of an Augmented Reality Assisted Science Game Card to Enhance Students' Learning Motivation on the Topic of Classification of Living Things

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ABSTRAK

Penelitian ini bertujuan untuk mengetahui kelayakan, kepraktisan, dan keefektifan media Science Game Card berbantuan Augmented Reality dalam meningkatkan motivasi belajar siswa pada materi klasifikasi makhluk hidup. Penelitian ini menggunakan metode *Research and Development* (R&D) dengan model ADDIE yang meliputi tahap Analysis, Design, Development, Implementation, dan Evaluation. Produk yang dikembangkan divalidasi oleh ahli materi, ahli desain, ahli pembelajaran, dan ahli instrumen sebelum diujicobakan pada 10 siswa dalam uji coba skala kecil dan 31 siswa kelas VII dalam uji coba skala besar sekaligus uji efektivitas. Hasil penelitian menunjukkan bahwa media yang dikembangkan memenuhi kriteria layak dengan hasil validasi berkategori valid hingga sangat valid. Media juga memperoleh respons guru dan siswa dengan kategori sangat praktis. Pada tahap akhir, hasil uji efektivitas menunjukkan bahwa media yang dikembangkan efektif

meningkatkan motivasi belajar siswa berdasarkan hasil uji Wilcoxon (Sig. = 0,000), nilai N-Gain sebesar 0,701 (kategori tinggi), dan hasil observasi motivasi belajar sebesar 86,29% (kategori sangat termotivasi). Dengan demikian, media Science Game Card** berbantuan Augmented Reality layak, praktis, dan efektif digunakan untuk meningkatkan motivasi belajar siswa.

ABSTRACT

This study aimed to determine the feasibility, practicality, and effectiveness of an Augmented Reality-assisted Science Game Card in enhancing students' learning motivation on the topic of classification of living things. This study employed a Research and Development (R&D) approach using the ADDIE model, consisting of the Analysis, Design, Development, Implementation, and Evaluation stages. The product was validated by material, design, learning, and instrument experts before being implemented with 10 students in a small-scale trial and 31 seventh-grade students in a large-scale trial. Data were collected through validation sheets, response questionnaires, learning motivation questionnaires, and observation sheets. The results showed that the developed media was feasible, obtaining validation scores of 79.5% (Valid), 90.0% (Highly Valid), 90.8% (Highly Valid), and 94.0% (Highly Valid). The media was also highly practical, with teacher and student response scores of 100%, 84.5%, and 97.4%, respectively. Furthermore, the effectiveness test indicated a significant improvement in students' learning motivation, with a Wilcoxon significance value of 0.000, an N-Gain score of 0.701 (High), and a motivation observation score of 86.29% (Highly Motivated). Therefore, the Augmented Reality-assisted Science Game Card is feasible, practical, and effective for enhancing students' learning motivation.

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A. Introduction

Science learning in the 21st century is expected not only to develop students' conceptual understanding but also to foster scientific thinking, problem-solving skills, and the ability to adapt to the rapid advancement of science and technology (Sakila et al., 2023). Achieving these goals requires strong learning motivation, as motivation encourages students to participate actively, persist in learning activities, and engage meaningfully throughout the learning process (Ryan & Deci, 2020). Students with high learning motivation generally demonstrate better conceptual understanding and academic achievement than those with low motivation (Wulandari et al., 2021). However, science is often perceived as a challenging subject because it involves abstract concepts, scientific terminology, and Latin nomenclature that are difficult to understand through verbal explanations or textbooks alone (Qois & Sukirman, 2025). Therefore, innovative instructional media are needed to enhance students' learning motivation while facilitating a more concrete understanding of scientific concepts.

Instructional media play a crucial role in creating effective and meaningful learning experiences. Appropriate instructional media enable teachers to present learning materials more clearly, making concepts easier for students to understand (Yuliansih et al., 2021). In addition, instructional media can enhance students' attention, interest, and learning motivation, thereby encouraging active participation throughout the learning process (Lubis et al., 2023). One instructional approach that has gained increasing attention is game-based learning, as it promotes active, collaborative, and enjoyable learning experiences (Azhura et al., 2024). One example is the Science Game Card, an educational card game designed to help students understand the classification of living things through play-based learning activities (Pradita et al., 2025). Through this learning approach, students not only enjoy a more engaging learning experience but are also encouraged to discuss, collaborate, and strengthen their conceptual understanding.

The rapid development of technology has also promoted the integration of Augmented Reality (AR) into educational settings (Alnajdi, 2022). This technology enables three-dimensional virtual objects to be superimposed onto the real environment, allowing abstract concepts to be visualized more concretely (Avila-Garzon et al., 2021). In science learning, such visualization helps students observe objects that are difficult to access or visualize directly, making learning experiences more meaningful (Herwin et al., 2023). Beyond improving conceptual understanding, AR has been shown to increase students' attention, curiosity, and learning motivation by providing highly interactive learning experiences (Yeremia & Chang, 2025). Therefore, integrating educational games with AR technology has considerable potential to create more engaging learning environments while enhancing students' learning motivation.

Previous studies have consistently reported the positive effects of both Augmented Reality and educational game-based media on learning outcomes. Ruijia et al. (2025) found that AR enhances students' learning motivation by providing interactive visualization of abstract concepts. Similarly, Ayundari and Manalu (2024) reported that AR-based instructional media demonstrated high validity and effectively improved students' learning motivation. Meanwhile, studies on quartet card games have shown that educational card games can increase students' engagement and participation during classroom learning. Nevertheless,

most previous studies have examined educational games and AR technology separately. Research integrating Science Game Cards with Augmented Reality to enhance junior high school students' learning motivation on the topic of the classification of living things remains limited. This gap highlights the need to develop an instructional medium that combines educational card games with AR visualization to create a more innovative and motivating learning experience.

Based on classroom observations and a needs analysis conducted at UPT SPF SMP Negeri 2 Percut Sei Tuan, science teachers have utilized textbooks, PowerPoint presentations, and images as instructional media. However, these media have not been sufficient to optimally enhance students' learning motivation. The results of the motivation questionnaire revealed that 55.17% of students had low learning motivation, 31.03% demonstrated moderate motivation, and only 13.79% showed high learning motivation. Low motivation was particularly evident in learning the classification of living things, a topic that involves numerous scientific terms, Latin names, and characteristics of living organisms that are difficult to visualize using conventional instructional media. Therefore, this study developed an Augmented Reality-assisted Science Game Card using the ADDIE model to determine its feasibility, practicality, and effectiveness in enhancing students' learning motivation on the topic of the classification of living things.

B. Literature Review

Learning media play an essential role in the teaching and learning process by helping teachers deliver instructional content effectively and helping students understand concepts more easily. Appropriate media can stimulate students' attention, increase interest, and encourage active participation in classroom activities (Yuliansih et al., 2021). Compared with verbal explanation alone, learning media present information through visual and interactive representations that simplify complex concepts and create more meaningful learning experiences, contributing to higher motivation, better conceptual understanding, and support for diverse learning styles (Lubis et al., 2023). Selecting appropriate learning media is therefore an important consideration in improving the quality of science education.

One instructional approach gaining attention is Game-Based Learning (GBL), which uses games as the primary medium for delivering content. Unlike gamification, which merely adds game elements to conventional instruction, GBL integrates learning objectives directly into gameplay, allowing students to learn through interactive and enjoyable experiences (Camacho-Sánchez et al., 2023). Previous studies show that GBL promotes active participation, collaboration, critical thinking, and higher motivation while creating a more engaging classroom atmosphere (Pradita et al., 2025), encouraging students to construct understanding through interaction, discussion, and problem-solving rather than passively receiving information.

In this study, the learning medium developed is an Augmented Reality-assisted Science Game Card adapted from the educational quartet card game. Science Game Cards present material through thematic card sets containing illustrations, brief descriptions, and supporting information that help students recognize relationships among scientific concepts (Samsiyah et al., 2021). During gameplay, students actively collect, compare, and classify cards while interacting with peers, making learning collaborative and enjoyable, as well as practical, easy to

implement, and effective in improving concentration, memory, and motivation (Soraya et al., 2023).

The effectiveness of educational games can be further enhanced by integrating Augmented Reality (AR), an interactive technology that overlays virtual objects, animations, and multimedia information onto the real-world environment through devices such as smartphones or tablets (Alnajdi, 2022). AR enriches real-world experience by enabling students to interact directly with three-dimensional virtual objects, making abstract concepts more concrete (Avila-Garzon et al., 2021). In science education, AR is widely recognized for improving conceptual understanding by allowing students to observe phenomena difficult to visualize through conventional media (Yeremia & Chang, 2025), while its interactive visualization increases curiosity, engagement, and active participation (Herwin et al., 2023).

Learning motivation strongly influences academic achievement, as it determines students' willingness to initiate, sustain, and complete learning activities; highly motivated students participate more actively, apply effective strategies, and persist through difficulties (Ryan & Deci, 2020). In contrast, teacher-centered instruction relying mainly on textbooks and lectures often results in passive learning and declining interest (Qois & Sukirman, 2025), highlighting the need for interactive media that foster motivation and engagement.

This study adopts Keller's ARCS motivational model, which conceptualizes motivation through four dimensions: Attention (attracting and maintaining curiosity), Relevance (connecting content to students' needs and goals), Confidence (belief in one's ability to succeed), and Satisfaction (positive feelings from achieving learning objectives or enjoyable experiences) (Fang et al., 2024; Oktaviani et al., 2021; Susanti & Imbiri, 2020). Because these dimensions can be shaped through instructional design, ARCS has been widely used to evaluate the motivational effectiveness of instructional media.

The integration of Science Game Cards and AR is expected to support all four ARCS dimensions simultaneously: gameplay captures attention through interactive, collaborative activities; AR enhances relevance through realistic three-dimensional visualization; structured gameplay and immediate feedback build confidence; and enjoyable experiences generate satisfaction that encourages continued engagement. These characteristics are especially relevant to the classification of living things, which requires students to distinguish organisms based on observable characteristics, habitats, reproductive systems, respiratory organs, and other criteria. Through interactive visualization and gameplay, students are expected to understand classification concepts more meaningfully while experiencing higher learning motivation, making the integration of AR and Science Game Cards a strong theoretical foundation for developing instructional media that enhances motivation in science learning.

C. Methods

This study employed a Research and Development (R&D) method to develop an Augmented Reality-assisted Science Game Card as a learning medium for the topic of the classification of living things. The development process adopted the ADDIE model proposed by Branch (2009), consisting of the Analysis, Design, Development, Implementation, and Evaluation stages. The developed media were systematically designed, validated by experts, revised based on their

recommendations, and implemented through field trials to evaluate their validity, practicality, and effectiveness in enhancing students' learning motivation.

The study was conducted at UPT SPF SMP Negeri 2 Percut Sei Tuan, North Sumatra, Indonesia. The validation process involved two material experts, two design experts, two learning experts, and one instrument validation expert, while one science teacher participated in evaluating the practicality of the developed media. Field trials were conducted in two stages, involving 10 seventh-grade students in the small-scale trial and 31 students in the large-scale trial. A One-Group Pretest–Posttest design was employed during the implementation stage to examine changes in students' learning motivation after using the developed media.

Data were collected through interviews, student needs analysis questionnaires, expert validation sheets, teacher and student response questionnaires, learning motivation questionnaires based on the ARCS (Attention, Relevance, Confidence, and Satisfaction) model, observation sheets, and documentation. Qualitative data from expert recommendations and implementation findings were analyzed descriptively to support product revision, whereas quantitative data were analyzed to determine the validity, practicality, and effectiveness of the developed media. Effectiveness was evaluated using the Shapiro–Wilk normality test, followed by the Wilcoxon Signed-Rank Test and the N-Gain test, while observation data were analyzed descriptively using percentage scores based on the ARCS indicators.

D. Research result

1. Analysis

The analysis stage consisted of media, curriculum, and student characteristics analyses. The findings indicated that science learning at UPT SPF SMP Negeri 2 Percut Sei Tuan mainly relied on textbooks, PowerPoint presentations, and picture media, which were considered insufficient to promote interactive learning and enhance students' learning motivation. Curriculum analysis showed that the developed media should align with the Merdeka Curriculum, particularly the learning outcomes and objectives for the topic of Classification of Living Things. Meanwhile, the student characteristics analysis revealed that students were interested in game-based and technology-assisted learning and had adequate access to smartphones. However, their initial learning motivation was predominantly in the low and moderate categories. These findings provided the basis for developing an Augmented Reality-Assisted Science Game Card to support a more engaging and motivating learning experience.

2. Design

The design process included determining the animal groups, card layout, learning content, game rules, and AR components. In addition to the playing cards, a supplementary card containing QR codes was developed to provide access to introductory learning materials and game instructions.

Table 1. Animal Groups Included in the Science Game Card

No	Animal Group	Card Color	Animal Members
1	Mammalia	Yellow	Lion, Cat, Elephant, Hyena
2	Aves	Pink	Macaw, Owl, Chicken, Eagle
3	Reptilia	Purple	Komodo Dragon, Crocodile, Snake, Green Sea Turtle
4	Insecta	Green	Butterfly, Rhinoceros Beetle, Bee, Grasshopper
5	Actinopterygii	Blue	Perch, Salmon, Pike, Clownfish

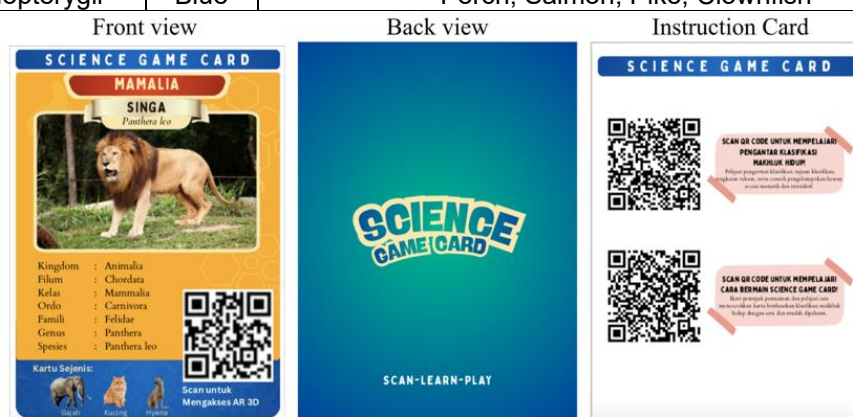


Figure 1. Design Results of the Science Game Card

The Science Game Card consists of 20 playing cards divided into five animal groups, with each group containing four related animals represented by different card colors. Each card includes the animal's common name, scientific name, two-dimensional illustration, seven taxonomic ranks, three related animals within the same group, and a QR code that provides access to Augmented Reality content. The cards were printed on linen paper measuring 5.5 × 8.5 cm to improve durability during gameplay. In addition, one supplementary card containing two QR codes was provided. The first QR code directs students to introductory material on the classification of living things, while the second provides instructions for using the Science Game Card and explains the game rules.

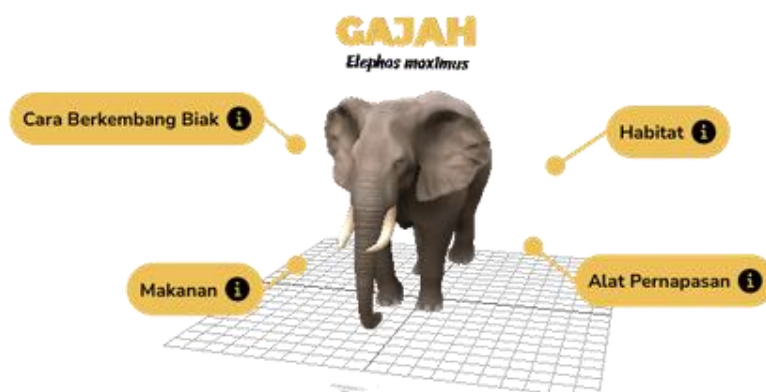


Figure 2. Augmented Reality Display

The Augmented Reality feature displays three-dimensional (3D) animal models that can be accessed by scanning the QR code printed on each card. Each AR display presents the animal's common name and scientific name together with brief information on its habitat, food, reproductive method, and respiratory organ. These features were designed to provide a more concrete visualization of the learning content and to support students' understanding through interactive exploration.

3. Development

During the development stage, the Science Game Card and its Augmented Reality features were developed based on the design produced in the previous stage. The prototype was then evaluated through expert validation involving two material experts, two media design experts, two instructional experts, and two motivation instrument validators. The validation process aimed to evaluate the content, media design, instructional suitability, and the quality of the research instrument before the product was implemented in classroom learning.

Tabel 2. Expert Validation Results

Aspect	V1	V2	Mean	Category
Material Expert	84%	75%	79,5%	Valid
Design Expert	95,6%	84,5%	90%	Highly Valid
Learning Expert	98,3%	83,3%	90,8%%	Highly Valid
Motivation Instrument	92%	96%	94%%	Highly Valid

Overall, all aspects achieved valid to highly valid categories, indicating that the developed media and research instruments were appropriate for implementation after several revisions based on the experts' recommendations.

Table 3. Summary of Expert Recommendations

Aspect	Category
Material Expert	All scientific names were revised using italic font throughout the Science Game Card.
Design Expert	The card size was increased to 7 × 12 cm, printed on Art Carton paper, the Aves group color was changed to gray, taxonomic level headings were bolded, and the QR code position was adjusted for a more balanced layout.
Learning Expert	Additional instructional materials and user guidance were organized into a printable format, allowing teachers and students to access the introductory material and game instructions more easily through the provided QR codes.
Motivation Instrument	Several questionnaire statements were rephrased using simpler and more comprehensible Indonesian while maintaining the intended motivational indicators.

4. Implementation

Table 4. Teacher Response Results

Aspect	Calculation Result	Kategori
Instructional Suitability	100%	Very Practical
Ease of Implementation	100%	Very Practical
Material Presentation	100%	Very Practical
Media Usefulness	100%	Very Practical
Use of AR	100%	Very Practical
Total Average for all aspect	100%	Very Practical

Table 5. Student Response Results

Aspect	Small-Scale Results	Large-Scale Results	Mean	Category
Media Appearance	82.50%	93.50%	88,00%	Very Practical
Ease of Use	85.00%	90.70%	87,85%	Very Practical
Material Presentation	82.50%	89.50%	86,00%	Very Practical
Media Attractiveness	90.00%	88.70%	89,35%	Very Practical
Media Usefulness	82.50%	91.50%	87,00%	Very Practical
Use of Augmented Reality	85.00%	90.30%	87,65%	Very Practical

Augmented Reality-Assisted Science Game Card achieved a high level of practicality based on both student and teacher evaluations. Students reported that the media was easy to use, attractive, and beneficial for learning, while the teacher considered it appropriate for classroom implementation.

Table 6. Normality Test

Tests of Normality							
	Kelompok	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Nilai	1	.142	31	.115	.926	31	.035
	2	.131	31	.187	.926	31	.035

Table 7. Wilcoxon Signed-Rank Test

		N	Mean Rank	Sum of Ranks
Posttest - Pretest	Negative Ranks	0 ^a	.00	.00
	Positive Ranks	31 ^b	16.00	496.00
	Ties	0 ^c		
	Total	31		

Table 8. N-Gain Results

No	Indicator	N-Gain Score	Category
1.	Attention	0.67	Medium
2.	Relevance	0,79	High
3.	Confidence	0,66	Medium
4.	Satisfaction	0,75	High
Mean		0,72	High

The effectiveness analysis demonstrated that the Augmented Reality-Assisted Science Game Card significantly improved students' learning motivation. Since the data were not normally distributed, the Wilcoxon Signed-Rank Test was applied and indicated a significant difference between the pretest and posttest scores. In addition, the N-Gain analysis showed improvements across all ARCS motivation indicators, with an overall N-Gain categorized as high. These findings confirm that the developed learning media was effective in enhancing students' learning motivation in learning the topic of Classification of Living Things.

Table 9. Observation Results

Indicator	Observer 1	Observer 2	Mean	Category
Attention	91.13%	74.20%	82.67%	Highly Motivated
Relevance	76.62%	75.00%	75.81%	Highly Motivated
Confidence	49.46%	54.84%	52.15%	Motivated
Satisfaction	86.29%	86.29%	86.29%	Highly Motivated

The observation results showed that students demonstrated high levels of learning motivation across all ARCS indicators during the implementation of the Augmented Reality-Assisted Science Game Card. Students actively participated in learning activities, showed enthusiasm in completing the game tasks, demonstrated confidence in using the learning media, and expressed satisfaction throughout the learning process. These findings are consistent with the results of the learning motivation questionnaire, confirming that the developed learning media effectively enhanced students' learning motivation on the topic of Classification of Living Things.

E. Discussion

The findings of this study demonstrate that the Augmented Reality-assisted Science Game Card successfully fulfilled the criteria of a valid, practical, and effective learning medium for improving students' learning motivation on the topic of Classification of Living Things. The expert validation results indicated that the developed product achieved valid to highly valid categories in terms of material,

media design, instructional aspects, and the learning motivation instrument. These findings suggest that the media was developed in accordance with the learning objectives, curriculum requirements, and students' characteristics while presenting scientifically accurate and visually appropriate content. Several revisions recommended by the validators, including improving the formatting of scientific names, enlarging the card size, refining the visual layout, and revising several questionnaire statements, contributed to improving the overall quality of the product before classroom implementation. These revisions indicate that the development process was not merely focused on producing an attractive learning medium but also on ensuring that every component met educational and scientific standards. Consequently, the final product became more suitable for classroom use because it had undergone systematic improvement through expert evaluation. This finding supports Delgado-Rodríguez et al. (2023), who stated that expert validation is an essential stage in educational media development because expert feedback ensures that learning media meet pedagogical, technical, and scientific requirements before implementation. Likewise, Amores-Valencia et al. (2022) emphasized that Augmented Reality-based learning media are more effective when they are systematically designed according to curriculum objectives and learners' needs.

The practicality results further demonstrated that the developed media was feasible for classroom implementation. Teacher responses reached the Very Practical category, while student responses also showed very positive evaluations in both the small-scale and large-scale trials, with higher scores obtained after product revision. These findings indicate that the integration of quartet card games and Augmented Reality created an interactive learning experience that was easy to implement and well accepted by both teachers and students. The attractive visual appearance, simple game procedures, and three-dimensional visualization encouraged students to become actively involved during learning rather than merely receiving information from the teacher. The increase in student response scores from the small-scale to the large-scale implementation also suggests that the revisions made after the initial trial successfully improved the usability and readability of the learning media. This indicates that the formative evaluation process within the ADDIE model contributed positively to the refinement of the product before broader implementation. Similar findings were reported by Milala et al. (2022), who explained that positive teacher responses indicate that learning media are practical for classroom implementation. Furthermore, Kalogiannakis et al. (2021) reported that combining game-based learning with digital technology can increase students' engagement and participation during science learning.

The effectiveness analysis confirmed that the developed media significantly improved students' learning motivation. Since the motivation data were not normally distributed, the Wilcoxon Signed-Rank Test was employed and revealed a significant difference between students' motivation before and after using the media. This finding was strengthened by the N-Gain analysis, which indicated a high level of improvement in learning motivation. These results demonstrate that integrating Science Game Cards with Augmented Reality successfully enhanced students' motivation during science learning. The combination of physical card games and digital visualization appears to have provided students with a more engaging learning experience by allowing them to observe organisms, discuss concepts collaboratively, and immediately explore additional information through

Augmented Reality. Such learning experiences reduce passive learning and encourage students to participate more actively throughout the lesson. Similar findings have been reported by Sidik et al. (2024), who concluded that Augmented Reality-based learning media consistently produce positive effects on students' motivation and engagement because they provide more interactive and meaningful learning experiences than conventional instructional media.

Further analysis of the ARCS motivation components showed that Relevance and Satisfaction achieved higher improvement than Attention and Confidence. This finding suggests that the developed media was particularly successful in helping students understand the usefulness of the learning materials while providing enjoyable learning experiences. During the learning process, students not only observed information presented on the cards but also applied their understanding through quartet game activities and explored additional information using Augmented Reality. Consequently, learning became more meaningful because students directly experienced how the concepts of classification were applied during the game. Meanwhile, the relatively lower improvement in the Confidence indicator indicates that developing students' self-confidence requires a longer learning process and repeated opportunities to participate actively in classroom activities. Confidence is influenced not only by instructional media but also by students' previous learning experiences, communication skills, and willingness to express their ideas. This explains why improvements in this indicator tended to occur more gradually than in the other motivational components. This finding is consistent with the ARCS motivation model proposed by Keller, which emphasizes that meaningful learning experiences and successful task completion contribute substantially to students' motivation. Similarly, Kalogiannakis et al. (2021) explained that game-based learning supported by digital technology encourages active participation and improves students' intrinsic motivation.

The improvement in students' motivation was also supported by the classroom observation results. Overall, students demonstrated motivated learning behaviors throughout the implementation, particularly in the indicators of Attention, Relevance, and Satisfaction. Most students actively participated in discussions, collaborated with group members, explored the Augmented Reality features, and remained enthusiastic during the learning activities. Although the Confidence indicator obtained the lowest observation score, students still showed gradual improvement in expressing ideas and completing learning tasks independently. The relatively lower confidence may have been influenced by differences in students' participation habits and the availability of smartphones during the implementation. Nevertheless, the consistency between observation findings and the statistical analysis indicates that the increase in motivation was reflected not only in questionnaire scores but also in students' actual classroom behaviors. The observation data therefore strengthened the quantitative findings by showing that motivational improvement could be directly observed through students' participation, interaction, and enthusiasm during learning activities. This finding agrees with Nurjanah et al. (2024), who reported that active and collaborative learning environments contribute positively to students' learning motivation and classroom engagement.

Overall, the findings indicate that the Augmented Reality-assisted Science Game Card effectively integrates game-based learning with Augmented Reality

technology to support science learning. The developed media was validated by experts, received highly positive responses from teachers and students, significantly improved students' learning motivation, and created an active and meaningful learning environment. The consistency of the validation, practicality, effectiveness, and observation results demonstrates that the developed media not only meets the quality standards of educational media but also provides meaningful learning experiences that support students' motivation. This consistency strengthens the argument that the successful implementation of instructional media depends not only on technological innovation but also on appropriate instructional design, curriculum alignment, and active student engagement throughout the learning process. Therefore, combining educational card games with Augmented Reality can serve as an effective alternative approach for improving students' motivation in science learning, particularly on the topic of Classification of Living Things at the junior high school level.

F. Conclusion

This study developed an Augmented Reality-assisted Science Game Card for the topic of Classification of Living Things using the ADDIE development model. The findings showed that the developed media met the criteria of validity, practicality, and effectiveness. Expert validation indicated that the media and the learning motivation instrument were categorized as valid to highly valid, while teacher and student responses confirmed that the media was highly practical for classroom implementation. The Wilcoxon Signed-Rank Test and N-Gain analysis demonstrated that the media effectively improved students' learning motivation, which was further supported by classroom observation results. Therefore, the Augmented Reality-assisted Science Game Card can be considered an effective alternative learning medium for improving junior high school students' learning motivation in science learning. Future studies are recommended to involve larger samples and experimental research designs with comparison groups.

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