Journal of Educational Sciences
Journal homepage: https://jes.ejournal.unri.ac.id/index.php/JES

P-ISSN 2581-1657
E-ISSN 2581-2203

Sport Smart Futsal: Development and Feasibility Evaluation of an Android-Based Educational Game for Basic Futsal Technique Instruction in Junior High School PJOK

Rahma Zaimatul Azhar, Nuur Wachid Abdul Majid*, Rhezwan Dhaifullah Romdhoni
Pendidikan Sistem dan Teknologi Informasi, Universitas Pendidikan Indonesia, Bandung, Jawa Barat, Indonesia

ARTICLE INFO

Article history:

Received: 12 June 2026
Accepted: 29 July 2026
Available Online: 05 Aug 2026

Keywords:

Android-Based Educational Game;
PJOK Learning Media;
Game Feasibility

* *Corresponding author:*

E-mail: nuurwachid@upi.edu

Article Doi:

https://doi.org/10.31258/jes.10.8.p.190-205

This is an open access article under the CC BY-SA license.

A B S T R A C T

Basic futsal technique instruction in Indonesian junior high schools is constrained by limited weekly contact time and the absence of technology-based supplementary media, leaving students with insufficient opportunity to consolidate passing, dribbling, and shooting competencies outside scheduled lessons. This study aimed to develop and evaluate Sport Smart Futsal, an Android-based educational game designed as a supplementary learning medium for Grade VII PJOK students, and to determine student responses to the game. Development followed the four-stage 4D model (Define, Design, Develop, Disseminate), producing a Unity-built game with three technique-specific levels integrating Video, Info, and Quiz functions with embedded gamification elements. Validation was conducted by a content expert and a media expert, followed by small-scale (n = 8) and large-scale (n = 40) student response trials. Content expert validation yielded 90.0% and media expert validation yielded 82.5%, producing an overall average of 86.2% (Very Feasible). Small-scale trial response averaged 91.1% and large-scale trial response averaged 90.1%, with all items rated Very Feasible. Sport Smart Futsal is confirmed as a valid and feasible supplementary learning medium for basic futsal technique instruction, with future research recommended to employ experimental designs measuring direct learning gains.

1. Introduction

Physical Education, Sports, and Health (Pendidikan Jasmani, Olahraga, dan Kesehatan, PJOK) is a compulsory subject in Indonesian junior high schools aimed at developing students' physical, cognitive, and affective dimensions through structured physical activity. Among the materials covered in the PJOK curriculum is futsal, a sport that enjoys widespread popularity among adolescents due to its fast-paced dynamics and adaptability to both indoor and outdoor settings. Mastery

of basic futsal techniques comprising passing, dribbling, and shooting is a foundational competency that all students must acquire, and one that demands execution under spatial pressure and time constraints (Mendes et al., 2022).

Despite its curricular importance, the teaching of basic futsal techniques in schools continues to face persistent challenges. Instructional time allocated to PJOK is limited to two hours per week, which is insufficient for students to develop and consolidate motor competencies that require repeated practice across multiple sessions. Furthermore, prevailing instructional approaches rely heavily on direct teacher demonstration without the integration of technology-mediated resources, a condition associated with diminished student motivation and engagement (Ishak et al., 2023). The absence of independent learning media means students have limited opportunity to review technique concepts outside of scheduled contact hours.

Research in educational game development has consistently demonstrated that well-designed digital games can produce moderate-to-large positive effects on learning outcomes across diverse educational domains (Gui et al., 2023). Crucially, this effect is strongest when game elements are tightly coupled with instructional content rather than functioning as cosmetic additions; games that embed content directly into their mechanics outperform those that treat educational material as peripheral to the play experience (Gui et al., 2023). These principles are particularly relevant for PJOK instruction, where cognitive understanding of technique must precede and accompany physical practice.

The potential of Android-based learning media in physical education has been demonstrated in several recent studies. Research on Android-based athletics learning media at the secondary level showed significant improvement in student cognitive achievement, with post-test scores (86.62) markedly exceeding pre-test performance (79.91) (Zuhdi & Sukarmin, 2021). Similarly, Android-based sports physiology media produced significantly higher cognitive scores in experimental compared to control groups (Adrizal et al., 2021). A survey among elementary school students further found that 80% held positive perceptions toward Android-based PJOK media, indicating broad learner acceptance of this instructional format (Haryanti et al., 2021). Broader reviews of electronic and interactive learning media reinforce this trend, spanning digital game-based instruction (Azura & Khairuna, 2025), interactive e-book adoption (Ihsanah, et al. 2026), and general electronic learning media practice (Mutipa Ramadani, et al. 2025).

The alignment between Android-based game media and Generation Z learners is a further consideration. Generation Z students, who have grown up within digital ecosystems, tend to be more responsive to interactive and technology-mediated instructional formats than to conventional approaches (Ardha et al., 2024). Digital educational games have been found to increase student motivation for learning, with learning engagement functioning as a significant mediating pathway between game use and motivational outcomes (Li et al., 2024; Shao et al., 2024). Gamification elements such as scoring systems, lives, and countdown timers can sustain engagement, although their effectiveness is maximised when grounded in

clear learning goals rather than functioning as purely hedonic incentives (Ratinho & Martins, 2023).

Despite the growing evidence base for educational game effectiveness, the development of game media specifically targeting basic futsal technique instruction within the Indonesian PJOK curriculum remains limited. Existing research on futsal technique instruction has demonstrated the effectiveness of cooperative learning (Ali & Muhammad, 2024) and nonlinear pedagogical approaches (Orangi et al., 2025) for skill acquisition, yet these studies address face-to-face practice contexts and do not extend to digital media solutions. The gap between the demonstrated potential of Android-based educational games and the relative scarcity of such media for futsal technique learning in Indonesian junior high schools constitutes the primary motivation for the present study.

Against this background, the present study undertook the development of an Android-based educational game entitled Sport Smart Futsal to serve as a supplementary learning medium for basic futsal technique instruction among Grade VII students. The game was developed using the Unity game engine following the 4D model (Define, Design, Develop, Disseminate). This study aimed to: (1) produce a Sport Smart Futsal educational game that is valid and feasible for use as a PJOK learning medium; and (2) determine student responses to the game across small-scale and large-scale trial conditions.

2. Methodology

Research Design

This study adopted a Research and Development (R&D) design following the 4D model developed by Thiagarajan, Semmel, and Semmel. The 4D model was selected for its systematic and structured character, well-suited to the iterative development and multi-stage evaluation of instructional media products (Hidayat et al., 2023). The model comprises four sequential stages: *Define* (needs identification and goal specification), *Design* (blueprint and instrument development), *Develop* (product construction, expert validation, revision, and small-scale trial), and *Disseminate* (large-scale trial and product dissemination). The full development procedure is illustrated in Figure 1.

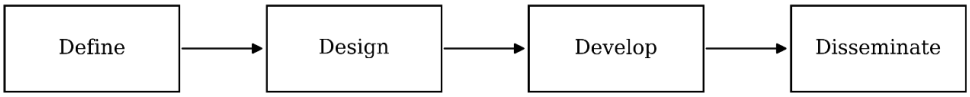

Figure 1. Research Design

Participants

Participants comprised three groups. Expert validators consisted of two teachers from SMPN at Purwakarta: a PJOK teacher serving as content expert (SS, S.Pd.) and an educational technology specialist serving as media expert (MN, S.Pd.), both holding a Bachelor's degree (S1). The small-scale trial involved 8 Grade VII

students selected through purposive sampling (4 male, 4 female). The large-scale trial involved 40 Grade VII students (18 male, 22 female) from one intact class.

Development Procedure

The *Define* stage involved structured needs analysis through classroom observation and semi-structured interviews with the PJOK teacher. Analysis confirmed that basic futsal techniques (passing, dribbling, shooting) are mandated competencies under the Merdeka Curriculum for Grade VII, and that available instructional time (two hours/week) was insufficient for adequate skill consolidation. No technology-based supplementary media were in current use. This needs analysis directly informed the two design priorities carried into the subsequent Design stage: embedding all three techniques within a single application, and ensuring the content remained accessible for independent use outside scheduled PJOK lessons.

The *Design* stage produced the initial product blueprint: a game interface design; a three-level structure corresponding to the three techniques; a storyboard specifying feature layout, content, and interaction flows; and validation instruments for content and media experts. The game was designed with three main functions: *Video* (technique instructional videos), *Info* (written material), and *Quiz* (level-based quizzes with 50 pts per item, 3 lives, and a 30-second timer), drawing on design principles that emphasise content-linked game mechanics as key to instructional effectiveness (Ishak et al., 2023). The *Develop* stage encompassed product construction using the Unity *game engine*, expert validation, product revision based on validator feedback, and a small-scale student trial. The expert validation process and its decision logic are illustrated in Figure 2. Revisions arising from this stage, together with the outcomes of the small-scale trial, are summarised in Table 3 prior to large-scale dissemination.

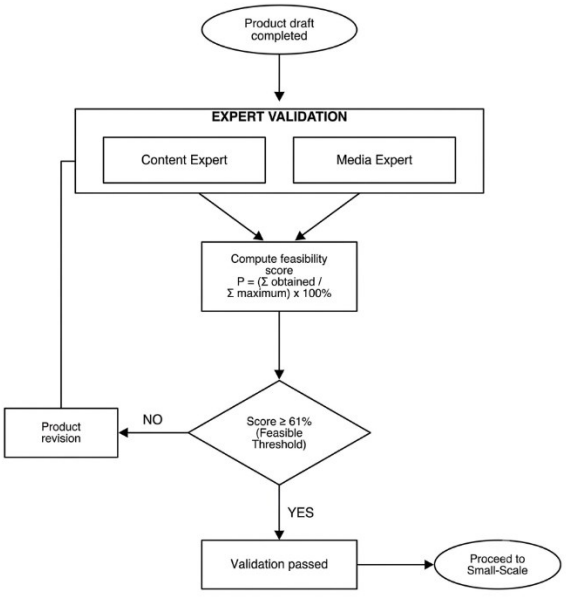

Figure 2. Expert Validation Flow

The Disseminate stage involved large-scale trial with 40 students, followed by data analysis and product dissemination. Responses collected during this stage were processed using the same descriptive percentage procedure applied throughout the study, converting raw Likert responses into feasibility percentages for each questionnaire item before aggregation into an overall student response score. This stage also encompassed preparation of the finalised product for potential use beyond the immediate research context, consistent with the dissemination principle of the 4D model. The trial and revision cycle linking the Develop and Disseminate stages is illustrated in Figure 3.

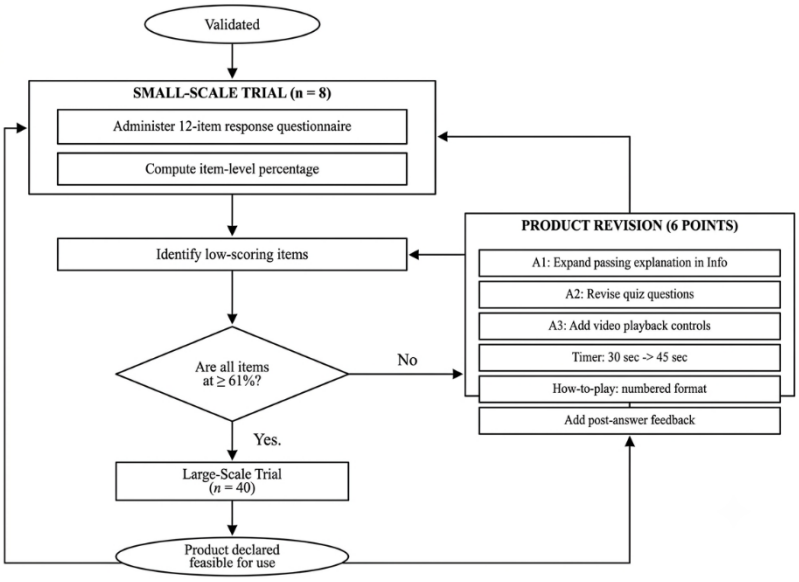

Figure 3. Trial Revision Cycle

Instruments and Data Collection

Three instruments were employed. Expert validation questionnaires (content and media) each comprised 8 items on a five-point Likert scale (1 = Very Poor to 5 = Very Good), covering content accuracy, curriculum alignment, visual design, navigation, and audio-visual quality. The student response questionnaire comprised 12 items on a four-point rating scale (SA = 4, A = 3, D = 2, SD = 1), covering game appearance, technique material clarity, video usability, quiz alignment, motivation, navigation, and perceived learning benefit. All instruments were reviewed by the respective expert validators prior to use.

Data Analysis

Quantitative data were analysed using descriptive percentage analysis. The feasibility percentage was calculated as: $P = (\Sigma \text{ obtained score} / \Sigma \text{ maximum score}) \times 100\%$. Scores were interpreted against the following conversion scale (Hidayat et al., 2023): 81–100% = Very Feasible; 61–80% = Feasible; 41–60% = Sufficiently Feasible; 21–40% = Less Feasible; 0–20% = Not Feasible. A product was considered to meet the feasibility threshold at a minimum of 61%. Qualitative data from expert comments were analysed thematically to guide product revision.

3. Results and Discussion

Development Overview

The development of Sport Smart Futsal proceeded through the four stages of the 4D model as illustrated in Figure 1. The selection of the 4D model was consistent with its established application in Indonesian instructional media development research, where it has been used to structure Android-based media development in mathematics (Hidayat et al., 2023) and science (Fiteriani et al., 2021), among other fields. Its emphasis on iterative revision ensures that products are refined through expert and user feedback before large-scale use, strengthening the validity of feasibility conclusions. A consolidated overview of the four stages, from initial needs analysis through to product dissemination, is presented in Figure 4.

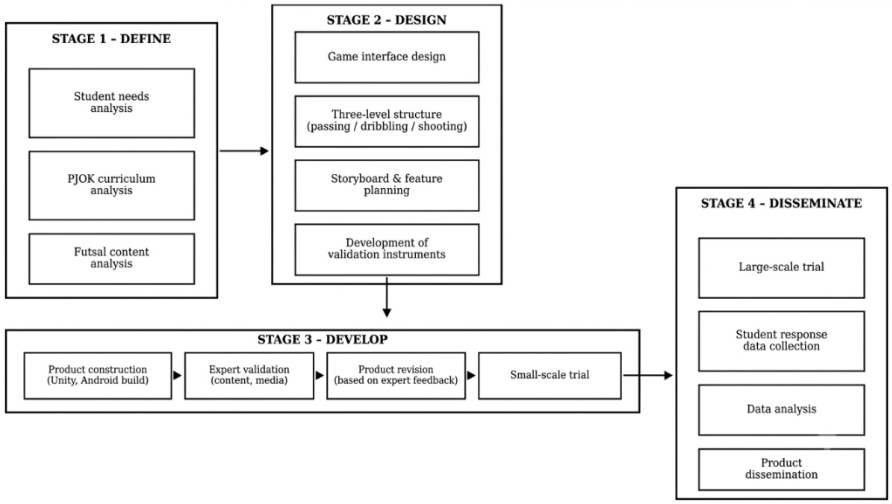

Figure 4. Development Overview

The Define stage confirmed two principal needs: a curricular need (passing, dribbling, and shooting are mandated competencies not adequately addressable within a two-hour weekly schedule) and a pedagogical need (absence of technology-based supplementary media in current practice). These findings are consistent with the broader literature on mobile learning in PJOK, which identifies flexible access to learning content outside scheduled contact hours as a primary affordance of Android-based media (Ardha et al., 2024). The Design stage produced a blueprint that embedded learning content directly into the game mechanics, a design decision supported by evidence that content-linked game elements are more effective for learning than cosmetic additions (Gui et al., 2023; Ishak et al., 2023). To substantiate the design outcomes described above, two representative screenshots of the design-stage quiz blueprint are presented in Figure 5 and Figure 6.

Figure 5. Design Result 1: Passing Technique Quiz

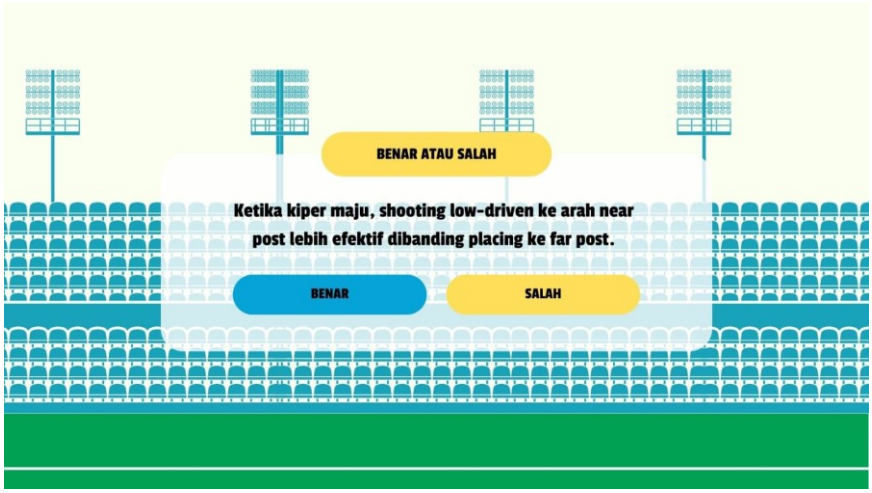

Figure 6. Shooting Technique Quiz

Figure 5 shows a passing-technique quiz item presented as a multiple-choice question, illustrating the three-level structure in which each technique level embeds discrete, curriculum-aligned quiz items rather than generic trivia. Figure 6 shows a shooting-technique item framed as a decision scenario against a goalkeeper, reflecting the storyboard design principle of progressing from simple recall questions toward applied, game-situated decision-making as players advance through the passing, dribbling, and shooting levels. Both blueprints were used as the direct basis for the Unity build described below, ensuring that the implemented content matched the validated instructional design. The corresponding development outcomes, showing the constructed product within the Unity environment, are presented in Figure 7 and Figure 8.

Figure 7. Sport Smart Futsal Title Screen

Figure 8. In-Game Quiz with Live Score Display

Figure 7 shows the completed title screen of Sport Smart Futsal, confirming successful implementation of the game interface design within the Unity engine. Figure 8 shows a quiz item running inside the built application, with the live score counter reflecting the 50-points-per-item scoring rule described in Section 2.3. The consistency between the design blueprints in Figures 5 and 6 and the corresponding development outputs in Figures 7 and 8 indicates that the content validated by experts prior to the student trial was faithfully carried through into the deployed product.

Beyond its validated feasibility, Sport Smart Futsal offers several practical advantages as a supplementary PJOK learning medium. It enables students to review passing, dribbling, and shooting technique material independently outside the two-hour weekly contact time. Its embedded Video, Info, and Quiz functions allow technique demonstration, conceptual explanation, and self-assessment to occur within a single integrated application. Its gamification elements, namely scoring, lives, and a countdown timer, sustain engagement across repeated use. In classroom practice, teachers can assign specific game levels as homework following each PJOK session and use in-game quiz scores as a low-stakes formative check on students' technique comprehension before the next face-to-face practice session.

Expert Validation Results

Product validation was conducted by a content expert and a media expert prior to the student trial, using the eight-item five-point Likert instrument described in Section 2.4. Results are presented in Table 1 and Figure 9.

Table 1. Expert Validation Results of Sport Smart Futsal Educational Game

Field of Expertise	Total Score	Max Score	Percentage(%)
Content Expert	36	40	90.0%
Media Expert	33	40	82.5%

The content expert assigned a total score of 36 out of 40, yielding 90.0% (Very Feasible). Perfect scores (5) were recorded on curriculum alignment (Item 1), material relevance (Item 3), sequential ordering of material (Item 7), and appropriateness of the scoring system (Item 8). The sequential structure presenting passing before dribbling, and dribbling before shooting was specifically affirmed as pedagogically sound, reflecting the principle that motor skill instruction is most effective when material progresses from simpler to more complex tasks (Orangi et al., 2025). The content expert noted that quiz item explanations required greater detail; accordingly, quiz text was revised across all three levels prior to the student trial.

The media expert assigned a total score of 33 out of 40, yielding 82.5% (Very Feasible). A perfect score was recorded on Item 2 (text, instruction, and quiz readability), indicating an intuitive and legible interface design. The media expert provided four targeted recommendations: (1) the 30-second quiz timer was too short; (2) the how-to-play section should be restructured as a bulleted list; (3) post-answer feedback should be added; and (4) the number of quiz items per level should be increased. These suggestions align with design principles for serious games, emphasising the importance of immediate feedback and appropriately calibrated task difficulty for learner engagement (Aster et al., 2024). All four recommendations were addressed before the student trial phase. Comparable validation outcomes have also been reported for other Android-based and digital game media developed for Indonesian classrooms, including interactive digital game media for language skills (Sulastri et al., 2025) and augmented reality science media (Khoiriah et al., 2026).

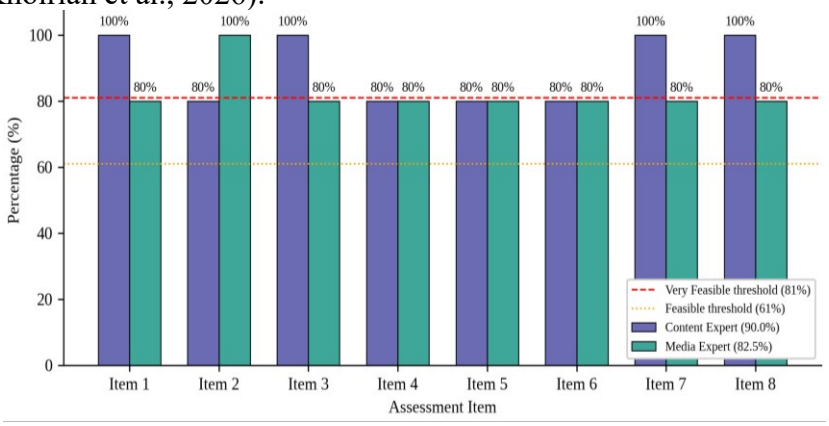

Figure 9. Expert Validation Results

The overall average validation percentage across both experts was 86.2% (Very Feasible). This result is comparable to multi-expert validation outcomes in similar Indonesian media development studies: an Android-based trigonometry media received 81% practicality (Hidayat et al., 2023), and an ethno-science poster received 89.3% from media experts (Fiteriani et al., 2021). This confirms that Sport Smart Futsal met the required standards for both instructional quality and technical design prior to student deployment.

Small-Scale Trial and Product Revision

Following expert validation and initial revision, the product was trialled with 8 purposively selected Grade VII students comprising four male and four female participants, consistent with the sampling procedure described in Section 2.2. Students completed the twelve-item four-point student response questionnaire covering game appearance, technique material clarity, video usability, quiz alignment, motivation, navigation, and perceived learning benefit. Results are presented in Table 2.

Table 2. Small-Scale Trial Result

Instrument	Score
A1	3.6
A2	4.0
A3	3.6
A4	3.9
A5	3.3
A6	3.8
A7	3.3
A8	3.5
A9	3.8
A10	3.5
A11	3.8
A12	3.8
Total Score	43.9
Percentage (%)	91.1%
Category	Very Feasible

The small-scale trial produced an overall average of 91.1% (Very Feasible), with individual scores ranging from 85.4% to 95.8%. Seven of the eight students were classified as Very Feasible. Item-level analysis identified three areas with the lowest average scores: A7 (quiz alignment, avg. 3.3), A5 (shooting material clarity, avg. 3.3), and A3 (passing material clarity, avg. 3.6). These data, combined with the expert recommendations, informed a structured revision programme before large-scale dissemination. The revisions are summarised in Table 3.

Table 3. Summary of Product Revisions Based on Small-Scale Trial and Expert Recommendations

No	Component	Finding / Suggestion	Revision Made
1	A3: Passing material clarity	Two students scored 3; the explanation text was perceived as brief and insufficient	Expanded passing technique description with step-by-step annotations in the Info feature

2	A7: Quiz alignment with material	Two students scored 2, and two scored 1; quiz items felt disconnected from animations	Revised all quiz questions to directly reference movements shown in level animations
3	A6: Video usability	Video playback controls were unclear and difficult to locate	Added visible play/pause/replay buttons and a progress bar to the Video feature
4	Timer duration (media expert)	A 30-second timer per question is considered too short for adequate reading and response	Extended timer to 45 seconds per question based on combined feedback
5	How-to-play format (media expert)	Instructions presented as single paragraph, difficult to parse during gameplay	Restructured "How to Play" into a numbered, point-by-point format

Six revision points were addressed: three from low-scoring trial items (passing clarity, quiz alignment, video usability) and three from expert recommendations (timer duration, how-to-play format, post-answer feedback). The addition of post-answer feedback is particularly noteworthy: research on serious game design identifies immediate corrective feedback as one of the most consistently effective design elements for knowledge acquisition and engagement (Aster et al., 2024). Extending the quiz timer from 30 to 45 seconds addressed a usability concern aligned with evidence that time-pressured tasks can elevate learner anxiety and impair performance, particularly among novice users (Tavares, 2022; Xu et al., 2023).

Large-Scale Trial: Student Response

The revised product, incorporating all six revision points summarised in Table 3, was subsequently trialled with 40 Grade VII students from one intact class (18 male, 22 female), using the same twelve-item four-point response questionnaire administered during the small-scale trial. This large-scale trial constituted the Disseminate stage of the 4D model and provided the primary evidence base for judging the feasibility of Sport Smart Futsal at scale. Results are presented in Table 4 and Figure 10.

Table 4. Large-Scale Student Response Results

No	%	Cat.
A1	86.2%	Very Feasible
A2	91.2%	Very Feasible
A3	86.2%	Very Feasible
A4	91.2%	Very Feasible
A5	89.4%	Very Feasible
A6	90.0%	Very Feasible
A7	88.1%	Very Feasible
A8	93.1%	Very Feasible
A9	92.5%	Very Feasible
A10	91.2%	Very Feasible
A11	88.8%	Very Feasible
A12	92.5%	Very Feasible

All 12 items received percentages between 86.2% and 93.1%, and the overall student response was 90.1% (Very Feasible), substantially exceeding the 61%

minimum threshold. The highest percentage was A8 (motivation: 93.1%), followed by A9 (navigation: 92.5%) and A12 (suitability for PJOK: 92.5%). The lowest were A1 (visual appearance: 86.2%) and A3 (passing clarity: 86.2%), both comfortably within the Very Feasible range. These findings are consistent with student response data for comparable Android-based PJOK media, where acceptance rates of 80% or above have been commonly observed (Ardha et al., 2024; Haryanti et al., 2021).

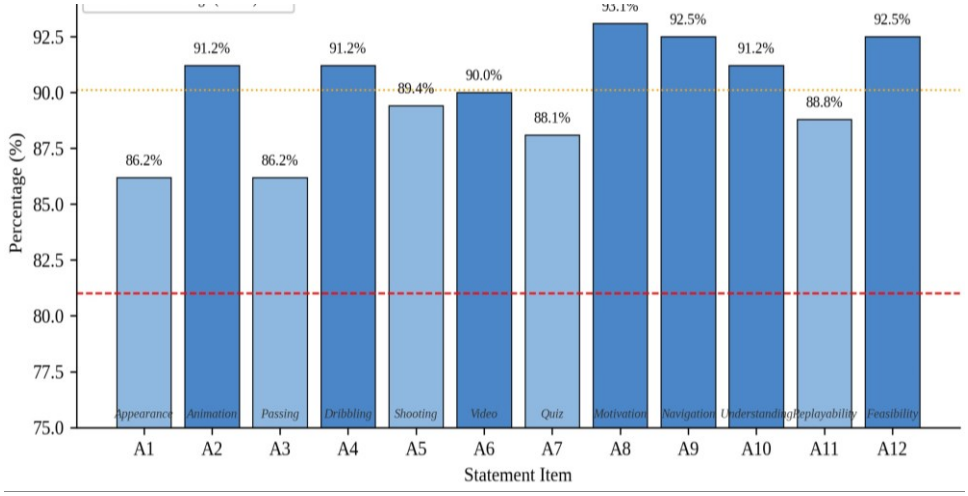

Figure 10. Student Response Percentage-Large Scale

Discussion

The convergence of high validation scores (86.2% average) and strongly positive student responses (90.1%) across both trial stages provides robust evidence for the feasibility of Sport Smart Futsal as an instructional medium for basic futsal technique learning. The following discussion situates these findings across the four thematic areas that structured this study. Concerning educational game design, the high content validation score (90.0%) reflects successful alignment between game structure and instructional goals. The three-level architecture with each level dedicated to one foundational technique instantiates the principle that game elements directly linked to learning content are more effective than those added for entertainment alone (Gui et al., 2023). The incorporation of the Info, Video, and Quiz features reflects the six universal attributes of effective educational games identified by Ishak et al. (2023): learning theory, instructional strategy, content, game elements, game principles, and interaction design. The post-revision addition of immediate feedback further aligns the product with design recommendations from serious game research (Aster et al., 2024).

Concerning learning media feasibility, the overall validation average of 86.2% positions Sport Smart Futsal within a range consistent with validated instructional media in the Indonesian context. The perfect score on text readability (Item 2: 100%) suggests the interface design succeeded in making instructional content accessible to junior high school users a factor identified as a key determinant of technology adoption in educational settings (Ismara et al., 2021). The structured multi-expert validation approach, combining content and media expertise, mirrors

best practice in Indonesian media development research (Fiteriani et al., 2021) and strengthens confidence in the feasibility conclusions drawn.

Concerning student learning motivation, the highest item score in the large-scale trial was A8 (93.1%), indicating the game was perceived as motivating by the vast majority of participants. This supports the growing evidence that digital educational games enhance student motivation through mechanisms of engagement and interactivity (Li et al., 2024; Shao et al., 2024). The scoring system, three-lives mechanic, and countdown timer function as gamification elements that sustain challenge and engagement consistent with research showing that purposefully designed gamification produces positive motivational effects (Ratinho & Martins, 2023). Item A11 (replayability: 88.8%) further suggests students were willing to re-engage with the game, an indicator of sustained intrinsic motivation associated with deeper learning (Burke et al., 2024).

Concerning basic futsal technique instruction, all technique-specific items (A2: animations 91.2%; A3: passing 86.2%; A4: dribbling 91.2%; A5: shooting 89.4%) received Very Feasible ratings, indicating successful conveyance of all three foundational techniques. The sequential presentation reflects the progressive skill acquisition framework supported in the futsal pedagogy literature, where cooperative and nonlinear instructional approaches are recommended for building foundational movement competencies in novice learners (Ali & Muhammad, 2024; Orangi et al., 2025). Item A10 (game helps understanding: 91.2%) suggests the media achieved its primary instructional aim, supporting the claim that technology-mediated instruction can effectively supplement direct physical practice by reinforcing cognitive understanding of technique (Adrizal et al., 2021; Zuhdi & Sukarmin, 2021).

A number of limitations warrant acknowledgement. The study did not include a pre-test/post-test design to measure learning gains directly attributable to game use; feasibility and student response data reflect perceptions rather than empirically verified outcomes. The sample was drawn from a single school, limiting generalisability. Future research should employ quasi-experimental or experimental designs to quantify the effect of Sport Smart Futsal on technique performance, extending trials to schools with varying profiles. As noted by mobile learning researchers, sustained effectiveness is contingent on adequate device access, teacher readiness, and institutional support (Ardha et al., 2024; Knoke et al., 2024).

4. Conclusion

This study developed and evaluated Sport Smart Futsal, an Android-based educational game designed to support the learning of basic futsal techniques (passing, dribbling, and shooting) among Grade VII junior high school students. Development followed the four stages of the 4D model, involving iterative expert validation and student trialling. Both the content expert and the media expert rated the game as Very Feasible, and the subsequent small-scale and large-scale student trials likewise rated every assessed item as Very Feasible, with the strongest

response recorded for the game's capacity to sustain learning motivation. These outcomes indicate that the first research aim, producing a valid and feasible Sport Smart Futsal game, was successfully achieved, as was the second aim of establishing consistently positive student responses across both trial phases. The convergence of expert and student judgements confirms that Sport Smart Futsal is a valid and feasible supplementary learning medium that addresses the limitations of constrained instructional time and the absence of technology-based technique-learning resources in the current school context. The study was not without limitations: feasibility and response data reflect perceptions rather than directly measured learning gains, and the sample was confined to a single school. Future research employing experimental designs across multiple school settings is therefore recommended to verify the extent to which Sport Smart Futsal improves actual futsal technique performance.

Acknowledgement

The authors wish to thank the content and media expert validators for their time and constructive feedback during the validation process. Sincere appreciation is also extended to the Grade VII students of a junior high school in Purwakarta who participated in the small-scale and large-scale trials, and to the school administration for facilitating access to the research site. The authors also express gratitude to all co-authors for their contributions throughout the research and writing process. This research received no external funding.

References

Adrizal, M., Iskandar, & Ilham, M. (2021). The Effect of Android-Based Learning Media on Student Cognitive Levels in Sports Physiology. *Proceedings of the 6th International Seminar on Science Education (ISSE 2020)*, *541*. https://doi.org/10.2991/assehr.k.210326.120

Ali, G. H., & Muhammad, F. H. (2024). The effect of skill exercises based on the cooperative learning method on acquiring some basic futsal skills for female students. *Journal of Humanities and Social Sciences Research*, *3*(5). https://doi.org/10.33687/jhssr.003.05.0402

Ardha, M. A. Al, Nurhasan, N., Nur, L., Chaeroni, A., Bikalawan, S. S., & Yang, C. B. (2024). Analysis of Android-Based Applications in Physical Education and Sports: Systematic Review. *Retos*, *57*, 390–398. https://doi.org/10.47197/retos.v57.107158

Aster, A., Laupichler, M. C., Zimmer, S., & Raupach, T. (2024). Game design elements of serious games in the education of medical and healthcare professions: a mixed-methods systematic review of underlying theories and teaching effectiveness. *Advances in Health Sciences Education*, *29*(5), 1825–1848. https://doi.org/10.1007/s10459-024-10327-1

Azura, D., & Khairuna, K. (2025). The Effect of Wordwall Media with Interactive Boards on Students' Learning Outcomes in the Classification of Living Things. *Journal of Educational Sciences*, *9*(5), 3777–3787.

Burke, C. M., Montross, L. P., & Dianova, V. G. (2024). Beyond the Classroom:

An Analysis of Internal and External Factors Related to Students' Love of Learning and Educational Outcomes. *Data*, *9*(6). https://doi.org/10.3390/data9060081

Fiteriani, I., Ningsih, N. K., Irwandani*, I., Santi, K., & Romlah, R. (2021). Media Poster dengan Pendekatan Etnosains: Pengembangan Bahan Ajar IPA Siswa Sekolah Dasar. *Jurnal Pendidikan Sains Indonesia*, *9*(4), 540–554. https://doi.org/10.24815/jpsi.v9i4.20984

Gui, Y., Cai, Z., Yang, Y., Kong, L., Fan, X., & Tai, R. H. (2023). Effectiveness of digital educational game and game design in STEM learning: a meta-analytic review. *International Journal of STEM Education*, *10*(1). https://doi.org/10.1186/s40594-023-00424-9

Haryanti, A., Yusuf, M., & Agung, L. (2021). Students' Perceptions About the Use of Android-Based Learning Media in Physical Education Learning. *AL-ISHLAH: Jurnal Pendidikan*, *13*(2), 836–842. https://doi.org/10.35445/alishlah.v13i2.633

Hidayat, W., Rohaeti, E. E., Hamidah, I., & Putri, R. I. I. (2023). How can android-based trigonometry learning improve the math learning process? *Frontiers in Education*, *7*. https://doi.org/10.3389/feduc.2022.1101161

Ihsanah, R. R., Sutopo, Y., Sukasih, S., Subali, B., & Widiarti, N. (2026). From innovation to impact: Trends and effectiveness of interactive e-books in elementary Indonesian language learning (2020–2025). *Journal of Educational Sciences*, *10*(4), 695–707. https://doi.org/10.31258/jes.10.4.p.695-707

Ishak, S. A., Hasran, U. A., & Din, R. (2023). Media Education through Digital Games: A Review on Design and Factors Influencing Learning Performance. *Education Sciences*, *13*(2). https://doi.org/10.3390/educsci13020102

Ismara, K. I., Suharjono, A., & Supriadi, D. (2021). Ubiquitous learning in occupational health and safety for vocational education. *International Journal of Evaluation and Research in Education*, *10*(1), 285–292. https://doi.org/10.11591/IJERE.V10I1.20823

Khoiriah, S. N. L., Khasanah, A. F., & Chaeroh, M. (2026). The effect of augmented reality-assisted spinner learning media on science learning outcomes of fifth grade students at MIN 2 Ngawi. *Journal of Educational Sciences*, *10*(6), 1033–1045. https://doi.org/10.31258/jes.10.6.p.1033-1045

Knoke, C., Woll, A., & Wagner, I. (2024). Health promotion in physical education through digital media: a systematic literature review. *German Journal of Exercise and Sport Research*, *54*(2), 276–290. https://doi.org/10.1007/s12662-023-00932-4

Li, Y., Chen, D., & Deng, X. (2024). The impact of digital educational games on student's motivation for learning: The mediating effect of learning engagement and the moderating effect of the digital environment. *PLoS ONE*, *19*(1 January). https://doi.org/10.1371/journal.pone.0294350

Mendes, D., Travassos, B., Carmo, J. M., Cardoso, F., Costa, I., & Sarmento, H. (2022). Talent Identification and Development in Male Futsal: A Systematic Review. *International Journal of Environmental Research and Public Health*, *19*(17). https://doi.org/10.3390/ijerph191710648

Mutipa Ramadani*, G. (2025). Electronic Learning Media on Chemical Bonding

Materials : A. *Journal of Educational Sciences*, *9*(1), 138–149. https://jes.ejournal.unri.ac.id/index.php/JES

Orangi, B. M., Ghorbanzadeh, B., & Basereh, A. (2025). A new idea in skill acquisition of children: coordinating motor competence with motor learning strategies. *BMC Pediatrics*, *25*(1). https://doi.org/10.1186/s12887-025-06019-3

Ramadani, M., & Guspatni. (2025). Electronic learning media on chemical bonding materials: A literature study. *Journal of Educational Sciences*, *9*(1), 138–149. https://doi.org/10.31258/jes.9.1.p.138-149

Rahmah Rivandani Ihsanah, Yeri Sutopo, Sri Sukasih, Bambang Subali, N. W. (2026). *From Innovation to Impact : Trends and Effectiveness of*. *10*(4), 695–707.

Ratinho, E., & Martins, C. (2023). The role of gamified learning strategies in student's motivation in high school and higher education: A systematic review. *Heliyon*, *9*(8). https://doi.org/10.1016/j.heliyon.2023.e19033

Shao, Y., Kang, S., Lu, Q., Zhang, C., & Li, R. (2024). How peer relationships affect academic achievement among junior high school students: The chain mediating roles of learning motivation and learning engagement. *BMC Psychology*, *12*(1). https://doi.org/10.1186/s40359-024-01780-z

Sulastri, S., Lastuti, S., & Akbar, M. R. (2025). Development of digital-based interactive games to improve Indonesian speaking skills of grade IV students of SDN 2 Suntu, Bima City. *Journal of Educational Sciences*, *9*(5), 3547–3558. https://doi.org/10.31258/jes.9.5.p.3547-3558

Shofia Nur Lailatul Khoiriah, Aulia Fajar Khasanah, M. C. (2026). *The Effect of Augmented Reality-Assisted Spinner Learning*. *10*(6), 1033–1045.

Sulastri, Sulis, Sri Lastuti, M. R. A. (2025). *Development of Digital-Based Interactive Games to Improve*. *9*(5), 3547–3558.

Tavares, N. (2022). The use and impact of game-based learning on the learning experience and knowledge retention of nursing undergraduate students: A systematic literature review. *Nurse Education Today*, *117*, 105484. https://doi.org/10.1016/j.nedt.2022.105484

Xu, M., Luo, Y., Zhang, Y., Xia, R., Qian, H., & Zou, X. (2023). Game-based learning in medical education. *Frontiers in Public Health*, *11*. https://doi.org/10.3389/fpubh.2023.1113682

Zuhdi, S., & Sukarmin, Y. (2021). Learning media development physical education sport and health that number athletic material based on Android application. *Quality in Sport*, *7*(1), 37–44. https://doi.org/10.12775/qs.2021.003

How to cite this article:

Azhar, R. Z., Majid, N. W. A., & Romdhoni, R. D. (2026). Sport Smart Futsal: Development and Feasibility Evaluation of an Android-Based Educational Game for Basic Futsal Technique Instruction in Junior High School PJOK. *Journal of Educational Sciences*, *10(8)*, 190-205.