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Development of an Aerobic Gymnastics Assessment Application at the Jambi Province Student Sports Education and Training Center

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Abstract: This study aims to develop an Android-based Smart Point application as an innovation in the aerobic gymnastics scoring system, specifically for PPLP aerobic gymnastics. The background of this research is the judging process that is still done manually using assessment paper, so it is prone to errors and is inefficient and makes it easier to conduct control tests on PPLP athletes before the competition. The method used is Research and Development (R&D) with the Borg and Gall model consisting of ten stages of development, from analysis to product implementation. The research subjects involved aerobic gymnastics judges, media experts, and material experts. The research instrument used a validation questionnaire and a Likert-based trial. The results showed that the assessment application called Smart Point has a high level of feasibility with validation from material experts 95.50%, media experts 93%, and language experts 94.25%. User trials showed that this application is practical, efficient, and able to speed up the score recapitulation process by up to 50%. The Smart Point application is considered effective in increasing the objectivity and efficiency of assessment in aerobic gymnastics competitions.

Keywords: Aerobic Gymnastics; Android Application; Assessment; PPLP

Introduction

Sport is an essential part of human life, serving not only to maintain physical fitness but also to shape character, improve social quality, and even serve as a symbol of achievement and national pride. In the context of national development, sport holds strategic value because it can enhance human dignity through achievements at the regional, national, and international levels (Praditya & Indrawan, 2016; Yosua, 2017). One form of sport that is growing rapidly in Indonesia is aerobic gymnastics, an artistic sport that combines strength, flexibility, coordination, and aesthetics in a single movement that is judged based on technical, artistic, and executional aspects (Palar et al., 2015).

However, the judging process in aerobic gymnastics competitions still faces various challenges. Based on field observations and the experience of judges, the scoring system is still carried out manually using paper-based score sheets. Each judge must write scores for several aspects of the assessment, such as artistry, difficulty element, and execution, and then submit them to the Chair of Judges for recapitulation and averaging. This process is not only time-consuming but also carries the risk of human error, delays in results, and potentially leads to a lack of objectivity in the judging (Allen et al., 2021; Mercier & Heiniger, 2018).

In the context of competitions involving many participants and judges, as regulated by the Federation Internationale de Gymnastique (FIG) with a requirement of 14 to 18 judges, this manual system becomes increasingly inefficient. Each participant can require up

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to 15 minutes of judging before moving on to the next participant. This situation certainly hampers the smooth running of the competition and reduces the quality of the championship (Hidayah & Sipayung, 2024; Soenyoto et al., 2023).

Furthermore, the manual scoring system struggles to ensure transparent results and accountable accountability. In some cases, there have been discrepancies in scores between judges, input errors, and even discrepancies with the Aerobic Gymnastics Code of Points (COP), the official FIG reference. This highlights the urgent need to modernize the scoring system by utilizing digital technology capable of supporting a fast, accurate, and objective scoring process (Navandar et al., 2025; Patrício, 2023).

Developments in information and communication technology, particularly the Android platform, offer significant opportunities to address these challenges. Digital applications can be used to facilitate the real-time scoring process, automate score calculations, store data digitally, and display final results quickly and transparently (Choirunnisa & others, 2025; Hardi & Servanda, 2021). Based on these needs, this research developed the Android-based Smart Point application as an innovative solution for the aerobic gymnastics scoring system in Indonesia.

The Smart Point application is designed to assist judges in scoring games based on aspects of the Code of Points, such as artistry, difficulty, and execution, and to automatically summarize scores. The application also allows each judge to connect directly with the Chair of Judges without the need for paperwork. Thus, the application is expected to improve judging efficiency, reduce human error, and enhance the objectivity and transparency of competition results (Mazurova & Penttinen, 2020; Retnawati et al., 2024).

The results showed that the Smart Point application was deemed feasible and effective for use in the aerobic gymnastics assessment process. Based on validation by subject matter, media, and language experts, the application achieved a feasibility score above 90%, with an effectiveness rate reaching 95.50% in user testing (Handayani, 2025). This demonstrates that the application of Android-based technology can improve assessment efficiency while strengthening the quality of sports competition systems.

This research is expected to contribute to the development of sports education and the digital transformation of sports assessment systems. In addition to providing a solution for aerobic gymnastics assessment, the Smart Point application also has the potential to be developed for other sports with complex judging systems. Therefore, this innovation is the first step towards the broader implementation of digital-based sports technology in Indonesia (Abror & Jati, 2016; Sukendro & Lestari, 2022).

Method

This research is a research and development (R&D) project aimed at producing an innovative product in the form of an Android-based Smart Point application as a digital assessment tool in aerobic gymnastics (Sugiyono, 2019). The development model used refers to the Borg & Gall (1989) model, which includes ten development stages: needs analysis and information gathering; product planning; initial product development; initial field trials; initial product revision; main field trials; operational revision; operational field trials; final product revision; and product dissemination and implementation.

This model was chosen because it was deemed appropriate for producing a valid, practical, and effective sports education technology product to support an objective competition assessment system. The research was conducted within the Jambi Province Indonesian Gymnastics Association (PERSANI) and lasted eight months. The research subjects consisted of: Material experts, namely lecturers and aerobic gymnastics coaches familiar with the FIG Code of Points 2024–2028; Media experts, namely practitioners or lecturers in the field of educational technology familiar with Android application development; Linguists, namely Indonesian language experts who assess the clarity and appropriateness of the language in the application; Aerobic Gymnastics judges (Users) from PERSANI Jambi, who are the main respondents in the limited trial and broad trial stages; PPLP athletes, who will be models in the trial aerobic gymnastics assessment tests.

Subject selection was conducted using purposive sampling, taking into account their expertise and direct involvement in aerobics assessment activities.

Needs Analysis

This stage was conducted through observations of provincial-level aerobics competitions and interviews with judges and coaches. The analysis revealed that the scoring system was still conducted manually using score sheets, which resulted in various challenges such as score input errors, delayed results, and a lack of transparency. A need was identified for a digital system capable of automatically and in real-time score recaps.

Product Design

Based on the analysis, the application design was created using the Unified Modeling Language (UML) approach, consisting of: Use Case Diagram (user-system

relationship); Activity Diagram (assessment process flow); and Class Diagram (database structure and application functions). The user interface was designed to be simple, intuitive, and easy to operate in a competition setting.

Initial Product Development

The application was developed using Android Studio with the Java programming language and the Firebase Realtime Database. Key features include: Multi-user login (admin, judges, and head judge); Input of scores for artistry, execution, and difficulty; Automatic score recapitulation according to the FIG system; and Output of assessment results in digital format (PDF and database).

Expert Validation

The initial product was validated by three groups of experts to assess the suitability of content, appearance, and language. Validation was conducted using a Likert-scale questionnaire (1–5), and the results were analyzed using Aiken's V formula to determine the level of agreement between validators.

Field Trial

The trial was conducted in two stages: a limited trial with 5 judges to assess usability and practicality; a broad trial with 10 judges in a simulated competition to assess the application's effectiveness in real-world conditions. The trial results were used to revise the product before the application was disseminated.

Revision and Dissemination

Feedback from experts and users was used to improve the application's appearance and system responsiveness, and to add a notification feature if input was incomplete. The final version of the application was then officially introduced to the Jambi Province PERSANI management.

The instruments used included: an expert validation sheet (material, media, language); a user questionnaire to assess practicality and effectiveness; and an observation sheet to record technical challenges during the trial.

Each instrument used a Likert scale ranging from 1–5, with categories ranging from very infeasible to very feasible. Data analysis was conducted quantitatively and qualitatively, including: validity analysis using Aiken's V ($V \geq 0.80$ = very valid). Effectiveness analysis using the Borich model with the following categories as shown in Table 1.

Table 1. Categories of analysis effectiveness

Range score %	Categories
81 - 100	Very Effective
61 - 80	Effective
41 - 60	Moderately Effective
< 40	Ineffective

Observation data and user responses were analyzed descriptively and qualitatively.

Result and Discussion

The product developed is an Android-based Smart Point application with judge login, score input, automatic recap, and final report features. Validation results showed very high feasibility: 95.50% material, 93% media, and 94.25% language. Field trials demonstrated the application's efficiency, with a score recap speed increase of up to 50% compared to manual systems. The application also improves the accuracy and transparency of assessment results.

Product Development Results

The resulting product is an Android-based Smart Point application, which helps judges digitally and automatically assess aerobics. The application has the following main features: input of artistry, execution, and difficulty scores; automatic score recap between judges; elimination of highest and lowest scores according to FIG rules; real-time display of assessment results; and storage of assessment data on a Firebase server.

This application is compatible with Android devices running version 9.0 and above and can be used both offline and online.

Expert Validation Results

Experts stated that the Smart Point app met the principles of content accuracy, attractive presentation, and clear and communicative language. Media experts deemed the interface easy to use, while content experts deemed the scoring system in accordance with the FIG Code of Points.

Table 2. Expert Validation Results

Validation Aspect	Average (%)	Categories
Material Expert	95.50	Very Worthy
Media Expert	93.00	Very Worthy
Language Expert	94.25	Very Worthy
Average Total	94.25	Very Worthy

Expert validation results showed an average feasibility rating of 94.25%, with a breakdown of 95.50% by material experts, 93% by media experts, and 94.25% by language experts. This score indicates that the

application meets all aspects of content, appearance, and language feasibility.

Field Trial Results
Limited Trial

Conducted with 5 judges to assess the practicality and clarity of the application's workflow. All judges stated that the application was easy to use and helped expedite the scoring process.

Extensive Trial

Involving 10 judges in a provincial-level competition simulation, the Smart Point application was able to reduce score recap time from 10–15 minutes to less than 5 minutes, with a 0% error rate.

Table 3. Extensive Trial

Trial Aspects	Percentage (%)	Categories
Practicality	95.50	Very Effective
Time Efficiency	94.25	Very Effective
Accuracy	92.50	Very Effective
User Satisfaction	93.45	Very Effective
Average	93.92	Very Effective

Product Effectiveness and Feasibility

Overall, the Smart Point application was deemed feasible and effective for use in aerobic gymnastics assessments. The application increased assessment efficiency by up to 50%, reduced manual input errors, and enhanced transparency of competition results. Judges appreciated the easy-to-access interface, automated scoring system, and rapid results display.

Discussion

The results of this study indicate that the development of the Smart Point application addressed the main challenges in aerobic gymnastics assessments: the lengthy time required to summarize scores, the potential for human error, and the lack of transparency in results (Mahmoud, 2024).

The successful development of this application demonstrates that the application of Android-based digital technology can improve objectivity and efficiency in sports assessment systems. Expert validation and effectiveness tests, which achieved a score of over 94%, demonstrate that this application meets the criteria for validity, practicality, and effectiveness.

Field trials demonstrated that the application had an average effectiveness rating of 94.25%, categorized as very effective, particularly in increasing scoring time efficiency by up to 50%, reducing manual input errors, and enhancing the transparency of competition results. The use of the Smart Point application allows for automated, real-time score recapitulation, accelerating the announcement of competition results and increasing trust in the scoring system (Mahazoya & Wiradinata, 2025). Conceptually, this study demonstrates that the application of digital technology in sports scoring systems can improve the objectivity, accuracy, and efficiency of judges. These results align with theory and previous research findings that emphasize the importance of digital transformation in sports education and performance evaluation systems (Chen, 2025; Ermakov et al., 2022; Oudah et al., 2024). Practically, the Smart Point application directly contributes to the development of aerobic gymnastics judges under the auspices of PERSANI. It can also serve as a model for developing digital scoring systems for other sports that require high objectivity. It is also very helpful in evaluating Jambi Province's PPLP aerobic gymnastics athletes easily, quickly, and accurately.

Theoretically, these results support Borg & Gall (1989) assertion that educational development products will be of high quality if they undergo systematic validity testing, revision, and implementation. Furthermore, these findings align with research by Branch (2021); Meier (2012), which states that the application of digital technology in evaluation systems can improve the accuracy and speed of assessments.

From a sports education perspective, this application makes a significant contribution to driving digital transformation in the field of sports education. By using the Smart Point application, judges not only act as assessors but also as technology users directly involved in the data-driven evaluation process. Furthermore, the development of this application demonstrates that sports technology can be effectively integrated into both competition and learning activities. The implementation of Smart Point supports the principles of fair play and objectivity, as fundamental to the FIG Code of Points.

These results also provide a basis for the development of similar systems in other sports with complex scoring systems, such as artistic gymnastics, rhythmic gymnastics, and diving.

Conclusion

Based on the research and discussion conducted, it can be concluded that the Android-based Smart Point application, developed using the Borg and Gall research and development model, has proven to be feasible, practical, and effective as a digital scoring system in aerobic gymnastics, specifically to facilitate the assessment and evaluation of PPLP aerobic gymnastics athletes in Jambi Province. The Smart Point application is designed to assist judges in awarding scores quickly, accurately, and objectively in accordance with the Code of Points (FIG). Therefore, it can be concluded that the development of the Smart Point application not only

produces functional technological innovation but also represents a strategic step towards the digitalization of sports scoring in Indonesia, supporting the creation of a transparent, accountable, and data-driven competition system.

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The research team contributed to the writing of this scientific paper, namely: idea, conception, data collection, analysis and interpretation of results, preparation of the manuscript, DP; Supervision of article writing, ZKP, and JJ; Funding acquisition, DP, and ANS.

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The author declares no conflict of interest in the publication of this article.

References

Abror, A. F., & Jati, H. (2016). Pengembangan dan analisis kualitas aplikasi penilaian e-learning SMK berbasis ISO 19796-1 di Yogyakarta. *Jurnal Pendidikan Vokasi*, *6*(1), 1–14. https://doi.org/10.21831/jpv.v6i1.7623

Allen, E., Fenton, A., & Parry, K. D. (2021). Computerised gymnastics judging scoring system implementation--an exploration of stakeholders' perceptions. *Science of Gymnastics Journal*, *13*(3), 357–370. Retrieved from https://eprints.bournemouth.ac.uk/35874/

Borg, R. W., & Gall, M. D. (1989). *Educational Research; An Introduction (5th Editon*. Longman, Inc.

Branch, R. M. (2021). *Instructional Design: The ADDIE Approach*. Springer. https://doi.org/10.1007/978-0-387-09506-6

Chen, H. (2025). Digital Transformation of Sports Enterprises and Construction of Governance Performance Evaluation Indicators. *The Frontiers of Society, Science and Technology*, *7*(4). https://doi.org/10.25236/FSST.2025.070406

Choirunnisa, D., & others. (2025). Manfaat Aplikasi Berbasis Android Dalam Mata Pelajaran IPAS: Tinjauan Literatur Yang Komprehensif. *QOSIM: Jurnal Pendidikan Sosial & Humaniora*, *3*(1), 481–490. https://doi.org/10.61104/jq.v3i1.869

Ermakov, A. V, Skarzhynskaya, E. N., & Novoselov, M. A. (2022). Digital transformation of professions in physical education and sport sector. *Theory and Practice of Physical Culture*, *3*, 7–9. Retrieved from https://cyberleninka.ru/article/n/digital-transformation-of-professions-in-physical-education-and-sport-sector

Handayani, S. G. (2025). Aplikasi GymApp Berbasis Android untuk Meningkatkan Keterampilan Handstand di Kalangan Pelajar Sekolah Menengah. *Jurnal Pengabdian Masyarakat Olahraga Dan Kesehatan*, *5*(1), 53–69. Retrieved from https://shorturl.asia/G7VD3

Hardi, R., & Servanda, Y. (2021). Integration of academic mobile applications at university. *Journal of Physics: Conference Series*, *1807*(1), 12035. https://doi.org/10.1088/1742-6596/1807/1/012035

Hidayah, U. N., & Sipayung, Y. R. (2024). Implementasi Sistem Penilaian Senam Artistik Berbasis Website Menggunakan Metode Waterfall di Persani Kota Semarang. *Jurnal Mahasiswa Teknik Informatika*, *3*(2), 139–146. https://doi.org/10.35473/jamastika.v3i2.3471

Mahazoya, A. S., & Wiradinata, T. (2025). Bridge Scorekeeping Automation: An iOS Application to Improve Tournament Scoring Accuracy and Efficiency. *SISTEMASI*, *14*(3), 1281–1293. https://doi.org/10.32520/stmsi.v14i3.5136

Mahmoud. (2024). Serious Game for Learning Gymnastic Elements: Preliminary development and validity assessment. *Tunisian Journal of Sports Science and Medicine*, *2*(2), 1–10. https://doi.org/10.61838/kman.tjssm.2.2.1

Mazurova, E., & Penttinen, E. (2020). Probing Athletes' Perceptions Towards Electronic Judging Systems: A Case Study in Gymnastics. *Annual Hawaii International Conference on System Sciences*. Retrieved from https://research.aalto.fi/en/publications/probing-athletes-perceptions-towards-electronic-judging-systems-a/

Meier, R. (2012). *Professional Android 4 application development*. John Wiley & Sons.

Mercier, H., & Heiniger, S. (2018). Judging the judges: Evaluating the performance of international gymnastics judges. *ArXiv Preprint ArXiv:1807.10021*. https://doi.org/10.48550/arXiv.1807.10021

Navandar, R. K., Hasan, S. H., Jadhav, N., Singh, K. U., Monisha, R., & Venkatram, N. (2025). Modernizing sports an intelligent strategy for entertainment

through internet of things in sports. *Entertainment Computing*, *52*, 100804. https://doi.org/10.1016/j.entcom.2024.100804

Oudah, A., Abbood, R., Shabib, S., Aldewan, L., & Ghazi, M. (2024). Developing physical education curricula within the framework of digital transformation to achieve sustainable development. *Teacher Education and Curriculum Studies*, *9*(3), 86–102. https://doi.org/10.11648/j.tecs.20240903.15

Palar, C. M., Wongkar, D., & Ticoalu, S. H. R. (2015). Manfaat latihan olahraga aerobik terhadap kebugaran fisik manusia. *EBiomedik*, *3*(1). https://doi.org/10.35790/ebm.v3i1.7127

Patrício, J. P. P. (2023). *Web-Based Sports Scoring System for Trampoline Gymnastics Competitions* [Instituto Politecnico de Leiria (Portugal)]. Retrieved from https://shorturl.asia/ndsNt

Praditya, & Indrawan. (2016). *Olahraga Membangun Bangsa*. Bogor: Nadi Pustaka.

Retnawati, H., Kardanova, E., Sumaryanto, S., Prasojo, L. D., Jailani, J., Arliani, E., Hidayati, K., Susanti, M., Lestari, H. P., Apino, E., & others. (2024). A Systematic Review of the Use of Technology in Educational Assessment Practices: Lesson Learned and Direction for Future Studies. *International Journal of Robotics and Control Systems*, *4*(4), 1656–1693. https://doi.org/10.31763/ijrcs.v4i4.1572

Soenyoto, T., Darmawan, A., Anjally, C. N., Amara, D. A., & Kurniawan, W. S. (2023). Gymnastics Talent Identification Test in Semarang City. *Proceedings of International Conference on Physical Education, Health, and Sports*, *3*, 418–428. https://doi.org/10.24114/jp.v6i2.42571

Sugiyono. (2019). *Metodelogi Penelitian Kuantitatif dan Kualitatif Dan R&D*. Bandung: Alfabeta.

Sukendro, & Lestari, P. A. (2022). Development of Media Applications Based on Cellular Difficulty Element Mandatory Junior Aerobic Gymnastics Persani Jambi. *3rd Progress in Social Science, Humanities and Education Research Symposium (PSSHERS 2021)*, 456–461. https://doi.org/10.2991/978-2-494069-33-6_50

Yosua, J. (2017). *Olahraga Membangun Bangsa*. Jakarta: Koni Pusat.