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Development and Evaluation of Android-Based Tutorial Learning Media to Improve Student Competence in the Education Dance Course

Mia Fahmiati [1*]

Olan Yogha Pratama [2]

Yos Surdaman [3]

Delvia Mona [4]

[1-4] Departemen Seni Drama, Tari dan Musik, Fakultas Bahasa dan Seni, Universitas Negeri Padang, Padang, Indonesia.

***email:**
miafahmiati@fbs.unp.ac.id

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Abstract

This study aims to develop and evaluate the initial effectiveness of an Android-based tutorial application to support learning in the Dance Education course. The research uses a Research and Development (R&D) approach by adapting the ADDIE model in the Analysis, Design, and Development stages, followed by limited trials as formative evaluation. A total of 30 students from the Dance Education Study Program participated in this study. Data were collected through cognitive competency tests, psychomotor assessment rubrics, observations, interviews, and expert validation. Analysis was conducted using descriptive statistics, paired sample t-tests, Cohen's d, N-gain, and thematic analysis. Validation results indicate good content quality, instructional design, and ease of use (Aiken's V = 0.84–0.93). The use of the application significantly improved students' competencies ($t(29) = 12.47$; $p < 0.001$; Cohen's $d = 1.94$; N-gain = 0.58). The integration of quantitative and qualitative findings provides initial empirical support that the Practice-Based Learning Environment (PBLE) framework has the potential to facilitate the integrated development of cognitive and psychomotor competencies in mobile learning-based dance education.

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INTRODUCTION

The development of digital technology has driven a significant transformation in higher education through the emergence of various forms of mobile-based learning. This approach allows the learning process to be more flexible, adaptive, and no longer limited by space or time, thereby supporting the development of student-centered learning (Stroe, 2023). Various studies have shown that integrating mobile devices into learning has a positive impact on students' academic outcomes, including engagement, motivation, and academic achievement (Sung et al., 2016). In this context, student engagement is viewed as one of the main factors that determine the success of digital learning because it is closely related to active participation, interaction, and the sustainability of the learning process (Martin & Bolliger, 2018). In addition to increasing access to learning resources, mobile technology also allows students to manage their study time more independently, access materials according to their needs, and gain a more personalized and contextual learning experience. In line with this, recent systematic reviews indicate that the implementation of mobile learning in higher education continues to develop because it can enhance the flexibility of learning while also expanding access to various digital learning resources (Naveed et al., 2023).

This development has driven a shift in the learning paradigm from a teacher-centered approach to a student-centered one. In this paradigm, students are expected to actively participate in building their knowledge and skills through exploration, practice, and reflection. Therefore, the use of technology is no longer viewed merely as a means of delivering information but also as part of a pedagogical design that supports the creation of meaningful learning experiences. This shift aligns with the growth of digital learning ecosystems that position technology as an integral part of the learning experience, while also

fostering the development of flexible, collaborative, and learner-centered learning environments (Sophonhiranrak, 2021).

Nevertheless, the implementation of mobile learning in skill-based fields, especially dance education, remains relatively limited. Dance learning at universities has different characteristics from conceptual learning because students are not only required to understand the concepts and principles of movement but also to be able to perform sequences of movements accurately, rhythmically, and expressively. Mastery of these skills requires repeated practice (deliberate practice), adequate feedback, and opportunities for continuous observation and imitation of movements (Schmidt & Lee, 2013).

These characteristics indicate that the success of learning dance is not only determined by the quality of the material delivered but also by the availability of a learning environment that can support the process of developing motor skills. In this context, students need opportunities to observe movement demonstrations, imitate them, receive feedback, and repeatedly go through this process until they achieve the desired mastery of skills. Such a process is often difficult to fulfill if learning relies solely on face-to-face interactions in the classroom.

In practice, conventional dance education still faces various obstacles. The teaching model dominated by direct demonstrations from the instructor is often limited by the allocated face-to-face time, giving students limited opportunities to practice independently outside of class. This condition results in the motor skill development process not occurring optimally and leads to low student practice intensity (Li et al., 2021). In addition, the variation in students' ability to understand and reproduce movements often requires different learning needs, while the classroom learning process generally proceeds at the same pace for all students.

Various efforts to utilize digital technology have actually been undertaken to address these issues. The development of web-based dance learning has been used to support blended learning models and expand students' access to learning materials (Rahayuningtyas et al., 2021). Other research shows that the use of interactive multimedia platforms can improve the quality of learning outcomes and student engagement in dance education (Xuan & Della, 2024). Recent developments even show that the integration of mobile technology with artificial intelligence can improve dance performance, learning motivation, and student engagement through the provision of more adaptive feedback (Xu et al., 2025).

In general, these studies indicate that digital technology is effective in enhancing accessibility, flexibility, and student engagement in dance and performing arts education. However, most of the research still positions technology as a medium for delivering material and has not extensively developed pedagogical designs that explicitly support the process of acquiring motor skills. Therefore, further investigation is needed on how digital technology can be designed as a learning environment that systematically supports the development of motor skills within the context of dance education at the higher education level.

The characteristics of dance learning that emphasize mastery of motor skills make the learning process not only dependent on the delivery of information but also on the availability of a learning environment that allows students to observe, imitate, and practice repeatedly. From a practice-based learning perspective, the opportunity to revisit movement demonstrations outside of class hours is an important factor in strengthening the formation of procedural memory, motor coordination, and gradually mastering skills. Therefore, the use of mobile applications should not only be positioned as a medium for distributing materials but also need to be designed as a learning environment that facilitates practice-based learning processes through observation, imitation, practice, and continuous reflection.

Theoretically, the effectiveness of video tutorial-based media can be explained through the Multimedia Learning theory, which states that the integration of visual and verbal information helps learners build more effective mental representations while also reducing irrelevant cognitive load (Mayer, 2020). In the context of dance learning, this mechanism allows students to focus on movement coordination, rhythm, and expression so that the process of developing psychomotor skills can occur more optimally. With the reduction of extrinsic cognitive load, students' cognitive resources can be allocated to observation, coordination, and reproduction of movements, thereby supporting more effective psychomotor skill development.

Although the development of dance learning technology shows a positive trend, systematic reviews indicate that research on mobile learning in higher education mostly focuses on technology adoption and usage, while studies on developing practical skills remain relatively limited (Crompton & Burke, 2018). Another study that specifically discusses dance education also shows that mobile learning research is still dominated by measuring achievements in the cognitive domain, while the development of psychomotor

skills has not become the main focus of the research (Songni et al., 2024). In fact, in dance learning, psychomotor competence is the main goal that cannot be separated from conceptual mastery.

Based on the literature review, there are still two main research gaps. First, there is still limited research on developing Android-based tutorial applications specifically designed for dance learning in higher education. Second, there are not many studies that integrate the development of cognitive and psychomotor competencies into a comprehensive pedagogical framework, so technology has not yet fully functioned as a learning environment that systematically supports the development of motor skills.

Addressing this gap is important because the development of a mobile learning-based learning environment that effectively supports psychomotor skills has the potential to provide a sustainable solution for improving the quality of dance and performing arts education at the higher education level. In addition to expanding access to learning materials, such a learning environment can also encourage students to develop practical skills more independently, flexibly, and sustainably.

Based on the gap identified, this study aims to develop an Android-based tutorial application for the Dance Education course and evaluate its initial effectiveness in improving students' cognitive and psychomotor competencies. To achieve this goal, the research employs a Research and Development (R&D) approach based on the ADDIE model, focusing on the Analysis, Design, and Development stages, with limited testing as part of formative evaluation of the developed product.

The main theoretical contribution of this study is the proposal of the Practice-Based Learning Environment (PBLE) pedagogical framework, which reconceptualizes the application of mobile tutorials not only as a medium for delivering material but also as a learning environment that facilitates observation, imitation, practice, and reflection processes in the integrated development of cognitive and psychomotor competencies. Unlike conventional mobile learning models that emphasize accessibility and content distribution (Hwang & Chien, 2022) as well as the Multimedia Learning theory which focuses on the processing of visual and verbal information (Mayer, 2020), PBLE places pedagogical design as the main mechanism in developing integrated cognitive and psychomotor competencies. Therefore, this research offers a conceptual framework that expands the function of mobile technology from merely a content distribution medium to a learning environment that actively supports the development of motor skills in dance education and performing arts.

RESEARCH METHOD

Research Design

This research uses a R&D approach based on the ADDIE model (Branch, 2009). The development process focused on the first three stages, namely Analysis, Design, and Development, which were then followed by limited testing as part of formative evaluation of the developed product. Therefore, the Implementation and Evaluation stages in the ADDIE model were not fully carried out but were adapted into the testing to obtain initial evidence regarding the feasibility and effectiveness of the product.

The R&D approach was chosen because this research not only aims to evaluate learning outcomes but also to produce a learning product that can be used in the context of dance education at higher education institutions. The adaptation of the ADDIE model in the first three stages was carried out in accordance with the research objectives, which focus on product development and formative evaluation before implementation on a larger scale (Creswell & Creswell, 2018).

Quantitative and qualitative data are collected as complementary evidence to gain a more comprehensive understanding of the initial effectiveness of the developed product (Creswell & Creswell, 2018). Quantitative data is used to measure changes in students' competencies, while qualitative data is used to explain and provide context for the patterns that emerge from the quantitative findings.

The initial effectiveness of the media was evaluated using a one-group pretest-posttest design. This design was chosen because it aligns with the characteristics of research and development at the formative evaluation stage, which aims to obtain preliminary evidence regarding the feasibility and effectiveness of the product before it is implemented on a larger scale (Campbell & Stanley, 1963).

The research was conducted at the Dance Education Study Program, State University of Padang, during the even semester of the 2024/2025 academic year. This research was carried out in accordance with the applicable research ethics guidelines within the institution. All participants provided written consent (informed consent) before participating in the study, and the respondents' identities were kept confidential throughout the data collection, analysis, and reporting processes.

Research Participants

The research participants consisted of 30 students enrolled in the Education Dance course. Participants were selected using purposive sampling techniques. Inclusion criteria include:

1. Students who are actively enrolled in the Dance Education course;
2. Possess an Android-based smartphone with a minimum operating system version of 8.0;
3. Are willing to participate in the entire research process;
4. Attend at least five of the six designed learning sessions.

Students who do not meet the criteria are not included in the study.

This sample size is considered sufficient for research and development at the formative evaluation stage aimed at obtaining initial evidence regarding the feasibility and effectiveness of the product before implementation on a larger scale. The selection of this number of participants also aligns with the characteristics of educational development research, which focuses on preliminary effectiveness testing of the developed product. Demographic data shows that 83% of the participants are female and 17% are male, with an average age of 20.3 years (SD = 1.1). All participants have Android devices compatible with the developed application.

Product Development Procedure

The development of the Android-based tutorial application was carried out using the ADDIE model through three stages.

1. **Analysis Stage**
   The needs analysis was conducted through structured interviews with three instructors of the Dance Education course and surveys of 45 students. Based on the established inclusion criteria, 30 students were then selected as participants in the initial product effectiveness trial. This analysis aims to identify learning obstacles, access to digital technology, and material learning needs. The results indicate that students do not yet have access to structured movement tutorial media to support independent practice outside of class hours, while mastering complex movement sequences requires ongoing observation and repeated practice.
2. **Design Phase**
   Based on the needs analysis results, the learning objectives are mapped to cognitive and psychomotor competency indicators. The material structure is designed gradually, starting from mastering basic movement units to assembling complete movement sequences. The learning design is developed by considering principles of motor skill acquisition that emphasize observation, imitation, and repeated practice (Schmidt & Lee, 2013). In addition to considering the course learning outcomes, the application structure is also designed to provide students with opportunities for independent practice at their own learning pace.
3. **Development Stage**
   The application is developed by integrating four main components, namely:
   - High-resolution video tutorial (1080p) showcasing movements from various angles;
   - Textual descriptions explaining each sequence of movements;
   - Step-by-step learning interface (tutorials);
   - Self-assessment checklist to support independent practice.

   Before being used in the trial, the application was validated by five experts consisting of two learning design experts, two dance education material experts, and one learning media expert to ensure content suitability, learning quality, and ease of use. As part of the development documentation, the interface display and main features of the application are presented in the research results section as a visual representation of the developed product.

Research Instrument

The initial effectiveness of the developed learning media is evaluated through the measurement of two dimensions of student competence, namely cognitive competence and psychomotor competence. Cognitive competence is measured using a 30-item multiple-choice test covering understanding of concepts and principles of movement in the Education Dance course. Psychomotor competence is measured using a performance assessment rubric consisting of six aspects: posture, rhythm accuracy, movement space accuracy, expression, smoothness of movement sequences, and coordination. Each aspect is rated on a four-level scale by two independent evaluators.

The content validity of the two instruments was assessed by five experts using Aiken's V index, which is widely used to evaluate the content appropriateness of instruments based on expert judgment (Aiken, 1985). Seluruh butir instrumen memperoleh nilai V ≥ 0,80 yang menunjukkan validitas isi yang baik. The instrument's reliability was tested using Cronbach's Alpha coefficient and yielded a value of 0.82, indicating good internal consistency (Benda et al., 2021). Inter-rater reliability for the psychomotor rubric was tested using Cohen's Kappa coefficient and resulted in a κ value of 0.79, indicating a high level of agreement among raters.

Research Procedure

The implementation of the research lasted for three weeks with six learning sessions, each approximately 90 minutes long. The research stages include:

1. Implementation of the pretest to measure students' cognitive and psychomotor competencies;
2. Introduction and installation of Android-based tutorial applications;
3. Conducting six learning sessions that integrate the use of Android-based tutorial applications with instructor demonstrations, motion observations, independent practice, group exercises, and feedback on students' performance;
4. Observation of the learning process during the second, fourth, and sixth sessions using structured observation sheets;
5. Conducting a posttest using instruments equivalent to the pretest; 6. Collecting supporting data through questionnaires and semi-structured interviews.

Data Analysis Techniques

Quantitative data were analyzed using SPSS version 25 software. Descriptive analysis was conducted to obtain the mean, standard deviation, minimum, and maximum values for the pretest and posttest results. The difference in scores before and after the treatment was analyzed using a paired sample t-test, while the effect size of the treatment was calculated using Cohen's d value. The improvement in learning outcomes is also analyzed using the Normalized Gain (N-gain) formula: g = (Posttest Score − Pretest Score) / (Maximum Score − Pretest Score).

The improvement in learning outcomes was analyzed using the Normalized Gain (N-gain) score, while the magnitude of the treatment effect was calculated using Cohen's d. The use of these two measures was chosen to provide more comprehensive information about the improvement in learning outcomes and the practical significance of the score changes (Nissen et al., 2018). Qualitative data obtained through observation and interviews was analyzed using thematic analysis techniques, which include the processes of data familiarization, initial coding, theme development, theme review, theme definition, and report writing of the analysis results (Braun & Clarke, 2006). To enhance the credibility of the findings, triangulation between instruments and member checking with two participants were conducted.

The integration of quantitative and qualitative data was conducted using a convergent integration approach. The results of the quantitative analysis were first used to identify changes in students' competencies, then observation and interview data were analyzed to explain the patterns that emerged from the quantitative results. The final interpretation was obtained through a process of comparison and integration of both types of data to identify consistency and complementarity between the findings (Fetters et al., 2013).

RESULTS AND DISCUSSION

Media Development Results

The ADDIE-based development process resulted in an Android-based tutorial application consisting of 12 video modules covering the entire sequence of movements in the Educational Dance course. This application is designed to integrate learning materials, practice videos, assignments, and supporting learning features into a single mobile-based learning environment. The development was carried out based on needs analysis results, which showed that students require flexible access to learning media to support independent practice outside of class hours. As a visual representation of the developed product, the interface appearance and main features of the application are presented in Figure 1.

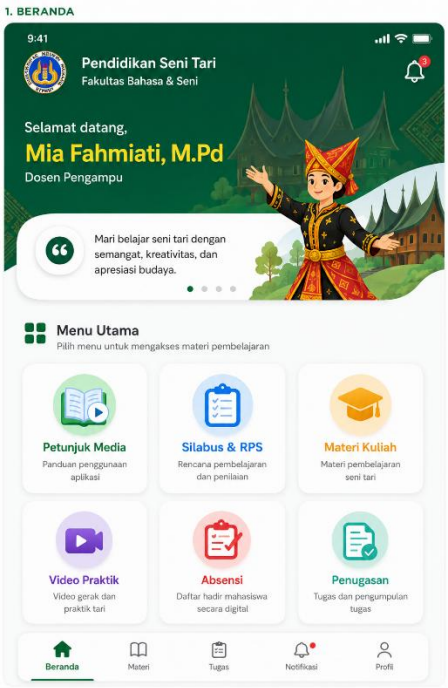

Figure 1. The main interface of the Android-based tutorial application developed for the Educational Dance course.

The application interface integrates learning materials, practice videos, assignments, and learning management features within the Practice-Based Learning Environment (PBLE) framework, incorporating elements of Minangkabau local culture. The application is developed by applying the principle of gradual presentation of materials (scaffolding), allowing students to learn basic movement units before progressing to more complex movement sequences. Each module is equipped with high-resolution demonstration videos that can be replayed as needed, textual explanations of movement characteristics, and self-assessment sheets that enable students to reflect on their learning process. The integration of these components is designed to support observation, imitation, practice, and reflection as key elements within the PBLE framework developed in this study.

The expert validation results indicate that the developed application meets all the evaluated quality criteria. The assessment was conducted by five experts, consisting of two instructional design specialists, two dance education material experts, and one learning media expert. A summary of the expert validation results is presented in Table 1.

Table 1. Expert Validation Results for the Android-Based Tutorial Application

Validation Dimensions	Average Score (1–4)	Aiken's V	Category
Accuracy and relevance of the material	3,87	0,93	Very Good
Quality of instructional design	3,74	0,91	Very Good
Video quality and clarity	3,80	0,92	Very Good
Ease of interface use	3,60	0,87	Very Good
Gradual presentation structure (scaffolding)	3,53	0,84	Good

Note. The assessment was conducted using a four-point scale. An Aiken's V value ≥ 0.80 indicates that the instrument has adequate content validity.

Based on the validation results, all dimensions received Aiken's V scores above the minimum recommended threshold, indicating the suitability of the instrument content and learning products. The aspects of accuracy and relevance of the material received the highest score (V = 0.93), demonstrating that the content of the application aligns with the learning outcomes of the Dance Education course. Meanwhile, the aspects of video quality and clarity also received very good ratings (V = 0.92), indicating that the movement demonstrations presented effectively support observation and imitation processes.

The ease of use of the interface received an Aiken's V score of 0.87, showing that the application is relatively easy for students to operate. The validators also provided feedback to clarify some navigation

icons and to enlarge the font size on certain pages to improve user comfort. These suggestions were incorporated during the revision stage before the application was used in a limited trial.

Additionally, the staged presentation structure dimension (scaffolding) received a good category with an Aiken's V value of 0.84. Although it was the lowest score compared to the other dimensions, the results still indicate that the sequence of material presentation has been aligned with skill-based learning principles, starting from mastering basic movements to assembling complete movement sequences. This staged structure is expected to help students develop skills progressively and reduce difficulties in mastering more complex movements.

Overall, the validation results indicate that the developed application has good content quality, instructional design, and ease of use, making it suitable for limited trial testing. The high scores in the aspects of material accuracy and video quality suggest that the application has met the dance learning needs that require clear, systematic movement demonstrations that can be accessed repeatedly by students.

This finding also shows that the developed application not only meets the standards of educational media quality but also possesses pedagogical characteristics that support practice-based dance learning. The integration of material, demonstration videos, assignments, and independent exercises within a single platform provides a foundation for creating a learning environment that allows students to learn more flexibly, independently, and sustainably. Therefore, this development provides a solid basis for continuing the formative evaluation process through trial use of the application in real learning contexts.

Initial Effectiveness: Quantitative Findings

Descriptive statistics and the results of inferential analysis of pretest and posttest scores are presented in Table 2.

Table 2. Descriptive Statistics and Paired Sample t-Test Results for Pretest and Posttest Scores (N = 30)

Measurement	Mean	SD	Minimum	Maximum	t	p
Pretest	75.3	8.4	58	91		
Posttest	89.6	6.7	74	99		
Paired Difference	14.3	6.3	3	28	12.47	< 0.001

Note. df = 29. Cohen's d = 1.94 (large effect size). N-gain = 0.58. The 95% confidence interval for the mean difference ranged from 11.95 to 16.65.

Based on Table 2, the average posttest score (M = 89.6; SD = 6.7) is higher than the average pretest score (M = 75.3; SD = 8.4). The mean difference of 14.3 points indicates an improvement in students' learning achievement after using the Android-based tutorial application. In addition to the increase in the average score, the score distribution in the posttest also shows less variation compared to the pretest, as evidenced by the decrease in standard deviation from 8.4 to 6.7. This condition suggests that, besides improving overall learning outcomes, the use of the application also tends to produce more consistent achievement among participants.

The results of the paired sample t-test indicate a statistically significant increase in scores between the pretest and posttest, $t(29) = 12.47$, $p < 0.001$. This value suggests that the probability of the score increase occurring by chance is very small, so it can be assumed that the observed change is related to the learning intervention provided. Additionally, the 95% confidence interval for the mean difference in scores ranges from 11.95 to 16.65, indicating that the improvement in learning outcomes occurred consistently in most participants.

The magnitude of the intervention's effect is also indicated by a Cohen's d value of 1.94, which falls into the large effect size category. This finding suggests that the improvement not only is statistically significant but also has practical significance in the learning context. Additionally, a Normalized Gain (N-gain) value of 0.58 indicates a substantial increase in learning outcomes, while the use of both N-gain and Cohen's d provides a more comprehensive picture of the effectiveness of the learning intervention (Nissen et al., 2018).

Individual-level analysis shows that 28 out of 30 participants (93.3%) experienced an increase in scores after using the application for learning, while the other two participants maintained relatively the same achievement. No participants showed a decrease in scores in the posttest measurement. This pattern indicates that the benefits of using the application are not only felt by a small number of students but are relatively spread across almost all participants in the study. Before conducting parametric analysis, the distribution of the score increases was first tested using the Shapiro–Wilk normality test. The analysis results

showed that the data distribution met the normality assumption (W = 0.96; p = 0.36), so the use of the paired sample t-test was deemed appropriate for analyzing score changes. Meeting these assumptions also enhances the reliability of the interpretation of the inferential analysis results obtained.

Overall, the quantitative findings provide initial empirical support that the use of an Android-based tutorial application has the potential to contribute to an increase in students' competencies during the formative evaluation stage of the developed product. The increase in average scores, a large effect size, a medium N-gain value, and the predominance of participants experiencing improved achievement indicate that the developed media has the potential to support the dance learning process more effectively. These findings are further explored through qualitative data analysis to understand how students' learning experiences while using the application contribute to these changes in achievement.

Initial Effectiveness: Qualitative Findings

A thematic analysis of observation and interview data resulted in three main themes that describe students' experiences during the use of an Android-based tutorial application in Dance Education learning. The theme identification was carried out through coding and grouping of meanings according to the thematic analysis approach developed by (Braun & Clarke, 2006). The three themes indicate that the use of applications not only provides easy access to learning materials but also influences how students develop skills, manage the learning process, and boost their confidence in practicing dance.

Theme 1 – Increasing Independence in Practice

Students stated that the application allows them to repeat and study movement sequences independently outside of class hours according to their individual needs. The ability to pause, rewind, and observe movement details from various angles helps the self-correction process, which is difficult to achieve through face-to-face learning. Most participants expressed that they no longer rely entirely on the instructor's demonstrations because they can access the material anytime.

> "*I can repeat difficult movements many times until I am truly confident I can do them on my own.*" (Participant 12)

Observation data also shows that students tend to be more active in doing independent practice before the practical session begins. In the fourth and sixth sessions, most students had prepared themselves by studying the material beforehand through the application, so the classroom learning time could be more focused on refining techniques and providing feedback. These findings indicate that the application supports the development of a more independent and student-centered learning pattern.

Theme 2 – Increasing Self-Confidence in Performing Movements

Observation data from the fourth and sixth sessions show an increase in students' confidence in performing movements and a decrease in hesitant behavior compared to the second session. Students appear more prepared to demonstrate sequences of movements in front of the lecturer and classmates, and are more willing to accept corrections on their performance. These behavioral changes indicate the development of psychomotor self-efficacy during the learning process.

> "*With this application, I don't worry too much about making mistakes because I can practice first before entering the class.*" (Participant 7)

Additionally, the interview results showed that the opportunity to practice independently before face-to-face learning helps students reduce anxiety when they have to perform movements in front of the group. Some participants stated that they felt more confident because they had an idea of the sequence of movements and could identify parts that still needed improvement before the practice session took place.

Theme 3 – Gradual Skill Development

Students and lecturers state that the tutorial structure, which is arranged gradually, makes the skill mastery process easier. The material presented, starting from basic movement units to the assembly of complete movement sequences, helps students understand the relationships between different parts of the

movement and learn them systematically. Students can also identify specific parts of the movement that still require additional practice before moving on to the next movement sequence.

> *"The gradual practice sequence makes it easier for me to understand which parts need to be improved before moving on to the next movement."* (Participant 18)

The observation results support these findings. At the beginning of the learning process, some students still experienced difficulties in maintaining coordination and smooth movements. However, in the subsequent sessions, there was a noticeable improvement in their ability to connect each movement unit into a more cohesive sequence. According to the instructor, a structured practice pattern through the application helps students develop skills progressively and facilitates the feedback process during learning.

Overall, the results of the qualitative analysis indicate that the use of the application not only enhances students' access to learning materials but also encourages the development of more independent, reflective, and systematic practice patterns. These findings suggest that the application functions not only as a medium for delivering content but also as a learning environment that supports observation, practice, and skill development gradually. The results also provide contextual explanations for the quantitative findings, which show an increase in students' competencies after using the Android-based tutorial application, further elaborated through the integration of quantitative and qualitative findings in the following subsection.

Integration of Quantitative and Qualitative Findings

The integration of research results shows a consistency between the improvement in students' competency achievement and changes in learning behavior during the intervention process. The quantitative findings indicating a significant increase in scores are reinforced by qualitative data that describe increased self-confidence, practice intensity, and student engagement in the learning process. This convergence pattern demonstrates that both types of data complement each other in providing a more comprehensive understanding of the initial effectiveness of the developed media, as recommended in mixed methods research (Fetters et al., 2013). The relationship between these two types of data is summarized in Table 3.

Table 3. Integration of Quantitative and Qualitative Findings

Quantitative Result	Qualitative Evidence	Integrated Interpretation
Significant score increase	Students reported increased confidence and more frequent independent practice	PBLE facilitates deliberate practice through repeated observation and self-correction.
Moderate N-gain	Students practiced outside class more frequently	Mobile learning extends learning opportunities beyond classroom boundaries.
Large effect size (Cohen's d = 1.94)	Lecturers observed better movement fluency and coordination	Structured tutorial sequences support progressive psychomotor development.

Table 3 shows that the quantitative and qualitative findings reinforce each other in explaining the initial effectiveness of the developed application, providing a more comprehensive picture of changes in students' competencies and learning behaviors. The score improvements obtained through statistical analysis are not standalone; they are supported by real changes in the learning process identified through observations and interviews. In other words, the quantitative data explain that there was an increase in learning achievement, while the qualitative data provide insights into how and why these improvements occurred.

Overall, the integration of both types of data indicates that the effectiveness of learning media is not only reflected in improved academic achievement but also in changes in practice patterns, learning engagement, and the development of students' motor skills during the dance learning process. Students not only showed an increase in scores on learning outcome measurements but also demonstrated a tendency to practice more actively on their own, be more confident in performing movements, and be better able to reflect on their weaknesses and progress made during the learning process.

The findings provide initial empirical support that pedagogical design based on the Practice-Based Learning Environment (PBLE) has the potential to facilitate the integrated development of cognitive and psychomotor competencies within the context of mobile learning-based dance education, where opportunities for independent learning, repeated observation, and reflection on the learning process become essential parts of students' skill development. The integration of materials, visual demonstrations, independent practice, and self-assessment allows students to build skills through a gradual and continuous process.

This finding aligns with previous research indicating that a mobile-based learning environment can expand learning opportunities outside the classroom and encourage active student engagement through repeated and structured practices (Bond et al., 2021). In addition to improving learning accessibility, integrating various digital learning resources into a single platform also allows students to develop independent learning and boost their confidence in mastering practical skills (Heilporn et al., 2021, p. 25). The findings are also consistent with research (Lin et al., 2019) which shows that the integration of mobile technology in dance learning can improve students' movement skills and self-efficacy through opportunities for repeated observation and practice. Therefore, this research reinforces the argument that digital technology can serve not only as a medium for delivering information but also as a tool that supports the creation of more active and student-centered learning experiences.

Furthermore, the results of this study indicate that the tutorial application developed not only functions as a medium for delivering material but also as a learning environment that supports observation, imitation, practice, and reflection processes continuously. These characteristics are at the core of the Practice-Based Learning Environment (PBLE) framework proposed in this research. Unlike conventional mobile learning approaches that typically emphasize flexible access to learning materials, PBLE places pedagogical design as the primary mechanism to facilitate skill development through systematic practice cycles. In this framework, students are not only passive recipients of information but also active learners who build their competencies through repeated interactions with the material, demonstrations, and practical experiences.

In addition to supporting the effectiveness of the initial media developed, the integration of quantitative and qualitative findings also shows that changes in learning outcomes are accompanied by changes in students' learning behaviors. Increased practice intensity, the development of self-efficacy, and the ability to reflect on one's own performance indicate that the use of the application has encouraged the formation of more independent and systematic learning habits. These behavioral changes are an important aspect of dance education because mastering motor skills fundamentally requires a consistent and ongoing practice process.

Thus, the integration of quantitative and qualitative findings not only provides evidence of the initial effectiveness of the developed application but also offers conceptual support for the utilization of mobile technology as a practice-based learning environment capable of integrating the development of cognitive and psychomotor competencies in higher education dance education. These results also reinforce the position of PBLE as a pedagogical framework that expands the functions of digital technology, from merely a media for distributing materials to an active learning environment that facilitates skill development through continuous processes of observation, practice, and reflection.

CONCLUSION

This research produced an Android-based tutorial application for the Dance Education course through the adaptation of the ADDIE model, focusing on the Analysis, Design, and Development stages, followed by limited trials as formative evaluation. Expert validation results indicate that the application has good content quality, instructional design, and ease of use, making it suitable as a supporting media for dance learning.

Quantitative findings show a significant increase in students' competencies after using the application, indicated by the difference in pretest and posttest scores, a large effect size, and a moderate N-gain value. Meanwhile, qualitative findings suggest that the application supports the development of more independent learning patterns, boosts students' confidence, and facilitates the gradual development of skills through repeated practice.

The integration of both types of data provides initial empirical support that the implementation of pedagogical design based on Practice-Based Learning Environment (PBLE) in mobile-based learning media has the potential to facilitate the integrated development of cognitive and psychomotor competencies in dance education. By combining materials, practice videos, assignments, and independent exercises in a single platform, the developed application has the potential to expand learning opportunities outside the classroom while also supporting practice-based learning.

Nevertheless, this study has limitations because it used a one-group pretest-posttest design with a relatively small number of participants and was conducted within a single study program. Therefore, future research is recommended to include a control group, a larger sample size, and implementation in various learning contexts to obtain stronger evidence of effectiveness and to test the sustainability of the PBLE model in mobile-based dance education.

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