

User Interface Design of Jaipong Dance Applications for Elementary School using the User-Centered Design (UCD) Method

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Abstract— The Jaipong dance is one of the traditional Indonesian dances, the nation's cultural heritage originating from West Java. Introducing dance to elementary school-level children is one way to maintain and preserve regional culture. However, the limited learning time causes the material to be delivered less in-depth, so students feel bored, lose motivation, and get some critical information from the material. This study aims to build a mobile-based learning application for Jaipong dance learning activities at the elementary school level using the User-Centered Design (UCD) method. The application evaluation involved fifteen public elementary school students in Ciamis, West Java. Participants were asked to answer a quantitative survey using the Quality Use Integrated Measurement (QUIM) instrument to discover their experience using the application during Jaipong dance lessons. The test results get an average score of 91%, included in the "excellent" category. These results were strengthened by the user's understanding of the Jaipong dance. As many as 86.7% of users who use the Jaipong dance learning application understand the material well. In contrast, only 33.3% of YouTube users understand the material well. This paper shows that the UCD method contributes to the design process according to the needs and characteristics of the user to design the user interface of the Jaipong dance learning application.

Keywords— Mobile application; user interface; Jaipong dance; user-centered design; QUIM; usability.

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I. INTRODUCTION

Indonesia is one of the archipelagic countries in Southeast Asia, with various unique and distinctive cultures [1]. One of Indonesia's cultural diversities is traditional dance. Traditional dances come from regions in Indonesia, which have the characteristics of each region that become the cultural identity of Indonesia [2]. Traditional dance is a cultural heritage that needs to be preserved [3]. The government's effort to preserve regional culture in Indonesia is to provide learning with cultural arts content as stated in Government Regulation of the Republic of Indonesia No. 19 of 2005 concerning National Education Standards [4]. Cultural Arts and Skills Education is provided in schools through a "learning through art" approach [5]. Dance learning involves physical activity in groups [6]. Therefore, dance learning is essential in influencing children's social, emotional, and intellectual development [7], well-being, and communicative skills [8]. Introducing dance to children is one way to maintain and preserve culture because it can shape children's values following the nation's culture [9].

Jaipong, a regional dance from West Java, is one of the dances taught at the elementary level. Currently, Jaipong dance learning at the elementary level emphasizes dance practice activities (such as: how to move or use movement as a medium of communication) rather than understanding dance theory itself [10]. Conceptual understanding is one of the crucial things in the dimension of cultural arts knowledge [11]. Lack of knowledge, especially about the concept and purpose of dancing so that students do not comprehend the meaning of the dance and rhythmic movements, causes the dance learning process in schools to be less effective [12].

Based on the results of initial interviews with teachers at one of the public elementary schools in Ciamis, West Java, currently known, the dance learning process uses various media, such as WhatsApp, YouTube, and Student Worksheets. The limited learning time (minimum study hours) causes the material presented to be insufficient, and this situation causes students to feel bored, demotivated, and miss some critical information about the material.

According to the Head of the Implementation Team of the National Information and Communication Technology Council, Ilham Habibie, encouraging students' motivation and

enthusiasm for learning can use technology [13]. Technology-based learning can increase motivation, engagement, and interest in learning to become effective and efficient [14], [15]. The utilization of technology-based learning causes learning to be carried out anywhere so that education is no longer restricted by space, period, psychological conditions, or geopolitical boundaries [16]. Mobile devices (gadgets) such as smartphones, tablets, and laptops are widely used in learning activities because of their flexibility [17]. The development of mobile-based learning media in Indonesia brings fresh air to Indonesian education because this media is practical, flexible, and personal, so it can improve learners' interest, motivation, and creativity in the learning process [18]. Mobile-based learning media complement learning that is expected to improve student learning outcomes and motivation because students can study the material in-depth without looking for sources elsewhere [18]–[20].

Many dance multimedia applications currently intended for learning use mobile technology [21]. In the last ten years, mobile-based dance applications have been widely applied at the college or adult level [22]–[25], high school [26], and elementary school [27]. There is still very little research on mobile-based learning in dance education at the elementary school level. This gap creates a void regarding understanding the effectiveness of mobile-based learning in dance education, especially at the elementary school level. This study aims to build a mobile-based learning application for Jaipong dance activities. This study explores the implementation of mobile-based learning in dance education and observes the effectiveness of mobile-based learning on student learning outcomes.

The user interface (UI) model was designed according to the end-users characteristics, namely elementary school children so that students are interested in knowing and learning Jaipong dance. We used the User-Centered Design (UCD) approach to involve elementary school students directly in the first stages of application development to obtain input regarding the features and uses of the product needed by students [28]. The UCD method can analyze user needs according to user characteristics [29] and focuses users' ease of task completion [30]. UCD is a model often adopted for developing various technology systems [31]. It puts the end-user at the design center and implementation technique to assure that the product is easy to use, increasing user interpretation and fulfillment [32]. The UCD method allows students to identify their needs and be involved in the software development cycle. Traditional design methods may not be successful enough for students to adapt quickly.

An important factor in software development is usability because usability can evaluate software features [33]–[35]. There are two types of usability evaluation concepts: summative (related to effectiveness, efficiency, and satisfaction) and formative (related to usability problem detection and intervention design) [36]–[38]. Usability evaluation is one technique that can ensure a high level of usability for a system [39], [40]. Usability is closely connected to the ease of learning or learnability without requiring high effort in carrying out tasks [41]. In this study, we assess the usefulness of the Jaipong dance learning application to measure satisfaction, convenience, and usability using Quality in Use Integrated Measurement

(QUIM). This framework provides a consolidated and hierarchical usability measurement model by integrating usability standards and conceptual models [42]. There are four QUIM hierarchies: data, factors, standards, and metrics [42]–[44]. QUIM provides a confederation of usability steps to work professionally on interactive system implementations for inexperienced developers or testers [45]. QUIM can measure usability based on efficiency, productivity, effectiveness, accessibility, satisfaction, security, learnability, trustfulness, universality, and usefulness [42]–[44]. The development of the Jaipong dance application was intended for elementary school students with little or no knowledge of usability, and QUIM is appropriate for this kind of user [46]. The usability evaluation results indicate whether the Jaipong dance learning application needs to be improved or redesigned before dissemination.

II. MATERIALS AND METHOD

The research uses the User-Centered Design (UCD) method. The UCD approach develops systems based on user requirements, not technical requirements [47]. The power of UCD is to implement a system that features design elements according to the needs and desires of users [31]. Figure 1 illustrates the modeling flow in the User Interface (UI) design process of the Jaipong dance learning application in this study. Figure 1 shows that the modeling flow divides into four stages: define the context of use, define user requirements, create design solutions, and assess the design.

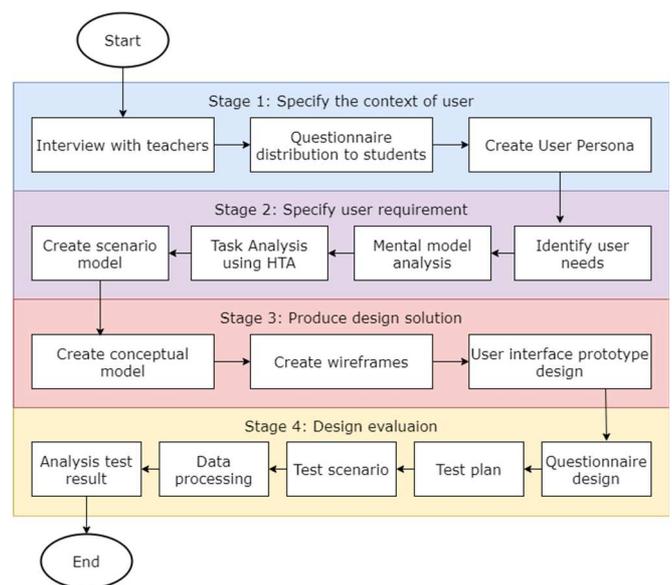


Fig. 1 Research modeling flow

In the first stage, specify the context of use. This research interviewed teachers at one of the public elementary schools in Ciamis, West Java. The first stage was conducted to obtain information about thematic books, student behavior during learning, and how Jaipong dance is learned in school. Furthermore, to find out the perceptions and habits of the users, we collected questionnaire data for elementary school students. The questionnaire results became the basis for the user modeling process using the user persona. User Persona is a crucial feature of UCD and is used extensively in product development and evaluation, creation, usability testing, and

product commerce [48]. A persona is a fictional user representation that summarizes the user's characteristics and experiences [49], [50]. Personas are tools used to understand end-users better and involve the end-user in the product innovation process [51]. Personas provide a clear picture of the user's capabilities when using the system and what they expect [48]. Table 1 describes the user persona in this study.

TABLE I
THE USER PERSONA OF ELEMENTARY SCHOOL STUDENTS

Category	Class Type	
	Low Grade (Grade 1 to 3)	High Grade (Grade 4 to 6)
Demographics	7-10 years Male and Female	10-13 years Male and Female
General knowledge and technology knowledge	This target user can spend 30 minutes-2 and hours using a mobile phone or accessing the internet. When downloading a new application, the target user takes hours to understand its use, and some even never download it. This target user is familiar with the application's two languages: Indonesian and Sundanese.	This target user can spend about 1-3 hours, and some even spend all day using their mobile phones or accessing the internet. The average target user immediately understands its use when downloading a new application. This target user is familiar with three languages when using the application: Indonesian, English, and Sundanese.
Behavior	Very often use mobile phones to study online. Frequently used features: WhatsApp group chat, YouTube, and student worksheets.	Very often use mobile phones to study online. Frequently used features: WhatsApp group chat, YouTube, student worksheets, and Google Search.
Attitude	When they find a confusing feature, users immediately stop using the application.	When finding a confusing feature, the target users will ask the people around them about it. However, some users immediately stop using the application.
Needs	The target user hopes that this application can create a learning atmosphere that is fun, not boring, facilitates learning, can be accessed anywhere and anytime, can test understanding, and can preserve regional culture.	The target user hopes that this application can create a learning atmosphere that is fun, not boring, can recognize the basics of Jaipong dance, can access learning anywhere and anytime, and can preserve local culture.

The second stage is specifying user requirements. We analyze user requirements, designing mental models, task analysis, and scenario models at this stage. User requirements are one type of stakeholder need that comes from the point of

view of system users as the basis for system requirements [52]. The mental model is an internal model of students comprehending a conception consisting of causal impressions about application functioning [53]. The mental model can be used to observe how students learn [54], think [55], or predict a phenomenon [56]. Mental models can visualize using concept maps, conceptual diagrams, mind maps, content maps, visual metaphors, or charts [57]. The following process is task analysis using Hierarchical Task Analysis (HTA). HTA is a task analysis strategy often used to analyze and understand task complexity [58]. HTA describes activities or workflows according to goals, sub-goals, operations, and plans. HTA is a prerequisite task analysis to answer what users do to achieve goals [58]. The last is the scenario model. The scenario model describes the user's sequence of activities using the Jaipong dance application. This research interface scenario model was based on the needs and goals of the users defined previously, namely user personas, user requirements, mental models, and HTA analysis. This scenario model has four tasks involving users: elementary school children in low-level grades (1 to 3) and high-level grades (4 to 6). Table 2 delivers a summary of the user requirements in this study. This study's mental model, HTA, and scenario model can be found at <https://bit.ly/3ndRm2r>.

TABLE II
USER REQUIREMENT

No	Needs	Requirement
1	Provide in-depth insight into Jaipong dance and know the basic movements of Jaipong dance.	Features that can help users get to know Jaipong dance in depth can start from the basics of Jaipong dance, such as history, characteristics, accessories, dance videos, and basic dance movements. Therefore, we made the features according to the user needs, namely: <ul style="list-style-type: none"> a. Features of Jaipong Dance History b. Characteristic Features of Jaipong Dance c. Features of Jaipong Dance Accessories d. Jaipong Dance Video Features e. Features of Jaipong Dance Basic Movement
2	The language used corresponds to the language used by the user.	Language swap feature. There are two languages used in this application, namely Indonesian and Sundanese.
3	The appearance of the application is colorful and comfortable for users to see.	Display with brightly colored application backgrounds and colors that users like. There are children's characters that adapt to the user.
4	Helping users test their understanding of jaipong dance.	Features Let's play a quiz consisting of theory and practice quizzes.

The third stage is to produce design solutions. We use wireframes to describe the design solutions of this study. The wireframe design was established on the user's initial needs and software prerequisites by creating simple visual components and specifying the structure of elements that can

sustain appropriate interaction to achieve user goals [59]. Wireframes ignore visual details with high fidelity, so prototype creation and refinement are quick, and effortless, and allow for visually different but relevant UI designs [59]. We designed a wireframe using the inVision application and built a Jaipong dance learning application prototype using Adobe XD. The final prototype develops after the wireframe is verified and iterated with refinements. The mobile prototype is built following Google's design rules in Material Design, providing functions and elements according to a wireframe design. Figures 2 and 3 are some examples of wireframes and prototypes in this study.

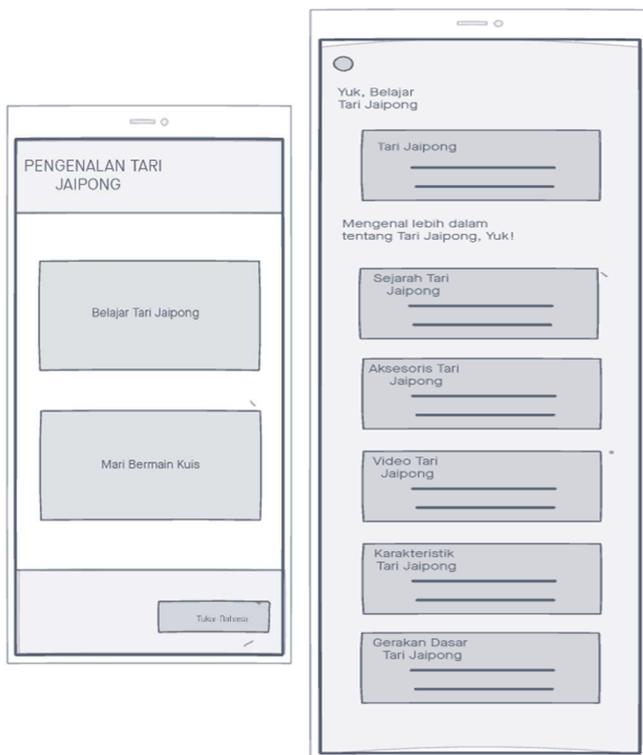


Fig. 2 Wireframe of main homepage and study menu

The colors used in the prototype interface of the Jaipong dance application are dominantly using bright colors because they match the character of elementary school students. The characters used are a boy and a girl with cheerful faces holding books and carrying bags. The characters can interpret that learning is fun and indirectly preserve Indonesian culture. The characters were taken from a free vector graphics site (freepik.com).

The main menu interface of this application contains a Jaipong dance learning menu, a quiz play menu, and a language switch button. The main menu background uses white and batik patterns from West Java. The colors of the children's characters in the main menu are pink and blue, according to their favorite colors, based on the questionnaire results. In addition, the colors used have a calm and youthful meaning.

The Jaipong dance learning menu interface contains learning categories that the user can select. The learning categories include Jaipong dance history, accessories, Jaipong dance videos, characteristics, and basic Jaipong dance movements. The background color on this menu uses white

and orange, which means cheerful, to excite users to know and learn the Jaipong dance.

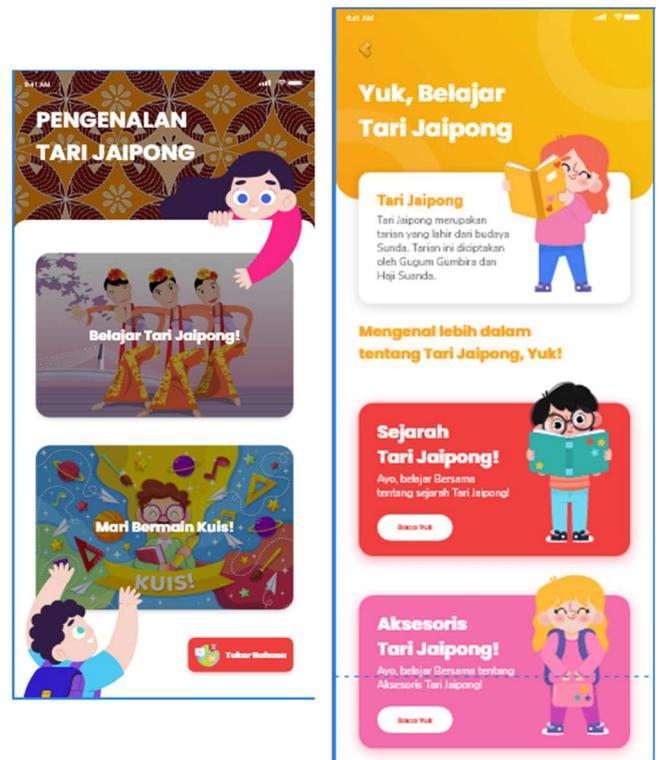


Fig. 1 Prototype of the main homepage and study menu

The fourth stage is an evaluation of the UI design. The evaluation was carried out using the QUIM questionnaire with a Likert scale of five points, from strongly disagree (1 point) to strongly agree (5 points). The testing scenario for the Jaipong dance introduction application was carried out according to the following stages.

- Users provided with a smartphone with the Jaipong dance introduction application installed.
- Users run tasks and all the Jaipong dance introduction application features while directed to use them.
- After using the Jaipong dance introduction application, researchers conduct interviews and observations with users by using questions following the questionnaire made by the QUIM factors and criteria.
- Researchers guide users in understanding the intent of the questions posed on the questionnaire to avoid misunderstandings.
- After that, the researcher recap and analyze the data obtained from the test results.

III. RESULTS AND DISCUSSION

Fifteen students at a public elementary school in Ciamis, West Java, evaluated the Jaipong dance learning application. Participants were asked to answer the questionnaire survey, QUIM, based on their experience using the app during Jaipong dance lessons. Participants are representatives from grades 1 to 6. The usability evaluation conducted on five participants will find 55% usability problems, while 15 will find 90% usability problems [60]. More test users will increase the finding of problems that need to be fixed [36], [60].

The tool used during the evaluation process is a smartphone with installed the Jaipong dance introduction application. After the participants completed the task, the participants then filled out the QUIM questionnaire. If the QUIM percentage value reaches 90%, the test is enough to do one time. However, suppose the percentage value is less than 90%. In that case, it is necessary to repair the prototype first, based on the usability problems found, and then re-evaluate the same user and in the same place.

A. Quality in Use Integrated Measurement (QUIM)

This study uses eight of the ten QUIM factors: effectiveness, efficiency, satisfaction, productivity, trustfulness, usefulness, learnability, and universality. The criteria selection for each factor adjust to the user's needs and the system's scenario. The usability factor in QUIM is dynamic so that the criteria can be used as needed [41], [43], [44]. QUIM applies an approach that regards a user interaction by specifying user tasks, gadget dynamics, and techniques for performing user tasks [44].

The evaluation questionnaire used refers to the usability factor of QUIM. There are 23 items (shown in Table 3) of the usability evaluation questionnaire with eight QUIM usability factors.

- *Efficiency* (4 items): how fast the user operates the application, selects menus and moves between menus.
- *Effectiveness* (1 item): how precise the information supplied to the user and the smoothness of the user in carrying out the task.
- *Productivity* (2 items): how much time was wasted when running applications without studying buttons or images.
- *Satisfaction* (3 items): how satisfied the user is with the appearance, user feel, and information provided by the application.
- *Learnability* (4 items): how satisfied the user is with the ease of the application to master and learn.
- *Trustworthiness* (3 items): refers to the information or task available in the application, whether it can be trusted and under the user's perception.
- *Universality* (2 items): how well the user understands the functions that exist in the application and the language used.
- *Usefulness* (4 items): is the application helpful in dealing with problems received by users?

TABLE III
QUIM ITEMS

QUIM Factor	Item
Efficiency	1. I can easily carry out the functions and features that exist in the Jaipong dance learning application.
	2. I understand using the Jaipong dance learning application.
	3. It didn't take me long to complete all the features of the app.
	4. I can move from each category on the Jaipong dance introduction app smoothly.
Effectiveness	5. I can display all the content of the Jaipong dance learning application, and then, when it's finished, I can exit every currently open feature.

Productivity	6. I can see the details of the results of the quiz that I have done.
	7. All the features of the app work as I expected.
Satisfaction	8. I like the design and display images presented in the Jaipong dance learning application, using them again.
	9. I will use this application to learn and get to know Jaipong dance.
	10. I will recommend this Jaipong dance learning application to my friends.
Learnability	11. I can find out information about the Jaipong dance from the Jaipong dance learning application.
	12. The Jaipong dance learning application system generates the appropriate output for each selected button.
	13. I feel that when I upload a photo, it matches the practice quiz questions, according to the picture in the question.
	14. I feel that the categories given follow the content of the Jaipong dance.
Trustfulness	15. The Jaipong dance learning application system provides an overview of Jaipong dance information and can be used as additional media in learning.
	16. Jaipong dance learning application aims to introduce jaipong dance originating from West Java.
	17. I understand how to use the Jaipong dance learning application.
Universality	18. I understand the information provided in icons, images, and videos displayed by the Jaipong dance learning application.
	19. I understand the language used in the Jaipong dance learning application.
Usefulness	20. I feel I can control the Jaipong dance learning application easily.
	21. I find it helpful to have pictures of children's characters in each menu category.
	22. I found it helpful in getting to know Jaipong dance, starting with the history, accessories, videos, characteristics, basic movements, and quizzes of Jaipong dance.
	23. I'm doing a quiz on the theory and practice of the Jaipong dance learning application getting better.

We did not use two QUIM factors in this study, namely accessibility and safety. That is because this Jaipong dance learning application users do not have physical and mental disabilities. In addition, users do not have to enter personal data into the system. Considering that this research was conducted during the COVID-19 pandemic, the evaluation was executed directly by implementing health protocols. Figures 4 and 5 illustrate the usability evaluation process.

In the QUIM approach, students must complete 23 items to measure the evaluation of application usability. The test results obtained a weighted value based on the feedback questionnaire that the user had filled out. The total feedback scores were calculated to obtain a cumulative score for each question factor. The whole cumulative value divides by the highest cumulative value obtained from each factor, resulting in a percentage of the QUIM value [61].



Fig. 4 Participants practice Jaipong dance using the application



Fig. 5 Participants evaluate the application prototype

The following were the steps taken to get the QUIM percentage.

- Calculate the cumulative number of 15 respondents with the enormous scale (5) and the smallest (1). The minimum cumulative score (1*15) is 15, and the maximum cumulative score (5*15) is 75.
- Calculate the lowest and highest percentage values. The lowest percentage value (15/75*100%) is 20%, and the highest (75/75*100%) is 100%.
- Calculate range values. The scope value is the biggest percentage minus the least divided by measurement scales. The size range value ((100%-20%)/5) is 16%.

Based on the value of the measurement range above, we use five categories of QUIM percentage assessment, as follows.

- Inferior: range of 20% to 36%.
- Poor: 37% to 52% range.
- Moderate: 53% to 68% range.
- Good: range from 69% to 84%.
- Excellent: range of 85% to 100%.

The average percentage of QUIM scores is obtained by formula 1 as follows.

$$x = \frac{1}{n}(x_1 + x_2 + x_3 + \dots + x_n) \quad (1)$$

Where x is the average percentage of QUIM score, x_i is QUIM percentage value in i -sample, and n is the number of samples.

TABLE IV
USABILITY EVALUATION RESULTS USING QUIM

QUIM Factor	Total Score	Percentage (%)	Category
Efficiency	272	90	Excellent
Effectiveness	64	85	Excellent
Productivity	136	90	Excellent
Satisfaction	211	93	Excellent
Learnability	273	91	Excellent
Trustfulness	211	93	Excellent
Universality	142	94	Excellent
Usefulness	278	92	Excellent

Table 4 gives the evaluation results based on the eight QUIM factors. Based on the table, the total average percentage of QUIM is 91% or is in the excellent category. The QUIM percentage value reaches above 90%; then, the test is enough to do in one time. So, we did not improve the prototype and re-evaluate usability in this study.

B. Analysis

Established on the usability evaluation results, the average percentage of the QUIM factor is above 90%. The application's user interface for elementary school children follows the user persona. The following paragraph will discuss the analysis of processing the QUIM questionnaire on the Jaipong dance learning application.

1) *Efficiency*: Evaluation of the efficiency factor got an average of 90% in the excellent category. These results indicate that users can adapt fast when using the Jaipong dance learning application.

2) *Effectiveness*: Evaluation of the effectiveness factor got an average of 85% in the excellent category. The effectiveness factor focuses on how the user completes tasks accurately and completely. These results indicate that the designed task is by the user's ability to understand the existing tasks easily.

3) *Productivity*: The result of evaluating the productivity factor is 90% in the excellent category. The productivity factor focuses on how much the user takes time or effort to finish a task. The excellent category on this factor can interpret that the user does not need to complete each task for long.

4) *Satisfaction*: The satisfaction factor evaluates how users respond and satisfy the user interface and information content of the Jaipong dance introduction application. The evaluation results of the satisfaction factor get an excellent category, and it can interpret that the user is satisfied with the Jaipong dance learning application. In addition, the children's characters are used so the user feels happy using this application.

5) *Learnability*: The evaluation of the learnability factor focuses on how easy it is for the user to learn and operate the application. The average result of the learnability factor is in the excellent category. The result means that users can quickly learn, use, and remember the features of this application.

6) *Trustfulness*: This factor relates to how the product interface fits its function, and the user can easily recognize the elements in the interface. In this study, the evaluation results of the trustfulness factor illustrate that the tasks in the application can work according to their functionality and provide appropriate information.

7) *Universality*: Evaluation of the universality factor is in the excellent category range. These results indicate that users easily understand the visual content of the application. In addition, the application has consistency on every page of the interface, can respond to users, and can provide easy navigation.

8) *Usefulness*: The usefulness factor indicates whether this application can be helpful for users and provides information that can be understood and operated easily by users. The results of the average usefulness factor in this study show that this Jaipong dance learning application can help elementary school students to get to know one of the cultures of West Java, namely, Jaipong dance.

C. Learning Outcomes

In addition to evaluating usability, this study also conducted external testing using experimental methods. Experiments were conducted to measure how far the resulting application could increase user knowledge about Jaipong dance. The test was carried out in two groups, where the experimental group used the Jaipong dance learning application, and the control group used the YouTube media. Each group consists of 15 students at a public elementary school in Ciamis, West Java.

The experimental and control groups were given identical time to study the Jaipong dance material. After the learning process, each group was given ten multiple-choice questions. The questions given relate to the material being studied. The correct answer gets a score of 2, and the wrong one gets a 0 score. We divided the three categories of knowledge improvement based on the total score as follows:

- High category: students who experience a good increase in knowledge with a score range of more than 16 (or give correct answers above 75%),
- Moderate category: namely students who experience an increase insufficient knowledge with a score range between 8 to 15 (or giving correct answers by 40% to 75%),
- Low category: students who experience an increase in less knowledge, with a score of less than 8 (or giving correct answers below 40%).

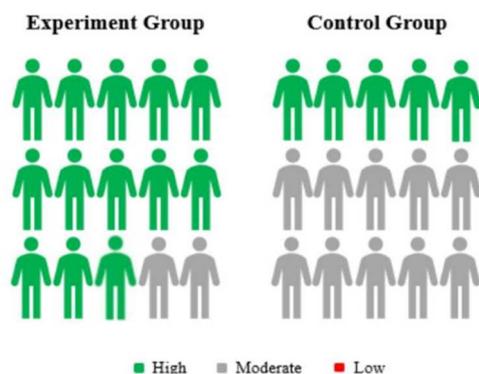


Fig. 6 External testing result

Figure 6 illustrates the learning outcomes acquired by the experimental and control groups. The external test results in Figure 6 show that the percentage of students who experienced increased knowledge in the experimental group increased more than in the control group. There were 13 (or 86.7%) students in the experimental group who got the high category. While in the control group, only five students (or 33.3%) got the high category.

The external test results showed that the Jaipong dance learning application helped students learn Jaipong dance. Students' learning outcomes in the experimental class were better than students in the control group.

IV. CONCLUSION

This investigation aims to build a mobile-based learning application for Jaipong dance learning activities utilizing the User-Centered Design (UCD) method. This study explores the implementation of mobile-based learning in dance education and observes the effectiveness of mobile-based learning on student learning outcomes. The Jaipong dance learning application's usability was evaluated by measuring the usability level using QUIM. In the earliest iteration of usability evaluation, the average usability evaluation result in the "excellent" category, 91%, indicating that the Jaipong dance learning application can function according to the user's characteristics. These results follow user learning outcomes regarding the understanding of jaipong dance.

This study describes how UCD can help build mobile-based learning applications, especially in dance education. This study proves that mobile-based learning tools in dance education can help students learn and understand Jaipong dance, both theory and practice, which has implications for improving student learning outcomes. The application built in this research is proven to be usable, valid, and reliable in dance education.

Future research should focus on adding Sundanese language features, developing applications to capture dance movements automatically, and enriching the content of Jaipong dance materials. In addition, it is essential to build a user interface from the teacher's perspective so that teachers can quickly provide assessments and analyze student learning progress.

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