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Interaction Design of Indonesian Local Language Learning Application Using User-Centered Design

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***Abstract*—The endangerment of Indonesian local languages is an issue requiring urgent attention. In response, the Indonesian government has initiated several revitalization movements, including the development and implementation of local language curricula in schools. However, challenges remain, particularly the lack of motivation among students to learn these languages. One way to address this issue is by using a more engaging learning approach through the utilization of technology. This paper addresses the challenge of designing a mobile learning app for Indonesian local languages, with a focus on Javanese as the sample language, employing a user-centered design approach. The MDA (mechanics, dynamics, aesthetic) framework is utilized to create an engaging and enjoyable learning experience, aimed at increasing student motivation. The final product is a high-fidelity prototype evaluated using two usability testing methods: the Single Ease Question (SEQ) and the System Usability Scale (SUS). The final prototype achieved an average SEQ score of 6.93 out of 7 and an average SUS of 95 out of 100. Additionally, an evaluation of the gamification element was conducted to assess their impact on student motivation. The results demonstrate that the prototype meets the usability goals of being easy to learn, and also achieved the user experience goals which are fun, motivating, and cognitively stimulating.**

Keywords—local languaage; mobile learning; gamification; user-centered design

I. INTRODUCTION

"Bhinneka Tunggal Ika," meaning unity in diversity, has been Indonesia's motto since independence, uniting the nation's diverse ethnic groups, cultures, and languages. Local languages are a vital part of this diversity and must be preserved. However, the number of local languages in Indonesia has been decreasing for these past few years. Out of 718 languages, 146 are at risk and 12 have become extinct [1]. In response to this urgent matter, the Indonesian Ministry of Education, Culture, Research, and Technology has initiated several language revitalization actions, as mandated by the 1945 Constitution of Indonesia. One of the actions includes incorporating local languages into school curricula. Despite these efforts, the implementation of local language in schools faces significant challenges [2], particularly the lack of student motivation and difficulty in understanding local language [3].

According to data from BPS (Badan Pusat Statistik), 68% of Indonesians above age of 5 owns a mobile phone. Children today spend considerable time playing games on their mobile phones [4], presenting an opportunity for innovative learning approaches like mobile learning [5]. Mobile learning is much more effective and instructional compared to traditional learning methods. [6]. Other advantages include flexibility, allowing students to adjust their schedules and learn at their own pace. One effective tool for enhancing mobile learning is gamification, which integrates game elements into non-game contexts [7]. Research has demonstrated that gamification in education creates a fun and engaging learning environment [8].

These insights could be optimized as a solution in facing the challenges of learning local languages at school. Based on the problem mentioned, this paper proposes the development of an interaction design for Indonesian local language learning app using user-centered design approach with gamification based on the existing local language curriculum. The user-centered design ensures that the final product meets user needs by involving users throughout the development process. The app aims to motivate students to learn local languages, thereby supporting language revitalization efforts.

II. LITERATURE STUDY

A. Interaction Design

Interaction design is the activity of designing an interactive product to support the way people communicate and interact in everyday life [9]. The goal of interaction design is to incorporate usability into the design development process, resulting in products that are easy and effective for users to use. One of the methods of interaction design is user-centered design. User-centered design involves user in every design stage so that the final product is tailored to the user needs [10]. There are four major steps in user-centered design as stated by the International Organization for Standardization (ISO), which consist of understanding and specifying the context of use, specifying user requirements, producing design solutions to meet the requirements, and evaluating the design. These steps are repeated in iterations as needed to produce a refined and effective design [11].

According to Preece et al. [9], there are six usability goals in interaction design: effectiveness, efficiency, safety, utility, learnability, and memorability. In addition to usability, user experience is also a crucial aspect of interaction design. The expected user experience while using an application includes satisfying, helpful, fun, enjoyable, motivating, proactive,

engaging, challenging, surprising, pleasurable, enhancing sociability, rewarding, exciting, supporting creativity, emotionally fulfilling, entertaining, cognitively stimulating, and experience flow.

B. Usability Testing

Usability testing is a process used to evaluate how easily a product can be used by users. The goal is to determine whether users can complete specific tasks within the developed product and to assess their satisfaction while using the product [9]. There are several methods of usability testing, such as Single Ease Question (SEQ) and System Usability Scale (SUS).

SEQ is a questionnaire used to assess how difficult users find it to complete a task within a product. It consists of a single question: "Overall, how easy or difficult did you find this task?" Responses are rated on a scale from 1 to 7, where 1 indicates very difficult and 7 indicates very easy. Based on data from over 400 tasks and 10,000 users, the average SEQ score is 5.5 [12].

SUS is a questionnaire designed to evaluate a product's usability [13]. It involves asking users 10 questions about their experience with the product. The results are presented as a single score on a 0-100 scale, simplifying the process of understanding and interpreting the data [14].

C. Gamification and MDA Framework

Gamification is a process that aims to make non-game contexts more engaging by integrating game thinking, game design, and game mechanics. The goal is to build engagement among specific groups. In the context of education, gamification aims to enhance activity, motivation, and learning outcomes [7]. For language learning, the use of gamification element encourages students to learn and participate actively, thereby enhancing the effectiveness of learning [15]. One of the frameworks used for gamification is MDA (Mechanics, Dynamics, Aesthetics) Framework. This framework is a fundamental framework in game design, where designers create functions (mechanics) that provide different user interactions (dynamics) and evoke emotions and experiences for users (aesthetics) [16].

Mechanics are components that motivate players to take action. This includes everything a player does, algorithms, and data structures in the game. Mechanics consists of a set of tools that, when used correctly, can generate responses (aesthetics) from players. Some examples of game mechanics include points, achievements, leaderboards, levels, missions, minigames, simulations, turn-based, feedback systems, and others [17].

Dynamics is the result of interaction between players and mechanics. In other words, dynamics determine what happens to players when game mechanics are in play. Some types of dynamic content include badges, role-playing, non-linear progression, quiz systems, and others.

Aesthetics describe the emotional responses desired and achieved by players when successfully interacting with the game system. These feelings or emotions can include joy, fantasy, frustration, and fellowship. For example, players may feel frustrated when scoring lower than others, or happiness when successfully completing a task and receiving rewards [16].

III. Research and Analysis

The development of interaction design in this study is based on the design process stages of user-centered design as stated in ISO 9241-210 [11].

A. Data Collection and Scope Determination

We use questionnaires to identify user challenges in learning local language. We gathered responses from 525 participants, consisting of 504 junior high school students and twenty-one local language teachers. The results of the questionnaire helped define the scope of this research in three areas: user scope, functionality scope, and development scope. The target users of the language learning application are junior high school students. This demographic was chosen based on their maturity to use applications and their prior experience with learning local languages in school. The language learning application includes essential functionalities for effective language learning, such as vocabulary, daily practice, and other key features. Lastly, for the development scope, the application is being developed for mobile platform using React Native.

B. Understanding and Specifying the Context of Use

The results of the questionnaire revealed that 93.5% of respondents have a mother language that is actively used. However, only 7.5% of respondents are fluent speakers, while others struggle with learning the local language at school. Most respondents spend 2-4 hours daily on their mobile phones, and 45.5% of the students have used mobile applications for language learning. After analyzing the questionnaire results, we identified the challenges and needs of students for learning local language. TABLE I. outlines the problems faced by students when learning local language in school.

TABLE I. Challenges in Learning Local Language at School

ID	Challenges
P-01	The learning process in class is boring, and it is hard to stay focused in classroom
P-02	Some students are not familiar with the language, requiring teacher to teach using two languages
P-03	Students find it difficult to keep up with the teaching pace, and the language used is hard to understand
P-04	The learning system is not customized to individual student learning styles
P-05	Local language consists of many vocabularies, and it is hard to memorize the regional scripts

In addition to the problems, students also highlighted several needs or requirements they would like to see in a local language learning application, as shown in TABLE II.

TABLE II. User Requirements

ID	Requirements
R-01	Users can study through a game-like system
R-02	Users can explore fun facts about the region
R-03	Users can learn vocabularies and regional scripts

C. Specifying Users' Requirements

Based on the identified user problems and needs from the previous stage, we can now analyze the required features and gamification elements for the application.

TABLE III. GAMIFICATION ELEMENTS NEEDS

Game Elements	Function	Correlation
Onboarding	Introducing users to the main features of the application.	P-01, R-01
Points	Providing points to reflect students' learning progress and motivate them to keep learning.	
Streak	Encourage student to be consistent in learning.	
Level	Dividing learning materials into smaller parts represented as levels, allowing more focused learning.	P-03, P-05, R-01
Leaderboard	Foster competitiveness among students for a more engaging learning experience.	P-01, P-04
Badge	Awarding badges as recognition for students' achievement in learning.	P-01
Personalization	Allow students to adjust settings for a more flexible and personalized learning experience.	P-04
Avatar	Represent students within the application to enhance engagement in learning activities.	P-01, R-01
Feedback	Provide immediate response and reviews to make learning more interactive.	R-01
Progress Bar	Visualize student progress and track learning activities.	P-01, R-01

TABLE III. presents the list of gamification elements incorporated into the local language learning application based on the MDA Framework. A total of ten game elements are used in the application. These elements represent game mechanics that are combined together forming a quiz-system game dynamics, including rewards. The incorporation of these elements allows users to experience a range of emotions while interacting with the application. The goal is to ensure that the learning process becomes enjoyable and motivates users to learn local languages consistently.

After identifying the game elements, we can now specify the key features required for the local language learning application based on the identified problems and needs. TABLE IV. illustrates the key features in the application.

TABLE IV. LOCAL LANGUAGE LEARNING APP FEATURES

ID	Feature	Description
F-01	Register	Registering email and password, walking through onboarding process.
F-02	Login	Logging into the application using registered email and password.
F-03	Learning Path	Start local language learning activities.
F-04	Text	Reading various texts in local language.
F-05	Badge and Leaderboard	Viewing collected badge and rankings on the leaderboard
F-06	Mistakes List	Reviewing mistakes made during learning and improving them by practice.
F-07	Vocabularies List	View list of learned vocabularies.
F-08	Regional Script	View list of regional script and practice for each letter.
F-09	Profile	View profile details and statistics.

Based on the identified key features, a total of 21 main pages are developed for the interaction design. Each page incorporates the identified game elements to ensure that the learning experience is engaging and enjoyable.

D. Usability and User Experience Goals

From the feature analysis, usability and user experience goals have been identified to achieve effective design. The primary usability goal is easy to learn aiming to assist students in studying local languages more effortlessly. Three main user experience goals to be achieved in the application are:

- Fun, the application should provide an interactive learning experience to keep students interested.
- Motivating, the design solution should utilize gamification elements to encourage and motivate students to learn local languages.
- Cognitively stimulating, the application should enhance cognitive ability such as focus, memory, and decision-making skills through the learning activities.

IV. IMPLEMENTATION AND EVALUATION

After outlining the features, the next step involves developing the design solution to meet user requirements. This process proceeds through three iterations. The initial iteration focuses on creating a low-fidelity prototype using Figma. Subsequently, the second and third phases involve developing a high-fidelity prototype using React Native. The high-fidelity prototype closely resembles the actual application.

A. Low-Fidelity Prototype

The low-fidelity prototype is designed to give user overview of the application, emphasizing layout, navigation, and the content on each screen. The prototype can be accessed through the link https://bit.ly/PrototypeLoFiTA-LokalLingo. The low-fidelity prototype is evaluated using the Single Ease Question (SEQ) and System Usability Scale (SUS) with five participants. The testing is conducted virtually, where participants shared their screens and used the think-aloud method.

In SEQ, the participants were given twelve tasks: registration, learning level 1, accessing chapter summary, reviewing mistakes, learning level 2, reading text, viewing list of regional scripts, learning regional script, viewing vocabulary lists, viewing user profiles, viewing badge and leaderboard. In SUS, participants were given 10 questions, divided into 5 positive and 5 negative questions.

The results show that the average SEQ score obtained is 6.48 out of 7 and the average SUS is 87.5 out of 100. These score indicates that the low-fidelity prototype is quite good. We also received feedback and suggestions from participants. Feedback mainly highlighted the need for better navigation, with users favoring accordion-style lists instead of showing all information simultaneously. These insights act as a guide for refinements in subsequent iterations of the prototype.

B. High-Fidelity Prototype Iteration 1

The next step is implementing the high-fidelity prototype using React Native. The dominant color used is yellow, complemented by brown and gold, which reflect the traditional culture of the region. In color psychology, yellow is considered a color that can stimulate brain and mental activity and gives an aura of warmth, optimism, and enthusiasm which aligns with the design experience goals that want to be achieved. There are several limitations to the implementation. Firstly, the application uses dummy data. Secondly, it is developed only for mobile platforms. Lastly, the filter and search functionality on the vocabulary list page is not be implemented.

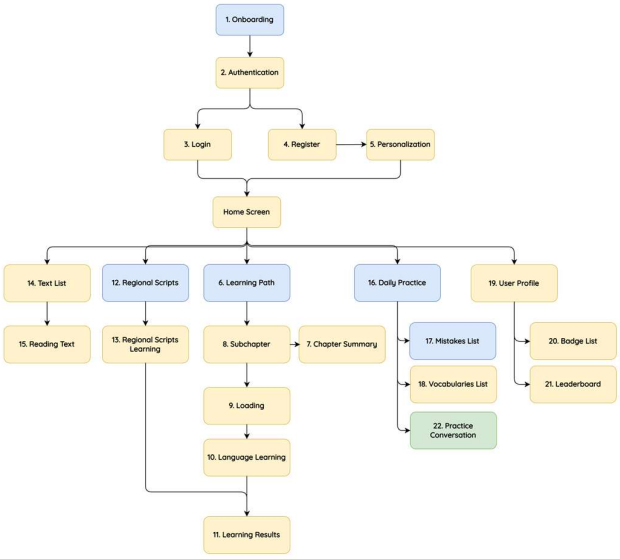

Fig. 1. Flow diragram of the application

Based on the feedback from previous iterations, the high-fidelity prototype incorporates several improvements. Fig. 1 presents the flow diagram of the application, with each box representing a page. Blue boxes indicate design changes from the low-fidelity prototype, while green boxes denote new pages to be added. The changes made from the low-fidelity prototype in the first iteration of the high-fidelity prototype are as follows:

1. Adjusting the colors on onboarding pages to enhance image visibility.
2. Displaying mistakes in an accordion format to ensure better visibility.
3. Adding descriptions to the icons in the navigation bar and changing the daily practice icon from a target to a more intuitive icon, such as a dumbbell.
4. Presenting regional scripts in an accordion format.
5. Introducing new question types for speaking practice.

The first iteration of the high-fidelity prototype is evaluated using the same methods as the low-fidelity prototype. In the SEQ testing, participants were assigned 12 tasks, similar to the previous iteration, with an additional task focusing on new question types for speaking practice. The average SEQ score obtained from this iteration is 6.89 and the average SUS score is 90.5. Based on the testing feedback, users suggested adding a back button in Task 2 (learning level 1) to allow navigation between lessons before proceeding to the quiz. Additionally, in the SEQ evaluations, users gave a low score for questions related to frequency of usage. Upon further investigation, it was found that users prefer having daily quests.

C. High-Fidelity Prototype Iteration 2

Based on the feedback from previous iterations, the second iteration of the high-fidelity prototype includes the following enhancements:

1. Adding a back button to navigate between lessons.
2. Adding daily quest feature

The average SEQ score obtained from the second iteration of the high-fidelity prototype is 6.93, showing an improvement of 0.04 from the previous iteration. The average SUS score is 95, which is an increase of 4.5 from the previous score. This demonstrates that the adjustments made have had a positive impact on the design, contributing to better user experience and usability.

In addition to SEQ and SUS testing, the effectiveness of the gamification design on achieving the user experience goals was also evaluated. The results from the questionnaire given to eight participants indicate that both user experience goals were met. This is proven by an average Likert score of 3.875, with participants agreeing that learning with gamification on mobile devices makes the learning process more enjoyable. Participants also provided positive feedback on the use of gamification elements, stating that these elements contributed to their overall learning experience. The elements that are considered motivating by the users are points, streaks, levels, onboarding, quests, badges, avatars, feedback, progress bars, and personalization. The final prototype APK can be accessed through this link: https://bit.ly/PrototypeHiFiTA_LokalLingo. Below are the details of the final high-fidelity prototype.

Fig. 2. Onboarding high-fidelity prototype

When users first install the application, they are guided through a series of onboarding pages as shown in Fig. 2. This process introduces them to the main features of the application. Onboarding is also one of the gamification elements utilized in the design, helping users become familiar and build their expectations for the app. Then, they are required to login or register to be able to use the application. The gamification elements present on this page include avatars and progress bar. The avatars, which represent students in the app, are chosen from Indonesia's exotic animals.

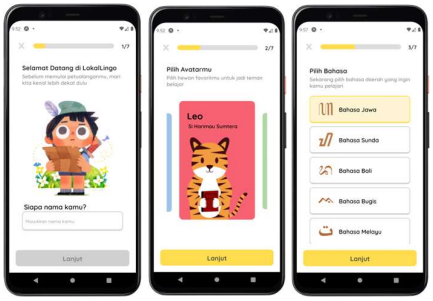

Fig. 3. Personalization high-fidelity prototype

For new users who register, they will be prompted to complete a personalization process consisting of six questions as shown in Fig. 3. This step is designed to identify the user's learning style and personal goals, thereby making the learning experience more customized and tailored to their needs.

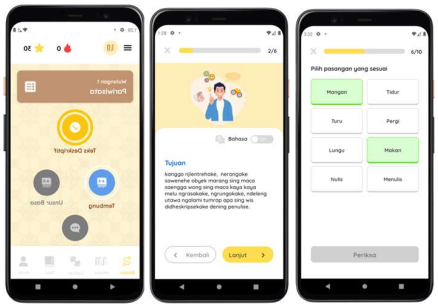

Fig. 4. Learning path high fidelity prototype

Based on the identified problems, users can learn local languages in an interactive, game-like environment. Since the approach is text-based, each chapter focuses on a text and cover key elements such as text structure, vocabulary, grammar, reading, and competency tests, each represented by levels. The material is derived from the Javanese handbook used by children in class, following the 2013 curriculum. Before starting the quiz, there will be a loading page that displays fun facts about Indonesia and its regions to meet user requirements as outlined in TABLE II.

The learning process employs a quiz system and incorporates gamification elements to enhance the learning experience and keep students engaged. The interface of learning path can be seen in Fig. 4. The gamification elements present on this page include points, streaks, progress bar, levels, and feedback systems. These elements make the learning process fun and engaging, demonstrating interactivity and scaffolding as described in the emotional interactive design framework to support the educational application for children [18]. The app also allows users to read stories in the local language, promoting text-based learning from the curriculum.

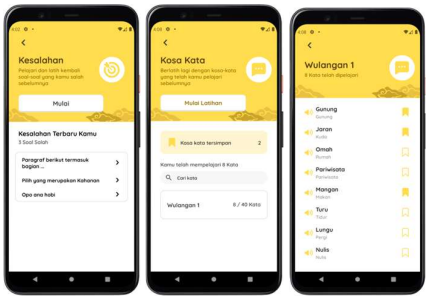

Fig. 5. Mistakes and vocabularies list high-fidelity prototype

Based on the identified user problem of difficulty in understanding, the daily practice feature helps users to review mistakes they made and see vocabularies they have learned. The vocabularies also display translations to Indonesian and provide audio for pronunciation, aiding in better comprehension and learning. Fig. 5 shows the interface of mistakes list and vocabularies list.

Fig. 6. Regional scripts high-fidelity prototype

Based on the identified problem, the app provides a list of regional scripts along with exercises to help students in memorizing each letter of the script, as shown in Fig. 6. Users can hear the pronunciation of each letter and see their progress after practicing the regional scripts. This makes the learning process more interactive and provides immediate feedback, allowing users to stay focused.

Fig. 7. Profile high-fidelity prototype

In the profile page, users can view their statistics. They can also track the badges they have collected and their position on the leaderboard. These elements are designed to enhance user motivation by fostering a sense of competitiveness and accomplishment in their learning journey. The interface of profile page can be seen in Fig. 7. We decided to stop the testing at 2nd iteration of the high-fidelity because, after the second iteration, it was evident that the average SEQ and SUS scores increased with each iteration. Additionally, users expressed satisfaction with the proposed learning design.

To summarize the testing scores from all iterations, the improvements made in SEQ for each iteration are depicted in the line chart shown in Fig. 8. The chart shows an increase of 0.41 from the first to the second iteration and a further increase of 0.04 from the second to the third iteration. This indicates that the changes made were effective and improved the design's usability, thus achieving the usability goal easy to learn. The evaluation of gamification elements also shows that the user experience goals of fun and motivating were achieved, as indicated by an average Likert score of 3.875. Furthermore, the learning process engages students' cognitive abilities such as memory and focus, demonstrating the achievement of the user experience goal of cognitive stimulation throughout their use of the application.

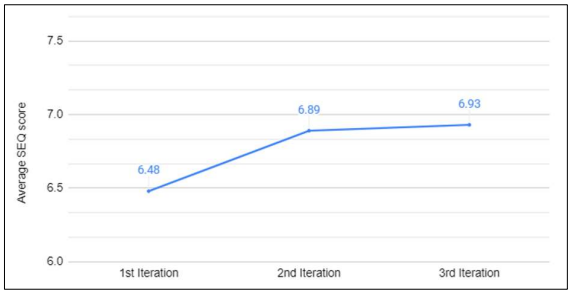

Fig. 8. Average SEQ score from each iteration

The proposed design solution is also applicable to other local languages as long as they have a curriculum designed by Indonesian government. It should also be noted that the design interface is developed for languages with regional script. For languages without regional script, the features that are related to scripts can be removed.

V. CONCLUSION

Based on the evaluation results, we can conclude that the design of the Indonesian local language learning app using the MDA framework, in alignment with the curriculum, has successfully met the specified requirements. The app includes nine main functionalities, as detailed in TABLE IV. It is also proven that incorporating gamification elements significantly impacts student motivation, resulting in a fun and positive learning experience. Key elements contributing to this success include points, streaks, levels, onboarding, quests, badges, avatars, feedback, progress bars, and personalization. The design solution has effectively achieved the usability goal of being "easy to learn" and the user experience goals of being fun, motivating, and cognitively stimulating. This is proven by the increase in average SEQ and SUS scores after each iteration, culminating in an average SEQ score of 6.93 out of 7 and an average SUS score of 95 out of 100 in the final iteration. Additionally, the gamification element evaluation indicates that the use of gamification enhances learning motivation and provides an enjoyable learning experience. These results demonstrate that the design has successfully met user needs.

However, several improvements can still be made in future work. These include implementing the proposed design for other local languages with existing curriculum and extending the testing period, potentially for a semester, to compare the learning outcomes of students in class with those using the application. Additionally, increasing the number of evaluators will generally enhance the objectivity of the evaluations.

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