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Development of the Desa Jago Literasi Digital for Frontier, Outermost, and Disadvantaged Areas

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Abstract

In today's digital era, technology plays a crucial role in bridging gaps in access to information and education, particularly in Indonesia's 3T regions (frontier, remote, and disadvantaged areas). However, limited infrastructure and insufficient access to appropriate technological tools remain persistent challenges. This study aims to develop the DJ LITA device as a practical solution for these communities and to ensure that the product meets the standards of validity, practicality, and effectiveness. The research employs a modified Borg & Gall model integrated with the Multimedia Development Life Cycle (MDLC), resulting in twelve stages of development: research and data collection, concept development, design, material gathering, production, initial testing, product revision, field testing, operational revision, operational testing, final revision, and dissemination. A descriptive approach was used to analyze the development process, validator feedback, and trial results. Given the small and non-random sample, non-parametric statistical methods were applied to align with the characteristics of the data and the research objectives. Black box testing confirmed the technical validity of the device, with no system errors detected. Expert validation further indicated that the DJ LITA 3T digital literacy multimedia application is suitable for use, demonstrated by scores of 88.23% for the programming aspect (very good category), 92.08% for the interface design aspect (very good category), and 91.42% for the user quality aspect (very good category). Practicality testing involving 25 participants in a small group and 30 in a large group yielded an overall practicality score of 96.22%. The effectiveness of the DJ LITA application was evidenced by a 63.38% increase in post-test scores compared to pre-test scores, indicating a moderate level of effectiveness.

Keywords: Disadvantaged, Outermost, Digital, Literacy

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INTRODUCTION

Internet access services and digital services in the era of Society 5.0 have become a primary necessity for humans in carrying out daily routines, whether for individual, group, organizational, or national needs. Indonesia itself has reached a percentage of 79.5% or 221,563,479 internet users out of a total population of 278,696,200 in 2023 (APJII, 2024;) (Kusumastuti & Nuryani, 2020).Equitable development of internet service infrastructure, with around 20.5% of Indonesia's population unable to access the internet due to being in blank spot areas or Leading, Outermost, and Underdeveloped Regions, most of which are spread across several

provinces in eastern Indonesia, such as: West Nusa Tenggara (1 district), East Nusa Tenggara (13 districts), Central Sulawesi (3 districts), Maluku (6 districts), North Maluku (2 districts), West Papua (8 districts), and Papua (22 districts) (Pemerintah Republik Indonesia, 2020;). (Nugroho & Nasionalita, 2020)

Indonesia has the lowest digital literacy rate among ASEAN countries, with its digital literacy level at around 62% compared to the average of 70% in other ASEAN countries. Digital literacy is the ability or skill of an individual to operate, search for, manage, analyze, and evaluate information from various media or platforms (Khoirul Anam, 2023). Digital literacy consists of four competencies, which are: Digital Skills: The ability of individuals to know, understand, and use ICT hardware, software, and digital operating systems.(Ismaul Fitroh et al., 2024; Putri H. B., 2024). Digital Culture: The ability of individuals to read, interpret, adapt, examine, and build national insight, Pancasila values, and Bhinneka Tunggal Ika (Unity in Diversity) in daily life. to the capacity to internalize national identity and values in the digital space (Gunawan A., 2023) Digital Ethics: The ability of individuals to be aware, exemplify, adapt, rationalize, consider, and develop digital ethics governance. Digital Safety: The ability to recognize, categorize, implement, analyze, and enhance awareness of digital safety in daily life (Asnawati et al., 2023;Martin et al., 2023). The issues mentioned above have significant impacts on Indonesian society, particularly in the Frontier, Outermost, and Disadvantaged regions. First, the gap in access to knowledge and information emerges as a major challenge, as identified through online media content analysis (Afrina et al., 2024). Second, the limited quality of education in rural areas continues to hinder the equitable distribution of learning opportunities(Oktaviani & Wibowo, 2023). Third, the inability to adapt to technological advancements affects the effectiveness of implementing e-learning programs in low- and middle-income countries(Manca & Ranieri, 2023). Furthermore, the increasing risks to digital security and the dependency on invalid information create new vulnerabilities in digital literacy(Novitasari & Fauziddin, 2022). Lastly, the obstacles to economic and social development are reflected in the digital literacy index and the sustainability of infrastructure in Riau Province(Hadriana et al., 2024;Elva Diana, 2024).

Based on the issues outlined above, it is crucial to develop a prototype referred to as the DJ LITA (Desa Jago Literasi Digital) device for 3T regions as an effort to accelerate the improvement of ICT services and digital literacy skills for communities in 3T areas. Enhancing digital literacy skills can have a positive impact on the progress of 3T communities across various sectors, namely: 1) Improving Education Quality: Educators, learners, and the general public can utilize the DJ LITA device as a digital-based learning media source(Wulandari Y., 2024). 2) Technological Skill Development: Assisting individuals in developing skills in using software, applications, and digital tools, which are essential for success in the Society 5.0 era workplace. 3) Communication and Collaboration: Facilitating effective communication through digital media or platforms, such as sending short messages and sharing various document formats. 4) Public Health: Supporting public health education and disseminating information on diseases and their prevention(Astuti & Ramadhan, 2024). 5) National Insight: Serving as a medium for the community to enhance understanding and awareness of the importance. Previous research that laid the groundwork for the prototype of the DJ

LITA device to be developed includes: "Implementation of a Mini Intranet Server to Support Islamic Studies Activities for Students at the Baitul Muttaqin Mosque, Polindra," a study that designed a web-based device that can be accessed in a limited area or intranet, with the aim of serving as both a digital study medium and an operational medium for the mosque (Muhammad Anis Al Hilmi et al., 2023).

Development of Android-Based Alphabet Construction Learning Media to Improve Reading Literacy and Digital Literacy," which developed an Android-based application specifically to improve digital literacy skills in the field of education (Nurhikmah et al., 2023). The connection between the studies lies in their shared focus on enhancing digital literacy through the development of digital devices. The difference lies in the approaches and objectives of each development. Previous research emphasized the development of mini-intranet server-based devices for various purposes—some aimed at developing digital media for specific studies, while others focused on creating media-based (Android) devices to improve digital literacy in education. This rationale serves as the foundation for the development of the current device. Furthermore, the DJ LITA device is developed as an application installed on a local server, allowing real-time access within specific areas covered by wireless signals. Users, particularly those in 3T (frontier, outermost, and disadvantaged) regions, can access the application without requiring an internet connection or data packages.

METHODS

The author developed the DJLITA (Desa Jago Literasi Digital) device using a combination of the Research & Development (R&D) method based on the Borg and Gall model(Sukardi, 2021) and the Multimedia Development Life Cycle (MDLC) framework (Wibowo & Pramudito, 2022). The stages of this development model are illustrated in Figure 1, which depicts the adapted combination of the Borg and Gall research and development approach with the MDLC framework.

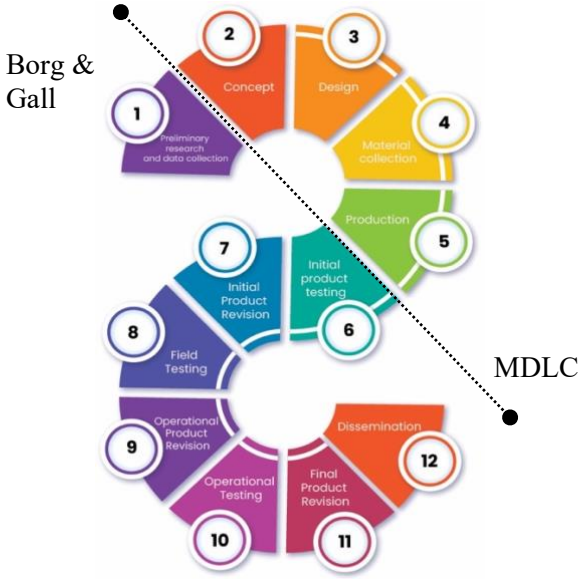

Figure 1. llustration of the Adapted Combination of the Research and Development Model (Borg & Gall) with the Multimedia Development Life Cycle (MDLC)

Research and initial data collection

Research and data are now being gathered through a review of the literature on digital literacy, research methodologies, theoretical studies, and the gap in internet facility development in 3T locations. Information on the restrictions of internet network coverage, population density, area size, and public facilities will be gathered through visits to the research site in Maibo Village Sorong Regency, Southwest Papua Province, and brief interviews. The challenge identified in this study, which is based on the research and information gathered, is how to offer the required modules or content as digital literacy tools that are accessible through an intranet network.

Concept

Planning is the next phase. A proposed research plan containing the development of problem-related expertise, the identification of targets to be met at each stage, and the scheduling of research activities is the result of this stage. deciding on the software to be utilized in the creation of multimedia apps and choosing the hardware to help accomplish the goals of this study. The development of the first product, the third step in the R&D process, comes next.

Design

The results of the analysis and evaluation stage serve as materials used in the design or system design stage as a way to obtain alternative problem-solving solutions that can be proposed in application development. This stage involves modeling for modules, processes, databases, and the flow of the multimedia application to be developed. The evaluation is used for system improvement according to the required conditions.

1. The coding of programs, modules, processes, and data that have been designed in the system design phase is implemented in the form of applications through coding. Program coding is done in a visual language and a SQL-based database. (Structured Query Language).
2. Prototype database, At this stage, a data storage model is developed in the form of a database, which functions not only to store data but also to process it according to the requirements of the program being developed.
3. Design of Templates, Forms, Menus & Reports. This stage is carried out to make proper adjustments so that a structured system (application) and good reports are obtained.
4. Designing network topology as a transmission medium for multimedia learning applications based.

Material collection

The items that follow are needed for the development of the multimedia application: Hardware: 1 server with specifications of core i5, 16 GB RAM, 1 TB hard disk, network devices (RB Mikrotik, access point); Software: Linux Mint, Xampp, Codeigniter Framework, PHP 8, Java Script Chrome; Collection of various video content (culinary, agriculture, livestock, cultivation, etc.); National films; books, journals, and pertinent materials. This step is completed concurrently with the development stage.

Coding

All items or resources used in the development of applications are based on the design stage throughout the production stage. Create fields, sizes, data kinds, and databases. Using the original design as a guide, create the multimedia application interface.

Testing

Conducted after the assembly phase is completed by running the application or program and checking for any errors. This stage is also called the alpha testing stage (Black Box) where the testing is conducted by the creator or the creator's environment itself. This black box consists of testing the application features and testing the markers. The testing of application features involves testing the buttons and displays to see if they are functioning as expected or not. The results are all in accordance with the test scenarios.

Initial Field Trial

After building a product design, testing will be conducted on the existing results. At this stage, consumers or users who are the subjects evaluate the design of the DJLITA device, and then the design is further validated by expert media application validators to identify any shortcomings in the design.

Initial Product Improvement

Product revisions are carried out after receiving evaluations from experts. All input, criticism, suggestions, and recommendations from experts and experienced lecturers are recorded and used as the basis for improving the developed product design. Products that receive validation from validators will have their weaknesses identified, and these weaknesses will subsequently be addressed by improving the design. After the product is revised and receives a good rating or is deemed valid, the developed product can proceed to the next stage, which is product testing.

Field Testing

Testing phase. The field testing phase was carried out after the product underwent revisions and improvements based on validator feedback. This stage aims to evaluate the effectiveness of the developed product. The product can be directly tested once it has been validated and revised by the experts. The results obtained from the field trials serve as a basis for further refinement and enhancement of the media. Any shortcomings identified during the testing process must be addressed to ensure continuous improvement of the product. The product testing was conducted in two stages involving different user groups. The first stage involved the village head as the local authority, along with elementary school teachers who were asked to provide feedback on the feasibility of the multimedia application as a learning tool. Their feedback was used as a consideration for improving the multimedia components before proceeding to the next testing phase. The second stage consisted of field testing with the general public. A small-group trial involving 25 participants was conducted, consisting of 5 teenagers, 5 adults, 5 parents, 5 teachers, and 5 students, selected through purposive sampling. Following

this, a large-group trial involving 30 participants was carried out to obtain a broader understanding of the product's effectiveness and user acceptance.

Operational Product Improvement

Product revisions are made based on the results of initial trials. The results of the field trials provided qualitative information about the developed program or product. Based on that data, is it still necessary to conduct the same evaluation using the same site. This product revision is carried out if, during the product trial with the community, there are still weaknesses that need to be addressed, so that it can later be used to improve the developed product.

Operational Testing

After revising the product and correcting all deficiencies based on the product results, the DJLITA multimedia application was subjected to usage testing by installing the application on the main server and transmitting it using a network topology setup. The application and network tools are run simultaneously to check for any issues, whether it's coding errors or incomplete network installation.

Final Product Improvement

After the multimedia application is running, further revisions are made to both the coding and any other supporting tools that were found during the usage trial.

Mass Production/ Dissemination

At this stage, the DJLITA device has been installed with hardware and software in the Maibo village, Aimas, Sorong Regency, and is now available for use by the community.

RESULTS & DISCUSSION

The results of the development of the DJ LITA 3T Intranet-Based Device include the following steps: needs analysis, design, prototype construction, evaluation (testing), design modification, and dissemination:

1. **Number System Requirements Analysis**

System requirements analysis can be defined as the breakdown of an entire information system into its component parts with the aim of identifying and evaluating problems, opportunities, obstacles that occur, and the expected needs so that they can be aligned with the expectations. There are two needs that must be addressed to produce a quality system, namely functional needs and non-functional needs.

Based on the instrument filled out by 30 respondents from three aspects: equipment needs, digital skills, and digital culture, with a total of 16 indicators, the knowledge or ability scores of the respondents were 8 in the high category and 22 in the medium category, thus it can be concluded that the average knowledge and ability of the community is medium. Of the 3 assessed aspects, the one with the

lowest score is the Equipment Needs Aspect, with a frequency of 0 (none) in the high category, 9 in the medium category, and a total of 21 in the low category. The Digital Skill aspect has 6 high-frequency categories, 0 (none) medium-frequency categories, and 24 low-frequency categories, while the digital culture aspect has 27 respondents in the high-frequency category, 3 in the medium-frequency category, and 0 (none) in the low-frequency category.

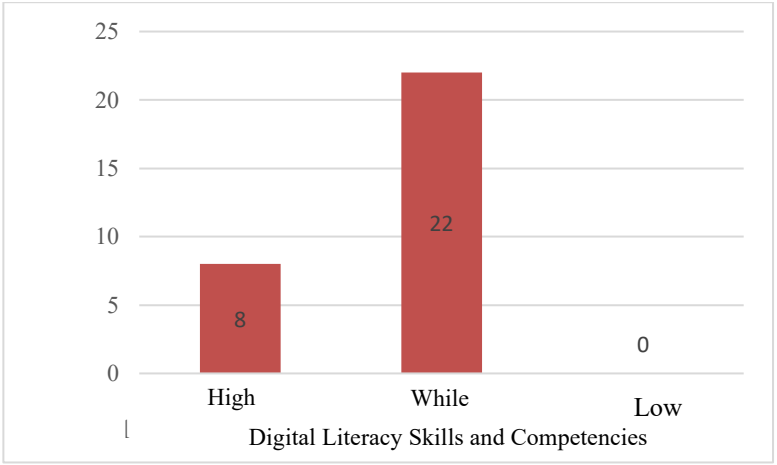

Figure 2. Results of the Functional Requirements Analysis of the System

2. Design

System design conducted includes context diagrams, DFD, flowchart, use cases, database, and interface.

a. Context Diagram

Context diagrams are created using notations to show how data flows from the application without taking into account the data's physical environment. They are also independent of data structures, software, and hardware.

Figure 3. Context Diagram

Figure 3 illustrates the access of admins and users (local government, employees, teachers, students, and the general public) in a reciprocal relationship, where admins log into the DJLITA system through a login process by entering a username and password to access all menus, content, and perform functions as admins such as create, read, update, and delete. Users are also required to create an account and log in using their user (phone number) and password that have been created previously to access the available features. The context diagram aims to explain the overall flow

of the system and can be further elaborated on in the Data Flow Diagram (DFD).

b. Flowchahrt

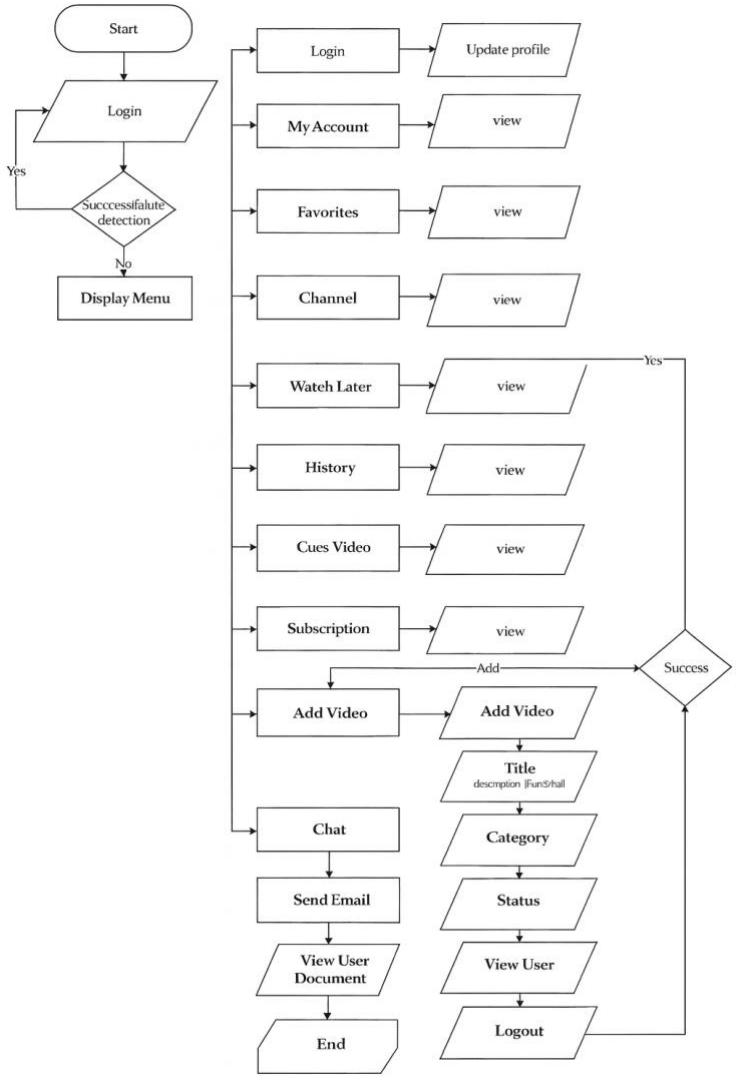

Figure 4. Flowchart User

The flowchart illustrates the workflow of DJ LITA, starting with the user login and authentication process. Once successfully logged in, users are directed to the main menu, which offers features such as account management, access to the homepage, channels, topics, history, videos, comments, and subscriptions. Users can also upload videos by submitting files along with relevant information such as the title, topic, summary, description, and tags before saving them. In addition, the platform includes social interaction features like chat, contact search, adding friends, and sending messages or documents.

c. Use case diagram

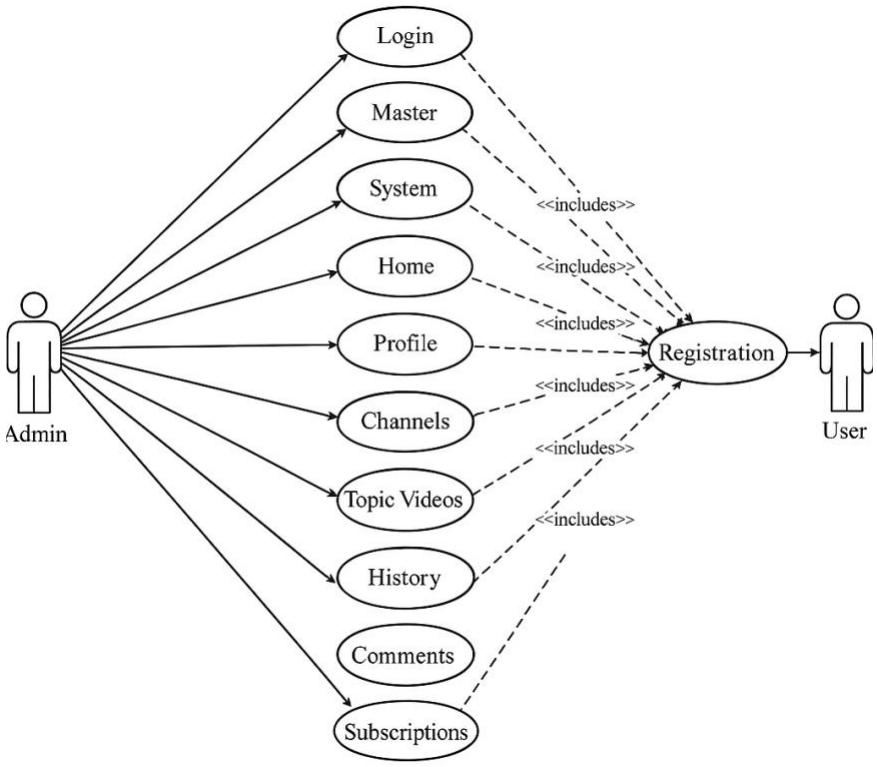

Figure 5. Use case diagram

The use case diagram illustrates the interaction between two main actors: Admin and User, within the DJ LITA platform. The Admin has full access to all features, including login, master data management, system settings, homepage, profile, channels, topic collections, history, videos, comments, subscriptions, video uploads, and chat. Meanwhile, the User can register and access all the main features through *include* relationships, indicating that these features are part of the registration process or general system usage. This diagram highlights the Admin's role as the system manager and the User's role as a limited-access participant.

d. Database Design

Entity Relationship Diagram (ERD) of the DJ LITA system, illustrating the relationships between the main database tables. The m_creator table stores information about content creators and is linked to the m_video table, which contains details of uploaded videos. Each video is categorized under a specific topic from the m_topic table. Users can interact with the platform by subscribing (tk_subscribe), viewing video history (tk_history), liking videos (m_like), and leaving comments (m_comment). The system also supports chat functionality through the m_chat table, which stores messages, and the m_room table, which

defines chat rooms between users. All entities are interconnected to support the platform's core features, such as educational video sharing, user interaction, and activity tracking.

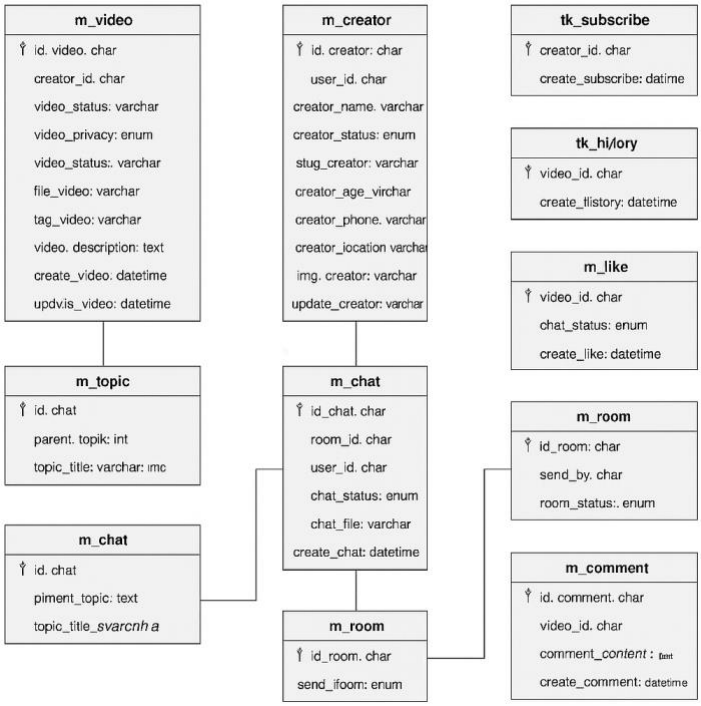

Figure 6. Database Design

e. Interface

The interface design was developed based on the needs of both users and administrators. The user interface includes features such as registration, login page, homepage, channels, history, your videos, discussion videos, comments, subscriptions, and chat each illustrated through a storyboard. The storyboard serves as a tool to visually represent the system's layout and functionality, ensuring that the DJLITA 3T Device interface is created in accordance with user requirements.

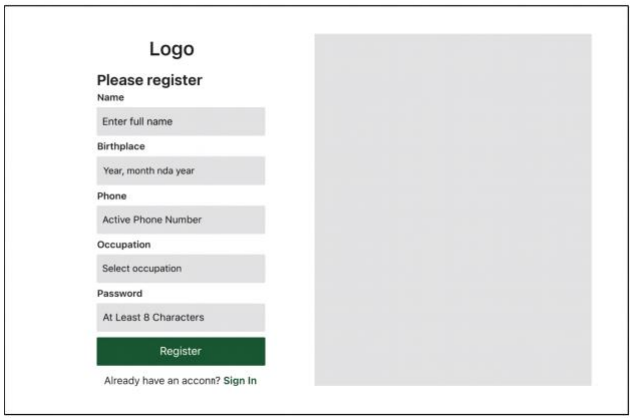

Figure 7. Storyboard of the Registration Form

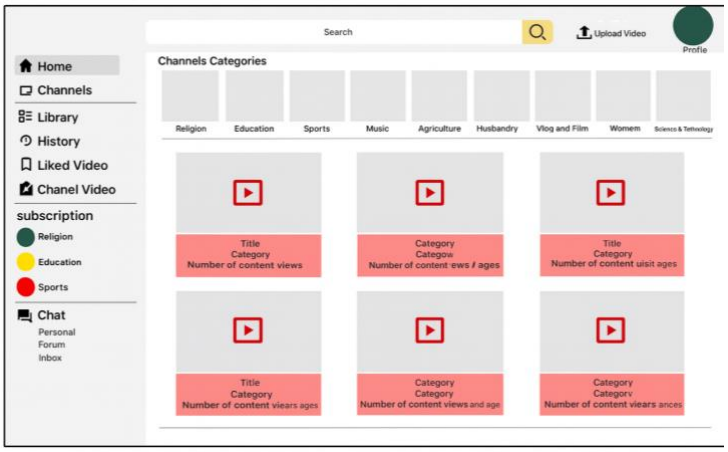

Figure 8. Storyboard of the Home Menu

3. Building Prototype

The prototype was created based on the interface design and database that were developed based on the analysis of the DJLITA 3T device requirements as follows:

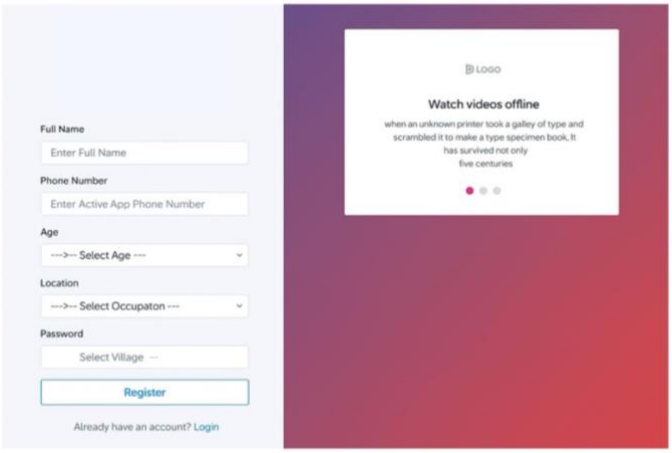

Figure 9. Login page

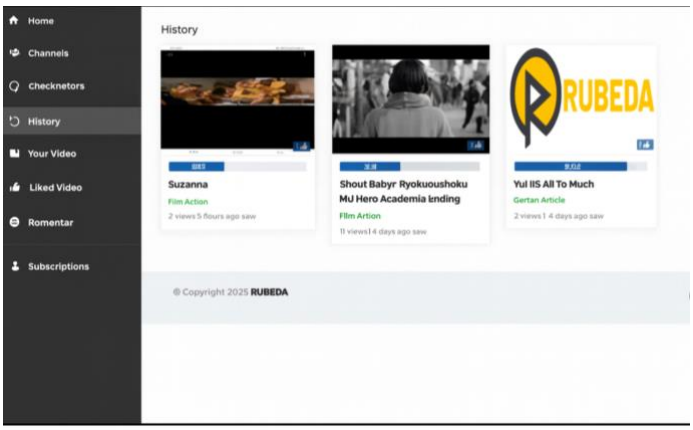

Figure 10. History page

4. Test results

The initial trial of the DJ LITA device used blackbox testing conducted independently by the researchers, where the input and output were tested for their conformity, followed by application performance testing, media transmission speed testing, instrument testing, expert validation testing, and small group trials. Next, large group testing will be conducted after making initial product improvements.

a. Blackbox Testing

Constructing Prototypes Blackbox testing is a functional test that tests use cases or inputs and outputs to see if the application functions as intended. The system's blackbox testing is separated into two user levels: administrator and user. The following table 1 lists the menu or features that were tested on the DJ LITA device: type.

Table 1. Results of the Blackbox Testing of the DJ LITA Device

No	Application Module Testing	Number of Test Case Items	Test Results
1	Internet network (Application Transmission Media)	5	Appropriate
2	Menu and account registration form	16	Appropriate
3	Menu and login form	4	Appropriate
4	Menu to search for content	3	Appropriate
5	User profile menu	13	Appropriate
6	Upload Content menu	8	Appropriate
7	Sidebar menu	38	Appropriate
8	Chat menu	12	Appropriate

All menus and procedures or steps included in the DJ LITA device application have worked as intended, according to independent system testing utilizing the black box approach. This means that the system is ready to go on to the first testing phase (expert validation).

b. Testing by programming and media experts by evaluating the program aspects, display aspects, and user aspects. Here are the evaluation results from programming and media experts:

1) Results of the Program Aspect Assessment. The software indicator has an average of 3.70 and a percentage of 92.50%, falling into the very good category. The practical indicator has an average of 3.5 and a percentage of 87.5%, also falling into the very good category. The effective indicator has an average of 3.67 and a percentage of 91.7%, again falling into the very good category. The manual book indicator has an average of 3.25 and a percentage of 81.2%, falling into the good category. Below is Figure 6.1, the program aspect assessment graph.

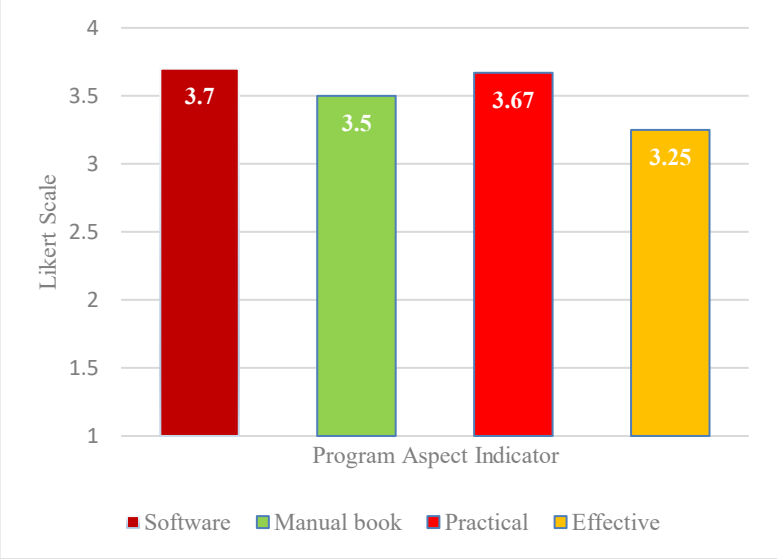

Figure 11. Program Aspect Evaluation Chart

2) The Program Aspect consists of four indicators, each divided into several items used to measure the application that has been developed. These four indicators are: (a) the Software indicator, consisting of 5 items; (b) the Practicality indicator, consisting of 5 items; (c) the Effectiveness indicator, consisting of 3 items; and (d) the Manual Book indicator, consisting of 9 items. The assessment is conducted on the entire system and all features contained in the content. A summary of the media expert's assessment is shown in the following image:

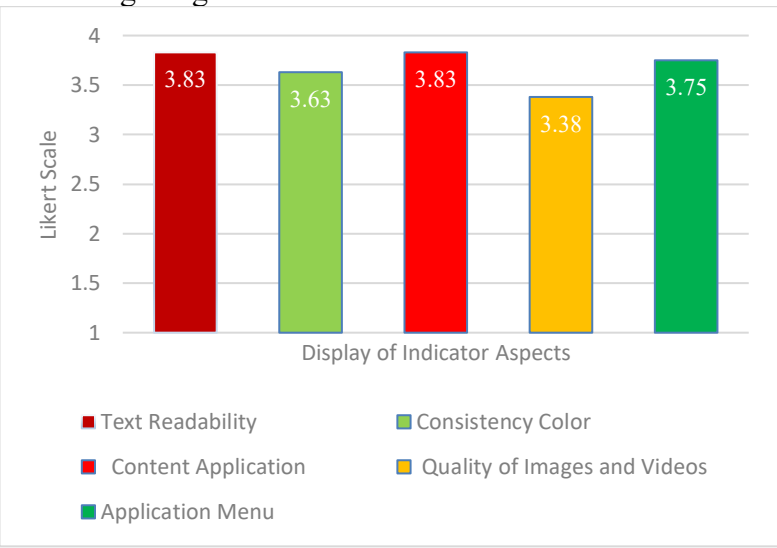

Figure 12. Evaluation Aspect Graph Display aspect

The bar chart presents the evaluation results of five display indicator aspects within the application, assessed using a four-point Likert scale. The findings show that all indicators fall within the

good to very good categories. Text Readability achieved the highest mean score of 3.83 (95.75%), indicating excellent clarity and legibility of the text. Consistency Color scored 3.63 (90.75%), demonstrating very good visual coherence across the application's color scheme. The Content Application aspect also obtained a mean of 3.83 (95.75%), reflecting its high relevance and well-structured presentation. Meanwhile, the Quality of Images and Videos received a mean score of 3.38 (84.50%), categorized as good, suggesting adequate visual quality with potential for further improvement. The Application Menu scored 3.75 (93.75%), indicating very good navigability and ease of use. Overall, these results demonstrate that the application's visual components are well-received by users and perform at a consistently high level.

3) User Aspects, consisting of 3 Aspects including: (a) Application Aspect which consists of 25 items divided into ease of use, reliability, response time, flexibility, and security, (b) Information Quality consists of 9 items divided into three components or indicators: completeness, format information, and relevance information, and (c) Application Usage Aspect consists of 1 component or item, which is user satisfaction.

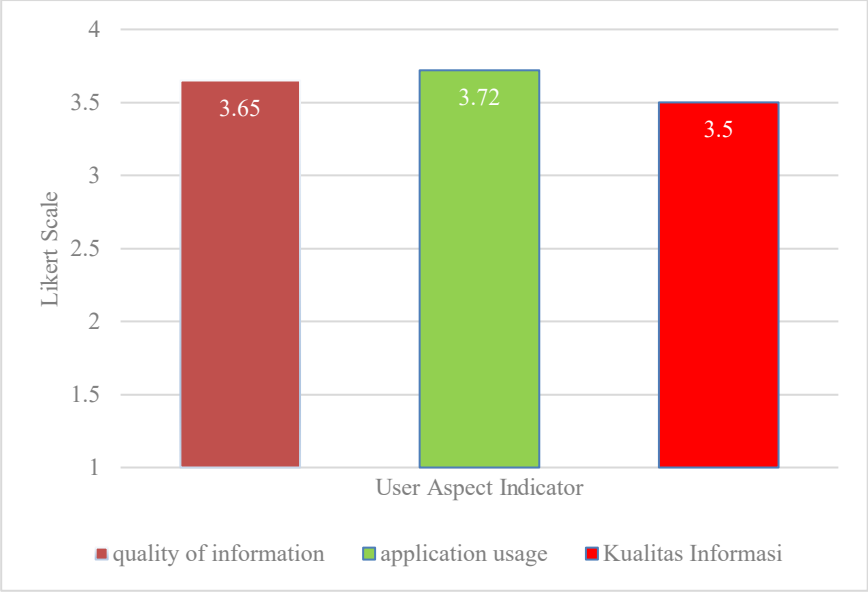

Figure 13. User Aspect Evaluation Graph

c. User Testing

Based on the validation results that have been conducted, all aspects have met the validation standards with an average score of 3.83 and 97.51% in the very good category from all indicators in the user aspect, making it suitable for testing on a large group. The average score of the user aspect evaluation in the small group trial can be seen in the figure below:

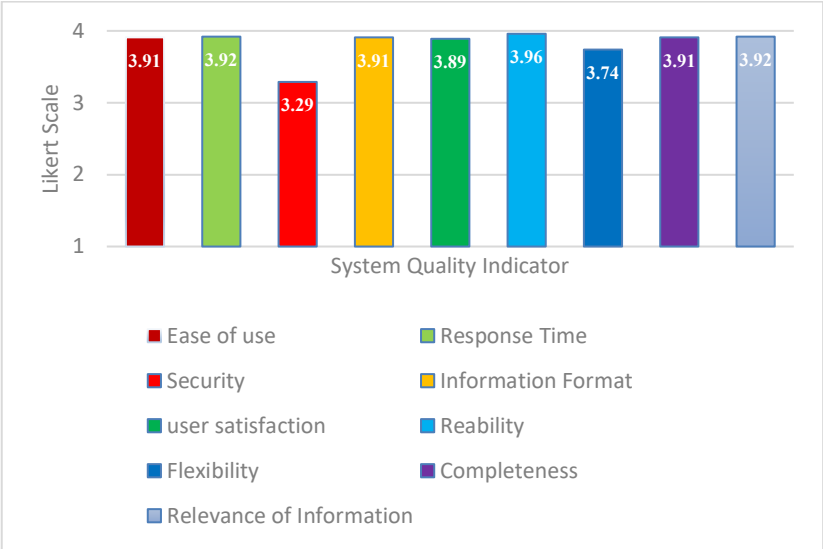

Figure 14. User testing graph

While the development process and user testing of the DJ LITA device show promising results, a deeper analysis is necessary to contextualize its contribution within the broader landscape of digital literacy initiatives. When compared to previous works such as the *Mini Intranet Server for Islamic Studies* (Hilmi et al., 2023) and the *Android-based Alphabet Construction Media* the DJ LITA device introduces a more comprehensive approach that integrates both hardware and software solutions, designed specifically for offline environments in 3T regions. Unlike Android-based application, which relies heavily on individual smartphones and internet access, DJ LITA functions through a local server with wireless intranet coverage—making it a more inclusive and reliable option in areas with limited or no internet connectivity. Additionally, DJ LITA's platform not only facilitates access to educational content but also empowers users to create, upload, and interact with content, encouraging user participation and collaboration.

Moreover, literature highlights the importance of tailoring digital literacy efforts to align with local cultural and national values (Sutianah & Sobandi, 2022; Tomczyk, 2020b). DJ LITA addresses this through its integration of national films, local knowledge content, and values-based discussions, thereby reinforcing digital culture and ethics—two of the four key pillars of digital literacy(Becker et al., 2023). Given Indonesia's current digital literacy index reported as the lowest among ASEAN countries at 62% (Khoirul Anam, 2023)the development of DJ LITA stands as a timely and strategic response. Its focus on functionality without internet dependency, usability by diverse user groups, and the promotion of digital values places it as a unique and contextually appropriate innovation for marginalized communities. In contrast to mainstream digital platforms that often follow a top-down dissemination model, DJ LITA adopts a bottom-up, community-based development process. This aligns with's call for digital systems that are ethical, inclusive, and adaptable to specific social contexts. Therefore, DJ LITA not only fulfills technical and usability standards but also addresses broader educational and socio-cultural goals in Indonesia's disadvantaged regions.

CONCLUSION

Based on the results of development, testing, and implementation, it can generally be concluded that the DJ LITA device is suitable for implementation as a medium to support the development of knowledge and digital literacy skills in 3T areas (underdeveloped, frontier, and outermost).This research has produced the DJ LITA (Digital Literacy Champion Village) device in 3T areas based on intranet as a medium that can be used to enhance knowledge of digital literacy culture and digital skills without cost for the people of Kampung Maibo, Southwest Papua, and other Indonesian communities in 3T areas. DJ LITA 3T is equipped with a menu that supports the enhancement of digital skills such as: a) the process of connecting devices with intranet connectivity; b) the process of user account registration; c) the process of searching for content according to needs; d) creating and uploading content; e) conversations, sending text messages, sending images, documents, and using emojis; f) providing feedback on other users' content by liking, unliking, commenting, following, and unfollowing.

Meanwhile, the menu to enhance digital culture knowledge offers a selection of national categories that include a collection of videos/contents such as films about the struggle for Indonesia's independence, interfaith tolerance content, and national insight content.

The DJ LITA has met the following criteria: a) The DJ LITA device can be concluded to meet the validity criteria based on the results of the alpha test using blackbox testing, with no functional errors or violations of the specified menu rules found. b) The results of expert validation state that the DJ LITA digital literacy movement multimedia application is suitable for use based on the assessment results of the programming aspect with a score of 88.23% in the very good category, the display aspect 92.08% in the very good category, and the user aspect of application quality 91.42% in the very good category. c) Small group trials and large group trials provided a quantitative assessment that the DJ LITA multimedia application has been practically used with a percentage of 97.51% in the very practical category, while its effectiveness demonstrated a significant improvement in users' knowledge and skills, with a percentage increase of 63.38%, classified as a moderate level of effectiveness.

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