




CLAYmb: The Development and Assessment of an Interactive Learning Application for Pottery Making

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Abstract:

This study aimed to design and develop an interactive learning application called CLAYmb, utilizing the phases of the SDLC, and evaluated its technical and quality aspects using ISO 25010 software standards. The study utilized a developmental research design, with IT experts and end-users as respondents, and the results demonstrated that the SDLC model was suitable for developing the system, and the respondents highly accepted it. The study's recommendations include conducting further research to evaluate the long-term effectiveness of CLAYmb, involving a more diverse set of respondents, and improving the system's usability through user testing and feedback analysis. Valuable insights into the development

and evaluation of interactive learning applications using SDLC and ISO 25010 software standards are presented in this study. It emphasizes the significance of involving users in the design and development process and underscores the need for continuous evaluation and enhancement of such systems. These findings can serve as a basis for improving the technical quality and quality of using interactive learning applications in the future.

Keywords: *assessment, CLAYmb, development, interactive learning, pottery making.*

Introduction

The Filipino culture has a rich history of using pottery, including ceramic jars that were part of livelihood during the pre-colonial period (Geronimo, 2018). Initially, pottery was used for holding the deceased, but later, it was used for various purposes like food vessels, water jars, stoves, flowerpots, decorative items, and other tools (Torres, 2021). Despite the changes in the market, the pottery industry has thrived. However, the COVID-19 pandemic has significantly impacted the industry, including clay art therapy (CAT), which was crucial in

treating depression and strengthening emotionality rating (Normal, 2021).

The pandemic has caused severe damage to the clay industry, which may take years to recover. Many businesses may remain closed, depriving Cabanatuan citizens of employment. Intensive publication using interactive applications can provide knowledge of the clay industry to everyone with web-based devices. To continue thriving in the digital age, the clay industry must step up and promote its businesses on different platforms. This will not only provide jobs but also preserve Filipino culture, which can have a positive impact on tourism in the city.



Publicizing clay-related industries will lead to the creation of more businesses related to clay and eventually create jobs for Cabanatuan citizens involved in creative industries.

The CLAYmb interactive learning application aims to teach users how to cultivate clay, turn it into productive tools, ceramic wares, and art, and promote culture and arts. The web-based interactive learning application will use illustrations and tutorials to provide users with a blueprint on how to start a clay business, the necessary equipment, and its proper usage. Clay-related arts and clay art therapy will provide users with a fresh perspective on what dirt can do. The application is intended to be used by as many Cabanatuan citizens as possible and accessible on any web-based device to bring the clay industry to everyone.

The Potential of Interactive Technologies in Education

Interactive learning applications have become an essential element for successful e-learning, allowing for communication, storing and transferring information, audio-visual media use and production, and knowledge sharing in the education sector (Violante & Vezzetti, 2017). With the increasing role of technology in education, it has expanded its application from a mere tool of study and inquiry to an integrated approach in education (Tuma, 2021). One area where technology has demonstrated great potential is in the use of Augmented Reality (AR) in education. Although research on AR is growing, there have been few studies on its application in the education field. AR has shown to be useful in various educational fields, providing an effective way to visualize models that require visualization, supporting seamless interaction between real and virtual environments, and allowing a tangible interface metaphor for object manipulation (Singhal et al., 2012).

The incorporation of Virtual Reality (VR) in pottery making in technology education was found to enhance students' practical and creative abilities, cognitive engagement, and behavioral, emotional, and social engagement compared to traditional paper-and-pencil approaches (Guan

et al., 2021). Incorporating interactive technologies such as AR and VR in education could lead to more engaging and effective learning experiences for students. Despite the challenges, various researchers have recognized the potential of virtual reality technology in the study and implementation of pottery (Xie et al., 2020). To this end, Chiang, Chang, and Chang (2018) presented a pottery-making training system focused on teaching fundamental knowledge and practical techniques in a virtual-reality environment. Additionally, Pottery Go, a virtual reality-based pottery system, has demonstrated the effectiveness of assisting beginners with learning the gestures used in pottery-making (Murahashi, 2013). Furthermore, the use of immersive technologies such as virtual environments and augmented reality has shown clear potential to support the public's experience of cultural heritage, complementing current tools and practices based on tangible goods such as museums, exhibitions, books, and visual content (Mortara et al., 2014).

Exploring the Significance of Interactive Learning in Pottery Making and Preservation

Maripipi pottery, once widely distributed to several islands in the central Philippines and coastal settlements of eastern Mindanao, was among the least known to anthropologists. However, the rise of the porcelain era led to the decline of Kalinga pottery-making's popularity and practice. Talibon pottery operation, as observed by Pobar, Pateña and Gentallan (2017), was slow to improve due to limited capital and facilities. To address this, Geronimo (2018) emphasized the need for free training and workshops, while Mahbib (2012) suggested using interactive learning to enhance pottery-making skills.

In pottery-art teaching, Zhang argued in 2016 that following professional teaching content and method was impossible and that training objectives and students' unique features should be considered instead (Zhang, 2016). Addressing student absenteeism, Heath (2017) highlighted the challenges that arise, particularly in courses

designed for whole-group instruction and frequent teacher feedback. A study by Zhang (2016) explored whether adding interactive video modules of key pottery demonstrations to traditional classroom instruction would mitigate the negative effects of absenteeism. Azizov, Azizov, and Boboeva, (2019) emphasized the use of didactic materials and modern technical teaching aids to make teachers more competitive.

Despite the scarcity of learning materials and weak written responses from potters noted by Gogerty (2019), informative interviews provided contrasting views on the interpretation of the production potter's position in the art. In conclusion, interactive learning can not only preserve culture but also improve cognitive processes, and using alternative materials during pottery-making can carry the message implied by the researchers, reintroducing the industry from a different perspective and educational method.

Statement of the Problem

This study aimed to design and develop an interactive learning application called CLAYmb. Specifically, it sought to describe the following:

- 1) How may the interactive learning application be developed based on phases of Software Development Lifecycle which include;
 - a. Planning;
 - b. Analysis;
 - c. Design;
 - d. Coding;
 - e. Testing;
 - f. Implementation; and
 - g. Maintenance?
- 2) How may the IT experts assess the system based on ISO 25010 standards in terms of
 - a. Functional Suitability;
 - b. Performance Efficiency;
 - c. Compatibility;
 - d. Usability;

- e. Reliability;
- f. Security;
- g. Maintainability and
- h. Portability?
- 3) How may the end-users assess the system based on quality of use in terms of
 - a. Functional Suitability;
 - b. Reliability; and
 - c. Usability?

Materials and Methods

In this study, developmental research design was utilized to develop the Claymb System. Developmental research design is a type of inquiry used in the instructional design and technology field to create knowledge, validate existing practices, and develop new products and processes. It is an ideal design for assessing changes over an extended period of time, and given that this research was focused on constructing and evaluating a system, it was the most suitable approach to employ.

At Cabanatuan City, Philippines, the study was carried out by the researchers who identified the respondents using purposive sampling technique. The study involved two sets of participants, namely IT experts and end-users, who were intentionally selected by the researchers. Table 1 displays the frequency and percentage distribution of the respondents in the study.

Table 1. Distribution of Respondents

Type of Respondents	Frequency	Percentage
IT Experts	15	50.00%
End-Users	15	50.00%
Total	30	100.00%

To evaluate the technical features and quality of the system, the researchers adapted two sets of instruments obtained from existing sources, but they modified them to suit the context of the

study. Prior to data collection, informed consent was sought from the respondents, and all necessary details regarding the project were provided. The instrument was then administered via Google Forms. The data collected were treated with utmost care, confidentiality, and anonymity and were used exclusively for this study.

In order to address the research problems, the researchers employed several data analysis techniques. They adhered to the stages of SDLC, as outlined in the first problem statement, to design and develop the system. The technical aspect of the system was evaluated by IT experts, who computed the mean rating of their assessment. The researchers used the scoring guide presented in Table 2a and 2b to analyze the data and address the third research problem.

Table 2a. Scoring Range and Verbal Interpretation

Range	Functional Suitability	Performance Efficiency	Compatibility	Usability
3.26 – 4.00	Very Functional	Very Efficient	Very Compatible	Very Usable
2.56 – 3.25	Functional	Efficient	Compatible	Usable
1.76 – 2.50	Needs Improvement	Needs Improvement	Needs Improvement	Needs Improvement
1.00 – 1.75	Poor	Poor	Poor	Poor

Table 2b. Scoring Range and Verbal Interpretation

Range	Reliability	Security	Maintainability	Portability	Acceptability
3.26 – 4.00	Very Reliable	Very Secured	Very Maintainable	Very Portable	Very Acceptable
2.56 – 3.25	Reliable	Secured	Maintainable	Portable	Acceptable
1.76 – 2.50	Needs Improvement	Needs Improvement	Needs Improvement	Needs Improvement	Slightly Acceptable
1.00 – 1.75	Poor	Poor	Poor	Poor	Not Acceptable

Results and Discussion

The Design and Development of the System based on the stages of the SDLC

1) Planning Phase

In this phase, the primary objective was to create a solid plan for constructing the developed system, which involved identifying how it was developed, its scope, and its functionality. Brainstorming was necessary to generate an excellent plan for ensuring that the developed system adhered to the processes involved and solved the problems encountered by the Pottery Industry. The researcher created a Gantt chart of the SDLC activities to guide the construction of the developed system.

2) Analysis Phase

During the analysis phase of the SDLC, the researcher gathered, understood, and documented the business requirements. In this phase, the researcher collected information, gathered data, and reviewed related literature to generate ideas for building the system. To fully comprehend and analyze the significant activities and processes involved in the developed system, the researcher created various process diagrams. A process diagram graphically represents the processes that capture, manipulate, store, and distribute information between a system and its environment. A data flow diagram (DFD) illustrated the movement of information between external entities and the processes and data stores within the system, while a use-case scenario diagram presented the activities and

their relationship to every external entity in the system. Figure 1 presents the context diagram.

Figure 2 presents the use-case diagram developed system containing the actors and the functional requirements of the developed system.

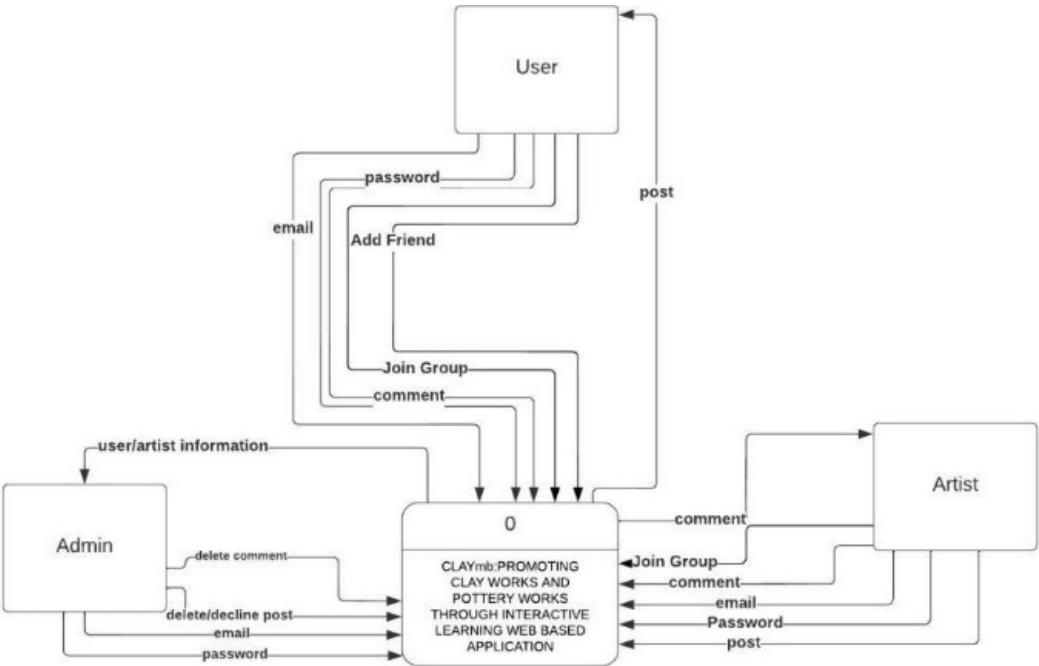


Figure 1. Context Diagram

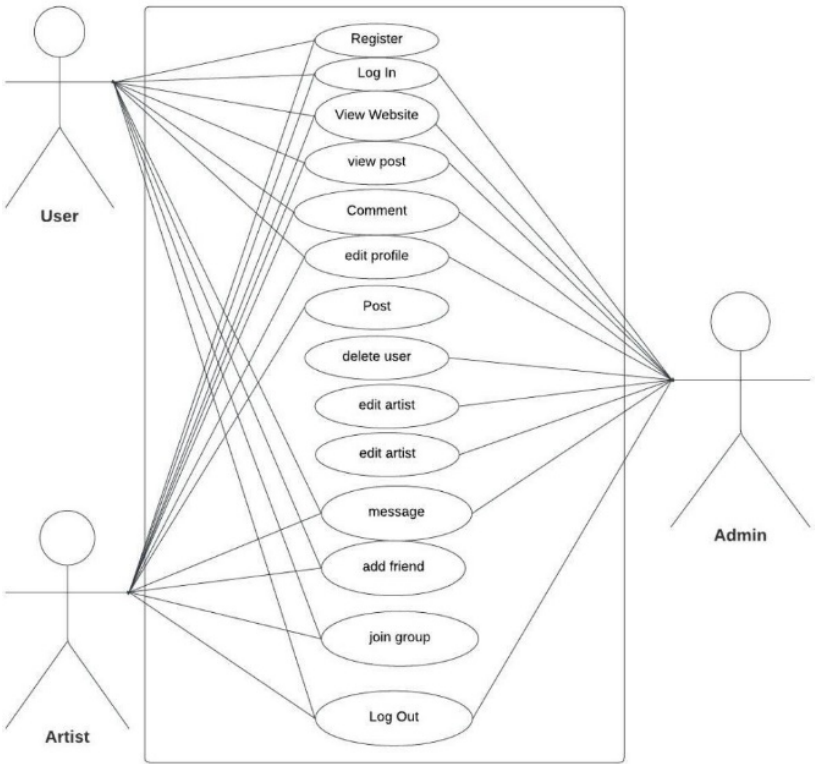


Figure 2. Use-Case Diagram

3) Design Phase

In the design phase, the researchers designed the necessary components of the system and utilized the appropriate tools. An Entity-Relationship

(ER) diagram is a graphical representation of entities and their relationships to each other. It is a powerful tool used in software engineering, database design, and business analysis to model the structure and relationships of data.

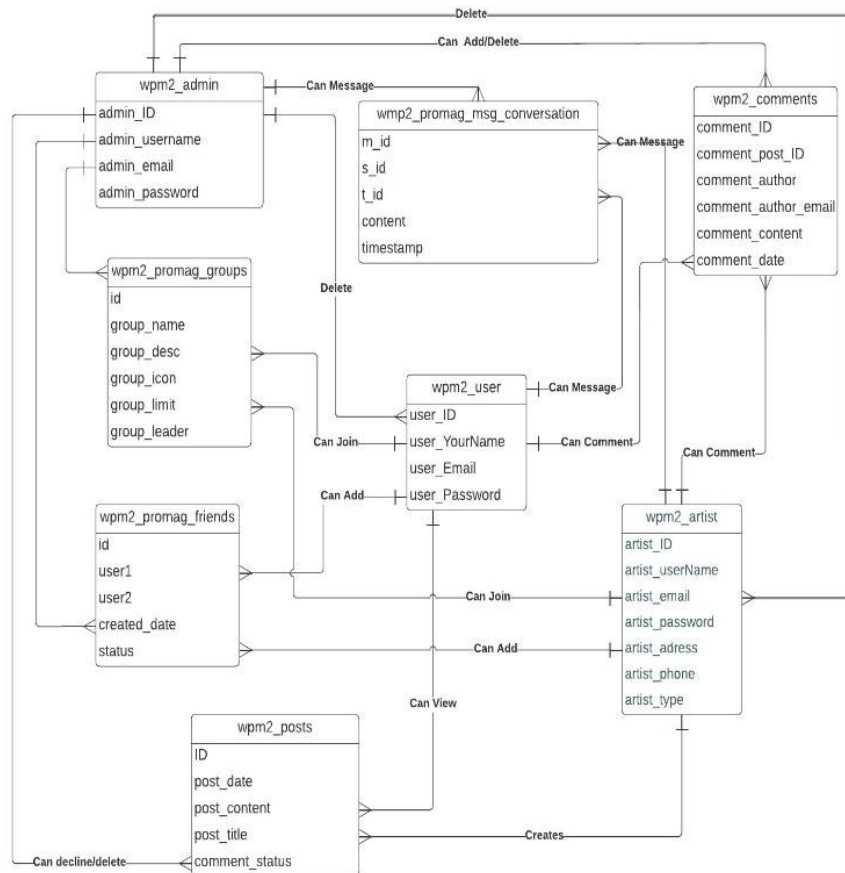


Figure 3. Entity-Relationship Diagram

4) Coding Phase

During the coding phase, the researchers employed a variety of applications or software to configure and build the Claymb System. They connected the system's database using Apache and MySQL, both running in the Web Host Control Panel. Additionally, the researchers utilized the Visual Studio Code text editor, which they used with PHP, CSS, and JavaScript to help or contribute to the design of user interfaces.

5) Testing Phase

During the testing phase, the researchers employed a prototyping technique to confirm that the system was functioning correctly. They opened the system on both a PC and a smartphone to test its performance on both platforms. They successfully completed the design of the system's user interface and implemented the established designs. All the basic UI components were used correctly and performed their intended functions. The system was straightforward and easy to use, and it met users' expectations.

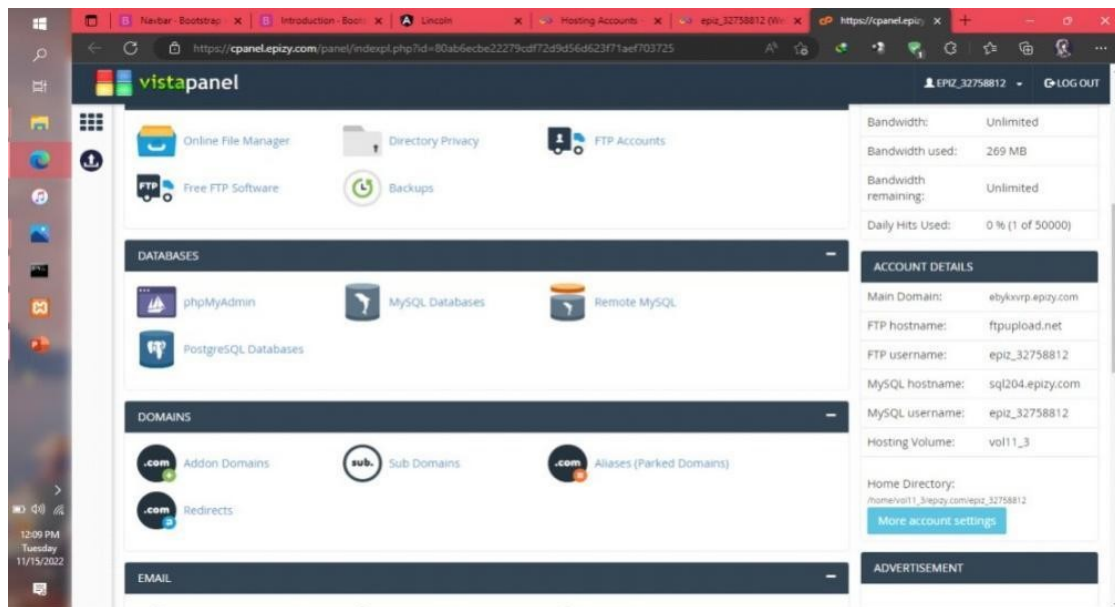


Figure 4. Web-Host Control Panel Dashboard

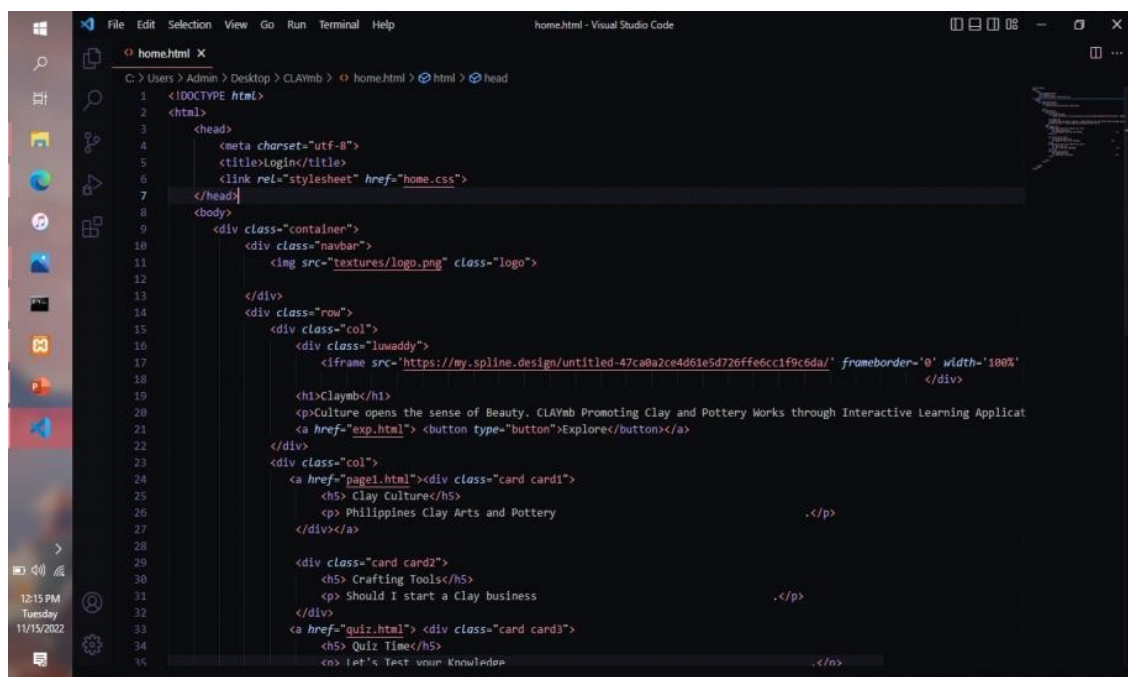


Figure 5. Sublime Text Editor

6) Implementation Phase

During the implementation phase, the researchers determined whether the system was functioning properly. They installed the system on a standalone PC and used it as the Claymb System's database server and operating system.

They successfully designed the system's user interface, and then implemented the established designs. They utilized all fundamental UI elements correctly and made sure they served their intended functions. Users were able to

operate the system simply and smoothly, which fulfilled their expectations.

7) Maintenance Phase

In this stage, the researchers intended to carry out various activities such as preventive, adaptive, corrective, and perfective software maintenance. During preventive maintenance, the researchers attempted to test the security of the UI for the safety of the users' information. In Corrective Maintenance, the researchers checked the UI to see if there was anything wrong with the system every little detail, and the

result was quite well. Adaptive Software Maintenance could be easily updated to any computer the researchers wanted because they used WordPress for their UI, so they could easily manipulate everything in their system anywhere as long as they were connected on a wireless fidelity. In the last phase of maintenance, which was Perfective Software Maintenance, the researchers polished or improved their UI for the users. Overall, the researchers performed the operations for maintainability and did them gradually every 1 to 2 weeks.

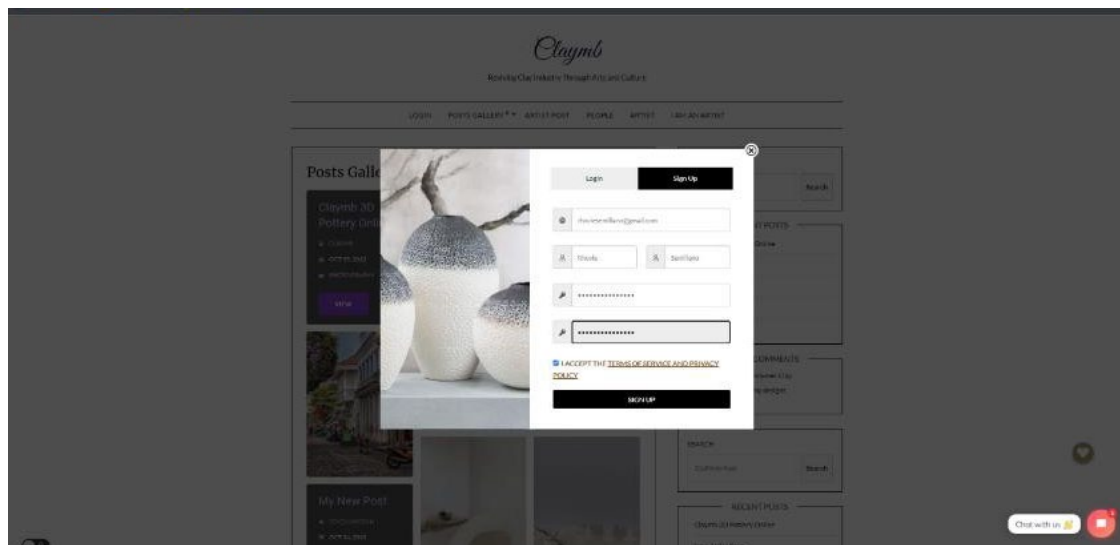


Figure 6. Sample Log-In Form of the System

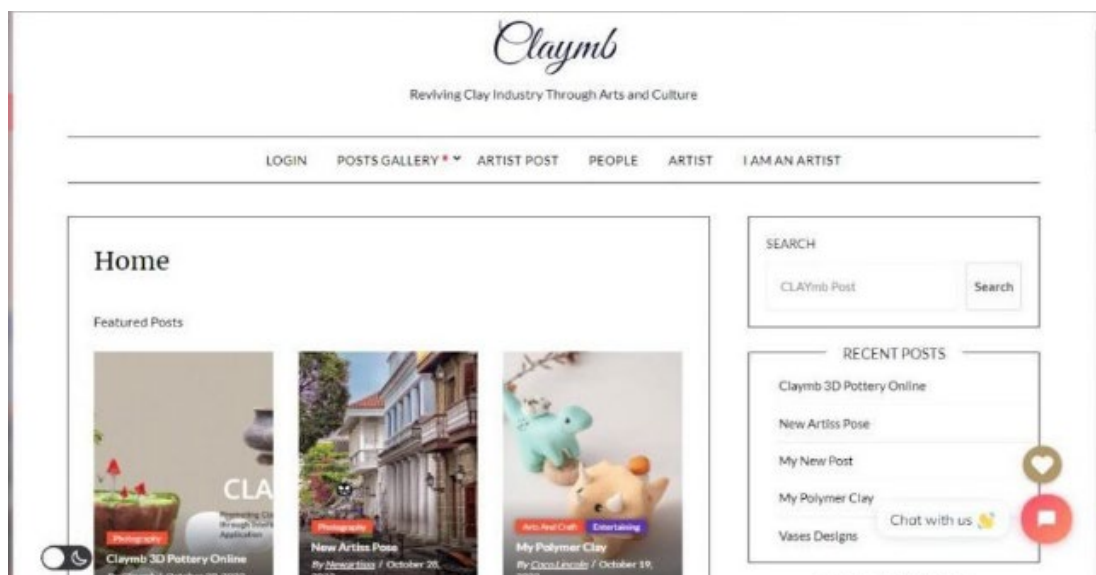


Figure 7. Dashboard of the System

The Assessment on the Technical Features of the System by the IT Experts

IT experts assessed the technical features of the system, which this section discusses. This assessment played a crucial role in the software system's development as it involved evaluating the system's technical aspects to ensure functionality and efficiency. Based on the ISO 25010 software standards, the experts reviewed

and tested the system's technical features. The primary objective of the assessment was to provide valuable feedback to the development team, allowing them to enhance the system's overall performance and reliability. The section also highlights the process of evaluating the system's technical features and emphasizes the significant role of IT experts in this process. Table 3 presents the assessment results.

The image shows a web form titled "Wall Post" for creating a new post. It includes input fields for "YOUR URL" (with a placeholder "http://facebook.com/23456789"), "POST TITLE" (with a placeholder "Claym"), and "POST CATEGORY" (with a dropdown menu showing "Arts and Crafts"). The "POST CONTENT" field contains a sample text about handicrafts. Below the text field is an "UPLOAD AN IMAGE" section with a "Choose File" button and a preview of a pottery image. At the bottom is a "Submit Post" button. To the right of the main form, there are two sidebars: "RECENT POSTS" and "RECENT COMMENTS", both showing a list of recent posts and comments with a "Search" button above them.

Figure 8. Content Posting Form

Table 3. Assessment on the Technical Features of the System by the IT Experts

Software Criteria	Mean	Verbal Interpretation
Functional Suitability	3.25	Functional
Performance Efficiency	3.24	Efficient
Compatibility	3.14	Compatible
Usability	3.32	Very Usable
Reliability	3.32	Very Reliable
Security	3.25	Secured
Maintainability	3.35	Very Maintainable
Portability	3.31	Very Portable
Total	3.27	Very Acceptable

The IT experts conducted an assessment on the technical features of the system, and the results are presented in Table 3. The table shows the mean scores for the software criteria, along with their verbal interpretation, based on the evaluation conducted by the experts.

Upon analyzing the assessment results in Table 3, it is clear that the technical features of the system are highly functional, efficient, compatible, usable, reliable, secured, maintainable, and portable. The overall mean score of 3.27 suggests that the system's technical features are very acceptable. The experts' evaluation provides valuable feedback to the

development team, indicating that the system's technical features meet the ISO 25010 software standards.

The insights from Table 3 show that the development team can focus on maintaining the high level of functionality, efficiency, compatibility, usability, reliability, security, maintainability, and portability in future updates. The table also highlights the importance of conducting regular assessments to ensure that the system's technical features remain at a high standard. The IT experts' assessment reinforces the significance of evaluating the technical aspects of the system to ensure its overall performance and reliability.

The Assessment on the Quality of Using the System by the End-Users

The primary objective of this section was to evaluate the system's quality by gathering feedback from end-users. This evaluation was crucial as it allowed for the assessment of the system's performance and functionality, while also identifying areas for improvement and ensuring that it met the users' needs and expectations. To achieve this objective, several techniques were utilized, including usability testing, surveys, and interviews.

Table 4. Assessment on the Quality of Using the System by the End-Users

Software Criteria	Mean	Verbal Interpretation
Functional Suitability	3.50	Very Functional
Reliability	3.50	Very Reliable
Usability	3.52	Very Usable
Total	3.51	Very Acceptable

Gathering feedback from end-users regularly was of great importance, as it provided researchers with valuable information to enhance the system's overall performance and effectiveness. By continuously improving the system, the researchers could ensure its relevance and usefulness over time. The utilization of the feedback from the end-users to

enhance the system's performance, functionality, and relevance demonstrates the significance of this evaluation in ensuring the system's success.

In the assessment, the end-users rated the system's functional suitability with a mean score of 3.50, which translates to "Very Functional." The system also received a mean score of 3.50 for reliability, indicating that it is "Very Reliable." Moreover, the end-users rated the system's usability with a mean score of 3.52, which means it is "Very Usable." Overall, the end-users found the system to be very acceptable, with a total mean score of 3.51.

The results suggest that the system has met the quality standards in terms of functional suitability, reliability, and usability. The end-users found the system to be very acceptable, indicating that it is effective in meeting their needs. These insights can help the development team identify areas for improvement and prioritize enhancements to the system's quality.

Conclusion and Recommendations

In conclusion, the study aimed to design and develop an interactive learning application called CLAYmb, utilizing the phases of the SDLC. The ISO 25010 software standards were used as criteria in evaluating the technical quality and quality of using the system. The researchers utilized a developmental research design involving two sets of respondents: IT experts and end-users. They adapted an instrument but revised it to suit the study's context. The results revealed that the SDLC model was fit and appropriate in developing the system, and the IT experts and end-users highly accepted the developed system based on the assessment. The findings of this study can be used as a basis for improving the technical quality and quality of using interactive learning applications.

Based on the study's findings, several recommendations were given. First, it is recommended to conduct further research to evaluate the long-term effectiveness of CLAYmb. Second, it is suggested to involve a more diverse set of respondents to evaluate the system's effectiveness. Finally, it is

recommended to further improve the system's usability by conducting additional user testing and feedback analysis.

Overall, this study provides valuable insights into the development and evaluation of interactive learning applications using SDLC and ISO 25010 software standards. It highlights the importance of user involvement in the design and development process and the need for ongoing evaluation and improvement of such systems.

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Conflict of interests

The researchers declares no conflict of interest.

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