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IMPLEMENTATION OF GAMIFICATION ELEMENTS IN UI/UX DESIGN OF E-LEARNING MOBILE APPLICATION AT UNIVERSITAS PENDIDIKAN GANESHA USING OCTALYSIS FRAMEWORK

Ida Bagus Kusuma Dewantara[1*], I Made Ardwi Pradnyana[2], Putu Yudia Pratiwi [3]

[1,2,3]Sistem Informasi, Universitas Pendidikan Ganesha; Jalan Udayana No. 11 Singaraja, Buleleng, Bali, Indonesia; Telp. (0362) 22570

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Corespondent Email:
kusumadewantara3@gmail.com

Abstrak. Penggunaan Learning Management System (LMS) seperti Moodle telah diadopsi secara luas di perguruan tinggi, namun masih ditemukan berbagai kendala dalam mendukung pembelajaran asinkronus secara efektif. Mahasiswa sering mengalami keterbatasan dalam interaksi, minimnya variasi format materi, serta rendahnya motivasi belajar saat menggunakan e-learning. Penelitian ini bertujuan untuk mengimplementasikan elemen gamifikasi yang lebih variatif menggunakan kerangka kerja Octalysis dalam desain UI/UX aplikasi mobile e-learning Universitas Pendidikan Ganesha, serta mengevaluasi dampaknya terhadap pengalaman pengguna melalui metode Task Scenario dan kuesioner User Engagement Scale Short Form (UES-SF). Metode penelitian yang digunakan meliputi studi literatur, analisis desain eksisting, perancangan prototipe, pengujian jarak jauh, dan analisis data kuantitatif. Hasil pengujian menunjukkan bahwa prototipe memiliki tingkat usability yang tinggi dengan success rate rata-rata 95%, efisiensi penyelesaian tugas sebesar 32,15%, dan waktu penyelesaian rata-rata 14,99 detik per tugas. Tingkat kesalahan pengguna tergolong rendah dengan defective rate rata-rata 2,5%. Evaluasi keterlibatan pengguna melalui UES-SF menunjukkan bahwa faktor estetika dan penghargaan memperoleh skor tertinggi (3,87), sementara faktor kegunaan hanya mencapai skor 1,27. Temuan ini mengindikasikan bahwa desain visual aplikasi telah mampu menarik perhatian pengguna, namun masih diperlukan perbaikan pada aspek fungsionalitas agar keterlibatan pengguna dapat ditingkatkan secara lebih menyeluruh.

Abstract. *The use of Learning Management Systems (LMS) such as Moodle has been widely adopted in higher education. However, challenges remain in effectively supporting asynchronous learning. Students often experience limited interaction, a lack of diversity in learning material formats, and low motivation on e-learning platforms. This study aims to integrate more varied gamification elements into the UI/UX design of a mobile e-learning application at Universitas Pendidikan Ganesha using the Octalysis Framework, and to assess their impact on user experience through task scenario testing and the User Engagement Scale Short Form (UES-SF). The research methods consist of literature review, analysis of existing designs, prototype development, remote usability testing, and quantitative data analysis. Usability testing results show high usability, with an average task success rate of 95%, task efficiency of 32.15%, and an average task completion time of 14.99 seconds. The defective rate was low, averaging 2.5%. User engagement evaluation through the UES-SF indicates that the aesthetic and reward aspects achieved the highest scores (3.87), whereas usability scored the lowest (1.27). These results suggest that although the visual design is appealing and engaging, improvements in functional usability are needed to optimize overall user engagement.*

1. INTRODUCTION

E-learning is an innovation used to support learning activities by students and lecturers. Asynchronous learning through E-learning can help overcome the limitations between lecturers and students in terms of space and time. Thus, E-learning makes learning more practical and efficient [1]. One of the higher education institutions that has implemented asynchronous learning through E-learning is Ganesha University of Education (Undiksha). However, in practice, students face various obstacles, such as minimal interaction and monotonous material formats (PDF, PPT, YouTube), which can lead to low student motivation. Additionally, E-learning is often utilized only for assignment submissions, not as an active and engaging learning medium. Based on interviews with students, it was found that they prefer face-to-face learning as it is easier to understand and interactive. This indicates the need for innovation in e-learning design to make it more engaging and suitable for students' learning styles.

To address this challenge, this research proposes the application of gamification elements in the UI/UX design of the Undiksha mobile e-learning application using the Octalysis Framework. This framework consists of eight core drives that represent the primary motivations of humans, and this study focuses on three of them: Development and Accomplishment, Empowerment of Creativity and Feedback, and Ownership and Possession. The application of gamification in an educational context has been widely researched before. An research demonstrated that integrating elements such as levels, points, leaderboards, and badges in e-learning can enhance user attraction and engagement [2]. Another researcher utilized the Octalysis Framework in a mathematics application and found that gamification elements such as challenges and progress bars could improve students' understanding and motivation [3]. In addition, a researcher also applied the Octalysis Framework in e-learning for the elderly and found that the effectiveness of core drives highly depends on user characteristics [4].

Garnisa [5] and Landebila [6] successfully integrated gamification into the Moodle Learning Management System (LMS) using the H5P plugin, which enhanced student learning motivation. Brian [7] designed a gamification-based distance learning application and observed an 83% increase in user engagement, as measured by UES-SF testing. Additionally, Maukar [8] demonstrated that core drives, specifically CD 2, CD 3, and CD 4, are effective in enhancing student motivation in online learning. [9] also identified that gamification elements such as points, badges, leaderboards, and challenges are the most common and effective in higher education.

Building on the findings from previous research, this study aims to design and test a prototype of the Undiksha conducted as a case study within a higher education environtment, as also explored by nurhansah [10]. This research will focus on the mobile e-learning UI/UX equipped with gamification elements based on the Octalysis Framework [10], as well as to evaluate user engagement using the User Engagement Scale – Short Form (UES-SF) and a task scenario. This approach is expected to enhance the quality of the learning experience for students significantly.

2. LITERATURE REVIEW

2.1. Learning Management System

The use of Learning Management Systems (LMS) such as Moodle has become increasingly important in higher education, especially to support both synchronous and asynchronous learning. With mobile access, LMS platforms offer greater flexibility, enabling students to engage in learning without being limited by location [11]. This makes mobile-based LMS a promising solution to improve learning accessibility and effectiveness.

2.2. Octalysis Framework

Figure 1. Octalysis Framework

Gamification is an approach that integrates game elements into non-game contexts, including education, to boost motivation and

engagement. Common elements such as points, badges, leaderboards, and virtual items are widely used in digital learning. The Octalysis Framework [12] is one of the well-known models for designing gamification. It

focuses on eight core drives that represent human motivation, including Development and Accomplishment (CD2), Empowerment of Creativity and Feedback (CD3), and Ownership and Possession (CD4). These core drives have been proven effective in increasing student motivation in online learning settings [8].

2.3. Task Scenario

Usability evaluation is commonly conducted using the task scenario method, where users are assigned specific tasks to complete within the system. This approach helps assess aspects such as learnability, efficiency, and error rate. A good usability score is typically reflected in a task success rate above 78% and a defective rate below 0.7 per task, ensuring that the design supports smooth and error-minimized interaction [2].

2.4. User Engagement Scale Short Form

User engagement in gamified systems can be effectively measured using the User Engagement Scale – Short Form (UES-SF). This tool evaluates four key dimensions: Focused Attention, Perceived Usability, Aesthetic Appeal, and Reward. The UES-SF provides valid, quick feedback on how users experience interactive systems, especially those that incorporate gamification [4].

3. RESEARCH METHOD

This study consists of several stages, including literature study to gather relevant theories and previous research, analysis of the existing e-learning design to identify opportunities for gamification, designing a gamification prototype that integrates selected game elements, gamification testing to evaluate the effectiveness of the gamified features, and UI/UX usability testing to measure user experience and system usability. The process and sequence of each stage are illustrated in the flowchart in Figure 2, providing a clear overview of the research workflow.

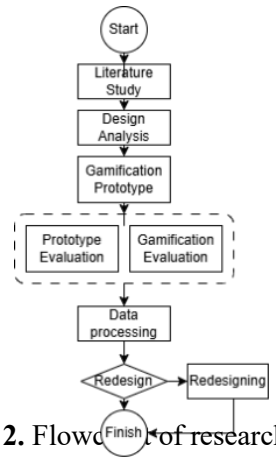

Figure 2. Flowchart of research stages.

3.1. Literature Review

The first stage involved a review of various scientific sources, including books, journals, and articles, to build a strong theoretical foundation on gamification, e-learning, and the Octalysis Framework. This was followed by an analysis of the existing Undiksha mobile e-learning UI design,

Table 1. Existing Design Analysis

No	Page	Gamification Potential	Solution
1	My Profile	Lacks identity personalization	Custom avatars, virtual goods, badges (CD4)
2	Class Assignment/ Exam/ Attendance	Weak appreciation & feedback	Points, levels, badges (CD2, CD3)
3	Class Dashboard	Lacks competitive elements	Leaderboard (CD2)
4	Class Assignment/Exam/ Video	Low interactivity	Quiz games, creative tasks (CD3)

3.2. Gamification Prototype Design

A high-fidelity prototype was developed using Figma. Gamification elements such as avatars, virtual goods, points, badges, leaderboards, levels, and quiz games were integrated based on the Octalysis Framework, particularly focusing on core drives CD2 (Development and Accomplishment), CD3 (Empowerment of Creativity and Feedback), and CD4 (Ownership and Possession).

3.3. Usability Testing

User engagement was evaluated using the User Engagement Scale – Short Form (UES-SF), which covers Focused Attention, Perceived Usability, Aesthetic Appeal, and Reward. Participants completed the questionnaire after trying out the gamification features in the prototype. User Engagement Testing

4. RESULT AND DISCCUSSION

This research examines usability indicators, including ease of initial use (learnability), time-based task completion efficiency (Time-Based Efficiency), and error rate (Defective Error Rate). The research results are presented in the form of a high-fidelity prototype design, which includes the addition of gamification elements (referenced in Table 1), as well as user engagement testing and task scenario-based evaluation to assess the usability of the prototype.

4.1. Color Design

The choice of colors in the interface of this application is based on functional and aesthetic needs, with a focus on consistency and visual clarity. Each color is selected to support the user experience by emphasizing visual elements tailored to the user.

Table 2. Prototype Color Code

No	Color	Color Code	Definition
1	Blue	#3550DC	This color is the primary color used on the main button, header, and active icons.
2	Pink	#FF8181	Used for the Call to Action (CTA) button.
3	Hera Blue	#6B74D6	Colors are used on decorative elements
4	Violet	#C868FF	Applied on pages that adopt gamification elements, namely on game buttons and quizzes.
5	Grey	#979797	Used for inactive or dead buttons, indicating non-interactive elements

The application of these colors is used to clarify the use of visual hierarchy, particularly in the application prototype.

4.2. Typography

Typography is one of the key elements in user interface design as it affects how information is displayed and received by users. The selection of font type, size, and consistent style can enhance readability, form a clear visual hierarchy, and help users navigate the application more easily. In designing the user interface of this system, various types of fonts are strategically used to support the function of each display element. The use of font combinations is not only based on aesthetics but also on the needs of visual communication, ranging from title text and descriptions to interactive elements such as buttons and gamification.

Table 3. Typography

No	Front types	Size	Style	Solution
1	Inter	24px	Bold	Used for main headings, such as page titles or important sections.
2	Inter	14px	Regu ler	Used in the body text and general descriptions in the display
3	Poppin s	14px	Semi Bold	Used for button labels and class menu text.
4	Popins	12px	Regu ler	Used for sublabels and additional information in the menu display
5	PT-Serif	20px	Bold	Used explicitly in gamificatio n elements, especially in avatar displays.

Specifically, this system utilizes three main font types: Inter, Poppins, and PT Serif, each applied in distinct visual contexts according to its function in the display.

4.3. Icon Design

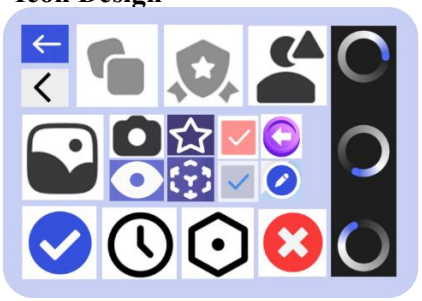

Figure 3. Icon Design

The interface design in this system utilizes various icons and graphic elements to clarify functions and visual appearance. The icons used are sourced from the Flaticon platform, an icon library that allows users to download graphic icons for use in their interfaces. The icons are employed to help users recognize features or navigation. Icons are inserted to add visual variety to the interface display.

Table 3. Icon Design

No	Icon	Gamification Potential
1	Back Arrow	Used for user navigation to return to the previous page
2	Backgrou nd Image	The icon is used when the user wants to use an image from the device's file or photo album
3	Correct Icon	The use of that icon is applied on the quiz page to visualize the correct answers for the user.
4	Virtual Goods Collection	The icon serves as a button to access the user's virtual item collection page.
5	Camera	The icon serves as a button to access the user's virtual item collection page.

6	Eye	It is used to take a camera capture that will be uploaded as the profile photo. That icon indicates the visibility of content, used to open content that is not visible on the page.
7	Clock	The icon is used to visualize the time allocated to user activities.
8	Badges	The icon is used to visualize the user's rank on the leaderboard. It is used as a button to navigate to the settings page.
9	Star	It is used as a button to navigate to the settings page. The usage of the icon is applied on the user profile to navigate to the avatar personalization page
10	Rank	It is used as a button to navigate to the settings page. The usage of the icon is applied on the user profile to navigate to the avatar personalization page.
11	Setting	It is a navigation icon character used in quiz games.
12	Avatar Edit	It is used as a button to navigate to the settings page.
13	Checklist Box	It is used as a button to navigate to the settings page.
14	Arrow Button	It is a navigation icon character used in quiz games. The icon is applied to the user profile to personalize the user's profile picture.
15	Personalized	The use of the icon is applied to the user profile to personalize the user's profile picture.
16	Cross Icon	The use of this icon is applied on the quiz page to visualize the user's wrong answers. The icon is used as an animation
17	Loading Icon	The icon is used as an animation to load the page when the user switches pages.

There are supporting graphic icons that previous researchers have used in the design of the Undiksha mobile e-learning interface, so the icons displayed in Table 4 are the new icons used by the researcher in designing the interface.

4.4. Appflow

Next, the following prototype flow illustrates the entire process of user interaction with the designed application interface. This flow is arranged as a visual unit to illustrate the relationships between pages and the main function that accessible for the users. The visual presentation of the application flow is intended to provide a comprehensive overview of the structure and navigation logic in the application which can be seen in Figure 4. Next, the following prototype flow illustrates the entire process of user interaction with the designed application interface. This flow is arranged as a visual unit to illustrate the relationships between pages.

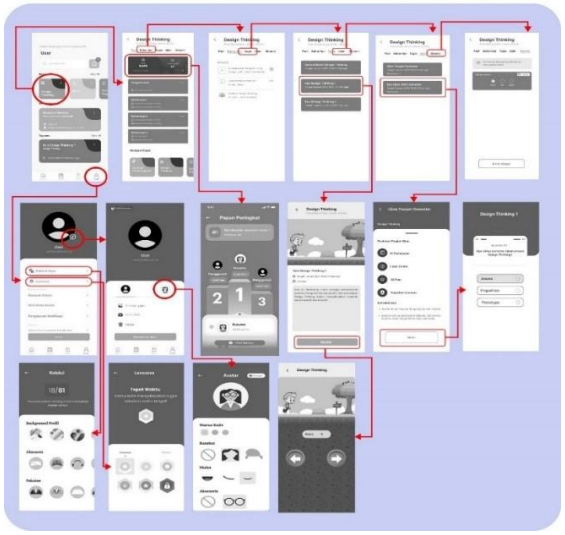

Figure 4. App Flow

Presentation of Figure 4 provides a brief overview of the entire application usage scenario. This page includes the Avatar Page, Virtual Goods Collection Page, Badges Page, Emblems Page, Leaderboard Page, Quiz Game Page, and Points System. Each connection between pages is designed to ensure a clear and connected user flow. The interface design on the profile page incorporates gamification elements, including a customizable avatar that users can personalize. The avatar is visually displayed as a cartoon character representing Undiksha students, which can be shown through the visual clothing designed to resemble the campus alma mater. Features available on this page include skin tone selection, hairstyle, and expressions.

4.5. Prototype Design

Figure 5. Edit Avatar Page

The results of the avatar edit page design shown in Figure 5 are placed on the profile page and aligned with the user's profile picture. Users have the option to choose to display a customized avatar or use a personal photo as their main profile picture.

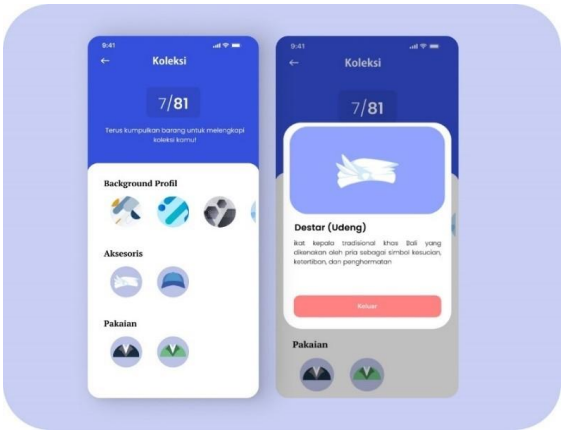

Figure 6. Virtual Goods Collection Page

Furthermore, the gamification element of Virtual Goods consists of digital ownership items that can be collected and used by users. Virtual items are obtained as a form of rewards after completing certain missions or activities in the application. The virtual goods that have been acquired will be stored in the user's collection and can be used to customize the profile appearance. In its design, there are three main types of virtual goods that users can collect, including profile backgrounds, accessories, and clothing.

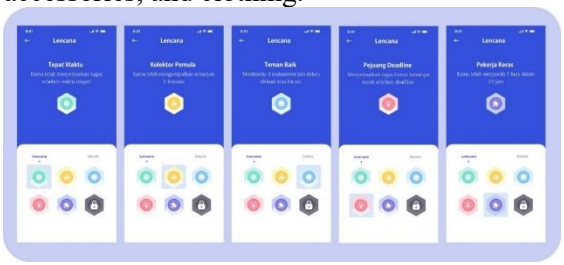

Figure 7. Badges Page

The user badge page is a feature that displays a collection of badges that users have successfully collected as a form of achievement for completing various activities, such as assignments, quizzes, or exams within the e-learning application. This element is part of the gamification implementation that focuses on Core Drive 2: Development & Accomplishment in the Octalysis Framework. Badges are automatically awarded to users who successfully complete specific activities according to predetermined criteria. Each badge has a unique visual and description that represents the type of achievement.

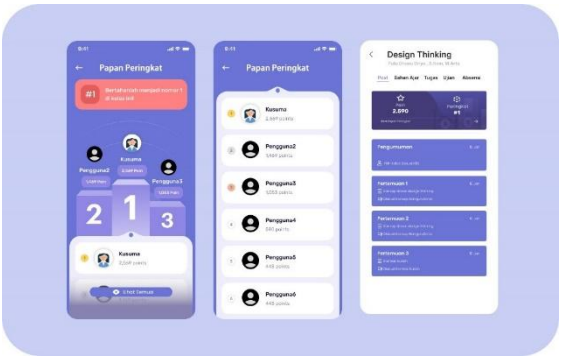

Figure 8. Leaderboard Page

The leaderboard page is designed to show users' rankings based on the total points they've earned from activities like assignments and quizzes in a specific course. It's a way to spark a bit of friendly competition and help students track their progress.

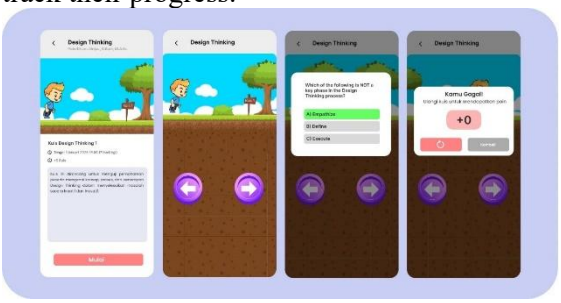

Figure 9. Quiz Game Page

This feature is designed to create a fun and engaging learning experience through a game-based learning approach.The quiz is presented in the form of a 2D runner game, where players learn by playing and answering questions as they progress through the game.

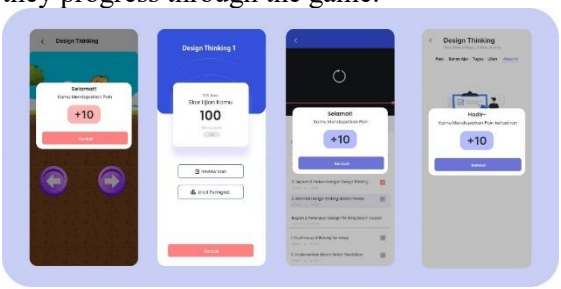

Figure 10. Points System Page

The gamification element, in the form of a points system, is applied to several key features within e-learning. Points are awarded as a form of recognition for users' participation and achievements in completing various learning activities. This system is integrated into several pages, namely: quiz game page, conventional quizzes, video-based learning materials, and attendance records. Each user completes activities on these pages. They will receive a certain number of points. These points are then accumulated and used as the basis for calculating scores on the leaderboard displayed in each class attended by the user.

4.6. Task Scenario Evaluation

The testing of the gamification prototype on the Ganesha University Learning Management System (LMS) was conducted through two main types of evaluations, namely usability and user engagement. Usability evaluation involves observing participants' success in completing predetermined tasks, as well as recording the completion time and the number of errors that occur during interaction with the prototype. Meanwhile, user engagement is measured using the UES-SF (User Engagement Scale – Short Form) instrument, which is analyzed based on the average scores of four main dimensions: focused attention, perceived usefulness, aesthetic appeal, and reward. The results of both evaluations provide a comprehensive overview of the effectiveness of the gamification design in enhancing user experience in the developed e-learning system.

Note:
NoS: Number of Successful
TP: Total Participants
CR: Completion Rate

Table 4. Task Scenario Result

No	Task	NoS	TP	CR (%)
1	TS 1	4	5	80%
2	TS 2	5	5	100%
3	TS 3	5	5	100%
4	TS 4	5	5	100%
5	TS 5	5	5	100%
6	TS 6	5	5	100%
7	TS 7	5	5	100%
8	TS 8	4	5	80%
Average				95%

The Learnability aspect of the prototype was measured through success rate measurement, which is the percentage of participants who completed the given tasks. This metric is calculated by dividing the number of participants who completed the tasks without any issues by the total number of participants, then multiplying by 100%. The test results are presented in Table 5. Based on the results in Table 5, out of a total of 8 tasks given, 6 tasks achieved a 100% success rate, indicating that all participants were able to complete the tasks without encountering difficulties. However, two tasks, namely TS 1 and TS 8, showed a success rate of 80%.

When calculated overall, the average success rate of all tasks is 95%. This value indicates that the prototype has a very good level of learnability. Based on the discussion in section 2.2.5 regarding success rate benchmarks, it is mentioned that the threshold considered good is 78%, while values classified in the upper quartile are above 92%. Therefore, it can be concluded that the 95% score obtained from this test has exceeded both thresholds, which means this prototype is classified as very easy for users to learn.

The results of the Time-Based Efficiency calculations show that the average task completion time by participants is 14.99 seconds per task. Considering the number of tasks completed and the total time used, a Time-Based Efficiency value of 0.3215, or 32.15%, was obtained. This indicates that the efficiency of time in using the application is at a reasonably good level, although some tasks require a longer time to complete. Visualizations related to the average completion time per participant are shown in Figure 10.

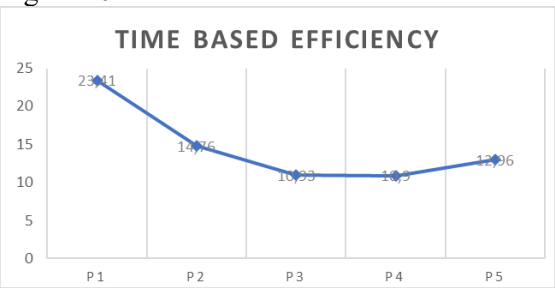

Figure 11. *Time-Based Efficiency Results*

Based on the usability testing results, there were three failures out of a total of 40 opportunities given to five participants to complete eight tested tasks. Task 1 experienced one failure out of 4 opportunities, resulting in a defective rate of 5%. Task 8 experienced two failures out of two opportunities, resulting in a defective rate of 20%. Meanwhile, tasks 2 through 7 did not experience any failures, with a defective rate of 0%. Overall, the average defective rate obtained from all tasks is 2.5%, indicating that the system has a low error rate. The visualization of the defective rate per task is shown in Figure 11.

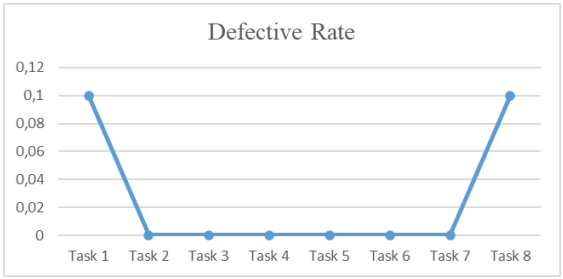

Figure 12. Defective Rate Results

According to the benchmark described in Section 2.2.5, the average user error rate considered good is 0.7 errors per task, equivalent to 14%. This indicates that the prototype interface successfully minimizes the occurrence of user errors during the interaction process.

4.8. User Engagement Evaluation

Based on the results of the UES-SF calculation, the user engagement scores in the e-learning application show significant variation. The experience factor (FA) scores range from 1 to 5, with an average value of 3.27. The usability factor (PU) scores range from 1 to 1.67, with an average of 1.27. The aesthetics factor (AE) scores range from 1 to 5, with an average of 3.87. The satisfaction factor (RW) scores range from 1.67 to 5, with an average of 3.87. The overall engagement score ranges from 1.17 to 4.17, with an average of 3.3. These results suggest that there is variation in user experiences related to gamification. Some high scores indicate satisfaction with visual aspects and experiences, while lower scores indicate usability issues within the application.

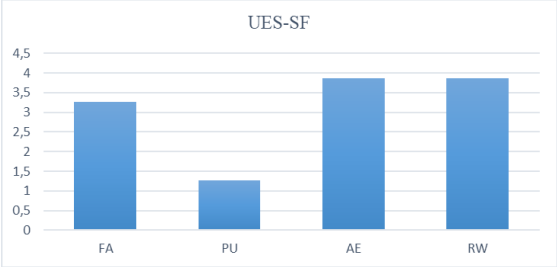

Figure 13. Results of Gamification Testing

The total score from all respondents is then converted into a percentage form and shows a final result of 83.66%. Based on the UES 2.2.4 assessment category classification, the obtained score falls into the good category.

This result showcases the effectiveness of the UI/UX design of a mobile e-learning prototype that has been enhanced with gamification elements based on the Octalysis Framework. From the visual design perspective, the choice of colors, typography, and icons has been tailored to align with good interface design principles and color psychology, thereby supporting readability, aesthetics, and user navigation. Blue, purple, and pink colors are used to highlight important elements, while the icons used are intuitive and familiar to users. In terms of gamification, elements such as avatars, virtual goods, badges, leaderboards, quiz games, and points have been successfully applied in accordance with the core drives CD2 (Development and Accomplishment), CD3 (Empowerment of Creativity and Feedback), and CD4 (Ownership and Possession). Each element is analyzed based on theory and previous research findings, which show that these elements can enhance user motivation, engagement, and sense of ownership over the system.

In the study by Gatsou [13], it was found that the appropriate use of icons can significantly impact the user experience in application interfaces, including in the context of gamification. The research revealed that pictorial style icons, which have a direct visual connection to the objects or actions they represent, are more easily recognized than symbolic icons. This finding is consistent with Nordin's, which noted that the graphic characteristics used in e-learning interfaces can influence users' perceptions, especially among young people. The choice of icons is also important in gamification design, where icons are often used to mark users' achievements or progress. Therefore, intuitive icon designs are crucial for users to easily understand the functions of these icons.

Then, in designing the gamification prototype interface for the e-learning system, the researcher adapted several principles from the 8 Golden Rules of Interface Design proposed by Ben Shneiderman. The selected principles were tailored to the context of user needs in online learning systems. Below is the implementation of these principles in the design. The principles include: Strive for consistency, offer informative feedback, Design Dialogs to Yield Closure, Error Prevention and Simple Error Handling, Support Internal Locus of Control, and Reduce Short-Term Memory Load. The gamification elements used include avatars, virtual goods, badges, leaderboards, quiz games, and points, each related to core drives such as CD2 (Development & Accomplishment), CD3 (Empowerment of Creativity & Feedback), and CD4 (Ownership & Possession) from the Octalysis Framework [12].

Each gamification element shows analysis results that align with previous research. For example, avatars and virtual goods enhance users' sense of ownership [14], badges encourage achievement and engagement [15], [16], and leaderboards motivate healthy competition [17], [18]. However, the effectiveness of leaderboards is also influenced by the user context [19]. Quiz games are designed with principles of visual hierarchy and icon consistency [20], while point systems have been shown to enhance learning motivation and user engagement [21], [22]. These findings suggest that incorporating appropriate gamification elements can improve user experience and engagement in online learning, provided they are designed with consideration for user context and sound design principles.

Usability testing reveals that the prototype exhibits an excellent learnability rate, with a success rate of 95%, which exceeds the good threshold according to Nielsen and Sauro's [23] standards, indicating that the interface is easy to learn. The average task completion time is recorded at 14.99 seconds per task with an efficiency of 32.15%, demonstrating relatively good time performance and also . Meanwhile, the user error rate (defective rate) is only 2.5%, which is far below the tolerance threshold of

14%, indicating that the prototype has successfully minimized user errors. Although the testing was conducted online and faced technical challenges such as unstable internet connections, the results still indicate that the prototype has outstanding usability performance [24], [25]

Based on the values displayed in Figure 7, the AE and RW scores show higher values compared to usability factors. This suggests that, although the application has a good visual appeal, certain user constraints impact overall user engagement. Improvements in usability aspects could be a primary focus for enhancing user engagement more evenly. The total user engagement score calculated from all UES-SF responses results in a final value of 83.66%. According to Abdulrohman [26], this score falls into the Good category. This result reinforces previous findings that, overall, the system has successfully engaged users quite well.

5. Conclusion

Based on the results of the prototype testing, it can be concluded that the prototype demonstrates very good performance in terms of usability. The average user success rate in completing tasks reaches 95%, indicating a high level of learnability and ease of understanding the interface even for new users. The efficiency of using the application is also considered good, with an average task completion time of 14.99 seconds and an efficiency of 32.15%, showing that the interface supports the task completion process quickly and smoothly.

The user error rate is very low, with a defect rate of only 2.5%, which falls below the commonly used tolerance threshold in usability evaluations. This indicates that the interface design has successfully minimized the potential for user errors during interactions. From the user engagement perspective, the evaluation results obtained via the UES-SF instrument indicate a total score of 83.55%, which falls within the good category. The factors of visual appeal and reward scored higher than the usability aspect, indicating that gamification and visual elements successfully capture user attention, even though there are still functional aspects that need improvement.

However, the online testing process presents its own challenges. Some technical obstacles, such as internet connection disruptions and potential social biases in participants' responses, can influence the evaluation results. Nevertheless, overall, the developed prototype successfully demonstrates that the application of Octalysis-based gamification elements can enhance usability and user engagement in e-learning applications

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