

# Gamified Learning Platform Analysis for Designing a Gamification-Based UI / UX of E-learning Applications: A Systematic Literature Review

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**Abstract**—Nowadays, the existence of e-learning in the educational system can provide convenience to both teachers and students. Gamification is considered to help students increase motivation to learn. With that technological innovation and new interaction patterns, User Interface (UI) and User Experience (UX) are becoming increasingly important and changing user expectations and demands. In the context of e-learning, poor UI and UX can affect students' attitudes towards e-learning. In this paper, the authors conduct a Systematic Literature Review (SLR) method to identify the gamification, UX, and UI concept of gamification e-learning for proposing a UI UX design conceptual elements, criteria, and requirements of gamification e-learning for Madrasah Ibtidaiyah. This paper aims to propose UI/UX criteria and requirements for designing gamification e-learning that suit learning needs and standards in Madrasah Ibtidaiyah, also to increase student motivation and their interest during the learning process.

**Keywords**—design, e-learning, gamification, user interface, user experience

## I. INTRODUCTION

The increasingly widespread use of internet-based information technology has attracted educational institutions to invest in new learning technologies. Electronic Learning or e-learning is an electronic-based information technology application via an internet network designed for learning purposes. The existence of e-learning can provide convenience to educators and students. If this can be utilized, it can provide great benefits for the learning process and the quality of the learning process itself [1].

Several problems occur in the learning process in schools, such as students feel not enthusiastic about taking lessons and tend to be passive in receiving explanations from the teacher [2]. Another problem in the learning process shows that the teacher only provides subject matter and rarely provides motivation to students in teaching. Gamification is considered to help students increase motivation to learn. Gamification supports individuals to acquire the potential to develop critical thinking and multitasking [3]. The application of the concept of gamification in e-learning is considered as a technique that can help students understand

the material provided so that students can be more motivated to actively participate in the learning process.

The existence of e-learning cannot be separated from how the e-learning service is designed. Service quality is a standard process that must be implemented in a service so that user satisfaction can be fulfilled [4]. With technological innovation and new interaction patterns, User Interface (UI) and User Experience (UX) are becoming increasingly important and changing user expectations and demands. In the context of e-learning, poor UI and UX can affect students' attitudes towards using e-learning. This can lead to misunderstanding or misuse of e-learning and affect acceptance, satisfaction, and efficiency of academic institutions. Failure to adhere to good quality aspects of UI UX can result in dissatisfaction, misunderstanding, or improper use, resulting in some criticism and a low level of acceptance of the e-learning platform [5].

Various educational institutions have begun to implement the use of e-learning as a step to face technological developments and increase the quality and effectiveness of education. This was evidenced by observations at the e-learning training for Madrasah Ibtidaiyah teachers in DKI Jakarta Province in January 2020. The training aims to improve teacher competence in the field of technology, especially the use of e-learning at school. One of the materials being taught is the use of a gamification-based learning application (gamified learning platform), namely Quizizz. However, based on observations during training, there are still many Madrasah Ibtidaiyah teachers who are confused when using the Quizizz application. This is due to the appearance and various features of the application, which still seem complicated for some teachers who are not used to using it. As stated by Lim et al., (2013) that "Different learners may have different learning needs, and different users may have different requirements on how the program content should be displayed" [6].

So to answer this problem, this paper intends to explore some literature in UI and UX analysis to identify the requirements and criteria for designing a gamification e-learning system that is suited the student's & teachers' needs

and their experience, as well as learning standards and user environment in Madrasah Ibtidaiyah (MI).

## II. RELATED WORK

Research by Naufal Irfan Hayanto & Seng Hansun [7] designed and built a science questions exercise application for Elementary School (SD) using the gamification method and the Mersenne Twister algorithm. The results in the form of the application are tested using HMSAM at SDN Sukasari 4 Tangerang and produced very good scores for the aspects of joy, perceived usefulness, perceived ease of use, control, and curiosity, and good scores for aspects of behavioural intention to use and focused immersion. However, the application still has several notes such as there is no friendship feature yet, a power-up feature for solving questions so that time can be paused or questions can be skipped, and there is still a need to add other gamification elements so that students can be more interesting and motivate them to use it.

Research by Ana Carolina Tomé Klock, Isabela Gasparini, and Marcelo Soares Pimenta [8] explores the gamification properties and analyze the results of the user-centred application. This research also proposed a framework called 5W2H that focused on user-centred gamification in the educational context taking into account personal, functional, psychological, temporal, playful, implementable and evaluative. After applying the framework in the e-learning system, the controlled experiment with 139 students revealed an increase in students' interaction, engagement and satisfaction.

Irwan Suprianto, Fajar Pradana, Fitra Abdurrachman Bachtar [9] in their paper, build an e-learning application by applying the gamification method to the implementation of its features or content. The results of testing using the white box testing method, and also black box testing, found no errors in the e-learning application. The application also generates a system usability scale score calculation with a value of 67.5 and is included in the Acceptable High category, which means that the E-learning application can be accepted by the user. However, the application is not yet available on a mobile platform which is considered more flexible to users later, and there is still a lack of application of gamification elements, in-depth calculations for testing using the User Engagement Scale (UES), and test objects to be increased more or more.

Research by Theerakarn Phunkaew, Chanakarn Phandan, Charoenchai Wongwatkit [10] propose an interactive learning story framework and design a UI that follows the concept of flat design and responsive mobile design, and conducts testing and evaluation with interactive prototypes. Teaching materials such as content, infographics, and animation to be correlated with student learning experiences and learning environments must be improved, pay attention to the selection of age-friendly words and texts for students to be better understood, increase infographics and animations to make them more beautiful, entertaining, and attract attention students take longer when using the app.

Sitairesmi Wahyu Handani, M. Suyanto, Amir Fatah Sofyan [11] in their paper successfully implementing the gamification concept into the e-learning system using the MDA (Mechanic, Dynamic, Aesthetic) framework and using Richard Bartle's theory to determine target players in compiling gamification into the e-learning system. But the

material contained in the system is still very limited, and the e-learning system is still limited to testing the system's functionally, it has not been tested from the user experience side so that it can be developed again by testing / evaluating from the user experience side.

## III. RESEARCH METHOD

This study uses the Systematic Literature Review (SLR) method to identify the requirement and criteria for the UI / UX e-learning gamification design that matches the user's needs and the learning standards of Madrasah Ibtidaiyah. Systematic Literature Review (SLR) is defined as a process of identifying, assessing, and interpreting all available research evidence with the purpose to provide answers for specific research questions [12][13]. This paper adopts the steps presented in [14], which are planning, conducting, and reporting.

### A. Planning

#### 1) Identifying the Need

As explained in the introduction, based on observations during the training, there are still many Madrasah Ibtidaiyah teachers who are confused when using the existing gamification application, Quizizz. Based on the author's observations in one of Madrasah Ibtidaiyah in South Jakarta, they do not have a gamification-based e-learning system. Therefore, the existence of gamification-based e-learning is expected to be a special attraction that supports learning activities and increases the effectiveness, efficiency, and satisfaction of the learning process in Madrasah Ibtidaiyah.

#### 2) Research Questions

The research questions (RQ) were specified to keep the review focused [12]. Research questions and motivations for this study are stated in Table 1.

TABLE I. RESEARCH QUESTIONS ON LITERATURE REVIEW

ID	Research Questions	Motivations
RQ1	What are some criteria needed for gamification e-learning applications?	Identify the most significant criteria needed to support good user experience and functionality in gamification e-learning applications.
RQ2	What kind of usability evaluation tools that most used for evaluating UI/UX design of e-learning applications?	Identify the best usability evaluation tools for evaluating e-learning applications, especially for elementary school/Madrasah Ibtidaiyah.
RQ3	What are gamification elements used most often for e-learning applications that suitable for elementary school or Madrasah Ibtidaiyah students?	Identify some gamification elements suitable for Madrasah Ibtidaiyah students.

### B. Conducting

#### 1) Conduct the Review

At this stage, the authors collected literature sourced from several leading online databases such as Google Scholar, Researchgate, IEEE Explore, and several university e-journal portals. In the literature searching process, the authors use several keywords such as "user

interface", "user experience", "UI / UX", "e-learning" and "gamification".

### 2) Inclusion and Exclusion

The literature that has been obtained will proceed with the stage inclusion and exclusion, and the author adopts the category inclusion and exclusion from [14]. For the category of inclusion, that is the literature indirectly or immediately answer one or all Research Questions (RQ), focusing on aspects of e-learning design, user interface, and user experience of applications (whether e-learning or not) or research related to the use of the gamification concept in applications (whether e-learning or not). While the literature exclusion category is irrelevant, not related to that research conducted and did not clearly explain each step of the research.

### 3) Quality Assessment

In this stage, the authors also adopt quality assessment categories from [14] to create the quality assessment category based on the accuracy (rigour) which has a comprehensive approach and in accordance with the research conducted, credibility (credibility) whether the findings are presented well and meaningfully from the literature. The authors also add other categories adopted from [15] whether journal papers were published in 2010–2020.

### 4) Data Collection

In the data collection stage, valid literature is included in 3 (three) sections based on their relationship with the Research Questions (regarding the use of usability evaluation tools, e-learning design, and the use of gamification elements).

## C. Reporting

This stage has 2 (two) stages, namely results and discussion, for this stage is further explained in the results and discussion section.

## IV. RESULT AND DISCUSSION

### A. Result

The authors obtained 54 literature. After passing the Conducting phase, only 20 literature was declared valid. Then, 20 literature is divided into 3 parts based on their relationship with the Research Questions (RQ) in this study (some literature are included in more than one category):

- 5 literature related to gamification-based e-learning design (for RQ1) : [7][16][11][10][9]
- 9 literature related to UX evaluation on e-learning (for RQ2) : [5][17][18][19][20][21][4][9][10]
- 12 literature related to the use of gamification elements in e-learning (for RQ3): [22][23][24][25][26][27][7][11][28][29][9][16]

#### 1) Most significant criteria on gamification e-learning applications for Madrasah Ibtidaiyah

- *Implement various gamification elements/features tailored to the target player.*

Among the five previous studies that have been described previously, two of them still lack the use of gamification elements or features. Therefore, the e-

learning design in this study will implement various elements of gamification features that are suitable for the user and the purpose of the e-learning system itself. The design also takes into account the types of players of the e-learning system users so that the gamification elements are designed according to the character and type of each user based on the proposed framework by [8].

- *Having a good UX and an attractive UI proven by direct testing with user and evaluation.*

As explained in the research background, a good UI / UX is needed, and this will be the focus of this research. Therefore this research will prioritize the interests of UI and UX so that the resulting e-learning design certainly has user experience and an attractive appearance which will then be proven by direct testing with users by several UI/UX testing methods. As for the UI, the study from [10] could be adopted, which is using a flat design approach.

- *Coverage of learning materials following user learning needs at Madrasah Ibtidaiyah.*

This study also refers to the existing e-learning gamification applications such as Kahoot & Quizizz. Those applications only cover the learning evaluation process, which is the exercises/quiz. Therefore, the further e-learning design in this study will include a more comprehensive learning process from implementation to learning evaluation.

- *A web-based system with a Responsive Web Design approach.*

In this research, the author will design a responsive web-based e-learning system interface, allowing users to be more flexible in using the e-learning system either via desktop or mobile.

#### 2) Most used UX evaluation tools for e-learning

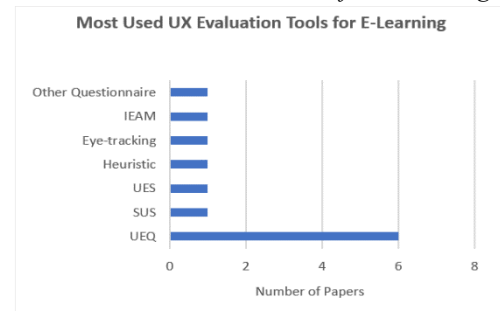


Fig. 1. review result related to UX evaluation tools for e-learning

#### 3) Most used gamification elements in e-learning

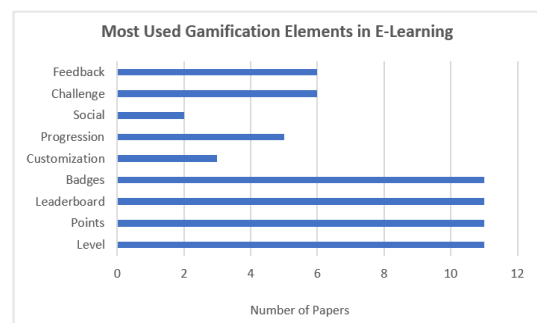


Fig. 2. review result related to gamification elements in e-learning

## B. Discussion

Based on the results of the research that has been done, the three research questions can be answered as follows:

RQ1: *What kind of features are needed for gamification e-learning applications?*

Based on the analysis of the comparison of 5 literature related to gamification-based e-learning design, the authors identified several criteria to complement the existing strengths and weaknesses of the previous research:

- *Implement various gamification elements/features tailored to the target player.*
- *Having a good UX and an attractive UI proven by direct testing with user and evaluation.*
- *Coverage of learning materials following user learning needs at Madrasah Ibtidaiyah.*
- *A web-based system with a Responsive Web Design approach.*

RQ2: *What kind of usability evaluation tools that most used for evaluating the UI/UX design of e-learning applications?*

From the data that the authors get from 9 literature related to UX evaluation in e-learning, most of the literature uses the User Experience Questionnaire (UEQ) for evaluating UX in e-learning systems. As for the context of e-learning for elementary school/Madrasah Ibtidaiyah, the authors refer to research [18] which concludes that UEQ enabled the experimenter to identify and understand the children's impressions on the prototype developed to support their playing interest.

RQ3: *What gamification elements are used most often for e-learning applications that suitable for elementary school or Madrasah Ibtidaiyah students?*

Based on data obtained from 12 literature related to the design of the gamification concept, it can be concluded that gamification elements in the form of points, levels, leaderboard, and badges are mostly applied to e-learning. Some literature also applies feedback, challenges, and other gamification elements to support the attractiveness of e-learning.

## V. CONCLUSION

This literature review aims to identify UI/UX criteria and requirements for designing gamification e-learning that suit learning needs and standards in Madrasah Ibtidaiyah, also to increase student motivation and their interest during the learning process. This study uses the Systematic Literature Review (SLR) method with steps presented in [13], which are planning, conducting, and reporting. Then, 20 literature published between 2010 and 2020 was considered valid and divided into several categories to answer the research questions of this study, as explained in the previous section. As for a future reference, the authors suggest conducting a systematic literature review with more literature with national and international publications with more specific topics, which related to e-learning in elementary schools.

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