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Development of *Electrojourney* Gamification Module Electronic Systems Topic Design Subject Grade 5

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ABSTRACT

Gamification or game-based learning can make the learning process more interactive in the classroom and student interaction and involvement more active. The development of this module is due to students who are easily bored with conventional learning methods. This study aims to identify the main elements in developing the ElectroJourney gamification module on the topic of electronic systems. A qualitative research design and a module were developed based on the ADDIE Model. Purposive sampling was used to access expert teachers interviewed using an interview protocol. Data was collected through expert interviews to assess the usability of the module. The study findings found that this module complies with the content of the Curriculum and Assessment Standard Document (DSKP) as well as notes and exercises following the gamification theme, and the effectiveness in learning reached the maximum level. In addition, this module can also measure the level of student learning achievement. The development of this gamification module is aims to improve student experience through a more interactive and fun approach. The gamification module is increasingly becoming a suitable tool in fostering student interest in this topic of electronic systems and play a vital role in improving learning experience in class.

1. Introduction

Teachers are less exposed to technology in education because they think that using technology requires high skills. There are still teachers who are not skilled in using sophisticated tools. In navigating the Industrial Revolution 4.0, teachers should creatively use sophisticated tools such as LCD projectors as teaching media in the classroom [11]. A teacher can apply sophisticated tools to make the teaching and learning process successful. This is supported by the study of [6], which says that educators must be able to master technological developments for the progress of the nation's children, especially in education. Therefore, teachers must be prepared to face the challenges of the

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Industrial Revolution 4.0 (IR4.0) in line with the era of globalization [16]. Armed with this triggered module with several skills training, it is hoped that it can help implement teaching and learning innovations in schools.

In addition, students have less understanding and interest in TVET subjects because of the lack of reference sources besides textbooks. Unlike other core subjects, reference books or guides for TVET subjects are still lacking in the market, and this results in students' achievement and interest in TVET being reduced because they find it difficult to understand what they are learning. This statement is evidenced by the agreement of opinions by Mustapha and Rahim [9], who stated that teaching aids for elective subjects such as Engineering Technology, Engineering Drawing, and Design are so limited in the market, causing students and teachers to rely entirely on textbooks only. Therefore, e-modules can further increase the reference source for students and teachers.

The public perception of TVET must be improved, and Malaysians should not view TVET as a path or last resort in their minds. According to Boateng *et al.*, [4], TVET is often the last choice for students continuing their studies. Therefore, with the implementation of TVET in the school curriculum since primary school, introducing the Technology Design subject can further strengthen students' interest in learning skills in agriculture, automation, designing and sewing. Accordingly, the existence of TVET subjects from the age of 10 can make TVET no longer the last choice for students to continue their studies.

The implementation of teachers teaching ICT skills in teaching and learning sessions is still less encouraging, and teachers prefer to use conventional methods due to a lack of knowledge in technology. This is because the prevalence of teachers since their initial teaching placement has felt comfortable using the "chalk and talk" method to teach, and it has become an attitude that is difficult to change, in addition to the use of technology being considered difficult to use. According to Abdullah [1], a lack of training and knowledge about technology is one of the factors that can prevent the use of computers in every subject. Therefore, to produce skilled and knowledgeable human capital in the fields of computing, automation and robotics in the country, teachers should be agents of change in applying technology skills in teaching and learning sessions.

Gamification or game-based learning can make the learning process more interactive in the classroom and student interaction and involvement more active. According to Korniienko *et al.*, [7], gamification is a concept that uses specific scenarios for computer games on computer devices. Game-based teaching and learning is applied in teaching sessions to attract students' interest in learning while providing opportunities for students to explore independent learning [14,15]. Among the examples of game-based learning applications are 'Genially, Kahoot, and Quizizz', which are among the popular game-based learning applications in Malaysia.

1.1 Quality Education through Gamification

The gamification module complied with the fourth Sustainable Development Goal (SDG) of Quality Education, which promotes equitable and inclusive lifelong learning opportunities. The principle of digital gamification elements that emphasize rewards in learning, such as badges and scoreboards in this module is related to Sustainable Technology- Integrated Education (STIE), which develops sustainable and interactive technology-based learning content. In this study approach, students not only learn electronic concepts and components theoretically but also learn electronics visually, virtual experiments and activities in online games [17]. The fourth SDG will impact students' knowledge abilities, positively impacting knowledge development.

The current generation of students is often exposed to the use of technology, especially gadgets, making the conventional learning process boring and not attractive to students to learn. To overcome

this problem, based on the study of Samad *et al.*, [12], Teaching Aids (BBM) that are sophisticated or in electronic form are less used by teachers since the process of developing a BBM software requires a lot of energy and knowledge. This negatively impacts students, who quickly become bored and cannot attract their attention and interest. BBM is insufficient and takes too long, which involves using the latest technological skills [2]. This study is further supported by Bee Choo [3], many teachers still rely on textbooks as the main guide to the teaching process. Therefore, by developing this teaching aid module, teachers can provide exposure to students using the latest technology, and students learn with simulations and basic components of electronic systems that can be practically applied in the classroom.

In addition, the problem that arises especially for new students who are less involved in interactive learning when entering this topic is that students face problems understanding the content of the electronics subject effectively, as supported in the study of [13]. Every student needs to master the basics of electronics at the beginning of learning before entering more difficult electronic systems-related topics. According to the study of Ningrum *et al.*, [10], the lack of innovative and engaging learning media will cause students' knowledge not to be extensive, causing students to lack understanding of a complex topic, and causing students to be less motivated to get involved [5]. This topic is also basic in electronics that students need to master. If students do not master this topic, they will experience difficulty in the following topics. Therefore, learning about this electronics topic requires support material for PdP that allows students to make direct observations and can help them increase their understanding of the topic of electronic systems.

2. Methods

2.1 Research Design

This study uses a qualitative approach to developing a module for comics. Recognizing symbols and functions and installing electronic components facilitates a deep understanding of the validity. The ADDIE model was used in this study. The interview session with three expert teachers has been conducted to analyze the module development elements and evaluate the module's usability.

2.1 Participants

In this study, a purposive sampling method have been done by focusing on expert teachers who teach the subject of design, especially the topic of electronic systems. The criteria's listed are the expert have been involved with module development, experienced more than 5 years teaching in the field of electronics, and having achievement as excellent teacher in their school as tabulated in Table 1.

Table 1
Respondent demographics

Position	Position	Subject
Teacher	16 years	Teaching in the subject of invention
Teacher	6 years	Teaching the subject of design
Teacher	5 years	Teaching the subject of design

The selection of the expert teachers from different schools teaching the Design and Invention subject in Form 5 to identify the elements of module development and evaluate the usability of the module that has been developed, because of recognizing that the usability of this module can be used to improve it.

2.2 Research Instruments

The research instrument used by the researcher in this study is the interview method, and the analysis is qualitative. The type of interview that will be used is semi-structured interview, providing questions related to the content, elements, and usability of the gamification module development. The validity of this study is determined by using three experts, consisting of teachers who teach design, to identify the main components in the module's development and assess the module's usability. Three (3) experts on the validity of the interview instrument are lecturers from the Department of Engineering Technology, Faculty of Technical and Vocational Education (FTV) at Sultan Idris Education University.

3. Results and Discussion

3.1 Prototype

In the development of the ElectroJourney gamification interaction module on the topic of electronic systems for the Design subject in Form 5, the ADDIE model is used. This model approach can provide perfect functionality for researchers and users to access this module. Implementing this system requires the cooperation of others so that this interactive module can be easily developed. The process is divided into 5 phases: Analyse, Design, Develop, Implementation, and Evaluation.

3.2 Analysis phase

In this first phase of the analysis, the first objective is to identify the content and elements needed to develop the ElectroJourney gamification module for the topic of electronic systems, Design subject, Form 5. Based on reading from previous studies, problems experienced in education that need to be solved have been identified. After finding the issues that arise, the development of this module will be able to solve these problems. This module is developed based on gamification, an easy-to-understand game teaching aid in this phase. This gamification is an application that is easy to use, following the level of learning and understanding of students today. The researcher used an interview method approach to find out what content is suitable for use and the appropriate design elements for developing this gamification module, using three experts from different schools.

3.3 Design phase

In this design phase, the development of this module needs to go through several research procedures involving several processes, starting with the researcher studying the Curriculum and Assessment Standard Document (DSKP) to fulfil the elements of this gamification module. After that, the researcher examined the software 'Jotform' and 'Genially' to develop this module. The 'Jotform' software is for a site to store notes and drills for this gamification module, making it easier for Form 5 students to access it. Next, the 'Genially' software fulfils the objective of this study, which is to develop a gamification module. In the 'Genially' software, various questions related to electronic systems will be used as drills. The following is the software information for the module in this study as presented in Figure 1.

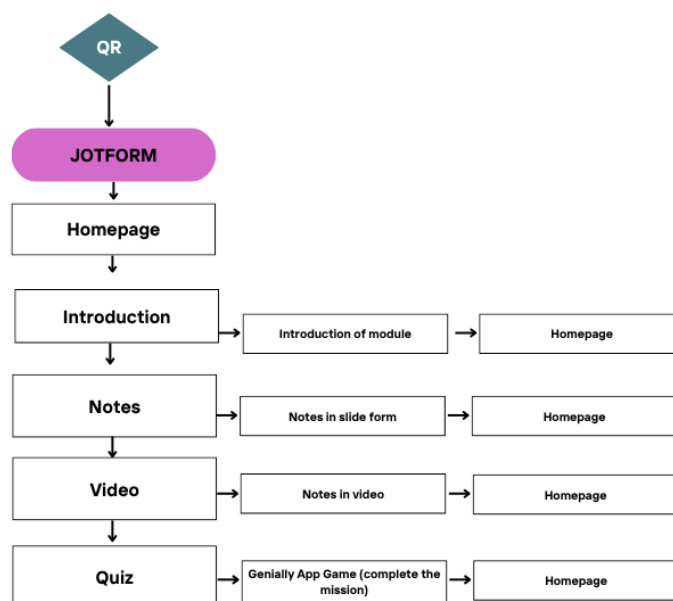


Fig.1. Information on the application module

3.4 Development Phase

For the development phase, this is a continuation of the design phase of the storyline that was made. To develop an interaction module based on the gamification module for the Form 5 electronic system topic, the researcher used the "Jotform" software for the software site before students accessed the gamification module. Students and teachers will be given a QR code to scan to display the elements in the software. Next, a display will appear for "Android" device users to add to the home page of their device screen without downloading the Jotform application and while "iOS" users, if they want to add this module to the home page of their device screen, need to download the Jotform application on the "App Store".

In this phase, the researcher will develop the software by providing a QR code to access this module. After that, various uses of the "Introduction, Notes, Videos and Practice" button icons will appear in this module to make accessing the module software easier and quicker. In this development phase, various forms of media are also provided to prevent students from getting bored quickly; the use of animation elements and audio also plays a role. In addition, the layout is designed neatly and organized to ensure students can use it most efficiently. Figure 2 illustrated the E-module that listed with four (4) main interphase, that are introduction to topic, followed by simple notes that explain all the important of electronic components and video component to enhance the understanding.

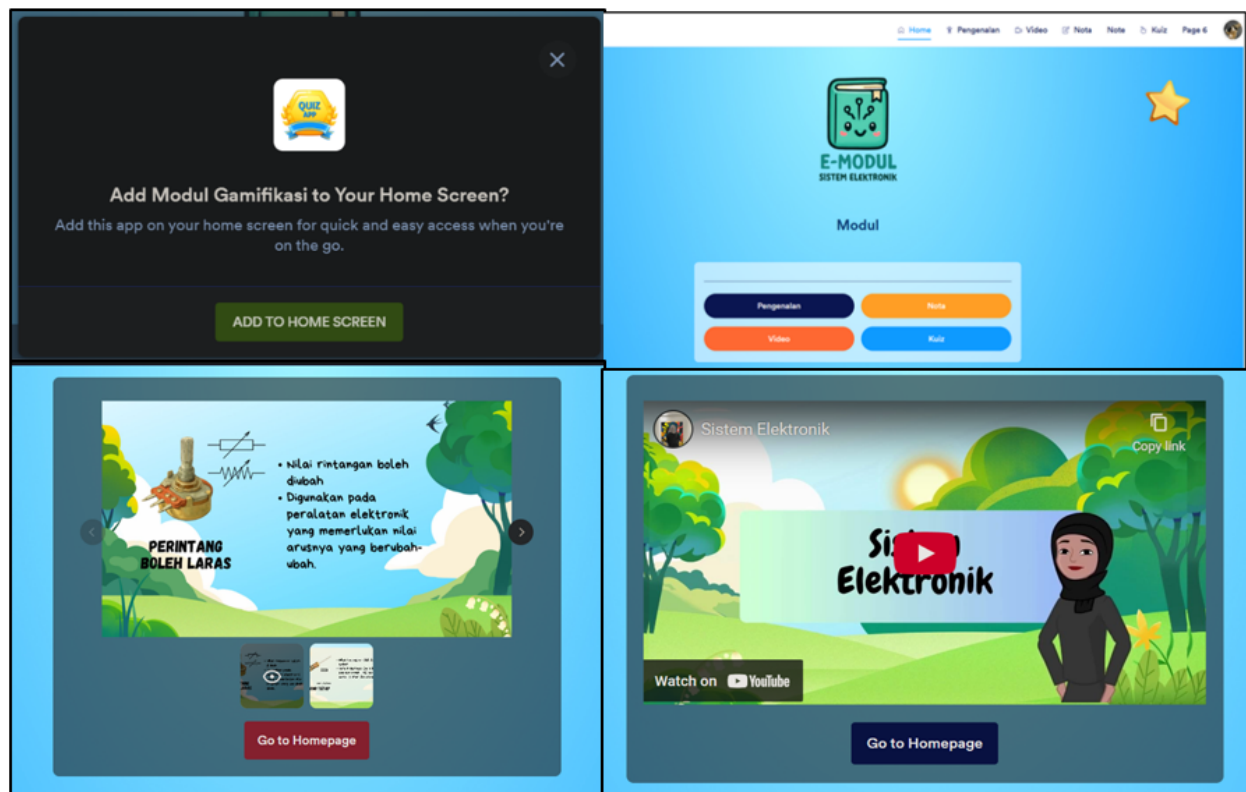


Fig. 2. Interphase of the ElectroJourney gamification module

3.5 Implementation Phase

For the implementation phase to achieve the third objective of this study, the researcher will see whether the interactive module software based on gamification has been developed perfectly or not. At the initial stage, after the successful development of this module, the usability of this module will be seen through a qualitative approach, namely semi-structured interviews with several experts and teachers who teach and have knowledge of the subject of design on the topic of electronic systems. Therefore, it can be ensured whether this gamification module has other problems. This software can be accessed using one device or computer; a good internet connection is required to access this game. In this modern era, the government is encouraging the community to use digital technology more, so digital technology in education also needs to be applied to facilitate the teaching and learning experiences towards students.

3.6 Evaluation phase

In the last phase, which is the evaluation, the researcher obtains responses from users after they use this teaching aid to fulfil the third objective in this study, which is to evaluate the usability of the development of the ElectroJourney gamification module for the electronic system topic of the Design subject for Form 5. From the method chosen by the researcher, which is the interview method with experts, the researcher obtained responses and information regarding the teaching aid software that was developed. In the reactions or feedback received by the researcher, he evaluated the level of usability of this interactive module software for students who took the Design subject for Form 5 for the electronic system topic. This evaluation aims to ensure that each process achieved the objectives of developing this interactive module. After completing the assessment based on the results of interviews conducted with several experts, improvements and suggestions can be made if problems

exist after developing the gamification-based interaction module and the effects of the module at the end of using this module.

3.7 Interview Session with Expert Teachers

The module development needs, and usability of the gamification module were assessed through a set of interview questions that included several sections for both interview phases. The interview questions for the module development element requirements had four (4) sections: section A, respondent demographics; section B, module content requirements; section C, module development design; section D, comments, and suggestions for module development. Meanwhile, the second interview, which was to assess the usability of the module, was divided into five (5) sections, namely section A, respondent demographics, section B module development design, section C module advantages, section D module development weaknesses, and section E module development suggestions and improvements. Qualitative data analysis was considered, among others:

3.7.1 Module content requirements

Regarding module content requirements, respondents provided various elements that should be present in this gamification module, such as visuals, animations, and audio. The following are the answers from the three respondents in this study:

"In my opinion, graphics need more pictures, and graphics must be related to the topic of electronic systems. The layout needs to be neater and more organised. Writing must be clearer, and the font size adjusted for easy reading. Colours are appropriate but more consistent, so they don't hurt the eyes. Audio can be included for additional explanations to increase student motivation. Instructions must be simpler and clearer so students understand what to do. (R1)

"The graphics should be interesting because your module is a games module, so the layout should be large to look bigger. The use of colours should not be too dark if possible. Each instruction should be explained clearly. And the questions should be related to the topic and according to the DSKP standards." (R2)

"I think the graphics, layout, writing, and colours should all follow your study theme, not mixed, but coordinated. The audio should be appropriate to recognise if the answer is wrong or right, there should be a certain sound in terms of instructions, and it should be clear. And the questions in your games should comply with the DSKP". (R3)

3.7.2 Module usability

Next, for usability, the researcher asked the respondents whether the module met the elements determined by the researcher and whether the module met the content of the DSKP. The following are the answers from the three respondents.

"In my opinion, in the video section of your notes, I was interested in how you installed the LED and Buzzer using a switch and using the Thinkercad platform and all of that according to DSKP standards." (R1)

"I watched your module in the video section and noticed you did a tutorial on installing LEDs and Buzzers using slide switches. I also followed along to install them. Very interesting. So for me, the content of the activities in your module includes LED and buzzer installation activities that involve switches and follow DSKP." (R2)

"Yes, it is possible to install LEDs and buzzers using switches based on DSKP. I saw your video using LED and buzzer installations, so your installation activities are according to DSKP." (R3)

Suggested application improvements. All respondents gave some ideas or suggestions. It included the following:

- Add SPM Question Paper.
- Video Notes Section Improvements

4. Conclusion

As a result, the ElectroJourney gamification module facilitating teaching and learning (T&L) of students in the subject of design, especially the topic of electronic systems, according to the Curriculum and Assessment Standard Document (DSKP). This gamification module helping teachers and students use multimedia in teaching and learning, such as video notes in the form of animation, notes in the form of comics and reinforcement exercises in the form of gamification. More precisely, this module was created to increase students' interest in the topic of this electronic system, making the learning environment more interactive and thus attracting students' attention so that they do not feel bored during learning.

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