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EXTENDED ABSTRACT

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The Development of Edu-Fertiblox Digital Game Using Roblox as ABM in The Topic of Fertigation Systems for The Subject of Design and Technology Level 1

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***Abstract*— A lack of practical facilities frequently causes problems for teachers and students. The Edu-Fertiblox digital game has been developed for the purpose of being a teaching aid for the topic Fertigation System Design Technology Level 1. The purpose of this study is to identify the needs of ABM for the topic of fertigation system, the development of the Edu-Fertiblox digital game as ABM and the usability of the digital game. The development of this digital game is by using the ADDIE model as a research design. The digital game was developed using Roblox Studio. After that, Edu-Fertiblox was evaluated for its usability through 3 informants consisting of teaching staff in the field of Technology Design to be interviewed. The findings that have been obtained have been analyzed using the content analysis method which shows that all the informants agree that the Edu-Fertiblox digital game can be used as a teaching aid for the Fertigation System of Technology Design Form 1 topic.**

***Keywords*— Roblox, Digital, ABM, ADDIE, Gamification**

I. INTRODUCTION

Some students believe that teaching and learning the subject of Technology Design is not as sophisticated as the subject's name suggests. Many lessons continue to employ antiquated or outmoded methods. The Fertigation System is one of the topics that still use in teaching. The fertigation system is a topic that is taught to Form 1 student. This has an impact on the student's cognitive level and practical skills. Due to a variety of factors, not all students can handle the practice without a systematic approach. This has made mastering the topic of Technology Design subject difficult for students.

Applications of gamification can be very diverse, and research often fails to acknowledge that many different game design elements at work can create affordances for students, ways of social interaction, and learning arrangements (Sailer et al., 2017). Therefore, game development using Roblox Studio is based on the teaching and learning needs of students and teachers themselves. Contextual and situational factors may influence the impact of gamification on learning outcomes and gamification research lacks methodological consistency (Dichev & Dicheva, 2017; Hamari & Koivisto, 2014).Therefore, the game development process using Roblox Studio is using the ADDIE framework.

In general, this study aims to develop a teaching aid (ABM) based on digital games. In the game, students will have a virtual experience of being on a fertigation farm according to the settings they have chosen. They can also get to know the components found in a fertigation farm more carefully because this game will give students a simulation of the farm according to the teacher's guidance.

In addition, the development of this game focuses on gamification as the main branch in education-based construction. The game is based on the teaching and learning of Form 1 Technology Design for the Fertigation System topic. The development of this game is also based on the theory of visual perception which requires students to have the ability to process acquisition, interpretation, selection, and organizing information from the senses. In other words, processing all visuals in the form of images to a teaching science.

Because the delivery style chosen in the classroom for the teaching and learning process (PdP) is flat and less appealing, students perceive the subject to be rather uninteresting and lose interest in learning (Jusoh et al., 2019). In conclusion, if the instructor continues to employ conventional or less current teaching approaches, pupils will get quickly bored during learning and facilitation sessions (PdPc) in class.

Good infrastructure can encourage teachers to utilize a range of acceptable tools to aid in the teaching and learning process. However, school infrastructure amenities varies from one another, particularly between schools in metropolitan regions and schools in rural areas (Juraidah, 2005). According to Junaidi (2007), one of the causes for students' inability to provide full dedication in class is a lack of practical equipment and comprehensive laboratories, as well as reference materials. This will limit the PdPc activities that the teacher has prepared.

According to Kok (1989) the use of equipment in the wrong way can cause accidents. Therefore, students can be exposed to safety risks when doing practical activities. The topic of fertigation systems requires students to undergo practical activities in the field.

II. LITERATURE REVIEW

The product development model is very important in helping the researcher do or complete related processes and works. There are several product development models that can be used, including the ADDIE, SAM, and AGILE models. However, the researcher used the ADDIE model for product development in this study. The ADDIE model consists of several phases namely Analysis, Design, Development, Implementation, and Evaluation (Gagne et al., 2005).

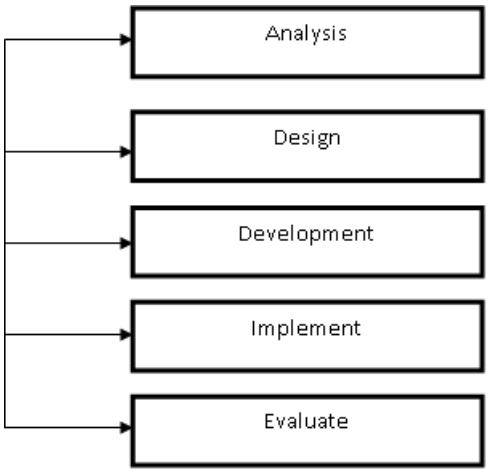

Figure 1 Model ADDIE

A. Visual Perception Theory

According to Davidoff, (1991) perception is the process that individuals use to select, organize and interpret input information to create a meaningful picture of the world. Perception depends not only on physical stimuli but also on stimuli related to the surrounding environment and the individual's condition.

Eyes as a sense of sight (visual) are closely related to the formation of students' perceptions. By simply looking at something, the brain will react and translate in the form of an interpretation. The brain's reaction to what students see is very different, depending on their life experiences. The brain understands visual objects by organizing sensory components that have relationships, patterns, or similarities into a whole (holistic). That thing is a visual perception.

III. METHODS

A. Research Design

This ABM development study was conducted to build a digital game based on the teaching and learning of Form 1 Technology Design for the Fertigation System topic. This study was developed using the ADDIE Model.

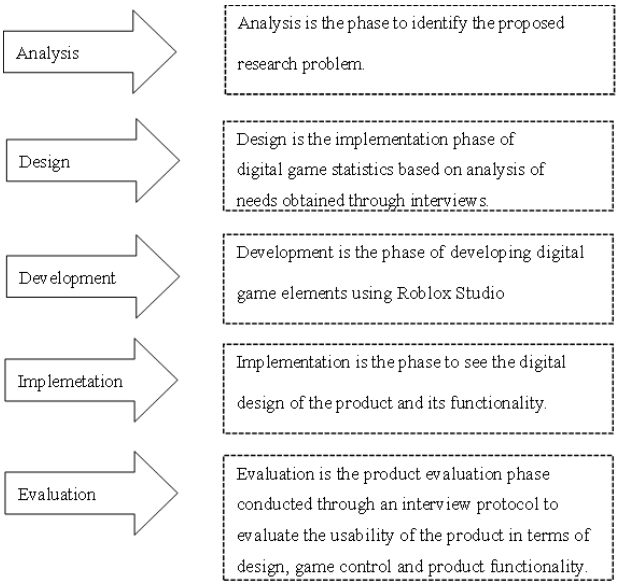

Figure 2 Model ADDIE Systematic Process

B. Population and sample

Sampling is a specialist related to the development of this product. The selection of experts facilitates the product design process to ensure that users can use the product's functions effectively. The design process of this product is guided by an analysis of the needs of teaching aids proposed by experts in teaching through digital games for the topic of fertigation systems. The development of this product is for teachers who teach and 1st grade students who study the subject of Technology Design. The study sample consisted of 3 experts or teaching staff related to the teaching of fertigation systems and in the teaching of Technology Design

C. Study Instrument

The researcher chose interviews as the main instrument in this study. Interviews are used because they are the best way in the process of gathering information. Information on the analysis of the needs of teaching aids can be obtained easily without avoiding any misinterpretation in the search for information. The interview was conducted through an interview protocol that is with the readiness of the level of understanding of a necessary information which in the context of this study, teaching aids and digital game development. After that, the researcher prepares a list of questions or comments that are needed to elicit responses from interview informants. Next, the researcher prepares a checklist to ensure that all questions related to the field have been asked. In addition, the researcher also needs to record all conversations during the interview session. Finally, the researcher needs to maintain good manners and be able to establish a familiar relationship with the informant so that the interview session runs smoothly.

Interviews are used again when the product has been completed and goes through the evaluation phase. Interviews help in assessing the applicability of this product as a teaching aid. The researcher will build structured questions to be asked to the informant. Interview protocols will be drafted in the development of this product. The researchers divided this structured interview question into 3 sections that asked about product usability, namely Part A (appropriateness), Part B (game design) and Part C (game content).

D. Data Analysis Methods

In the study methodology, data analysis is the last step in the product construction process. The study used a study instrument i.e., an interview. However, the interviews used for both objectives are not the same. The first objective that analyzes the need for teaching aids for the topic of the fertigation system using the semi-structural interview method. The final objective is to evaluate the usability of Edu-Fertiblox digital games as ABM using structured interview methods.

After that, data analysis from the interview was analyzed using the content analysis method. Content analysis can help researchers study areas of sociology that are otherwise difficult to analyze, such as gender issues, business strategies and strategies, human resources, and organizational theory.

IV. RESULTS AND FINDINGS

After the text edit has been completed, the extended abstract is ready for the template. Duplicate the template file by using the Save As command, and use the naming convention prescribed by your conference for the name of your abstract. In this newly created file, highlight all of the contents and import your prepared text file. You are now ready to style your abstract; use the scroll down window on the left of the MS Word Formatting toolbar.

A. Analyzing ABM Development Requirements for the Fertigation System Topic in the Subject of Technology Design

1) Analyzing ABM Development Requirements for the Fertigation System Topic in the Subject of Technology Design

a) Informant background and Introductory Questions

Based on the interview, the experts interviewed were 2 teachers who taught RBT and 1 lecturer who taught RBT, namely agriculture. The similarity between these 3 experts is their area of expertise in RBT related subjects. A significant difference is in the experience of these experts in the field of RBT where 2 teachers have teaching experience during the RBT subjects introduced in the school while 1 lecturer has 3 years of experience in teaching RBT at a higher education institution in Malaysia.

b) Transitional Questions

The interview found that all three informants had moderate problems in students lacking proficiency in subjects involving teaching fertigation systems topics. Informant 1 and Informant 2 share the same opinion that the teaching of fertigation systems is only problematic in producing mock-up models of fertigation systems.

Next, Informant 2 and Informant 3 agreed that the students experienced problems in mastering the topic of the fertigation system especially in terms of mastery of the fertigation system as a whole.

> *"Mastery becomes difficult because fertigation has an organized system and students need to master the basic points in fertigation to master it"*
>
> Informant 3

Based on the excerpts quoted from Informant 3, it is clear that the fertigation system is a complex teaching topic for students.

c) Key Questions

Furthermore, all three informants agree that the problem that is often encountered is in coming up with the idea of designing a fertigation system. Informants 1 and 3 explain that students are less creative in generating ideas to form a fertigation model. This causes problems in the teaching of the fertigation system without an appropriate approach.

Informant 1 states that educators and students have trouble teaching and learning the topic of the fertigation system due to the lack of readiness for the location to practice. However Informants 2 and 3 state that the lack of experience and fundamentals in agriculture is a problem for teachers and students in the topic of the fertigation system.

Informants 2 and Informant 3 use ABM in their teaching which is a fertigation model. The ABM used should provide early exposure on agriculture especially fertigation. ABM, on the other hand, needs to be equipped with careful fertigation components.

The interview continues by questioning the suitability of digital games as ABM for the topic of fertigation systems. All informants agree that digital games are very suitable for use as ABM in particular the topic of fertigation systems. Furthermore, the digital games developed are specifically to find experiences and assessments of students.

> *"Digital games are suitable for assessment to see how well students understand the teaching of fertigation systems"?*
>
> Informant 3

Two of the three informants state that the necessary components in developing digital games as ABM for the teaching of fertigation system topics are all systems that include. This is to ensure that the students who play the game are able to know all the main components of the fertigation system in order to master the topic of the fertigation system itself.

d) Closing Question

At the end of this interview the informant provided suggestions, comments, and improvements. Informer 1 encourages to produce a game application that does not need to be the best and simply provide a foundation in the fertigation system. Informant 2 also suggested producing a game in the form of *a puzzle* included with a quiz. Informant 3 stated that this study was interesting and able to attract students in the world of agriculture through digital games.

In conclusion, an interview conducted to analyze the need for the provision of Teaching Aids (ABM) for the topic of Form 1 Technology Design Fertigation System is urgently needed. All informants agree that the development of ABM for education is excellent to improve teaching and learning in schools.

B. Evaluating the Usability of the Edu-Fertiblox Digital Game as an ABM for the Fertigation System Topic in Design and Technology

1) Suitability of Edu-Fertiblox As ABM

Based on interviews that have been conducted, it was found that all three informants thought this Edu-FertiBlox digital game was very good. Informant 1 stated that an attractive ABM can attract students while students do not lag behind the ever-growing circulation of technology. Informer 3 also supported the findings.

Furthermore, the three informants stated that Edu-Fertiblox is very suitable to be used as a Teaching Aid (ABM) with Informant 3 stating that ABM in the form of digital games is very helpful for students, especially with the growing flow of technology.

All informants also agreed that the Edu-Fertiblox digital game helps teachers achieve teaching objectives and helps them assess students using the game's score system. Informer 1 asserts that game objectives must comply with the teaching objectives in DSKP on the topic of fertigation systems in order for digital games to remain relevant for use as ABM.

All informants also agreed that Edu-Fertiblox could provide a true picture of the fertigation farm. Thus, it can be attributed to the Visual Perception Theory that the game can provide the process of choosing, compiling and interpreting information

inputs to create a meaningful picture of the world. The tomato fertigation farm found in the game is just a visual that can be applied to students to create a true picture of the farm in the real world.

2) Edu-Fertiblox Design as a Digital Game

All informants had a positive opinion about the design of the '*interface'* used in the game, namely menus, controls, and settings. They are of the same opinion that the design of a simple *shaped 'interface'* or a game system that is very easy to understand especially for level 1 students

The three informants also had a good opinion about the design of the tomato fertigation farm used in this digital game. However, informants 1 and 2 think the game should be improved.

> *"There are many types of farms and each farm has its own standard category. Diversity in the types of farms can help students to identify what fertigation approaches are suitable for the farm."*
>
> - Informant 2

Based on the excerpts quoted from Informant 2, it is clear that digital games need to be improved by diversifying the types of fertigation farms in the game. There are different types of fertigation farms such as chilli plantations, cabbage, cucumbers and so on that can be used in this game.

Next, the design of the quiz game in fertigation gets positive comments from the informant. All the informants are of the opinion that the questions used in this game are medium high and medium low can test the students' understanding especially with the form 1 student level.

All informants also agreed that the graphic design and 'gameplay' design were good. All informants thought that graphic design was very attractive to use and suitable for use at the age level of level 1 students. Informant 2 stated that the design of the 'gameplay' was good but should be improved while other informants gave positive comments.

> *"There is a chronology or flow in this game that makes this game not boring."*
>
> - Informant 3

3) Fertigation Topic Content

All three informants state that there is a content of the Fertigation System topic in this game which includes the definition of the fertigation system, the components of the fertigation system and the fertigation farm itself. Informant 1 reiterated that it is important that the content of the game is to follow the DSKP set by the Ministry of Education Malaysia.

However, 2 out of 3 informants stated no or nothing to the process of building a fertigation system in the digital game Edu-Fertiblox. Informant 2 stated that there was no because students had to analyze the model itself conventionally and not in the game only using imagination as their visual.

2 out of 3 informants also stated that the Edu-Fertiblox digital game did not reach Performance Standard 3 (apply, create, design, design, use, example, complete). The informant asserted that the game only achieved half of the requirements required to achieve Performance Standard 3.

> *" The Edu-Fertiblox digital game achieved Performance Standard two overall but only part of Performance Standard 3. But not all ABMs need to achieve multiple levels of performance in one game."*
>
> - Informant 2

In conclusion, based on an interview to evaluate the applicability of Edu-Fertiblox as ABM it can be formulated that Edu-Fertiblox can be used as ABM. Informants all agree that Edu-Fertiblox can be used as ABM. Edu-Fertiblox can be used as an ABM that not only dances the interests of students but flows with the growing tide of technology today. Not only that, teachers and students can use this ABM to explore on their own or *self-learning* when playing this game.

V. CONCLUSIONS

Overall, it can be underlined that the objectives of the study are perfectly achieved by the researchers. The question presented has also been analyzed more carefully in Chapter 4 to assess the extent of the usability of the Edu-Fertiblox digital game as ABM for the topic of the Form 1 Technology Design Fertigation System. The analysis is to ensure that teachers and students can use the digital game in teaching and learning sessions. The researchers also believe that all the comments made by the informant can improve the digital game such as adding farm types as well as making the game flexible with easy updates to do.

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