Research Paper

Development of 3D Simulation Application for Production Multimedia Subject

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Abstract: The development of 3D simulation applications for Production Multimedia Subjects is intended to provide exposure and convenience to teachers, especially prospective teachers of Universiti Pendidikan Sultan Idris in exploring the 3D virtual world of the classroom and school environment in the context of learning and facilitate teachers to obtain daily information in finding relevant information. 3D. The objective of this study is to identify the 3D elements needed to build a school environment, design and develop a virtual reality application simulation application program that can be developed and evaluate the function of this 3D simulation application can help teachers teach and learn in schools. In addition, the use of applications such as simulators is basically for research and educational purposes. This study uses the ADDIE model used in the development of a 3D simulation application for this Multimedia Production subject. Simulation is capable of producing a virtual world of the surrounding atmosphere and a real environment. This Multimedia Production subject learning simulation can give students an idea of the learning environment in school. There is no denying that the use of simulation applications is not widespread as most of the available applications mostly focus on skills such as aeroplane piloting. With this, applications such as simulators are developed to give students an experience of the virtual learning environment.

Keywords: 3D, ADDIE, Multimedia, Simulator Application.

1. Introduction

Develop a simulator application that aims to provide exposure and convenience to teachers, especially prospective teachers of Universiti Pendidikan Sulltan Idris in exploring the 3D virtual world of the classroom and school environment in the context of learning. Development of this simulation application in the form of 3D objects and a simulation of animal characters such as birds in user control. According to Yanti & Dewi [1], 3D simulation interactive learning applications about physics learning with solid material elasticity materials, static fluids, dynamic fluids, and desktop-based thermodynamics have been successfully built with good functionality and validated materials. Built-in learning applications are proven to help students in understanding the elasticity of solids, static fluids, dynamic fluids, and thermodynamics with the acquisition of a superior comparison or improvement compared to using conventional media, namely 21.33% for the elasticity of solids, 14% for static fluids, 16% for dynamic fluids, and 19% for thermodynamics. The built-in learning application can be used as an alternative interactive learning media for teachers in delivering solid material elasticity, static fluids, dynamic fluids, and thermodynamics by obtaining user satisfaction test results of 89.21% with excellent category and usability test of 73.20% which indicates the application has been accepted. Here, we can see that the 3D simulation application development application is able to help in the process of learning and teaching in the classroom no matter whether at the school or university level.

According to Żukowski [2] meanwhile, the 3D computer game engine consists of a set of API libraries that contain 3D routines. From this library, a program can import and use the elements of this library. A 3D computer game also known as an "over-the-shoulder-shooter" is based on a user viewing a virtual world displayed through the eyes of the computer game actor. Through this study, we can see that the development of virtual 3D objects can highlight or evoke a learning atmosphere as in a real classroom. As a result of this, it can increase the level of focus and understanding in a learning context regardless of whether the topic is complicated or difficult to explain through conversation only as in google meet. However, every 3D object development requires thorough research and this makes the development as a whole require a complete group with skills for a field such as design, colour, coding and so on. A virtual reality application can be generated by making modifications to the elements mentioned above either through 3D modelling, graphic and sound manipulation or script programming. To produce an effective and realistic virtual world, textured images and high-quality materials are used. Using a high-resolution digital camera, the actual image is taken then edited and processed to obtain a texture format compatible with the game engine 3D. In addition, light, sound and interactive effects can also be incorporated into the virtual dimension. Every development or idea that is translated follows the passage of time which nowadays requires high technology [3]. In line with the passage of time, this idea arose where simulation applications were translated into the field of education by bringing ideas from applications that are available or being developed. Zarocostas [4] stated once expressed that his hope is that in the next decade, the meta-verse will reach one billion people, host hundreds of billions of dollars of digital commerce, and support jobs for millions of creators and developers.

2. Literature Review

This study is based on the reality of life today where all the needs or matters done are based on the use of technology. Here, it is associated with a user who wants to explore an area far from the place where he lives but wants to explore the area. Based on the statement Tangkui & Keong [5] explained that players can have good reasoning and can test it at the same time in a simulator game. For example in the bus simulation that must take into account when driving on the road or about to park the bus, because it is the player who controls the entire game. Here it can be seen that the experience of playing a simulator game can be an advantage when the player reaches the intended place in the virtual 3D. For example, school children who want to know the buildings in the school can be explored through a virtual 3D application. Looking at the state-of-the-art environment coupled with access to technological facilities such as smart-phones can be accessed by children as young as 5 years old, there is no denying that this virtual reality simulator application can be accessed by a number of students at school as well as the public such as parents. Not to forget, education today uses a lot of advanced technology as a teaching aid. According to Mayer [6] stated that BBM is needed in order to provide a learning experience to students.

In this case, students will gain experience through technology-based BBM. Technology-based fuel has a great impact on students. The list of new tools for educational technology is increasing from time to time created by the concept of Research and Development. Here it can be concluded that the rapidly

evolving technology will make it easier for users to access this 3D virtual reality simulator application plus the school is an institution that produces many educators who can take advantage of such technology ideas in educational institutions. In this study, there are two fractions of ideas that are used in in-game technology today and used to develop simulator applications and also virtual technology such as 3D building objects. Simulation games are a category of games that emphasize realistic elements such as everyday life. There are many things to consider in this simulation game such as fuel, food, direction while driving a car and many more. In addition to the above difficulties, the game control of the simulation game is also quite complicated and consists of many buttons so it requires a good memory to play it. Here we can see that this simulator application can be used to achieve the feeling of being in an environment. The object of the simulator is also the surrounding animals such as birds so it can facilitate control for the player [7].

2.1. Simulation Application System
The simulation application system is one of the main systems used in developing 3D simulation development applications for Multimedia Production subjects. A simulation is an imitation of the operation of a real-world process or system over time. The simulation requires the use of a model that represents a key feature or behaviour of a selected system or process, while simulation represents the evolution of the model over time. Often, computers are used to perform simulations. Simulations are used in many contexts, such as technological simulations for tuning or performance optimization, safety engineering, testing, training, education and video games. Simulation is also used with the scientific modelling of natural systems or human systems to gain insights into their functions as in economics. Simulations can be used to show the actual eventual effects of alternative conditions and actions. Simulation is also used when the actual system cannot be used, because it may not be accessible, or it may be dangerous or unacceptable to engage, or it is being designed but not yet built, or it may not exist. Key issues in modelling and simulation include the acquisition of valid sources of information about the selection of key features and related behaviours used to construct the model, the use of simplifying approximations and assumptions in the model, and the fidelity and validity of simulation results [8]. Procedures and protocols for model validation are areas of academic study, refinement, ongoing research and development in simulation technology or practice, particularly in computer simulation work. The application to be developed requires simulation technology as described above. This simulation technology plays an important role in the 3D simulation application of this Multimedia Production subject because it involves a realistic atmosphere where it depicts a real building or object. Therefore, the use of simulation systems in an application aimed at education is a good thing in order to improve the quality of education, especially when we face this phase of the covid-19 pandemic.

2.2. 3D Objects
3D objects are the main factor why this 3D simulation application of Multimedia Production subject is able to be an attraction to students in schools and also teachers, especially teachers of Multimedia Production subject.
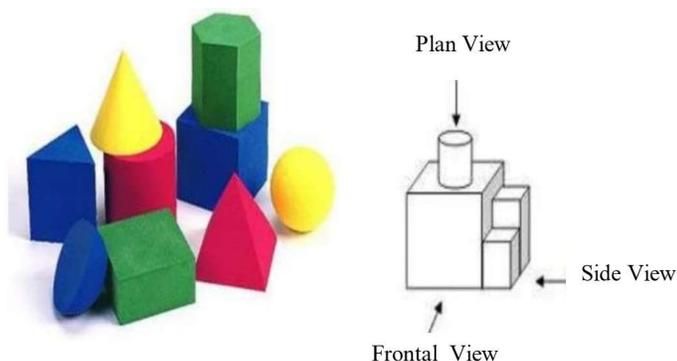
Figure 1. The Shape of a 3 Dimensional Object

According to Li et al [9], 3 Dimensional shapes refer to objects that exist in real or tangible space. It has volume, and mass and can be felt and touched. It is also an object that is concrete, volumetric, and has a sis view, left, right top and bottom. Natural objects, man-made objects or illusory forms and icons. The following is an example of Figure 1 regarding the shape of a 3 Dimensional object.

The use of 3D objects in the development of 3D simulation applications of the subject of Multimedia Production is important to show the realistic shape of objects compared to the display of pictures only. This allows a realistic atmosphere to be created when the student-school children explore the virtual world. In addition, the development of these 3D objects is also the basis or the main object developed using the 3D Max application as well as Unity 3D.

2.3. Pupils' Level of Focus on the Content of the Lesson

Each student has their own characteristics or personality traits where not all the content presented by the teacher can be accepted by the student. Mastery of content 'content knowledge' can be meant as subject matter content knowledge 'subject matter content knowledge' should be possessed by teachers in their respective fields [10]. A good teacher is a teacher who has a variety of ideas in shaping the content of the lesson in the classroom. This means that each subtopic has a variety of ways or methods of delivery in each learning session. A teacher should also have a well-developed content knowledge structure to produce optimal teaching and learning.So here, the introduction of 3D simulation applications in learning is a new idea that is trying to be highlighted in achieving the mission to interest students in knowing the content of learning. Also, it is to give the teacher a trigger to the ideas in learning [11].

3. Methodology

This section will discuss the methods used to develop the product the researcher will describe the entire production process of the product. The product to be developed is a 3D simulation application on the subject of Multimedia Production. Each process shown covers the entire requirements in the production of a complete 3D simulation application starting from the software used, hardware, content and elements used in the simulation system and 3D object development. Based on Figure 1 above, shows the ADDIE model used in the development of a 3D simulation application for this Multimedia Production subject [12]. The ADDIE model is an instructional design framework used by instructional designers in training and development [13] [14] [15]. The different phases are the Analysis, Design, Development, Implementation and Evaluation phases which represent dynamic and flexible guidelines for building effective support and training tools.

Figure 2. ADDIE Model

According to Figure 2 there are 5 phases shown, 3D simulation application of the Multimedia Production subject is developed based on the ADDIE model. The Analysis phase is to make a survey

on online learning. The Design phase is the phase in which the idea for the formation of a virtual environment. The Development Phase is the phase where the application is developed using Unity 3D and 3D Max. The Implementation Phase is a testing phase in stages according to the suitability of the application. Finally, in the evaluation phase is the feedback from the respondents based on the questionnaire.

1. Analysis Phase

   In this phase, will present a 3D Simulation Application title where users will explore an area such as a school area. The main purpose of the built-in app is to create an experience of exploring the school grounds as well as provide a school-like atmosphere. This app is only focused on students and parents only. However, after review and research, the researcher decided to expand the scope of the application by including a learning medium where there is lesson content in the simulation application. With this, the idea arose in producing a 3D Simulation Application for Multimedia Production Subjects. This 3D simulation application ranges from users limited to students only and subsequently, teachers can also use this application in building new teaching techniques. This makes it possible to indirectly add benefits to this simulation application. In building an application, certain software is required in developing important elements in an application. Based on the research, the researcher has decided to use two 3D development applications, namely Unity 3d and 3D Max.

2. Design Phase

   This phase is the second phase according to the ADDIE model process. This phase aims to build and create ideas for the formation of a virtual learning environment. Design is the second phase in designing teaching according to the ADDIE module. This second phase aims to determine and design the instructional methods to be used. In this phase, the researcher designs all the simulation application maps. The school area buildings are the researchers' primary reference in designing this 3D simulation application. Among the designs are classrooms or classrooms, school canteens and school libraries [13].

3. Development Phase

   During this development phase, researchers developed applications using Unity 3D and 3D Max software. In the initial process, the researcher will develop 3D objects using 3D Max software. Here every object that is in the school such as school desks, whiteboards, and computer screens and so on. In addition, the background and texture of the object are also developed based on each shape and colour of the actual object. Next, is the development of a simulation system using Unity 3D [14]. In this system, the researcher uses c ++ and java programming. The programming code mostly refers to the official Unity 3D website https://unity.com/learn. The main system used is the motion control system where the application user controls the character using W, A, S and D buttons. For camera navigation control, the researcher took a front view perspective as it is easier to see by the user than a wider view distance.

4. Implementation Phase

   In this phase, the implementation of a 3D simulation application for the user or respondent is intended to obtain feedback. Applications that have been thoroughly tested by researchers will be published and uploaded into Google Drive. Next, users will have two ways to either view the app's travel videos or download the app and try out the app itself [15]. After the test is done, users will be given a link to the questionnaire using google form. Users will fill in the questionnaire according to the level of effectiveness of this 3D simulation application on learning. Here, the researcher gets a random distribution of data from the respondents.

5. Evaluation Phase

   In this phase, evaluation is conducted to ensure that this 3D simulation application product achieves the objectives that have been planned by the researcher at the beginning of the phase. The feedback that has been filled in by the current respondents for the implementation phase is used in this evaluation phase [16]. The data that the researcher can randomly be used to make the analysis and findings of this study.

4. Discussion and Results

In determining the level of usability and functionality of this 3D simulation application, the researcher used the Likert table method to determine the level of user agreement on this 3D simulation application. The following is a description of the content items in the questionnaire. Based on Table 1 above, shows

the demographic distribution of respondents involved in this study. The results of the study showed that females dominated the males with a number of 13 people (72.2%) while males were 5 people (27.8%). As for the demographics of the category, it shows that the number of teachers dominates the number of students which is 15 people (83.3%) while the students are only 3 people (16.7%). Next, for the third item, the researcher wants to get the distribution of respondents' experiences in using simulation applications either through applications on mobile phones or on computers. The results found that 16 people (88.8%) had used this simulation application while only 4 people (22.2%) had never used this simulation application.

Table 1. Demographic Distribution of Respondents

Gender	Demographic	Total	Percentage (%)
	Male	5	27.8
	Female	13	72.2
Categories			
Have you used Simulation Application before either an application on a smart-phone or a computer?	Teachers	15	83.3
	Students	3	16.7
	Ever	16	88.8
	Never	4	22.2

Table 2 shows the distribution of the level of use of this 3D simulation application in everyday learning. The results of the study showed that for the use of simulation applications in daily teaching there are 9 people (50.0%) strongly agreed while 8 people (44.5%) agree with the use of this application. However, there was one (5.5%) respondent who disagreed. Next for the second item is the use of applications 3D simulations for subjects other than Multimedia Production, there were 9 people (50.0%) strongly agreed while 9 people (50.0%) agreed. For the results of the third study which is the use of simulation applications for school teachers where teachers can create a new technique in teaching, there are 15 people (83.3%) who strongly agree while 3 people (16.7%) agree. As for the results of the last study, which is the use for students where students get new experiences in learning, there are 16 people (88.9%) who strongly agree while 2 people (11.1%) agree.

Table 2. Distribution of this 3D Simulation Application

3D Simulation Applications	Agree	Strong Agree
The interface of this application is attractive *(Application Interface)*	4 (22.2%)	14 (77.8%)
3D object design is similar to real object design	2 (11.1)	16 (88.9%)
This simulation application serves to deliver learning materials wanted	3 (16.7%)	15 (83.3%)
The learning content in this simulation application is easy to understand	11 (61.1%)	7 (38.9%)

5. Conclusion

The idea in the development of this 3D simulation application is inspired according to the current situation where limited movement complicates students and the community to explore new areas. So such an application can make it easier for them to explore without having to go to the Sultan Idris University of Education. With the help of current technology, then the development of this simulator application can be developed through the available software and can develop virtual 3D objects as well as a simulator control programming system. Through a combination of two main software, namely Unity 3D and Auto-desk 3D Max, this simulator application can be developed. With this, the experience of exploring new areas can be achieved without the need to go to an area.

In addition, the idea in the development of this simulator application was inspired by several simulator applications that are already available such as ship control simulator applications and also vehicle testing simulator applications. This simulator application provides various positive impacts such as increased experience, cost savings and even controlled security. Through this application, the idea arose in the development of a 3D simulation application for the subject of Multimedia Production.

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