

Usability of Augmented Reality (AR) Application in 'Fertigation System' Among Form 1 Students at Sekolah Menengah Kebangsaan Behrang 2020, Perak, Malaysia

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ABSTRACT

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The purpose of teaching aid is important to attract students to always be active in the classroom. It is important to focus on educational activities among students such as the usage of teaching aid during the teaching and learning process. Therefore, the objective of this study is to identify the usability of augmented reality (AR) application 'Fertigation System' among form 1 students of SMK Behrang 2020 who took Design and Technology subject. The application was developed using the ADDIE model which has five phases including analysis, design, development, implementation, and evaluation. The design of the studies used was quantitative method (survey method). The instrument of study used was a questionnaire. In the first phase (Analysis), a questionnaire that was endorsed by experts was distributed to 35 respondents to identify the needs of the AR application development. In this phase, there were 72% of respondents agreed the needs of the AR application development. For the next phases, an AR 'Fertigation System' has been designed and developed. A questionnaire was distributed together with the AR application that has been developed and verified by three experts from different fields (language, education, content). After that, a pilot study was conducted among 50 students of form 1 who took Design and Technology subject at SMK Behrang 2020 as respondents for improvement purposes (Implementation phase). For the final phase (Evaluation), a questionnaire and application of AR 'Fertigation System' which has been verified and improved was distributed to 76 respondents comprising form 1 students who took Design and Technology subject at SMK Behrang 2020. The results of this study showed that 62.72% of the respondents strongly agreed with the usability of the AR application 'Fertigation System'. All data obtained was analyzed using the Statistical Package for Social Science (SPSS) to obtain the average value, percentage, frequency and standard deviation. In conclusion, the results of this study show that the AR application of the 'Fertigation System' that has been developed can be used among form 1 students who took Design and Technology subject at SMK Behrang 2020, Perak.

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Introduction

Today's technology interacts with society on many different levels and can generate a variety of outcomes depending on the environment or situation. With this rapid technological development, it brings great changes especially in the world of education. Student acceptance in the teaching and learning process also changed. Design and Technology is a new subject that has been developing to replace the Integrated Life Skills subject which involves from form one to form three students. There is a change in the Design and Technology subject especially in terms of its learning standards where it focuses more on solution methods, project production, design ideas and many more. The Design and Technology is a practical subject that strongly emphasizes the integration of technology in learning while developing the potential of students in a holistic, balanced way and integrated (Masingan and Sharif, 2019).

According to Harun (2014), to ensure that students can fully master the Design and Technology subject, teachers need to use the skills they have in terms of knowledge, teaching practices and the use of technology in creating the appropriate teaching aids according to the needs of the subject. A skilled teacher is a teacher who has extensive knowledge about a subject that will be taught, experienced, good at using technology and wise in managing time is a criterion of a good teacher from a student's perspective (Bullock, 2015).

The use of teaching aids or materials in the teaching and learning process helps teachers a lot while delivering lessons in the classroom. The teaching lessons will be easier with the availability of these teaching aids especially when the tools are used in accordance with the topic of the lesson. Utilizing technology in the teaching and learning process is one of the essential teaching aids in use today. Malaysia is a nation that is actively evolving right now, parallel to the advancement of technology. Thriving technological advances cannot be separated from people's lives regardless of computing, agriculture, communication and so on. Through the development of this technology, the world of education is also no exception in undergoing a transformation to the world level.

According to Zayyadi et al. (2017), with this rapidly evolving technological advance, educators should take advantage of it to aid in the educational process. One of the more widely adopted forms of technological progress by society is computers. As we know, there are many types of technology applications that are already available to the community and are ready to be adopted or harnessed for educational needs. One of the teaching aids that teachers can use in implementing teaching and learning process that interests' students is the augmented reality (AR) application. Augmented Reality refers to a concept in which it combines the real world with a virtual world created by a computer. The selection of media in the appropriate education can attract students' interest or attention to the topic to be studied. With the advent of this AR technology, it can attract the attention of students as the material presented is virtual in three-dimensional images where they

better understand the images displayed. Previous study also showed that through the possibilities it offers, AR is able to identify practical solutions at the areas where learners struggle during learning (Altinpulluk, 2019). In addition, this technology is using many fields including agriculture area. Nowadays, most of the agricultural field work is done by machines that are operated by people in farming and there is an increasing trend in study into integrating AR in agriculture (Huuskonen and Oksanen, 2018). The use of AR in agriculture will enable farmers to produce a better and larger yield (Pandey et al., 2020). Therefore, the objective of this study was conducted to determine the usability of augmented reality (AR) application in 'Fertigation System' among Form 1 students who took Design and Technology subject at Sekolah Menengah Kebangsaan Behrang 2020, Perak, Malaysia.

Method

This study was conducted at Sekolah Menengah Kebangsaan Behrang 2020, Perak, Malaysia. The ADDIE (Analysis, Design, Development, Implementation, Evaluation) model was used to develop this Augmented Reality (AR) 'Fertigation System' application. The ADDIE model is very easy to use, understand and easy for teachers and students to practice as well as it can assist teachers in creating more interesting teaching and learning methods than traditional teaching methods. Quantitative method was used in this study as it is a simpler method and can save costs and time.

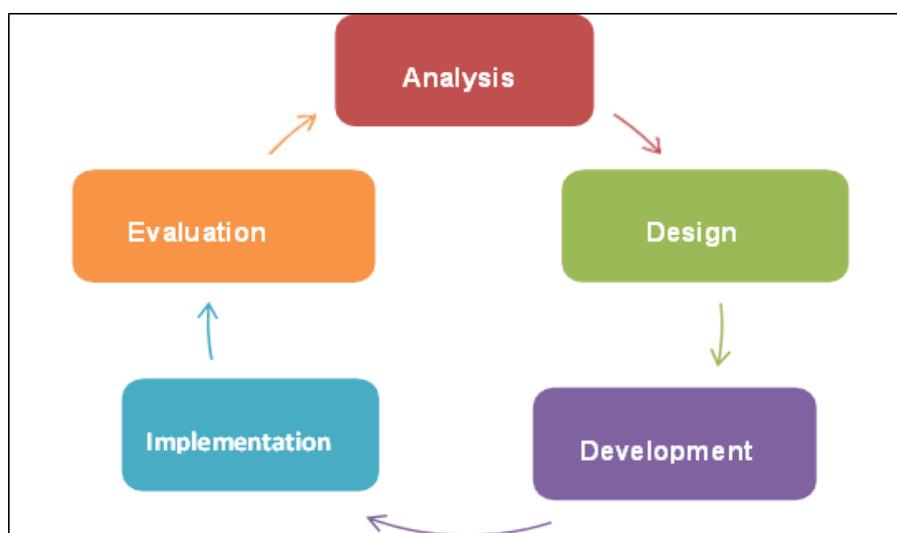


Fig 1: ADDIE Model

Analysis Phase

The ADDIE model consists of 5 phases. In the first phase (Analysis), a questionnaire that was endorsed by experts was distributed to 35 respondents of Form One students at Sekolah Menengah Kebangsaan Behrang 2020, Perak to identify the needs of the AR application development. In this phase, there were 72% of the respondents agreed the needs of the application development.

Design and Development Phase

The second and third phase are design and development where an Augmented Reality (AR) application 'Fertigation System' was designed and developed.



Fig 2: Pamphlet and Augmented Reality (AR) Module

Implementation Phase

In this phase, a questionnaire was distributed together with the AR application that has been developed and verified by three experts from different fields (language, education, content). Then, a pilot study was conducted among 50 students from form 1 who took Design and Technology subject at SMK Behrang 2020, Perak as respondents for improvement purposes.

Evaluation Phase

For the final phase (Evaluation), a questionnaire and application of AR 'Fertigation System' which have been verified and improved was distributed to 76 respondents comprising form 1 students who took Design and Technology subject at SMK Behrang 2020, Perak

Research Instrument

The research instrument used in this research was a questionnaire. Questionnaires are commonly used, and it is a quantitative study. The questionnaire consisted of three sections. The first section is about demographic information of respondent, and it contains three items. The second section is about design of teaching aid (AR) and it contains seven items. The last section is about the content of teaching aid (AR) and it contains eight items which to evaluate the usability of Augmented Reality (AR) application in 'Fertigation System' among form 1 student who took Design and Technology subject at Sekolah Menengah Kebangsaan Behrang 2020, Perak.

Collection and Analysis of Data

There were 76 samples of students collected in this study. The sample size was determined by using Krejcie and Morgan Table. The data were returned around one week. All data obtained was analyzed using the Statistical Package for Social Science (SPSS) to obtain the average value, percentage, frequency and standard deviation.

Result

Demographic Result

Table 1 shows that there are 76 students in this survey (100%) comprising 31 male respondents (40.8%) and 45 female respondents (59.2%) of the total respondents. However, the value of respondents who answered this questionnaire amounted to 76 respondents out of a total of 97 form 1 respondents who answered the actual study of the use of AR as a teaching aid. The respondents of this survey were 76 students (100%) comprising 70 Malay respondents (92.1%) and 6 Indian respondents (7.9%) of the total respondents and no Chinese respondents. Based on the Table 3 below, all respondents have knowledge of the topic of Fertigation System in RBT subjects.

Table 1. Distribution of respondents by gender

		Gender	
		Frequency	Percent (100%)
Valid	Male	31	40.8
	Female	45	59.2
	Total	76	100.0

Table 2. Distribution of respondents by race

		Race	
		Frequency	Percent (100%)
Valid	Malay	70	92.1
	Indian	6	7.9
	Total	76	100.0

Table 3. Analysis frequency and percentage of respondents on knowledge in fertigation system

		Knowledge of the Fertigation System	
		Frequency	Percent (%)
Valid	Yes	76	100.0

Data Analysis Design of Teaching Aid (Augmented Reality (AR)) Application

Mean scores were interpreted based on five points Likert Scale as in Table 4. The information obtained from the respondents was analysed using the Statistical Package for Social Science (SPSS).

Table 4. Mean interpretation

Mean Score	Interpretation
1.00 - 1.80	Very Low
1.81 - 2.60	Low
2.61 - 3.20	Medium
3.21 - 4.20	High
4.21 - 5.00	Very High

Table 5. Mean value and standard deviation of design of teaching aid Augmented Reality (AR) application

Item Statistics		
	Mean	Standard Deviation
Teaching aid AR application Fertigation System easy to access	4.37	.486
Teaching aid AR application Fertigation System easy to use	4.49	.529
The teaching aid AR application Fertigation System works well	4.66	.478
The teaching aid AR application Fertigation System have a simple note	4.68	.468
The teaching aid AR application Fertigation System attracts students to learn	4.66	.478
The front page and content of learning teaching aid of AR application Fertigation System is beautifully decorated	4.61	.492
The title of the teaching aid of the AR application Fertigation System is clearly stated	4.82	.390

Table 5 above shows the findings of the study of each question where it contains a mean score and standard deviation involving all respondents (n = 76). The mean range based on the table above is from (M = 4.37 to 4.82). The mean score value of the entire question in this part B is (M = 32.28). The title of the AR Fertigation System application is clearly stated to record the highest mean score (M = 4.82, SD = .390, n = 76). While the item shows that the AR Fertigation System application is easy to access recorded the lowest mean score (M = 4.37, SD = .486, n = 76). If viewed from the overall mean score recorded, there is not much difference in the mean score between these seven items. The mean interpretation in the Table 4 above shows that if the mean score range (M = 4.21 – 5.00) indicates a very high interpretation, it means that the design of the teaching aid (AR) application managed to achieve the objectives of the study.

Data Analysis Content of Teaching Aid (Augmented Reality (AR)) Application

Table 6. Mean value and standard deviation of the content of teaching aid (Augmented Reality (AR)) application

Item Statistics		
	Mean	Standard Deviation
Fertigation System AR application have interesting notes	4.51	.554
The teaching aid of AR application Fertigation System has a clear / complete video of the steps of the installation of the fertigation system	4.55	.501
The teaching aid of AR application Fertigation System is easy to understand and clear	4.55	.501
AR application of Fertigation System gives areal picture of the system	4.51	.503
The teaching aid of AR application Fertigation System gives exposure to the use of technology	4.84	.367
Teaching aid of AR application Fertigation System provide new experiences	4.87	.340
Teaching aid of AR application Fertigation System has complete content	4.66	.505
The layout of the topic in the teaching aid of the AR application Fertigation System is in order	4.58	.497

Table 6 above shows the findings of a study of each question where it contains a mean score and a standard deviation involving all respondents ($n = 76$). The mean range based on the table above is from ($M = 4.51$ to 4.87). The mean score of the entire question in this C section is ($M = 37.08$). Table 6 shows that the Fertigation System application teaching aid has interesting notes and gives a real picture of the system recorded the lowest mean score ($M = 4.51$, $SD = .554$ & $.503$), respectively. However, the item shows that the AR application of Fertigation System provides a new experience recorded the highest mean score ($M = 4.87$, $SD = .340$). If viewed from the overall mean score recorded, there is not much difference in the mean score between these eight items. According to the Table 4 above, if the mean score range ($M = 4.21 - 5.00$) indicates a very high interpretation, it means that the content of the teaching aid (AR) application managed to achieve the objectives of the study.

Discussion and Conclusion

The study's findings give a general overview of how well the augmented reality (AR) application in the "Fertigation System" functions as a teaching tool. In comparison to the traditional teaching methods most frequently employed by teachers, AR teaching materials have improved the learning process for Design and Technology subject. The teaching materials used were shown to have increased students' concentration, enjoyment, happiness, and satisfaction. In the learning process, both within and outside of the classroom, the use of media as a tool is crucial. The utilisation of instructional materials like textbooks and other traditional media only makes the student a passive participant in the learning process. As a result, more sophisticated technologies are required to provide an interactive learning environment. Virtual reality and the real world may now be integrated with AR and the usage of AR in the education can improve student performance (AlNajdi, 2022).

Previous researchers also showed that achievements and visual thinking were much higher for students utilising the AR mode than for those using the simulation option (Aldalalah et al., 2019). Moreover, previous study also proved that by encouraging students to self-study, raising audience interest in educational content, developing a desire to use contemporary interactive technical capabilities and technologies, and substituting multimedia computer models for textbooks and laboratory apparatus, the introduction of augmented reality technology provides the opportunity to enhance the quality of education (Gurevych et al., 2021). Users can interact with virtual and real-time applications because to its advanced technology, which also gives users access to natural experiences (Saidin et al., 2015). The best education that can be provided to students today is visual education since it will help the advancement of science and technology (Gurevych et al., 2021). This technology itself can be widely applied to a variety of learning media, including printed media like newspapers, books, and magazines as well as smartphones, which is making it easier for teachers and students in terms of teaching tools and learning materials. In addition, the use of AR in the education has the potential to enhance students' conceptual

knowledge and understanding as well as key abilities like problem-solving, teamwork, and communication (Ke and Hsu, 2015). Numerous studies also demonstrated that the AR-based learning environment significantly improves students' critical thinking and learning (Faridi et al., 2021).

Overall, the findings of this study are consistent with several earlier studies that have demonstrated that integrating AR application into education has favorable effects. Because AR technology can increase academic accomplishment by streamlining the teaching and learning processes and ensuring that learning is enjoyable, teachers recommend mastering and maximising its use to provide a better and more effective learning environment.

In conclusion, there isn't enough research has been done on the learning strategy of utilising AR in the educational system. In high school, AR technology utilisation in Design and Technology subject is still in its beginnings. To determine the effectiveness of teaching media employing AR films among students generally, additional research is suggested using a wider and random sample of students from a variety of various schools.

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