

# Multimedia Education Tools for Effective Teaching and Learning

Azyan Yusra Kapi@Kahbi, Norlis Osman, Ratna Zuarni Ramli and Jamaliah Mohd Taib  
Faculty of Computer and Mathematical Sciences, Universiti Teknologi MARA Negeri Sembilan,  
Kampus Kuala Pilah, Pekan Parit Tinggi, Kuala Pilah, Negeri Sembilan, Malaysia  
azyanyusra@ns.uitm.edu.my

**Abstract**—A multimedia application is an effective teaching tool. Many teaching tools are being developed to make learning in subjects such as Islamic studies, language, science and technology less abstract and theoretical, thus making it easier to learn and capture the students' interest. Visualization and interaction techniques are being applied in several e-learning projects in our classrooms. Three e-learning projects which are 'Greenfoot as a Teaching Tool in Programming', 'Visualization makes Array Easy (VAE)' and 'e-Tajweed Yassin' applications strive to engage the students by allowing them to visualize the concept learned, its behaviour and operation using animation, games, simulation and other elements, in contrast to more conventional teaching method. Hence, the students can obtain a new learning experience with better understanding of the concepts and perform better in their assessments. The outcomes from these studies have shown positive results from the students. This paper compares between the three applications: Greenfoot, VAE and e-Tajweed where it discusses the design models used that meet the instructional goals and objectives, and how non-technical students respond to the information presented.

**Index Terms**—Innovative Teaching; Multimedia; Teaching Tools; Visualization.

## I. INTRODUCTION

A multimedia application is a creative presentation of a combination of media such as sound, graphic, text and animation. The development of such applications supports education system by improving knowledge sharing process and at the same time influence people to think creatively. There are many multimedia applications in the market that serve for educational purposes that can be used freely or with some fees. Each application has certain area or subject taught which is following a certain syllabus and the syllabus may vary for different courses. Currently, department of computer science in UiTM Negeri Sembilan has developed three multimedia applications which are Greenfoot, Visualization makes Array Easy (VAE) and e-Tajweed for education purpose. Different approaches are used to develop the application; nevertheless, the feedbacks from users are reasonably good. The objective of this paper is to compare the development process of the three applications in terms of constructivist approach; integration of formal and informal activities; integration of social learning and the delivery hours needed for the teaching and learning process in order to identify the best approach that can be used to develop multimedia application for educational purposes.

This paper presents the idea by using the following scheme: a) Literature review, b) Justification of three multimedia applications, c) Methodology used, d) Result and discussion and e) Conclusion.

## II. EXISTING TEACHING TOOL

An e-learning system can support learning with the aid of multimedia components such as text, audio, video and animation. There are a number of studies that have identified multimedia components to assist learning for students. Past research has identified that complication of the multimedia component has enabled students to use their mental skills in a more effective way [1]. At the same time, multimedia and interactive components also support self-learning [2, 3]. Many teaching tools are being developed to make learning in subjects such as Islamic studies, language, science and technology to be less abstract and theoretical. A study has demonstrated educational technology such as PowerPoint presentation has played a positive role in Islamic studies [4]. The success of the Computer Application of Electromagnetic Education (CAEME) is another proof of effectiveness with the use of multimedia in education [5]. CAEME uses innovative multimedia modules which have been supported by the IEEE society. With the implementation of multimedia as a tool for learning, it has captured the students' interest and made them passionate in the learning process [6]. It can be concluded that multimedia components such as animation and videos to be a powerful tool to communicate facts, explain concepts and trigger emotions [7]. The following section will discuss the three applications; Greenfoot, VAE and eTajweed Yassin in details.

### A. Greenfoot as a Teaching Tool in Object Oriented Programming

Greenfoot is a tool that allows the creation of scenario to ease visualization of 2D objects interaction in teaching object-oriented programming [8]. A scenario is a term used in Greenfoot to indicate a project. The scenario has been created by using Greenfoot environment and has been used as a teaching tool for Introduction to Object-Oriented Programming course. The scenario created in Greenfoot demonstrates the visualization and object interaction elements, engage student's interest in learning; provide a clear illustration of object-oriented concepts and easy development of a game-like application from the scenario provided. One of the sub-topics covered in the scenario is how a method is invoked in Java. Figure 1 depicts the Greenfoot's screen that shows the method invocation with a return parameter.

The scenario in Greenfoot has been tested to 20 students to assess the usability of the teaching tool. System Development Life Cycle (SDLC) has been applied as a methodology. Students found that learning object-oriented using the teaching tool which is created using Greenfoot environment

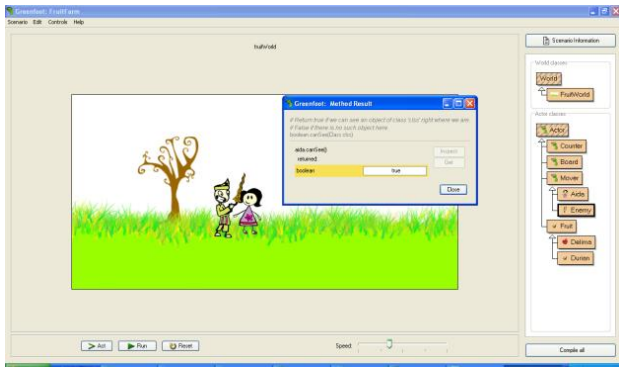


Figure 1: Screen showing the method invocation

is easy-to-use and simple to learn. Hence, the students responded that they are able to visualize object quickly by using this teaching tool.

**B. VAE**

VAE is developed based on the ADDIE model (Analysis, Design, Develop, Implement and Evaluate) which is a model of instructional design. In the analysis, visualization techniques are identified as one of the main factors that cause students to easily understand the concepts of programming. VAE design process takes about one week in order to create a storyboard. The storyboard is used as a guide to develop VAE. In the development process, the two main softwares that have been used to develop VAE are Video Scribe and MS PowerPoint with i-Spring. VAE is beneficial to the students and lecturers in teaching and learning the introduction to programming. Array is the main focus in VAE since the lecturers had found that it was hard for the students to understand.

A simple test is carried out by 60 students and the results showed that VAE with simulation technique is effective in helping the students to learn the concepts of programming. Features such as learnability, efficiency, memorability, accuracy and satisfaction are contributing factors in determining the effectiveness of the prototype VAE. VAE helps the students to understand the concepts of programming. There is a significant increase in the student test results and therefore can be concluded that the VAE has helped them in getting a better understanding and further showed better results [9]. Figure 2 shows VAE screen that uses constructed an analogy to explain swapping values in the array.

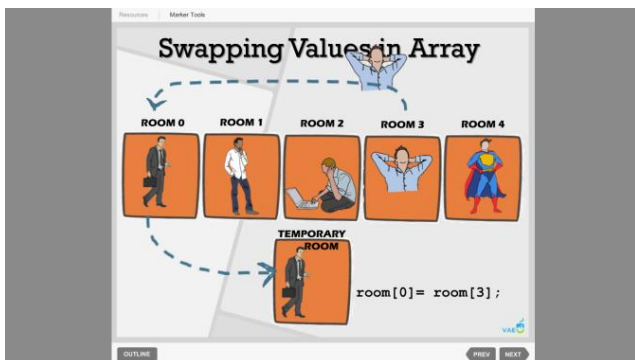


Figure 2: VAE screen to show on how two values swap in array

**C. e-Tajweed Yassin**

The ADDIE model was being used to develop the E-Tajweed Yaasin system as an e-learning application. The

technique of visualization and interactive was identified to support studying and understanding of tajweed during the analysis stage. In the design stage, the layout of contents was designed to be easily accessible by the users. The graphical user interface (GUI) was to imitate the traditional method known as syafawiah. The system emphasizes on the common mistakes that usually done by the previous students who have undergone the course. There are animated pointers for each part of a verse that also being highlighted with red colour as shown in Figure 3. Notes of common mistakes are supported with audio. Finally, the actual recitations of the verse are presented by a video of an authentic reciter for each of the verses in the Surah of Yassin.



Figure 3: Screenshot of e-Tajweed Yaassin

The MS-Powerpoint with i-Spring features was employed in the development process. Students were enabled to identify and revise the tajweed for the surah of Yaasin. The combination of audio, video and animation was more effective than text mode of promoting learning [17]. A number of 51 students were selected to use the system and later, they were being evaluated based on their ability to read the surah of Yaasin. Data collected was based on student's ability to recite the verses of twenty until forty of the surah of Yassin after the implementation of this interactive system. The result of these students was then compared to the previous semester students who did not use the system. It was found the e-Tajweed Yassin system was able to improve the reading of students where the numbers of mistakes have been reduced to all the rules. The system is beneficial to the student and instructors since it reduced the instructional time and allowed self-study for students [16].

**III. METHODOLOGY**

This experimental study is intended to look at the effectiveness of teaching and learning approaches/strategies in three different multimedia education tools developed: Greenfoot, VAE and E-Tajweed in order to improve the content and delivery.

In comparing the identified multimedia education tools, four elements are being used.

**A. Constructivist Approach**

Constructivism is a learning theory where students are able to construct knowledge based on their experiences. It is used with pedagogical approaches that promote active learning. Past researcher mentioned in his research that to be successful, a teaching method motivated by constructivism needs to be organized around a set of activities [10, 13, 14].

These activities then will keep the students actively engaged in the knowledge being constructed.

### B. Integration of Formal and Informal Activities

The use of audiovisual media added with video, animation and simulation can effectively improve the context of the learning process and academic assessments results [9, 11, 15].

### C. Integration of Social Learning

The Social Learning Theory [12] focuses on the participation process of individual learner to develop their skills and abilities. Generally, social learning is the understanding which is built through interaction with the learning elements in the application.

### D. Delivery Hours

The delivery hours slotted per topic are usually set in the course syllabus. The time that the teacher spends for the delivery to make the learner understand are varied according to the learner's cognitive capability but still within the allocated time.

## IV. RESULTS AND DISCUSSION

Three elements that are evaluated in these three applications are constructivist approach; integration of formal and informal activities and integration of social learning. Based on Table 1, all three elements existed in Greenfoot, while in VAE there are only two elements except constructivist approach and e-Tajweed has the element of social learning only. Even though all three identified elements are not found in all the three multimedia applications (Greenfoot, VAE, eTajweed), but they managed to meet the objectives of making the students to be able to understand their topics better and incite their interests.

Table 1  
Comparison of Identified Elements in Multimedia Education Tools

Application	Constructivist Approach	Integration of Formal and Informal Activities	Integration of Social Learning
Greenfoot	√	√	√
VAE	×	√	√
eTajweed	×	×	√

where: √ = element exists in application  
× = element not seen in application

Other than that, the results of this study showed that the use of teaching tool has eased the process of teaching and learning by reducing the delivery hours as shown in Table 2. The considerable point of this study is the effect of these three multimedia education tools on teaching and learning process in term of hours spent. Multimedia education tools could promote the ease of use and provide better guideline with the help of sounds effect, video, animation and more effective than traditional face-to-face lecture method. For example, the lecturer took 8 hours to deliver and discuss the topic with the students in the class. In contrast, by using VAE, the allocation of time can be reduced by 2 hours.

Table 2

Comparison of Element: Delivery Hours for Teaching and Learning Process

Application	Delivery hours without application	Delivery hours with application
Greenfoot	56 hours	48 hours
VAE	8 hours	6 hours
eTajweed	3 hours	2 hours

The reason for this difference lies in the nature of multimedia itself. Since multimedia education tools can help the student to interpret and visualize about ideas and concepts, it will allow the students to engage and increase their motivation and understanding for their learning. Therefore, in multimedia education tools, the students can learn by themselves, save time spent for teaching and this will promote self-learning as well.

## V. CONCLUSION AND FUTURE WORKS

In this study, four elements have been used to compare between three multimedia education tools. The first three elements include constructivist approach, integration of formal and informal activities and the integration of social learning. The existences of all three elements were shown in Greenfoot application, but not in VAE and e-Tajweed. Both constructivist approach and integration of formal and informal activities do not show in eTajweed; however, the latter is shown in VAE. Although the three elements did not show in all the applications, experimental results indicate that these multimedia tools can reduce the delivery hours if compare to the traditional lecture face-to-face. In conclusion, multimedia education tools can promote effective teaching and learning in general.

In future works, a multimedia education tool will be developed based on the three elements mentioned and integrate it with game-based learning, quizzes and usability test will be conducted in order to add a variety of elements offered in a tool, thus promoting a better multimedia education tool.

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## REFERENCES

- [1] H. D. Surjono, (2015). The effects of multimedia and learning style on student achievement in online electronics course?. Turkish Online Journal of Educational Technology, 14 (1), pp. 116-122
- [2] R. W. H. Lau, N. Y. Yen, F. Li, & B. Wah, (2014). Recent development in multimedia e-learning technologies. World Wide Web, 17(2), 189–198. <http://doi.org/10.1007/s11280-013-0206-8>
- [3] D. Srinivasan, (2013). Effectiveness of e-learning Components in Building Stronger Foundation in Engineering Fundamentals. In 2013 IEEE 5th Conference on Engineering Education (ICEED) (pp. 78–83). <http://doi.org/10.1109/ICEED.2013.6908307>
- [4] A.M. Zedan, M. Y. Z. Mohd Yusoff, M. R. Mohamed, An Innovative Teaching Method in Islamic Studies: The Use of PowerPoint in University of Malaya as Case Study, Procedia - Social and Behavioral Sciences, Volume 182, 2015, Pages 543-549, ISSN 1877-0428, <http://dx.doi.org/10.1016/j.sbspro.2015.04.776>.
- [5] M. F. Iskander, "Multimedia and technology based electromagnetic education," 2014 IEEE Antennas and Propagation Society International Symposium (APSURSI), Memphis, TN, 2014, pp. 531-532. doi: 10.1109/APS.2014.6904597

- [6] S. Dawn, "Multimedia, animation, and computer graphics — Mapping of study of virtual characters to cognitive understanding," 2013 IEEE International Conference in MOOC, Innovation and Technology in Education (MITE), Jaipur, 2013, pp. 75-79. doi: 0.1109/MITE.2013.6756309
- [7] W. Horton, *e-Learning by Design*, Wiley, 2011.
- [8] M. Kölling, *Greenfoot – A Highly Graphical IDE for Learning Object-Oriented Programming*. Journal of ITiCSE'08, 2008.
- [9] R. Z. Ramli, A.Y. Kapi & N. Osman, Visualization makes Array, Testing and measurement: Techniques and applications: Proceedings of the 2015 International Conference on Testing and Measurement Techniques (TMTA 2015), 16-17 January 2015, Phuket Island, Thailand, CRC Press, 2015. pp. 381-384.
- [10] S. Hadjerrouit . *A Constructivist Approach to Object-Oriented Design and Programming*. Journal of ITiCSE'99, 1999.
- [11] J. Fombona and M. Pascual . *Audiovisual resources in formal and informal learning: Spanish and Mexican students' attitudes*. International Education Studies, 2013, 6 (2), 1-11.
- [12] M. R. Cubas, E. C. R. D. Costa, A. Malucelli, L. Y. I. Nichiata, and F. S. Enembreck. *Components of social learning theory in a tool for teaching Nursing*, 2015, Revista Brasileira de Enfermagem, 68(5), 906-912.
- [13] D. Luo, *Using Constructivism as a Teaching Model for Computer Science*. Journal of Information Technology, Beijing Forestry University, 2005.
- [14] J. R. Savery and T. M. Duffy. Problem Based Learning: An instructional model and its constructivist framework. Journal on Learning and Technology, 16, 2001.
- [15] B. Daniel, *Lime a recommendation model for informal and formal learning, engaged*. IJIMAI, 2(2):79–86, 2013
- [16] J. Mohd Taib, N. Mohamad Yusof, H. M. T. Jamil, H. R. Aris, & H. Satari, (2016). An Interactive Approach of an e-TajweedYaasin System. In J. @ E. Luaran, J. Sardi, A. Aziz, & N. A. Alias (Eds.), *Envisioning the Future of Online Learning* (pp. 115–123). Singapore: Springer Science+Business Media Singapore. <http://doi.org/10.1007/978-981-10-0954-9>
- [17] J.D. de Oliveira Neto, W.D. Huang, & N.C. Azevedo Melli. Education Tech Research Dev (2015) 63: 555. doi:10.1007/s11423-015-9392-7.