THE EARTH & UNIVERSE AUGMENTED REALITY EDUCATIONAL BOOK

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Highlights: Students have been perceiving even simple concepts in science are particularly difficult to grasp, since many ideas involve three-dimensional thinking. So, an Augmented Reality learning tool was developed to provide easy-to-use teaching/learning tools for learners and educators. The unique capability that allows virtual objects to appear in real world can serve as an effective tool to facilitate students to acquire better understandings on science and assist teachers to teach concepts that cannot be easily seen in a natural environment. Thus, AR-SMB has a bright potential for expansion and among potential markets include schools, parents and collaboration with publisher like Sasbadi/Pelangi.

Keywords: augmented reality; multimedia; educational technology; science; 3D modelling

Introduction

Learning science is not easy. Many of the concepts and phenomena they learn are not only new and unfamiliar, but they are also unable to directly experience it. Learning science may be crucial in early childhood, serving not only to afford opportunities for children to develop a better understanding of the world around them but also to build important skills and attitudes for learning. Even simple concepts in science are particularly difficult for students to understand, since many ideas involve three-dimensional thinking. However, much of the teaching materials used in science education are 2D in nature and there are still few targeted instructional materials for science concepts available for educators and learners. This may cause their losing interest in the subject, which would later render their negative attitude towards learning. Previous studies on science education have discovered that students commonly hold robust misconceptions that are fundamentally contrary to actual scientific concepts. These pretentious ideas are typically labeled as an alternative ideas or misconceptions in science education (Vosniadou & Skopeliti, 2017). According to (Taber, 2017) the alternative frameworks that students possess are beliefs and perceptions that differ from the beliefs of scientists. Students will hold this belief firmly and will affect their learning and this may cause their losing interest in the subject, which would later render their negative attitude towards learning. Hence, it is a great need for effective teaching tools that assist students in restructuring and changing their existing conceptual understanding. Thus, Augmented Reality (AR) may have the potential to situate students in conceptual knowledge development.

In an era of rapidly changing technologies, AR technology has received increasing emphasis and wide usage among educational practitioners and researchers. With the unique capability to display computer-generated information on top of a view of the real world, the comprehension of environments could be enhanced. So, an Augmented Reality (AR) learning tool called "The Earth & Universe Augmented Reality Educational Book" was developed to provide easy-to-use teaching/learning tools for learners and educators. The product is an AR book-based educational tool that allows the webcam to recognize pages in the book and turn them into 3D presentations to help students acquire new concepts and overtake misconceptions about science. The product provides both virtual and real world simultaneously to users and allows users to work in the real world and interact with virtual objects that are projected on real scenes around them. This capability makes this technology an interesting resource in any type of teaching that is unachievable with the use of other technologies. In addition, appearing of 3D objects in real world creates a magical feeling causing a high degree of surprise and curiosity that lead student to have more engagement in learning.

The product has an ability to encourage kinaesthetic learning. It allows students to manipulate the 3D virtual objects from a variety of perspectives to enhance their understanding by just using their bare hands. This friendlier

interface allowing users to use their hands to manipulate the visualizations rather than clicking and dragging the mouse which body movement helps people remember what they perceive and provides a cue for future recall. Furthermore, since AR use 3D registration of virtual and real objects, it could allow user to view the learning content in 3D perspectives. This affordance can help students who usually encounter difficulties to visualize the phenomena that are not possible to view in real world or complex concept. This can facilitate students to acquire better understandings on science and assist teachers to teach concepts that cannot be easily seen in a natural environment. AR can support students by inspecting the 3D object or class materials from a variety of different perspectives or angles to enhance their understanding. The AR environment also could boost students' motivation and interest, which in turn could help them to develop a better understanding in learning contents. The product also enables student-cantered learning as recommended in Pelan Pembangunan Pendidikan Malaysia 2013-2025. Furthermore, the product encourages students to engage in an interactive learning environment that makes learning interesting leading to improved academic results. The product also can encourage parents to involve themselves more in their children education by suing the product to encourage the learning and amaze their children.

The product also has been tested in a real setting where it involved 34 fifth grade elementary school students to incorporate the product in their teaching and learning process. The findings from the real settings showed that learning through the product has a statistically significant improvement on student's science performance score and visualization abilities. The findings also indicated that most participants were able to shift from misconception to a scientific understanding after learning through the product. The findings of this research show that the integration of AR in learning was considerable effective in facilitating conceptual change. The amount of student-student's interaction and students-AR interaction also were high indicating that they were really interacting and active in the learning activities.

There are no similar existing products in terms of the design and educational principles used in the current product. The product has been developed based on educational Predict-Observe-Explain inquiry-based learning design and the cognitive theory of multimedia learning (CTML). Unlike other AR applications, which require users to wear goggles or other head-mounted display devices, this invention is used without any devices on the user's body. It only requires a laptop and a webcam to render virtual objects, small in data storage and can run on any platform ranging from Windows XP to Windows 7.

AR has a bright potential for expansion because of its affordability. Therefore, we can commercialize the product to all school since the subject content of the product was based on science syllabus. Among potential markets include schools, ministry of education, teachers, parents and collaboration with publisher like Sasbadi/Pelangi.

Acknowledgement

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