Mobile Augmented Reality: Enhance Visualization Skills in Learning Abstract Concept in Chemistry

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INTRODUCTION

For the last few decades, integrating technology in teaching and learning in the classroom has been an important issue. According to Lee et al. (2013), there are several meta-analyses have been conducted in order to examine the specific modes or educational practices that can enhances the effectiveness of student learning and teaching with technology. The digital technologies that being used is now not limited to the usage of computer only. There are others digital technologies also arise which are the mobile devices, digital media creation and distribution tools, video games and social networking sites (Collins & Halversont, 2010).

The NMC Horizon Report: 2013 Higher Education Edition listed out the six technologies that to highlight emerging technologies with considerable potential in education. One of the technology is tablet computing. The benefit of using the tablet computing is it's relieve the burden of complex IT infrastructure management but also involves the cost savings on the maintenance of the applications (Chandra & Borah, 2012). Besides, the development of this technologies also generate a considerable amount of excitement among academics because it transforming traditional learning to tablet learning. (Kim, 2012).

One of the examples of the tablet computing application that integrating technology in education is Augmented Reality (AR). Many researchers believe that this integration can improve student learning and performances (Chen & Tsai, 2012). According to Clemens, Purcell and Slykhuis (2013), AR is a live, direct or indirect, view of a physical, real world environment whose elements are augmented by computer-generates sensory input such as sound, video, graphics or GPS data. The latest technologies in AR are MAR which AR had been used in the mobile applications (Danakorn et al., 2013). Danakorn et al. (2013), also stated that MAR have make a learning more meaningful and overall participants from the previous study felt motivates, enjoyed and show a positive educational effects on participants. This will improve the engagement in the learning performances of the students.

PROBLEM BACKGROUND

The advanced technology that emerged in education is now being explored in order to solve the problems in the teaching and learning process. This is because the traditional chalk and talk teaching method and the use of static textbooks are failing to engage students and leading to poor learning outcomes. According to Mcclenney and Greene (2005), the students claimed that every week chalks and talks routine is boring and this lead to the decreasing of the engagement of students to the subject. Technology is one of the solutions to help in solving this problem which technology encourages active learning and computers application rarely make the students bored (Marshall, Cartwright & Mattick (2004). Besides, nowadays the energetic generation need challenges and often bored in traditional classroom and they prefer quick interactions with content which required visualization skill (Black, 2009). In addition, Wu, Krajcik & Soloway (2001) also claimed that computerized models can serve as a vehicle for students to generate mental images which then will help the

students visualize and understand better.

Difficulties to visualize the abstract concept in Chemistry.

Chemistry is one of the electives science subject and the core to the others part of sciences which is less interested by student in Malaysia. This is because they found it is hard to understand. Chemistry is a sciences subject that will equip the student with the knowledge that can help them in problem solving, decision making and also will need they think critically and scientifically in order to find a solution. There are many researches (Nahum et al., 2004; Daniel, Kang & Sai, 2001; Ozmen, 2004) have been conducted that shows the students are weak in Chemistry and they always fall in the misconception problems. According to Uzuntiryaki and Geban (2005), students have difficulties in understanding most of the abstract concepts in Chemistry and hold misconceptions which lead to the prevention of meaningful learning.

Palmer (2001) claimed that misconception among the student has to be taken into account because it can interfere with student's learning of scientific principles and concepts. There are many researches (Nakiboglu & Tekin, 2006; Stefani & Tsaparlis, 2009; Duis, 2011) have been conducted in identifying student's misconception in Chemistry. Thus, selection of teaching method plays an important factor in avoiding the student's misconception (Palmer, 2001).

Chemistry will be the topics that commonly will involve when talking about the problems in the visualization in sciences education. This is because Chemistry is a visual science which visualization plays a major role in daily practices (Wu & Shah, 2004). Chemical Bonding is one of the examples of basic topic which contain an abstract concept that cannot be directly applied to everyday life. Thus, students faced difficulties in understanding the chemical bonding concept (Uzuntiryaki & Geban, 2005).

Nahum et al. (2004) stated that from the research conducted around the world, it's shown that the concepts associated with

chemical structure and bonding, such as molecules, ions, hydrogen bonds, and giant lattices are abstract. These abstract concept will create a difficulties that may lead to misconception because of the students have a fundamental misunderstanding. As example in chemical bonding, there is great potential for the formation of alternative conceptions as students try to derive meaning from what is said by the teacher or what is written in the textbooks because the concepts of the topic is abstract (Daniel et al., 2001).

Besides, scientific concepts are complicated because many scientific ideas and models are too sophisticated to be taught in schools. Thus, in Taber (2001) research he suggests that school curriculum should include representations of science. There is also research by Kelly and Jones (2008), which found that many students are able to correct their misconceptions after viewing either static molecular visualizations or animations (Jones et al., 2008).

According to Mohd Nor and Nur Afza (2010), they make a conclusion from their research that there are few problems in the study of chemical bonding that lead to the misconception among the students. There are students which cannot identify the type of bonding and still answering single and double bond instead of the right answer which are covalent and ionic bond. Besides, they also found that the students cannot identify the conditions of every chemical bond that form between the elements. Students also not master in drawing the diagram of the electron sequences for the ionic compounds and covalent compounds. Thus, make the diagram that they are drawn become dysfunctional. Other than that, the problems in the topics of chemical bond that exist among the students are they cannot draw the Lewis structure in the right way. This is because they do not understand the concept and they cannot visualize the abstract concept (Mohd Nor & Nur Afza 2010).

Thus, effectives teaching strategy or new tools to enhance the teaching and learning qualities which can help in the visualization of abstract concept in Chemistry for example chemical bond

should be developed. According to Campbell et al. (2010), tools or technologies in classroom learning is good to enhances visualization of complex concept and also will eventually facilitate communication and collaboration between the students. Besides, the visualization skill also can be improved with the help of technology which it have ability to mentally manipulate complex spatial dimensional and 3D figures (Tsai and Yen, 2014).

Potential Technologies in Visualization the Abstract Concept in Chemistry

According to Wu, Krajcik & Soloway (2001), many students have difficulties in learning symbolic and molecular representation of Chemistry. To promote understanding of chemical representation, a computer-based visualizing tool, eChem had been introduced to the students which allowed them to build molecular models and view multiple representations simultaneously. They also prove in their research that, to help students understand Chemistry, technology can be used a learning tool this is because multiple link representations that represent by multimedia allows students to visualize the interactions among molecules and avoid the misconception related to the chemical concepts.

There are a lot of technologies in education that aiming to help students in visualization which is including simulation and animation. According to Prinz, Bolz and Findl (2005), the technology such as simulations has limitations which the resolution of the videos is not consistent and the quality of the videos also low which the students have to replay many times to make them understand. Besides, Falvo (2008) claims that because there are recent advances technology is available and develop the possibilities of research related to animations and simulations in education are becoming low. Falvo (2008) also said that researcher must keep exploring the best visualization technologies to be integrating in modern classroom to make sure the learning process is efficient.

With the existing of AR in education, the technology can be used in Chemistry field on solving the misconception among the students. There are because many processes, ideas and concepts can be better illustrated using both images of the real world and graphics (Sighal et al., 2012). According to Gudyanga & Madambi (2014), the strategies of using visualizing tools as ways of minimizing learners misconception is a good initiatives because it will make teaching and learning environment more visual than conceptual so that student can understand the concept better.

MAR ENHANCE STUDENTS' VISUALIZATION SKILLS

If referring to Horizon Reports from 2004 to 2011 they reported that they highlighted the potential of mobile devices to be adapted in the future. Thus, AR is now being developed and designed to be integrated in a mobile devices. According to the Martin et al. (2011), the mobile technologies most likely will affected the education fields. Besides, Martin et al. (2011) also stated that the current and the most potential mobile technologies that expected will be emerged widely is mobile augmented reality (MAR). MAR provide the user ease which it is not constraining the user to used it in specific areas (Hollerer and Feiner, 2004). Houser, Thornton and Kluge (2012) stated that mobile devices have advantages over desktop PCs because mobile devices have the ability to move with its user.

AR is proven can enhance the visualization skills of the student. This supported by the statement claimed by Kalfoken et al. (2011) which they said that AR is a powerful visualization tool for exploring real world structures along with additional contextual information. AR also shows a great potential in visualization which it's also increasing the understanding and ease the learning of Chemistry for students by visualizing and controlling virtual models of molecules in the research by Maier, Klinker & Tonnis (2009). Beside of the advantages of AR in enhances the visualization skills, AR also shows a good responses from the

participants that experiencing the AR technology.

AR by Burton et al. (2011) shows a result that participants were clearly excited about the potential that this technology has for sharing information and learning about new concepts. The usage of AR using a smartphones is also known as mobile augmented reality (MAR) allows a learning experience that is linked to the formal classroom, so that students can learn outside of class hours and outside of school limits (Burton, 2011). Future research suggested by Lamounier et al. (2010), is to improve the internet portability in order to facilitate users access to the system and students and potential users can use it anytime and anywhere. This will give opportunity to the students to use AR using a smartphone which gave first-hand how powerful AR can be as a learning tool and were inspired by the amount of content knowledge they gained and maintained due to their interaction with the smartphone activity. This is suit with the harness development of MAR in education field as reported in the Horizon Reports 2004-2010.

CONCLUSION

As conclusions, from the above statement its proven that technology especially AR really can be used in order to enhances visualization skills. It's also may help the students to encounter the difficulties in visualization of abstract concept in Chemistry. Based on the meta-analysis from the previous researches that been conducted on AR, there are a lot of applications had been developed on several fields and not limited to education. The use of AR in education, particularly mobile learning is still in their early phase which it stills in the phase of changing and improving but from the research it shows that AR can be used very successfully for situated and constructivist learning, particular where collaboration and student inquiry take places. Furthermore, mobile phone or tablet computing professed high degree of comfort and familiarity with the affordances available with the technology which it's enhances portability compared to laptops.

So, MAR should be explored more to discover the potential that exist for improving the process of teaching and learning.

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