

Elements of Augmented Reality Application Design in Teaching and Learning Process

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Abstract--- *In this study, the purpose is to identify the elements of Augmented Reality (AR) application design for analysis phase to develop AR application. Information and communication technology has acquired numerous advantages in all areas of organization in every country such as in education field. AR application has been utilized in many field such as in innovation using technology for teaching and learning process but there is still lack of knowledge, skills and devices in its operation. AR is an application that consolidates virtual objects and real objects in real life to attract students using AR applications. AR application utilizing fascinating introduction systems using interesting presentation techniques such as displaying 3D objects, audio, video and animation by simply scanning the smartphone camera towards a particular picture that has been structured. Therefore, the methodology research is based on past reading and literature studies by using document analysis. At the end of the study, there are several main element were found in this research which is multimedia, device, student and social elements that can be use in design phase analysis of AR applications.*

Keywords--- *Provide Augmented Reality, Education, Element, AR Application, Document Analysis.*

I. INTRODUCTION

In educational technologies advancements are develop at an incredible speed now days, and influencing the reform in the learning processes (Craig et al., 2006). Through the use of technology, it has given a change in the education system and provides an opportunity to engaging, realistic and fun learning environment (Kirkley & Kirkley 2004), as well to enhance student engagement and understanding of the content of lessons (Di Serio et al., 2012; Kreijns et al., 2013). Augmented Reality (AR) is one of the technology that combines virtual objects into real world and users can interact with virtual objects in real time (Azuma, 2004; Kuo & Kuo, 2015). According to Billingham & Duenser (2012) shown that AR is suitable for use in the field of education, which can help students in cognitive process, especially with visual spatial ability (Thornton, Ernst, & Clark, 2012).

AR design plays an important role in the use of the application. Designs that are relevant to the teaching and learning process also contribute to the active participation of students and the teaching process can be done more effectively. There are several elements to create an AR application design to fulfill the user's criteria and requirements such as multimedia, devices, students and social elements. According to Thomson (2014) multimedia elements can helps student to motivate and provide a solid memory aid while using AR application because multimedia element it consists of text, graphics, audio, video and animation. Other than that, device element is a tools used as a link between the user and the technology (Koole & Ally, 2009). There are several criteria of device

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elements in the design of AR applications, which is based on the physical features of the device and the capabilities of the device. On the other hand, student element is refers to how they use existing knowledge, store and transmit the information they acquire and enhance the sense of student engagement among the student community itself (Squire & Jan, 2007), encouraging students to self-explore their subjects (Kaufmann, 2006). Besides that , social elements are related to the process of social interaction and cooperation. The interaction is in the form of communication and allows users to gain knowledge and exchange information. Some researcher have claimed that online interactions can add or replace themselves in interaction (Wellman, Haase, Witte & Hampton, 2008), Thus, the aim of the research is focus on the AR application design elements to improved the production of AR quality applications that are comparable to other technologies in the use of learning processes.

II. LITERATURE REVIEW

The conventional of one-way teaching pattern can cause of contributing to the weakness of the students (Mohamad Noor et al., 2016). Thus, lack of the detailed information about teaching materials to attract students such as colorful, an attractive graphic and animation approaches in the presentation of elements and topics will slow down the students' understanding process (Mohd Sergeant, 2012). In addition, the more devices in AR are used the greater the risk of failure on device for example GPS error make cause and difficulty of students to continue learning (Dunleavy et al., 2009). Besides that, there is also problems in the pedagogy that the content were incomplete in AR applications shows the content and sequence of predetermined teaching (Kerawalla et al., 2006), teachers quiet difficult to make changes to accommodate students' needs to achieve teaching objectives (Bergig, Hagbi, El-Sana & Billinghamurst, 2009). In addition,lack of skilled of manpower in managing AR application in learning also seen as a factor in the implementation of the technology (Klopfer & Squire, 2008).Thus, designing an application it must be assessed in advance according to each requirement that is needed, so the production can be done to fulfill the criteria.

III.METHODOLOGY

The methodology for this research is document analysis. According to Krippendorff (2013) and Duriau et al. (2007) document analysis is a widely used method of research covering various fields, and its application is widely used. Among the researchers, this content analysis has several advantages, including its sensitivity to the textual content of a document or report (Krippendorff 2013). Its usefulness is to cover various areas such as business policies and strategies, organizations, research methods, organizational behavior, human resources, technology and innovation management, international management as well as organizational theory (Duriau et al., 2007). The content analysis method is also widely accepted in the field of information communication and science, as a method for the detection of media images and textual content (D'Agostino et al., 2011) and also applied in the field of environmental research (Altaweel et al., 2012) . For the purpose of sampling articles, this study has adapted the methodology used by Duriau et al. (2007). The research article search is based on the use of two keywords and involves two main stages. In this research, the purpose of reviewing articles comprehensively, which include the theme design of AR applications, reference books and past studies. Two main keywords have been used: Augmented Reality (AR) Technology In Teaching and Learning Processes and AR Design Elements derived from literary studies at the pre-level stage. The next second stage involves reviewing the list of article references at the

end of the article, referred to the beginning stage. The articles obtained from this two-tier sampling stage provide a comprehensive and up-to-date database for document analysis.

IV. RESULTS AND FINDINGS

The result and findings of the research was analyzed based on the research objective.

4.1 Element In Augmented Reality Design Application

There are several elements that have been selected for AR application design to fulfill the criteria required and produce a suitable AR application in education through many researcher. The first element is multimedia, according to Umar (2000) multimedia is the common element that can help people in storing, receiving, memorizing and using information. Mat Noor & Mohd Arif (2002) also argue that the role of online learning involves using multimedia technology can makes teaching and learning process very encouraging and more effective by using almost all human senses. Besides that, Ismail (2008) states that multimedia is a combination of voice, data, text, animation, audio and video which can be displayed in an interactive computer software and suitable for teaching and learning. After that, for another element were selected based on The Framework for The Rational Analysis of Mobile Education (FRAME) theory which is student, device and social element. Hence, for the second element is device, according to Koole & Ally, (2009) AR design refer to input and output capabilities and application internal processes such as storage capabilities, processing speeds and compatibility through device. Information technology revolutions include aspects of memory, speed, functionality, hardware, software and other aspects that contribute to today's sophisticated computer (Holmes, 2005). Based on Rosli et al., (2010) AR can save time in acquiring knowledge and giving teachers an alternative to using a more interactive, engaging and effective teaching medium.

The third element is for student, that refer to the aspect on how the student uses the existing knowledge to understand, store and use the information obtained. This aspect takes into account individual cognitive abilities, existing knowledge, memory, motivation and emotion. Through the use of AR applications, students can improve the motivation, contributing positively to the learning experience, especially for weak students (Freitas & Campos 2008), helping to develop creative thinking, to improve understanding and to change the paradigm of student learning arc in studying subjects (Rosli et al, 2010). With use of information technology, students are able to provide high-quality and quality ideas to enhance their career and career development (Scibid.Inc, 2012). The last element is social element, according to Wellman, Haase, Witte, & Hampton,(2001) claiming that online interactions can add or replace themselves in interaction. This element aims to look at the relationship with the process of social interaction and cooperation while using the AR applications.

4.2 Multimedia Element In Augmented Reality Design Application

Multimedia is the one of important element to design a media application with the combination of text, graphics, video, audio and animation based on the use of computers or electronic media (Krieken, 2018). In design of multimedia elements through many researcher, the use of multimedia in technology can produce skilled, creative and critical students targeted by Ministry of Education to produce semi-professional students. It is supported by Osman (2004), multimedia can encourage students to use and build new knowledge. Students can access using a

synchronous learning method by Sharpe (2006), synchronous e-learning or learning happens at the same time. In general, synchronous e-learning is assisted by multimedia elements such as video conferencing and chats. The multimedia elements can affect the appearance and design of an application at the same time, also can influence the student's use of it. There are many criteria presented by the previous researcher categorized into the text (Adnan et al., 2015; Thomson, 2014; Arockiam & Selvaraj, 2013; Bakar & Long, 2013; Khanum et al., 2012; et al., 2015; Faghih et al., 2013; Khanum et al., 2012; Reyna, 2013; Keong et al., 2005), video (Sadiman, 2010; Rusman, 2013), animation (Adnan et al., 2015, Faghih et al., 2013) and audio (Sadiman, 2010; Billinghamurst et al., 2015: Wood et al., 2004). Table 1 shows the research conducted by previous researchers and the frequency of multimedia element design criteria used in previous studies.

Table 1: Elements of the multimedia elements of the previous study

Author	Text	Graphic	Video	Audio	Animation
Adnan et al. (2015)	√	√			√
Reyna (2013)	√	√			√
Khanum et al. (2012)	√	√			
Sadiman, (2010)			√	√	√
Faghih et al. (2013)		√	√		√
Bakar & Long, 2013	√				
Kamaruddin (2012)	√	√			
Ramakrisnan, Jaafar & Razak (2012)	√	√			
Yaa & Adzobu (2014)			√	√	
Rusman (2013)			√	√	√

4.3 Device Element In Augmented Reality Design Application

Device element refers to the physical, technical and functional features of the device. Through research Shelton and Hedley (2004), AR are not only produces visual images, but also delivers space signals directly to consumers. Teaching methods through these technologies can help instructors to teach more effectively and efficiently as they enable observation and testing to be done by simulating the process involved without involving a time-consuming transformation process (Ying, 2010; Owaidah, 2015). AR also has features as users can move virtual objects and look from different angles such as seeing and holding a real object (Billinghurst, 2002), supporting seamless interactions between virtual environments with reality and using the world metaphorical interface of the reality to do manipulation replaces input devices such as mouse and keyboards. Information can be stored within the AR environment and reused at the required time (Gaukrodger & Lintott, 2007). While according to Koole & Ally (2009) emphasizing the physical features of the device, it also affects the user to manipulate the device and responds while using the device, and allows the human body to feel in-device changes and interact with it.

4.4 Student Element In Augmented Reality Design Application

In this element of student refers to the situation and tasks performed to achieve the results required in the use of AR applications. This element takes into the cognitive abilities, existing knowledge, emotions and motivation of students while using AR applications. Based on, Ambigapathy & Suthagar, (2003) demonstrate in their study that students have positive attitudes and perceptions towards the use of IT in education, which is 76.67 percent agree that

ICT is an effective teaching tool. The AR application has the potential to encourage, stimulate, motivate and increase student engagement by viewing and manipulating learning materials from different angles (Kerawalla et al., 2006), giving a positive impact on learning experiences especially for weak students (Freitas & Campos, 2008). Furthermore, AR also able to provide a fun new learning experience and encourage students to self-exploration based on the learned subjects (Kaufmann, 2006; Juan, Beatrice, & Cano, 2008), and encouraging students to self-explore their own subjects (Kaufmann 2006). Sense of presence can enhance the sense of student engagement among the student community itself (Squire & Jan, 2007). AR application also can provide students with a sense of preoccupation, which is a subjective notion that one seems to be participating in a comprehensive and realistic experience (Dede, 2009).

4.5 Social Element In Augmented Reality Design Application

The use of information and communication technology is increasingly important in education because of the ability to provide proactive learning and teaching environments (Gabare et al., 2014), building an authentic learning environment that is compatible with various student learning styles (Classroom Learning with AR, 2010). According to Condie & Munro, (2007); Keong et al. (2005) teacher as a facilitator and the learning process base on student centered by used of technology as a learning tool . AR application also have the potential to encourage collaboration among students with teachers or other fellow students (Billinghurst, 2002), and allowing students to organize and control their own learning (Hamilton & Olenewa, 2010). The uniqueness of AR and the new experiences that students will be looking forward to, will enhance their attention to focus and continue to collaborate in teaching and learning process. The findings were also supported by previous researchers (Rosli et al., 2010; Juan et al., 2008; Sumadio & Rambli, 2010). AR application also helps learning process through the student environment because of its character, allowing users to move virtual objects and see them from various angles like seeing and holding a real object (Billinghurst, 2002).

V. CONCLUSION

The design in media application plays an important role to achieve the objective in learning processes and student interaction to used AR applications. Failure on design to fulfill the needs of consumers are a key factor in the implementation of AR applications thus reducing student commitment to interacting in the learning process. Among previous researchers get their own opinion that they should pay more attention to the design of the application itself to get attraction from students. Therefore, there are four elements that have been listed in the AR application designs such as multimedia, device, student and social elements through this research. Based on the literature review by analysis document, these four selected elements are most often mentioned in the last research. Hopefully, with this AR application design element, it can be used as a guide in process of analysis phase to develop AR application for teaching aids and more interactive used in the 21st century. With the use of technology it can help students in developing designs that are tailored to the needs of consumers especially in the teaching and learning process.

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REFERENCES

- [1] Adnan, A. S., Ali, M., & Ahmad, R. (2015). The Utilisation of Visual Elements on Interface Design of e-learning . In *International Conference on Information Technology & Society* (pp. 273–279).
- [2] Altaweel, M., Marsh, A. & Mühl, S. (2012) New investigations in the environment, history, and archaeology of the Iraqi Hilly Flanks: Shahrizor Survey Project 2009– 2011. *Iraq* 74: 1–35.
- [3] Ambigapathy, P. Dan Suthagar, N. (2003). "*Literasi Teknologi Komputer: Persepsi dan Penggunaan di Kalangan Guru.*" dalam Pandian, A. (ED.). "*Bahasa dan literasi: penyelidikan dan peninjauan untuk pendidikan.*" Serdang: Penerbit Universiti Putra Malaysia.
- [4] Arockiam, L., & Selvaraj, J. C. (2013). User Interface Design for Effective E-Learning based on Personality Traits. *International Journal of Computer Applications*, 61(14), 28–32.
- [5] Azuma, R. (2004). Overview of Augmented Reality.
- [6] Bakar, Z. A., & Long, P. (2013). A Study of Visual Appeal Interfaces Based on Subjective Preferences, (November), 25–26.
- [7] Bergig, O., Hagbi, N., El-Sana, J., & Billinghamurst, M. (2009, October). In-place 3D sketching for authoring and augmenting mechanical systems (pp. 87–94).
- [8] Billinghamurst, M. (2002). Augmented Reality in Education. New Horizons for Learning, December 2002. (Atas talian) dari <http://www.newhorizons.org/strategies/technology/billinghurst.htm> September 20, 2013.
- [9] Billinghamurst, M., & Duenser, A. (2012). Augmented Reality in the Classroom. *Computer*, 45(7), 56-63. doi:10.1109/mc.2012.111
- [10] Billinghamurst, M., Clark, A., & Lee, G. (2015). A Survey of Augmented Reality. *Foundations and Trends in Human-Computer Interaction*, 8(2–3), 73–272.
- [11] Classroom Learning with AR (2010). Trends in EdTech wiki. (online learning) from <http://augreality.pbworks.com/Classroom-Learning-with-AR> July 12, 2013
- [12] Condie, R., & Munro, B. (2007). The Impact of ICT in Schools – A Landscape Review. (L.Seagraves & S. Kenesson, Eds.). *University of Strathclyde, UK: Becta Research*.
- [13] Craig Errey, Paul Ginns, dan Claudia Pitts.(2006). "Cognitive load theory and user interface design: Making software easy to learn and use." *The Performance Technologies Group*
- [14] D'Agostino, N., D'Anastasio, E., Gervasi, A., Guerra, I., Nedimovic, M.R., Seeber, L. and Steckler, M. (2011). Forearc extension and slow rollback of the Calabrian Arc from GPS measurements. *Geophysical Research Letters* 38: doi: 10.1029/2011GL048270. issn: 0094-8276.
- [15] Dede, C. (2009). Immersive Interfaces For Engagement And Learning. *Science*, 323(5910), 66-69.
- [16] Di Serio, Á., Ibáñez, M. B., & Kloos, C. D. (2012). Impact Of An Augmented Reality System On Students' Motivation For A Visual Art Course. *Computers & Education*, 1-11. Elsevier Ltd
- [17] Dunleavy, M., Dede, C., & Mitchell, R. (2009). Affordances and limitations of immersive participatory augmented reality simulations for teaching and learning. *Journal of Science Education and Technology*, 18(1), 7–22.
- [18] Duriau, V.J., Reger, R.K. and Pfarrer, M.D., 2007. A Content Analysis of the Content Analysis Literature in Organization Studies, Research Themes, Data Sources and Methodological Refinements. *Organizational Research Methods*, 10(1), 5-34
- [19] Faghieh, B., Azadehfar, M. R., & Katebi, S. D. (2013). User Interface Design for E-Learning Software. *The International Journal of Soft Computing and Software Engineering*, 3(3), 786–794.
- [20] Freitas, R. & Campos, P. (2008). A System of augmented reality for teaching 2nd grade students. *Liverpool, United Kingdom*.
- [21] Freitas, R., & Campos, P. (2008). SMART: a System of Augmented Reality for Teaching 2nd grade students. *Paper presented at the Proceedings of the 22nd British CHI Group Annual Conference on HCI 2008: People and Computers XXII: Culture, Creativity, Interaction - Volume 2, Liverpool, United Kingdom*.
- [22] Gabare, C., Gabarre, S., Rosseni Din, Parilah Mohd Shah, & Aidah Abdul Karim. (2014). iPads in the foreign language classroom : A learner's perspective. *The Southeast Asian Journal of English Language Studies*, 20(1),115-128.
- [23] Gaukrodger, S. J., & Lintott, A. (2007). Augmented reality and applications for assistive technology. In *Proceedings of the 1st international convention on Rehabilitation engineering & assistive technology in*

- conjunction with 1st Tan Tock Seng Hospital Neurorehabilitation Meeting - i-CREAtE '07 (p. 47). New York, New York, USA: ACM Press.
- [24] Hamilton, K. & Olenewa, J. (2010). Augmented Reality In Education [PowerPoint slides]. (Atas talian) dari Lecture Notes Online Web site: <http://www.authorstream.com/Presentation/k3hamilton-478823-augmentedreality-in-education/> August 12, 2013
- [25] Holmes, D. (2005). Communication theory: media, technology and society. London: Sage Publications.
- [26] Ismail, M.F.K. (2008). Model Kognitif Visual pelajar Teknikal Melalui Perisian Animasi Grafik. *Universiti Tun Hussein Onn Malaysia: Tesis Sarjana*.
- [27] Juan, C., Beatrice, F., & Cano, J. (2008, 1-5 July 2008). An Augmented Reality System for Learning the Interior of the Human Body. Paper presented at the Advanced Learning Technologies, 2008. ICALT '08. Eighth IEEE International Conference on Advanced Learning Technologies.
- [28] Kaufmann, H. (2006). The potential of augmented reality in dynamic geometry education, paper presented at the 12th International Conference on Geometry and Graphics (ISGG), Salvador, Brazil.
- [29] Kaufmann, T. (2006): Quality Assured Road Data by Using the PDCA-cycle – experiences from EuroRoadS. Lecture at Transport Research Arena – Europe 2006, Göteborg, Sweden, June 12 -15
- [30] Keong, C. C., Sharaf Horani, & Daniel, J. (2005). A Study on The Use of ICT in Mathematics Teaching. *Malaysian Online Journal of Instructional Technology (MOJIT)*, 2(3), 43–51
- [31] Kerawalla, L., Luckin, R., Seljeflot, S., & Woolard, A. (2006). “Making it real”: exploring the potential of augmented reality for teaching primary school science. *Virtual Reality*, 10(3), 163–174.
- [32] Khanum, M. A., Fatima, S., & Chaurasia, M. A. (2012). Arabic Interface Analysis Based on Cultural Markers. *International Journal of Computer Science Issues (IJCSI)*, 9(1), 255.
- [33] Kirkley, B. S. E., & Kirkley, J. R. (2004). Creating Next Generation Blended Learning Environments Using Mixed Reality, *Video Games and Simulations, TechTrends* 49(3). 42-53
- [34] Klopfer, E., & Squire, K. (2008). Environmental detectives: the development of an augmented reality platform for environmental simulations. *Educational Technology Research and Development*, 56(2), 203–228.
- [35] Koole, M. L., & Ally, M. (2006). Framework for the rational analysis of mobile education (FRAME) model: Revising the ABCs of educational practices. *Networking International Conference on Systems and International Conference on Mobile Communications and Learning Technologies*, 216 -216.
- [36] Kobie van Krieken, K.V. (2018). Multimedia Storytelling in Journalism: Exploring Narrative Techniques in Snow Fall.
- [37] Krippendorff, K. (2013). Content Analysis. An Introduction to Its Methodology (3rd ed). California, CA: Sage Publications.
- [38] Kuo, Y.T., & Kuo, Y.C. (2015). The Role of Augmented Reality and Its Application in Education and Personalized Learning. Paper presented at the Society for Information Technology & Teacher Education International Conference.
- [39] Mahamad Noor, Z., Hamat, A., & Embi, M. A. (2016). Persepsi Pelajar Terhadap Aplikasi Perisian Multimedia dalam Pembelajaran KOMSAS Bahasa Melayu Tingkatan 1. *Jurnal Pendidikan Bahasa Melayu*, 2(1), 1-16.
- [40] Mat Noor, S.F., dan Mohd Arif, S. (2002). Pendekatan Multimedia Dalam Perisian Kursus Kisah Teladan Wanita Islam. *Fakulti Teknologi & Sains Maklumat, UKM*.
- [41] Mohd Sarjan, S. (2007). Penggunaan Web Terhadap Pencapaian Pelajar Dalam Topik Pembinaan Geometri. *Universiti Tun Hussein Onn Malaysia: Tesis Sarjana*.
- [42] Osman, A. M., (2004). Pembangunan Modul Elektronik Berasaskan Laman Web Belajar Mengenai Macromedia Fireworks MX. *Tesis Sarjana, Universiti Kebangsaan Malaysia*.
- [43] Owaidah, A. A. (2015). Hajj crowd management via a mobile augmented reality application: a case of The Hajj event, Saudi Arabia. (MSc), *University of Glasgow, UK*.
- [44] Ramakrisnan, P., Jaafar, A., Razak, F. H. A., & Ramba, D. A. (2012). Evaluation of user Interface Design for Learning Management System (LMS): Investigating Student’s Eye Tracking Pattern and Experiences. *Procedia - Social and Behavioral Sciences*, 67, 527–537.
- [45] Reyna, J. (2013). The importance of visual design and aesthetics in e-learning. *Australian Institute of Training and Development*, (40), 28–32.
- [46] Rosli, H.W., Baharom, F., Harryizman, H., Daud, A.Y., Mohd, H& Mud. Darus, N. (2010). Using augmented reality for supporting learning human anatomy in science subject for Malaysian primary school., Putrajaya.
- [47] Rosli, H.W., Baharom, F., Harryizman, H., Daud, A.Y., Mohd Haslina, H., & Muhd. Darus, N., (2010). Using Augmented Reality for Supporting Learning Human Anatomy in Science Subject for Malaysian

- Primary School. *Paper presented at the Regional Conference on Knowledge Integration in ICT (INTEGRATION2010), Putrajaya.*
- [48] Rusman. (2013). *Model-Model Pembelajaran. Jakarta: Raja Grafindo Persada.*
- [49] Sadiman, A.S., Rahardjo R., Haryono A., Rahardjito. (2010). *Media Pendidikan: Pengertian, Pengembangan, dan Pemanfaatannya. Cetakan ke-13. Jakarta: PT. RajaGrafindo Persada*
- [50] Scrbid.Inc. (2012). *Teknologi Internet dalam Pendidikan: Ciri-ciri, Penggunaan, Aplikasi dan Multimedia Interaktif. (f)*
- [51] Sharpe, R., Benfield, G., Roberts, G., Francis, R.I. (2006). *The Undergraduate Experience of Blended Elearning: a Review of UK Literature and Practice Undertaken for the Higher Education Academy. Retrieved 15 September 2007.*
- [52] Shelton, E. B. & Hedley R. N. (2004). Exploring a cognitive basis for learning for learning spatial relationships with augmented reality. *Technology, Instruction, Cognition and Learning* 1(4): 323-357.
- [53] Squire, K., & Jan, M. (2007). Mad City Mystery: Developing Scientific Argumentation Skills With A Place-Based Augmented Reality Game On Handheld Computers. *Journal of Science Education and Technology*, 16 (1), 5 – 29.
- [54] Sumadio, D. D., & Rambli, D. R. A. (2010). Preliminary evaluation on user acceptance of the augmented reality use for education. *Second International Conference on Computer Engineering and Applications*, 2, 461-465.
- [55] Thomson, S. (2014). 9 Tips To Improve Online Learners' Engagement.
- [56] Thornton, T., Ernst, J. V., & Clark, A. C. (2012). Augmented Reality as a Visual and Spatial Learning Tool in Technology Education. *Technology and Engineering Teacher*, 7(18), 18-21.
- [57] Umar I.N. (2000). *Kesan Gaya Kognitif Dan Strategi Pembelajaran Terhadap Prestasi Pelajar Di Dalam Persekitaran Hipermdia. Konvensyen Teknologi Pendidikan Ke-13. Ipoh, Perak, 19-21.*
- [58] Wellman, B., Haase, A. Q., Witte, J., & Hampton, K. (2008). Does the Internet increase, decrease, or supplement social capital? Social networks, participation, and community commitment. *American Behavioral Scientist*, 45(3), 436.
- [59] Wood, Z., Ho Pp E, H., Des Bru N, M ., And Sc Hr Od Er , P.(2004). Removing excess topology from isosurfaces. *ACM Transactions on Graphics* 23, 2 (April), 190–208
- [60] Yaa, N., & Adzobu, A. (2014). Design, Use and Evaluation of E-Learning Platforms: Experiences and Perspectives of a Practitioner from the Developing World Studying in the Developed World, 147–159.
- [61] Ying, L. (2010, 20-22 Aug. 2010). Augmented Reality for remote education. Paper presented at the Advanced Computer Theory and Engineering (ICACTE), 2010 *3rd International Conference on the Advanced Computer Theory and Engineering (ICACTE).*