March-April 2020
ISSN: 0193-4120 Page No. 6724 - 6731

Smart Rekben Tube for TVET Education Instrument

*Che Zalina Zulkifli, Nur Hazlina Abu Hassan, Hasnatul Nazuha Hassan, Abu Bakar Ibrahim
Che Zalina Zulkifli Corresponding Author*
Department, Faculty of Art, Computing and Creative Industry Sultan Idris Education University, 35900, Tanjong Malim Perak, Malaysia
chezalina@fskik.upsi.edu.my, hazlinahassan_77@yahoo.com, nazuha@fskik.upsi.edu.my, abubakar.ibrahim@fskik.upsi.edu.my*
Endang Noerhartatie
Departement of Agroindustrial Technology, Universitas Wijaya Kusuma Surabaya, Indonesia
endang_noer@uwks.ac.id
Tri Andjarwati
Fakultas Ekonomi, Universitas 17 Agustus 1945, Surabaya, Indonesia
triandjarwati@untag-sby.ac.id
Enni Sustiyatik
Fakultas Ekonomi, Universitas Kadiri, Kediri, Indonesia
enni_sustiyatik@unik-kediri.ac.id
Ahmad Ridwan
Fakultas Teknik, Universitas Kadiri, Kediri, Indonesia
ahmad_ridwan@unik-kediri.ac.id
Kunto Eko Susilo
Fakultas Ilmu Komputer, Universitas Narotama
kunto.eko.susilo@narotama.ac.id

Article Info
Volume 83
Page Number: 6724 - 6731
Publication Issue:
March - April 2020

Article History
***Article Received**: 24 July 2019*
***Revised**: 12 September 2019*
***Accepted**: 15 February 2020*
***Publication**: 04 April 2020*

Abstract:

Technical and Vocational Education and Training (TVET) is a growing field in line with RI 4.0's automation technology. To drive Malaysia's development in line with other developed countries, TVET needs to be given priority. In parallel, electrical and electronic subjects are important subjects in technical and vocational schools and even in daily schools. TVET is important in delivering a strong graduation and will be able to fill jobs and prepare for this RI 4.0. It is difficult to understand how the concept of electric current flows, for example, if it is explained verbally with a printed reference. The problem of the lack of technological media to help understand the concept of electricity and electronics limits young minds in engineering. Now, the lack of tool kits and instrument education with technical features that can reflect the real situation on the basis of electricity and electronics supports this research. Therefore, the purpose of this research is to design, apply, develop and test the effectiveness of Augmented Reality (AR) technology in focusing on electrical and electronic subjects as teaching aids called RekBen Tube (AR) as well as reference materials for engineering and vocational students. The methods used throughout this research are quantitative / quasi-experimental methods. To prove the effectiveness of this application, T-test with the help of SPSS software was used to calculate student achievement. Significant of $p < 0.000$ proves that the RekBen Tube application has a positive impact on student achievement.

***Keywords:** Augmented Reality, Education Tool kit, Electric and Electronic Subject, TVET*

Published by: The Mattingly Publishing Co., Inc

March-April 2020
ISSN: 0193-4120 Page No. 6724 - 6731

I. INTRODUCTION

Technological advancement is a thing that cannot be avoided because it is in line with the advancement of knowledge. Humans have benefited from today's technology. Various technologies have been developed including technology that has resulted in the education sector. The use of technology in education is inevitable because students spend a lot of time outdoors by using technology, so it is desirable to expect them to recognize the advanced educational technologies that are capable of helping them in the learning process. Additionally, there is evidence of the effectiveness of technology utilization in some studies (Ghaleb Alnahdi, 2014).

Technical Education and Vocational Education (TVET) is the formation of human labor to meet the industry's workplace demand. It is very important because the Ministry of Education of Malaysia (MOE) is actively implementing the transformation of TVET into a developed nation by 2020. The upgrading of vocational schools to Vocational College and the restructuring of vocational subjects in secondary schools was also implemented.
The field of electrical engineering plays an important role in bringing Malaysia towards becoming an industrialized country as the electrical and electronics (E&E) sector is an important contributor to the national economy where in 2009 it contributed 6% of Malaysia's gross national income (GNI) of 522,000 jobs and 41% of Malaysia's total exports (Economic Transformation Plan, 2010). Countries across the world need a lot of talent in electrical and electronics as the demand of labor in this specific area is increasing. Due to the rapid development of the electrical and electronic industries, higher learning institutions need to play its role in providing knowledge, experience and skills to students to cope with the demand (Uk Raai, Alias Masek, Mohd Hasril, 2014).

II. LITERATURE REVIEW

The purpose of this AR application is to make it easier for people to understand what is difficult to convey. The tools developed in this work have had a double effect as they allow teachers to improve their guidance during laboratory sessions and offer interesting teaching aids and motivational tools to students during the learning process (Jorge, Pena, Wanda, Maria, Carlos, 2015).

IR 4.0 and TVET in Industry

Human life often deals with technology and information. The Industrial Revolution 4.0 will make it easier for people to live their lives and human resources will be replaced by machines and technology. In RI 4.0, more manufactured products will be smart products. Based on connectivity and computing power, the main idea behind smart products is that they will incorporate self-management capabilities (Almada-Lobo, 2015). Skills are one of the criteria that are needed in today's job market. Thus, the main focus of TVET education in the country towards the industrial revolution 4.0 (RI 4.0) requires many skilled workers for the rapidly growing electric and electronic production industry as one of the advanced countries (Norulaini & Nazlina, 2019).

Electrical and Electronic Engineering Courses

Electrical and Electronics Engineering courses are considered as the basic courses in electrical and electronics in vocational engineering education. The concept of charge and power supply is a starting course followed by the circuit elements and the principle of current. In addition, the course provides students with exposure to electricity and power. Disclosure in this course will focus on electronic analog circuits, devices, magnetism, magnetic circuits and digital electronic bases. Emphasis on training needs and skills that meet the demands of the industry especially in the electrical-based industry should be given attention by all public or private training skill institutions offering these fields of study to produce a quality training curriculum to produce graduates who can meet the occupational standards in electric fields (Zaliza, Arasinah, Tee & Mohd Hasni, 2016).

Education Theory

The Experience Based Learning Model described by Kolb (1984), which is the learning process that gives students the opportunity to build their own experiences or experiencing everything on their own (Juwairiah, Jamilah, Anis, & Jamal, 2018). One of the most important factors in remembering and understanding knowledge over a long period of time is to provide interesting and meaningful experiences and learning throughout the teaching and learning process. Students in electrical and electronic engineering who lean more towards the technical side also need cognitive theory, which is based on learning theory that focuses on information processing (Mohd Izwan, Sidek, Jamaludin & Wan Marzuki, 2016). Learning is a process of relating new information to concepts relevant to one's cognitive function so that the learning process not only memorizes concepts or facts but also attempts to link the concepts together to produce a stronger understanding and thus making the concept that has been learnt better to be understood and not easily to be forgotten (Isbadar Nursit, 2015).

Issues in the Basics of Electric and Electronic Circuits

Learning electrical and electronic engineering based on spoken language and teacher-centered makes learning in the classroom less effective for students. They can hardly describe the concept of a circuit with less imagination because the electric current is not visible to the naked eye but it must be visualized. Simulation techniques and learning can also be used to demonstrate the basics of electrical and electronic circuit theory but simulations take a long time to teach, depending only on the student activity,

Published by: The Mattingly Publishing Co., Inc

March-April 2020
ISSN: 0193-4120 Page No. 6724 - 6731

and many students do not like simulated learning because of its complex learning and tight control (Afiful Brotherhood, 2017). In contrast to the technology of using AR to learning basic theory of the circuit because it is more convenient, more interactive, more effective and widely implemented into a variety of media- its production is also less costly and is easy to use therefore making many researchers interested in conducting this study. (Illumination & Nanang, 2017).

3. RESEARCH FRAMEWORK

In order to produce a more effective learning process for students and to contribute high quality work to the country, the conceptual framework (Figure 1) below will explain how the information is delivered from the teacher to the student.

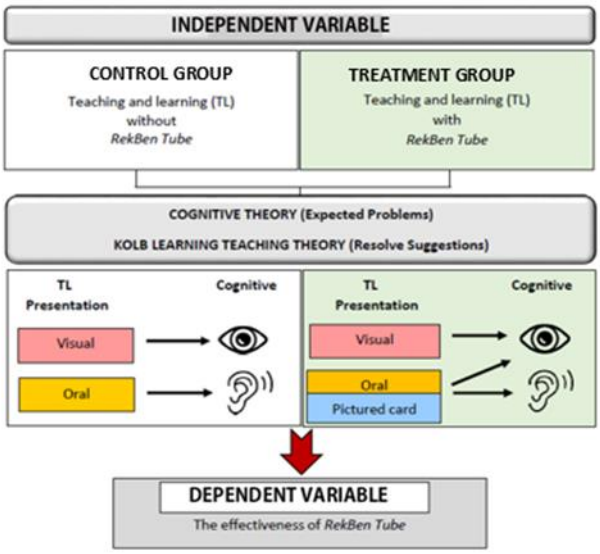

Figure 1. Conceptual Framework Model

The effectiveness of AR technology is important to see how far the level of achievement and understanding of students on the basis of electrical and electronic circuits. Technical learning requires a deep understanding especially in its application when dealing with real objects. In addition, teaching also takes a long time to explain the actual concept to the students, especially first year students of vocational schools who are still new to the technical subjects (Nor Zainiah Yahiya, 2006). There are two variables that can be classified as independent variables and non-dependent variables. The first group was a control group that did not use the AR application in classroom/workshops while the second group was a treatment group that used the AR application in teaching. The theory was developed to test the effectiveness of AR use in teaching and learning (TL). The processing of information in the human memory goes through two combinations of sensory such as visual and verbal sensory. Not all students can learn something by using oral sensory, some students understand better and acquire information faster with the power of oral sensory and visual card. A person's memory can memorize longer by presenting through visual sensory, verbal sensory and picture cards.

III. RESEARCH METHODOLOGY

This study uses a fully quantitative (quasi-experimental) approach that involves only pre- and post-test. The study sample consisted of 30 vocational and experimental college students running for approximately 4 to 6 weeks. In this study there were groups that were known as the control group and the treatment group. A t-test was conducted on both groups to see the effectiveness of the application. A questionnaire was also conducted on the respondents involved (electrical and electronic engineering students) to obtain more authentic data for this research.

Observation

Observation was conducted at a school, Vocational College Sri Iskandar, and one class from that school was selected. The researchers chose one teacher to handle the class. The researchers stayed at the back of the classroom when the course of electrical and electronic studies was conducted to observe students' behavior, acceptance of students towards the learning of the topic and the method of teaching used by the teachers during learning and teaching. The researchers only sat behind the workshop throughout the observation process; everything that happened in the classroom was video recorded and pictures were also taken. This observation was taken in the first week (pre-post) and the last week (post-test) of experiment. The researchers had also jotted down important notes in the notebook for future references.

Interviews

The proposed research conducted interviews with teacher. This interview had been done after the teacher has ended their teaching session in class. The purpose of this interview is to measure the level of understanding and achievement of students before and after *RekBen Tube* AR applications are applied to students regarding electrical current and electronic circuits.

Research Design

According to Nik Aziz (2003) the framework is the basis of the study which illustrates the approach used in this study. It can be considered as a reference to provide the context for research problems or questions that are the focus of the study. To build this AR application, the methodology used is the ADDIE model.

Published by: The Mattingly Publishing Co., Inc

March-April 2020
ISSN: 0193-4120 Page No. 6724 - 6731

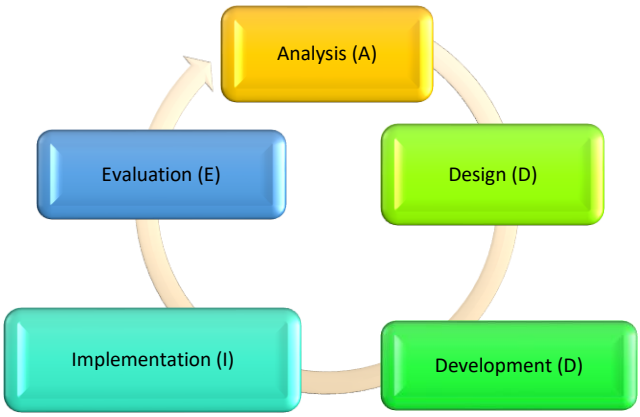

Figure 2. Framework by ADDIE process

This study uses the ADDIE study design voluntarily. The ADDIE model is a product-oriented model. The first process of this design is analysis. The process of analysis involves multiple processes to determine and identify problems to be resolved. The analysis stage functions to determine the needs of users whether they are needed or not in this era of technology.

The second process involves the design process. At this stage, an overview of the form, structure, theory, type of media and technology will be involved. This phase is crucial in determining the development of strategies to achieve teaching goals. The elements in the design phase include target, objective writing and test items, choosing a delivery system and how to prepare teaching.

The third stage involves the construction phase (development) to build a real system using all the media and technology elements selected based on the title requirements. The purpose of this phase is to produce an easy-to-use application and latest teaching technology. The development work for this multimedia project will be made by the agreed specifications. Every development will be tested and seen gradually resulting in a fairly satisfactory production of users together with efficient and different use from other teaching aids.

The fourth process is the implementation stage. At this stage, teaching materials are used in real terms. The AR application will be used to test the effectiveness to identify errors or satisfaction and increasement of the app. In the event of an increase or repairing error made is prior to the submission of the actual target.

The last step is the evaluation phase. This phase is divided into two types, namely formative and summative evaluations. Formative assessment is an assessment conducted at all levels to ensure its effectiveness. Summative assessment involves testing content elements, strategies and multimedia elements by interviews, questionnaires, supervision and testing. This product rating is not a formative assessment that involves formal interviews but rather provides questionnaires to target users once the AR application is shown.

Test

In this design, the respondents are divided into two groups namely control group and treatment group as table 1 shown below. Both groups have gone through the pre- and post-test. Based on the table 1 below, both groups have taken the pre-test (T1) at the beginning of the study, prior to the implementation of the intervention to identify the students' existing skill level. Subsequently, the researcher performed the treatment (X1) which was the implementation of first activity for approximately four weeks against the children in the control group. Meanwhile, the children in the control group received normal learning during that time. Subsequently, children in both groups took the post-test (T2) to determine if there are any changes to their existing skill level.

Table 1
Pre-Post Tests Design

Group	Number	Pre-Test	Treatment	Post-Test
Control	15	T1	-	T2
Treatment	15	T1	X1	T2

Guidance:
T1- Pre-Test
X1- Treatment
T2- Post-Test

All data collected were analyzed using Statistical Package for Social Science (SPSS) version 18.0 software as it was more efficient and faster for statistical analysis work. There was two type of process analyzing data which is the descriptive statistics and the inference statistics. To answer the research question, inference statistics were used to derive results from the pre and post-tests while descriptive statistics were used on the distributed questionnaires.

Questionnaire

The tool used for electrical and electronic engineering studies was the AR application. In addition, the questionnaire was also given to each individual respondent (student) to get feedback on the AR application to be shown. The questionnaire was prepared and required the respondents to complete the form after the AR application was conducted. The questionnaire is divided into three sections which is for Part A: Background, Part B: Responses with respect to AR, and Part C: Suggestions and improvements.

Published by: The Mattingly Publishing Co., Inc

March-April 2020
ISSN: 0193-4120 Page No. 6724 - 6731

IV. RESULT

The testing of the AR application, *RekBen* Tube has been tested on 30 respondents in a school to see how effective it is. This test also aims to ensure that this application has functionality and effectiveness as well as find faults in the application. The application test comprises the testing process of installing this application into a mobile phone in the .apk file and then testing it to technical and vocational students in electrical and electronics engineering.

Experimental Design

30 students participated in this experimental test. The age of all the students are the same and they are also all electrical and electronic engineering students. No student has prior knowledge on the topics to be tested and evaluated or have any experience on using the Augmented Reality app (AR). The experimental tests performed on students consist of four main steps:

1. Pre-test (T1): The first step of the experimental test is to do a pre-test to know the prior knowledge of the students in assessing electrical and electronic subjects before using the *RekBen Tube* (AR) application. This pre-test consists of 10 questions on electrical and electronic basic and electrical current on systematic circuit for Technical and Vocational students. This test was given to both groups.
2. Interaction with teacher is only allowed for the Control Group: Teachers teach as usual in the classroom without the use of teaching materials other than the existing textbooks. The two-way interaction occurs between the teacher and students only.
Interaction with the *RekBen Tube* (AR) application for the Treatment Group (X1): The teacher acts as an assistant to the students as they describe the oral theory on the basis of electrical and electronic circuits. The students then take a card with electronic circuits as a teaching aid. Students are formed into two groups to facilitate teachers to explain what they have learnt. The hardware used to drive the app is the OPPO F9 smartphone. Students have a maximum of 10 minutes to interact with the application along with given circuit cards.
3. Post-test (T2): The third step is to create a post-test to determine the level of understanding and efficacy of the student on the application. Like the pre-test, the post-test also contains 10 questions to investigate whether the application helps them to understand the basic concepts of electronic circuits or not. Subsequently, students were given a questionnaire to answer the relevance of the tooling of the Augmented Reality (AR) technology application kit.
4. Investigations: Finally, the experimental test can be concluded after students make a survey based on the likert questionnaires on learning and interaction processes with this AR application.

Results and discussion

Results obtained from the experimental tests performed by students in the level of learning achieved by the students. Paired T-Test was used to measure students' performance in groups that did not use the set of *RekBen Tube* (AR) apparatus, the control group. Tables 2 below show the comparison analysis of mean pretest and post test scores for control group.

Table 2
Comparison Analysis of Mean Test Pre and Post-Test Scores for Control Groups.

Group	**N**	**Mean**		**Significant (p)**
		Pre-Test	**Post-Test**	
Conventional teaching	15	36.00 (16.28)	55.27 (11.85)	< 0.000

Table 2 shows the comparative analysis of student achievement in groups that did not use the *RekBen Tube* (AR) application set of controls. The mean score for this group in the pre-test was 36.00 (16.28) while the post-test was 55.27 (11.85). This increase was significant with p value <0.000.

This section is an analysis of paired T tests used to measure student achievement in groups using the *RekBen Tube* (AR) set of treatment groups. Table 3 shows the results of this group analysis:

Table 3. Comparative Analysis of Mean Test Pre and Post-Test scores for the Treatment Group

Group	**N**	**Min**		**Signi (p)**
		Pre-Test	**Post-Test**	
Teaching using *RekBen Tube* (AR) tool kit	15	49.27 (18.64)	82.27 (6.92)	< 0.0

Table 3 shows the comparative analysis of student achievement in groups using the *RekBen Tube* (AR) application set of treatment groups. The mean score for this group in the pre-test was 49.27 (18.64) while for the post-test it was 82.27 (6.92). This increase was significant with p value <0.000.

Published by: The Mattingly Publishing Co., Inc

March-April 2020
ISSN: 0193-4120 Page No. 6724 - 6731

Paired-sample T-tests were used to compare groups formed by different types of matches or to compare single-group performance on pre- and post-treatment or on two different treatments. In this analysis, the researchers studied two different groups in the pre and post-test tests where the signatures were seen in the Pre-control test (KPra) and the Pre-treatmen test (RPra) test. The analysis also saw the signatures for the Post-test for the control group (KPasca) and the Post-test for the treatment group (RPasca). Table 4 shows the comparative analysis of the scores of the two study groups.

Table 4. Comparison of Mean Scores and Significance of Pre and Post-Examination for Both Study Groups.

Group	**N**	**Mean**	
		Pre-Test	**Post-Test**
Conventional Teaching	15	36.00 (16.28)	55.27 (11.85)
Teaching using *RekBen Tube* (AR) tool kit	15	49.27 (18.64)	82.27 (6.92)
Comparison	-	-13.267	-27.000
Significant (p)	**30**	**> 0.093**	**< 0.000**

***** KPra / RPra = p > 0.05
KPasca / RPasca = p < 0.05

Table 4 shows the mean and significant comparison (p) of pre- and post-test scores for the two study groups, the control group and the treatment group. The mean pre-test mean score for the control and treatment groups was 13.267 while the mean post-test mean score for the control and treatment groups was 27,000. The results of the SPSS T-test analysis indicated that the significance of KPra and RPra was p> 0.093 which means that both groups had the highest achievement scores with no significant differences before the post-test. The results of the analysis of KPasca and RPasca are p <0.000 meaning that the results of the use of this set of Intermediate Reality (AR) or RekBen Tube apparatus give changes in student achievement in the subject of electrical and electronic circuits to students of College Vocational Seri Iskandar, Perak.

There was a significant change in student achievement of the test scores given after using the *RekBen Tube* (AR) application tool kit during the teaching and learning (TnL) process, while there was a slight change in the achievement test scores for TnL that did not use the *RekBen Tube* (AR) application tool kit. Therefore, *RekBen Tube* (AR) application tool kit is successful in impacting student learning achievement.

V. CONCLUSION

The Augmented Reality (AR) application will provide an overview of the electrical and electronic circuits for technical and vocational students as this field is inadequate for teaching and learning material during the workshop to make it more effective. The AR will produce examples of the current currents in circuits such as alternating current (AC), direct currents (AT), electrical circuit connections on components or devices and the creation of electrical circuit designs and others. The new students need an accurate understanding especially to the theory of electrical and electronic learning as it is difficult to imagine regarding its current. Students should not be able to describe the picture of electric and electronic current travel generated in daily life. In order to provide a more engaging picture and learning technology, the Augmented Reality app is expected to help students actively learn, to better understand learning and to remember the concept of electricity and electronics.

VI. ACKNOWLEDGEMENTS

The authors would like to thank to supervisor, Assoc. Dr. Che Zalina Bt Zulkifli and Sultan Idris Education University (UPSI) for helping and contribute for this work and also thank you to Puan Hasnatul Nazuha for sponsoring this research entitle The Learning Base of Digital Techniques Uses Augmented Reality in The Study of Electrical and Electronic Engineering to Technic and Vocational Students (2019-0088-107-01).

VII. REFERENCES

[1] Almada-Lobo, F, The Industry 4.0 Revolution and The Future of Manufacturing Execution Systems (MES), *Journal of Innovation Management*, vol. 3, no. 4, pp. 16-21, 2015.

[2] Alnahdi, G, Assistive Technology in Special Education and The Universal Design for Learning, *The Turkish Online Journal of Educational Technology*, vol. 13, no. 2, pp. 18-23, 2015.

[3] Afiful, I, Metode Simulasi Pembelajaran dalam Perspektif Islam, *Jurnal Pendidikan Islam*, vol. 2, no. 2, pp. 1-33, 2017.

[4] Anuar, A., & Jimggan, N, Pengaruh Kompetensi Kemahiran Guru dalam Pengajaran Terhadap Pencapian Akademik Pelajar dalam Mata Pelajaran Sejarah, *Jurnal Kurikulum & Pengajaran Asia Pasifik*, vol. 3, no. 2, pp. 1-11, 2015.

[5] Aruna, G., & Che Zalina, Z, Blending Intelligent Voice Recognition Technology Toolkit into Teaching English Pronunciations for Pre-Schooler, *Journal of Applied Environmental and Biological Sciences*, vol. 7, no. 2, pp. 70-73, 2017.

[6] Bintari, K. S, Desain Pembelajaran Model ADDIE dan Implementasinga dengan Teknik *Jigsaw*,

Prosiding Seminar Nasional Pendidikan, pp. 87-102, 2017.

[7] Cabero, J., & Barraso, J, The Eduzation Possibibilities of Augmented Reality, *Jurnal in Approaches in Educational Research*, vol. 5, no. 1, pp. 44-50, 2016.

[8] Chavan, S. R, Augmented Reality vs Virtual Reality: Difference and Similarities, *Journal International of Advance Research in Computer Engineering & Technology*, vol. 5, no. 6, pp. 1947-1952, 2016.

[9] Chania, Y., Haviz, M., & Sasmita, D, Hubungan Gaya Belajar dengan Hasil Belajar Siswa Pada Pembelajaran Biologi Kelas X Sman 2 Sungai Tarab Kabupaten Tanah Datar, *Journal of Sainstek*, vol. 8, no. 1, pp. 77-84, 2016.

[10] Che Ghani, C. K., Mohd Zaini, O., & Nur Faeeza, A. G, Kompetensi Tenaga Pengajar dalam Pengajaran Amali Pembuatan Perabot di Malaysia, *Jurnal Sains Humanika*, vol. 3, no. 3, pp. 25-32, 2018.

[11] Che Zalina, Z., Aruna, G., & Nur Hazlina, A.H, Usability Assessment Development of English Oral Toolkit with Intelligent Voice Recognition for Early Age Children, *Journal Advance in Natural and Applied Science*, vol. 7, no. 13, pp. 1-5, 2015.

[12] Che Zalina, Z., & Sumiati, S, A Proposed Framework for Integration of Visualization Techniques and Active Learning Strategy in Wireless Communication Network, *Journal Advance Science and Technology Letters*, vol. 71, pp. 1-6, 2014.

[13] Cheung, L, Using the ADDIE Model of Instructional Design to Teach Chest Radiograph Interpretation, *Journal of Biomedical Education*, pp. 1-6, 2016.

[14] Christian, D., Mauricio, H., & Gustavo, M, How The Type of Content in Educative Augmented Reality Application Affect the Learning Experience, *Procedia Computer Science*, vol. 75, pp. 205-212, 2015.

[15] Claudia, M. T. D., & Jung, T, A Theoretical Model of Mobile Augmented Reality Acceptance in Urban Heritage Tourism, *Current Issues in Tourism*, pp. 1-24, 2015.

[16] Dewi, I., Siti, Z., & Herawati, S, Pengaruh *Project Based Learning* Terhadap Motivasi Belajar, Kreativititas, Kemampuan Berfikir Kritis, dan Kemampuan Kognitif Siswa pada Pembelajaran Biologi, *Jurnal Pendidikan Biologi*, vol. 7, no. 1, pp. 9-21, 2015.

[17] Gutierrez, J.M., Fabiani, P., Benesova, W., Meneses, M. D., & Mora, C.E, Augmented Reality to Promote Collaborative and Autonomous Learning in Higher Education, *Journal Computers in Human Behavior*, vol. 51, pp. 752-761, 2015.

[18] Huda, S., Tsani, I., Syazali, M., Umam, R., & Jermsittiparsert, K. (2020). The Management of Educational System Using Three Law Auguste Comte: A Case of Islamic Schools. *Management Science Letters, 10*(3), 617-624.

[19] Hun, H. L., Stephen, J. H. Y., Sherry, Y. C., Tarng W,The Influences of The 2D Image-Based Augmented Reality and Virtual Reality on Student Learning, *Journal Educational Technology & Society*, vol. 20, no. 3, pp. 110-121, 2017.

[20] Ilmawan, M., Nanang, K, Pengembangan Media Pembelajaran Berbasis Augmented Reality, *Jurnal Edukasi Elektro*, vol. 1, no. 1, pp. 36-48, 2017.

[21] I Ketut, S, Optimalisasi Penggunaan Teknologi dalam Implementasi Kurikulum di Sekolah (Persepektif Teori Konstruktivisme), *Jurnal Ilmu Pendidikan*, vol. 1, no. 1, pp. 8-15, 2018.

[22] Irwansyah, F. S., Yusof, Y. M., Ramadhan, M. A, Augmented Reality (AR) Technology on The Android Operating System in Chemistry Learning, *Journal in Materials Science and Engineering*, vol. 288, pp. 1-7, 2017.

[23] Isbadar, N, Pembelajaran Matematika Menggunakan Metode Discovery Berdasarkan Teori Beban Kognitif, *Jurnal Pendidikan Matematika*, vol. 1, no. 1, pp. 42-52, 2015.

[24] Iulian, R, Augmented Reality in Education: A meta-review and Cross Media Analysis, *Journal in Pers Ubiquit Comp*,18, pp. 1533-1543, 2015.

[25] Jamaliah Jamaludin, *Kesediaan Guru Kolej Vokasional dalam Pengajaran Amali Teknologi Elektrik di Negeri Pahang*. Master thesis, Universiti Tun Hussein Onn Malaysia (unpublished), 2015

[26] Mahdokht, K., Philipp, R, Exploring the Early Adopters of Augmented Reality Smart Glasses: The Case of Microsoft HoloLens, *Progress in IS*, pp. 1-16, 2018.

[27] Mantasia, & Hendra, Y, Pengembangan Teknologi Augmented Reality sebagai Penguatan dan Penunjang Metode Pembelajaran di SMK untuk Implentasi Kurikulum 2013, *Jurnal Pendidikan Vokasi*, vol. 6, no. 3, pp. 281-291, 2016.

[28] Mohammad, K. K., & Ihsan, A. E, Applying Learning Theories and Instructional Design Models for Effective Instruction. *American Physiological Society*, vol. 40, pp. 147-156, 2016.

[29] Mohd Azilan, M., Ramlee, M., & Roszelina, A.R, Hubungan Kemahiran Kebolehan Pelajar Kolej Vokasional Pertanian dengan Kesediaan Menghadapi Revolusi Industri 4.0, *Journal of Life Long Learning*, vol. 2, pp. 1-15, 2018.

[30] Mohd Izwan, M., Sidek, M. N., Wan, M. W. A, Modul Kesediaan Kerjaya Berdasarkan Teori *Cognitive Information Processing* (CIP), *Jurnal Kurikulum & Pengajaran Asia Pasifik*, vol. 4, no. 3, pp. 59-75, 2016.

[31] Mohd Jalil, A., Noor Hisham, J., & Annas, A. H, TVET di Malaysia: Cabaran dan Harapan, *Seminar Kebangsaan Majlis Dekan-dekan Pendidikan Awam*, pp. 340-346, 2015.

[32] Nia, S, Pengembangan Media Pembelajaran untuk Anak Usia Dini Menggunakan *Augmented Reality*. Jurnal IPTEK, vol. 20, no. (1), pp. 95-108, 2016.

[33] Nicholas, A. H., Greer, K, Designing for Engagement: Using ADDIE Model to Integrate High

Impact Practices into an Online Information Literacy Course, *Communications in Information Literacy*, vol. 10, no. 2, pp. 1-20, 2016.

[34] NorHafizah Jalil, *Kecenderungan Pelajar Cemerlang Akademik Terhadap Pemilihan Bidang PTV*. Master thesis, Universiti Tun Hussein Onn Malaysia, (unpublished), 2015.

[35] Norulaini, M. R., & Nazlina, S, Senario Penghasilan Pola Pakaian Di Malaysia Bagi Program Fesyen TVET, *Jurnal Seni dan Pendidikan Seni*, vol. 7, pp. 31-40, 2019.

[36] Noor Hisham Jalani, *Kecekapan Pembelajaran Berasaskan Model Contoh Masalah dalam Pembelajaran Teori Litar.* PhD thesis, Universiti Tun Hussein Onn Malaysia (unpublished), 2015.

[37] Noor Hisham, J., & Chee, L. S, Kesan Pembelajaran Contoh Masalah dan Pembelajaran Pemusatan Guru Terhadap Usaha Mental Pelajar dalam Domain Teori Litar. *Jurnal Kurikulum dan Pengajaran Asia Pasifik*, vol. 2, no. 4, pp. 1-10, 2015.

[38] Noor Hisham, J., & Chee, L. S. Perbandingan Kesan Pembelajaran Berasaskan Contoh Masalah dan Pembelajaran Pemusatan Guru Terhadap Pemerolehan Pengetahuan Pelajar, *Jurnal Kurikulum & Pengajaran Asia Pasifik*, vol. 3, no. 1, pp. 1-10, 2015.

[39] Nurasykin, F., & Noorazlina, H, Faktor-faktor yang Menggalakkan Keberkesanan Penggunaan Bengkel bagi Pendidikan Teknikal dan Vokasional (TVET) di Kolej Komuniti, *E Proceeding National Innovation and Invention Competition Thtrough Exhibition*, pp. 1-13, 2017.

[40] Rifqi, G., & Nur Islami, The Development of Learning Media for the Kinetic Theory of Gases Using the ADDIE Model with Augmented Reality, *Journal of Educational Sciences*, vol. 1, no. 1, pp. 1-10, 2017.

[41] Roslinda, R., Fitri, N. A. N., Nor Effendy, A. S, Teknologi Realiti Luasan: Satu Kajian Lepas, *Jurnal Penyelidikan dan Inovasi*, vol. 5, no. 1, pp. 1-11, 2018.

[42] Salman, F. S., Nur Saadah, F., & Kamaliah, M, Pembangunan Perisian Kursus 'Saya Suka Belajar' untuk Pembelajaran Bahasa Melayu bagi Kanak-kanak Autisme, *Jurnal Pendidikan Bahasa Melayu*, vol. 4, no. 1, pp. 1-10, 2015.

[43] Setia, W, Pemanfaatan Teknologi Augmented Reality (AR) Untuk Pengenalan Aksara Jawa pada Anak, *Jurnal Teknologi*, vol. 8, no. 2, pp. 104-111, 2015.

[44] Syafawati, A.M., & Che Zalina, Z, A New Architecture of Embedded RFID Technology for Materials Flow Management. *Journal of Science, Mathematics and Technology*, vol. 2, no. 2, pp. 68-75, 2015.

[45] Syamsulaini, S., & Mashitoh, H, Pengajaran Berasaskan Video dalam Pembelajaran Berpusatkan Pelajar: Analisis dan Kajian Kritikal, *Journal of ICT in Education*, vol. 3, pp. 24-33, 2016.

[46] Yusri, K., Khairul A., Muhammad, S., Norazrena, A. S, Masalah dalam Pengajaran dan Pembelajaran dan Pembelajaran bagi Kursus Teknologi Elektrik di Kolej Vokasional, *International Education Postgraduate Seminar*, pp. 1-8, 2017.

Biographies

Che Zalina Zulkifli is an Associate Professor in Computer Department, Faculty of Arts, Computing and Creative Industry at Sultan Idris Education University, Malaysia. She had over 18 years professional teaching experience as a lecturer and active researcher in the Electronics & Electrical Engineering, Information Technology, Embedded System, Industry Creative & Networking area. Experience as a Test Engineer in the multinational company. Her research projects have been collaborated with multinational company which contributes to a network that lead to new ideas and concrete research project. The developed automation projects that focused on Sensor Monitoring, Embedded System, Software, IoT and Wireless Communication fields have been successfully adopted by the industry to date. A total of more than a million Ringgit has been generated as an income to the University mainly from the Research grant, Commercialization of research innovative products and also the services as a principle consultant. Expertise in the agriculture sector with new invention to improve the crop production adopted high technology. Sincerely dedicated to the very wise in the green project about recycling and reusage of waste. She has won several international awards and national award. She has developed confidence and interest in researching and teaching areas to enhance Creative Innovation in Engineering, Science & Technology.

Nur Hazlina Abu Hassan holds a Bachelor Education of Computer Aided-Design degree at Sultan Idris Education University, Malaysia. Then she continue her Master in Information Technology Education (IT), Faculty of Arts, Computing and Creative Industry at Sultan Idris Education University. She had an experience about five years working as Research Assistance (RA) for a lecturer as an author at Sultan Idris Education University.