Interactive Courseware for Supporting Learners Competency in Practical Skills

Baharuddin
Department of Electrical Engineering Education, State University of Medan, Jalan Willem Iskandar Pasar V Medan 20221, Sumatera Utara, Indonesia
E-mail: dr.baharuddin@gmail.com

Juhriyansyah Dalle
Department of Informatics Engineering, University of Lambung Mangkurat, Jl. Brigjen Haji Hasan Basri, Kayu Tangi, Banjarmasin 70124, Indonesia
E-mail: j.dalle@unlam.ac.id

ABSTRACT
This study is carried out to develop an interactive multimedia learning aid that increases students' competency in practicing electrical motor installation. Students of Public Vocational High School in Langkat, Indonesia involve in this study. The Research and Development (R&D) methodology by Borg and Gall (1998) is adapted in this study, in which the steps include understanding the problem, gathering information, design and development, validation, product improvement, product testing, product revision, installation, design improvement, and product distribution. In terms of pedagogy, ASSURE learning model (that consists of Analyze, State Objective, Select Methods, Utilize, Requirement, and Evaluate) is incorporated in the product. When data were tested, the results prove that generally, respondents believe that the developed learning aid is highly qualified to be used. More ever, all parties highly believe that the developed learning aid is able to increase the students' competency in electrical motor installation.

INTRODUCTION
Education is a process that people go through for continuous improvement. Also, education is important to assist people to expand their potentials. In Indonesia, every individual is guaranteed with similar right to receive similar education in improving the quality of life. The 1945 Constitution of the Republic of Indonesia Section 31 Sentence (1) states that each citizen is eligible to get access to education. Further, Sentence (3) urges that the government designs and maintains a national education system that upgrades faith and god-fearing as well as moral in up-lifting the life of the nation.

In terms of the advantages of media, Asyar (2011) believes that besides teachers' creativity, instructional considerations is also one of the determining factors. In most cases, teachers have not optimized learning media appropriately, in which they use the aids without considering the efficiency and effectiveness aspects (Churcill, 2011; Zulaiha & Mutalib, 2015a). The use of media is very much related to the quality of teaching and learning. Beyond that, the teaching and learning could contribute to the meaningful learning experience; facilitate interactions between students and teachers and among students regardless of locations, which enriches learning experience (Aziz & Mutalib, 2016; Norshahila, Fatimah, & A'fza, 2014). It is believed to be an agent that twists passive learning environments (Hoon, Chong, Ngah, & Kee, 2009; Chinn, 2012; Aziz, Mutalib, & Sarifi, 2014). In an active environment, students dynamically discuss and search for learning resources, while teachers facilitate the learning process.

The availability of various learning media and technology assists learners to flexibly achieve their learning outcomes (Hanim & Fatimah, 2011; Aziz & Mutalib, 2016). The development of interactive media is very important in overcoming the drawbacks in the available conventional learning aids. When learning media is self-developed by respective teachers, they feel more confident with the contents (Aziz, Eshak, & Mutalib, 2011). Besides, it increases their credibility and professionalism (Schittek, Mattheos, Lyon, & Attström, 2001; Aziz, Hazwani, Shiela, & Mutalib, 2010). On top of that, it is better for the students' knowledge acquisition.

In Indonesia, vocational high school is one educational stream that significantly develops human capital in technical aspects, as outlined by the curriculum development unit. Indonesian government regulation no. 19 The year 2005 on national education standards article 26 point (3) states that vocational education aims at increasing intelligence, knowledge, personality, and moral as well as skills to be independent. Further, it also provides opportunities for students to further extend their studies in their respective technical intelligence.

Although the government is aware of the importance of skill development among learners, realizing it is a puzzle. Records (details are confidential) prove that the achievement by learners in vocational high school is continuously low. Generally, learners score below the average. This is a mismatch because something important is not well-achieved. At the same time, efforts in establishing and running a vocational high school are huge. This study believes that the establishment of the vocational high school is not a wrong decision, but the teaching and learning practice needs to be revisited. It is the symptom that alerts this study. Accordingly, a close observation was arranged.

This study went to the vocational high school and spent tens days to understand the scenario. It was focused on understanding the teaching and learning practice, and learners behavior while learning. After tens days observing, this study gathers a significant answer to the symptom. It This study found that teachers use conservative techniques and materials like boards, books, chalks in their classroom. The classroom is very teacher centered, leaving learners passively listen to the explanation. Books show static pictures with a wordy explanation. With such limitations, books are not able to demonstrate a process. It contradicts with the philosophy of skill development, which requires learners to digest processes. When that happens, learners do not focus on their learning. Hence, this study noticed that most of them do not focus on the learning contents. Further, to better understand the scenario, this study interviewed the teachers and learners.

Altogether, this study interviewed five teachers and tens learners, one at a time, separately. Based on the interviews, teachers are not happy to use textbooks in teaching the skill-based subject, particularly the electrical motor. They feel very difficult to impart knowledge into learners because the textbooks are not able to visualize the process. As a result, learners are not happy and are not engaged in the learning process. It is commonly seen that learners do something else during the class sessions, like playing games and chatting with peers. They believe that the delivery should be altered to suit the current scenario. While learners are exposed to technologies, their learning experience should also acknowledge that. Otherwise, it creates a conflict that leads to learning gap. When learners were asked about the experience, they also agree with their teachers. Although one learner does not really concern about the delivery technique and materials, the other four learners really concern about it. For them, they prefer something that could visualize processes for them. It is highly appropriate because they learn about processes in an electrical motor. Furthermore, most of them are very exposed to technologies at home.

Based on the observation and interviews, this study asked them whether they prefer if an appropriate interactive learning material (courseware) is available for them in their learning activity. The teachers responded positively. For them, courseware could help a lot. For learners, they really expect for the courseware. They believe, courseware could enable them to learn on their own. While teachers as human are tired of repeating for them, courseware can repeat as many times as they want. Also, the combination of various media could enrich the knowledge delivery.

Based on the findings from the observation and interviews, this study discovers the gap in skill development among learners in vocational high school, particularly in the electrical motor subject. While the contents in the subject are mostly skill-based, the delivery should support its needs. Hence, the current conservative teaching delivery and materials should be transformed into something more appropriate for current development. Thus, this study proposes to use interactive learning material in supports for skill development in Vocational High School.

Based on the gap as discussed in the previous paragraph, this study aims at accomplishing the following objectives: (1) to design and develop an interactive learning material for an electrical motor subject, and (2) to test the interactive learning material through expert and users.

LITERATURE REVIEW

Learning Models

Learning is an activity carried out by a person to obtain certain knowledge and skills to increase his or her competencies, which commonly involves a teacher and a learner (Pribadi, 2009). Learning is also viewed as an elaboration process in discovering means of certain tasks. Basically, the learning process is carried out to increase certain abilities or competencies. That makes Sadiman, Rahardjo, Haryono, and Rahardjito (2009) formulates that learning is a lifelong complex process. When learning has taken place, it effects in behavioral changes, which could be observed in cognitive and psychomotor, as well as those related to value and attitude.

A learning model is a conceptual framework that visualizes a comprehensive inter-connected concept and outlines systematic procedures in organizing learning experience in achieving learning goals, and that it guides designers and teachers in their teaching practice (Pribadi, 2009; Trianto, 2010). Before that, Joyce, Weil, and Calhoun (2009) stated that a teaching model is a description of a learning environment, including teachers' behavior. Generally, models guide practitioners in various stages, ranging from planning lessons and curriculums to designing instructional materials, including multimedia programs. That is the reason Supriatna and Mulyadi (2009) convincedly expressed that models are highly advantageous, because of their variations.Among the advantages can be seen in the openness for selecting the most appropriate learning design to meet learners' characteristics and the context. Besides, existing models could be adapted into meeting current phenomenon to meet the necessities.

There are various learning designs, in which some are very popular. One of the popular ones is called ASSURE model (Smaldino, 2008; Smaldino, Russell, Heinich, & Molenda, 2005). The names combine the keyword of each step in the model: Analyze - State Objective - Select Methods - Utilize - Require - Evaluate (ASSURE). ASSURE is a model that formulates activities for learning to teach, which is also known as a class-oriented model. The model consists of six steps (Figure 1):

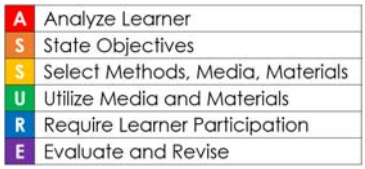

Figure 1: Steps in ASSURE learning model

Interactive Multimedia

According to Asyhar (2011), learning media refers to everything that could transfer information from a sender to a receiver in a planned manner, in a conducive environment that makes learning process effective and efficient. Additionally, Musfiqon (2012) defines it as physical or non-physical tools purposely used as mediators between teachers and learners in ensuring learning contents are well-understood. They have to be designed to ensure learners are happy with the learning contents so that they learn further. In this era, learning contents need to incorporate various media. Mayer (2009) defines multimedia as a combination of text and pictures. Meanwhile, Ariani and Haryanto (2010) and Pilli and Aksu (2013) further clarify that multimedia is used in learning and teaching to deliver information (knowledge, psychomotor, and attitude) and stimulate thinking, feeling, attention and willingness so that learning happens and well-guided.

Interactive learning material with various media has been developed for various types of users. For Ariani and Haryanto (2010), interactive multimedia should be equipped with learner control mechanism, so that they could entertain their needs, rather than the tool controls them. It agrees with Schittek, Mattheos, Lyon, and Attström (2001) when they developed their courseware project. Sidhu and Manzura (2011) solved problems faced by dyslexic learners. Meanwhile, Fatimah, Shahrina, and Syafiza (2013) developed solutions for slow learners in their learning practice. Also, works to solve problems faced by slow learners have been carried out by Zulaiha and Mutalib (2015b) and Fatimah, Shahrina, and Syafiza (2013). Visually-impaired people has been handled by Aziz, Mutalib, and Sarif (2015b). Besides, interaction styles for use in a big crowd have been researched by Al-Aidaroos, Mutalib, and Zulkifl (2013).

Learning Tool

Prastowo (2011) states that learning tools are materials designed systematically either written or non-written that enables learners to learn. It could be anything, as long as it supports learning either in the classroom or out (Sofiani & Ahmadi, 2010). It continuously dynamically develops to meet the demands of the society and inline with technology advancement (Ahmadi, Amri, & Elisah, 2011). It has to be critically designed for purposes like it (1) meets the needs of the curriculum by considering the necessities of the teachers, learners, and context, (2) assists learners in learning through alternative materials besides textbooks, and (3) assesses teachers in their teaching practice. The tools have various types, including: (1) visual materials including printed and non-printed, as well as real objects, (2) audio materials, (3) audio-visual materials, and (4) interactive multimedia including Computer Assisted Instruction (CAI), Web-based Learning (WBL), and collaborative learning.

In the early of the 21st century, Bactiar (2009) found that learners were very enthusiastic with his computer-based learning materials. Eventually, the use of computer-based learning materials optimizes his learners' interest and knowledge acquisition. Since then, the use of computers in teaching and learning were extensively studied and practice. Various learning tools have been developed, including for disabled people. Learning

contents for visually-impaired people have been developed by Aziz, Eshak, and Mutalib (2011) by incorporating Multiple Intelligence theory, in which it was extended with SECI model by Aziz, Hazwani, and Mutalib (2011). Later, Aziz, Mutalib, Sarif, and Jaafar (2013) extended the study to determine the potential of learning content for a creative environment.

Meanwhile, Adelina (2009) found that incorporation of learning model in her planning for teaching leads to an increase in the quality of delivery. Besides, her learners experience the learning activities very positively. The incorporation of the learning model has to be considered while designing the scheme of work. At the same time, Aziz, Hazwani, and Mutalib (2009) found similarly.

Not only that, Mursid (2010) discovered that (1) practical-oriented competency learning is highly potential in improving cognitive, psychomotor, and affective skills, (2) method and teaching model should meet the learning needs, (3) work-based learning could highly increase learners' performance, and (4) work-based learning should be critically designed to ensure effectiveness and efficiency, and to optimize learners' interest in meeting the demand in the industry.

METHODOLOGY

To ensure the problem could be solved and objectives are achieved, this study has gone through a common methodology consisting of three phases; the understanding problem, design and development, and testing (illustrated in Figure 2). In understanding the real problem, this study first determined the symptom. As a response to the symptom, this study observed the context of study very closely, and then interviewed the subject of study to gather first-hand data. This eventually clarifies the real problem being solved, as explained in detail in the problem statement. Regarding design and development, Sukmadinata (2006) believes that Research and Development Methodology (Borg & Gall, 1983) (with steps visualized in Figure 3) is a very potential research method and strategy for improving practice.

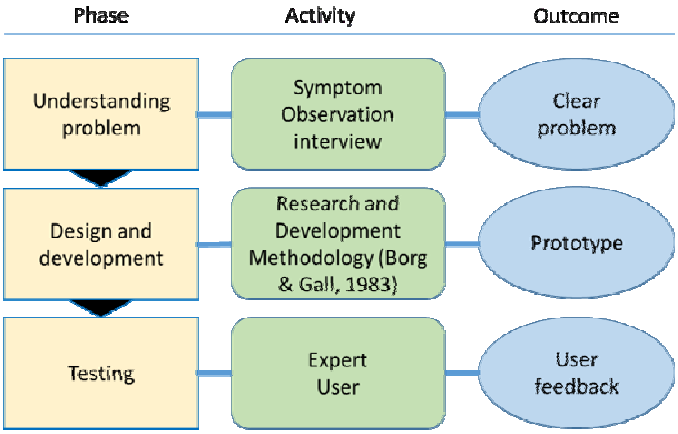

Figure 2: Research methodology

Design and Development Phase

Figure 3 visualizes the steps in Research and Development Methodology by Borg and Gall (1983). It is seen that there are ten steps in the methodology, which are quite similar to the methodology adopted by Aziz, Hazwani, and Mutalib (2009). Each step is elaborated in the following paragraphs.

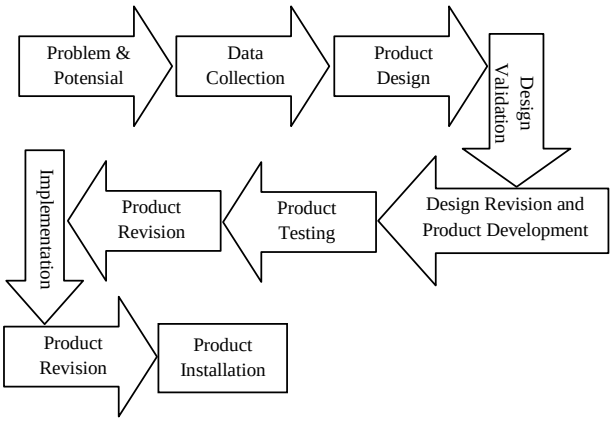

Figure 3: Design and development steps (Borg & Gall, 1983)

Problem and potential

Needs analysis comprises two levels; performance analysis and needs analysis. Performance analysis was carried out to determine the performance problem being faced. Also, it is important to identify the solution to the problem, such as either learning program and management need certain revision and coordination. Meanwhile, needs analysis determines the abilities and competencies learners need to equip themselves with in improving their learning performance.

Regarding that, this study focuses on the competencies in practical aspects. For the need analysis, direct observation and interview were carried out (as explained in the problem statement), in which teachers were observed and interviewed in their natural setting in their schools. From the observation and interviews, the following facts and understandings were obtained.

- Learning contents were delivered through oral explanation, where learners just listen. They were allowed to ask questions when necessary.Through the interview, this study found that the learning is focused on theory, not involving practical.
- Learners expect some alternative media that could complement the existing practice so that it is easier for them to understand the learning content, specifically the installation of an electrical motor. In addition to that, they prefer some visual representation that supports practical training rather than merely theoretical explanation.
- According to the learners, the content on the installation of the electrical motor is important because it is the basic for other advanced courses.
- The school is located in a town, which is surrounded with internet cafe and computer rental store. Other than that, some learners have their own laptop.

As the problem has been clarified in the previous phase, this step was focused on analyzing on the potentials of the solution. Hence, in terms of potential, this study decides the following:

- The medium of distribution – DVD – since anything on the network might be distracted by the communication medium.
- Language – Indonesian language – because it will benefit students more than any other languages.
- Content – follow the standard by the ministry – this study focuses only on the design.

Data collection

The users involved in this study through seven times workshop in each school from April to November 2015, in designing, developing, and testing process. Data were gathered from the real users through a workshop. In the workshop, learners demonstrated their tasks. A few samples of interactive applications, with different interaction styles and degrees of difficulty, were made available in the workshop. This study observed their activities to understand their strengths and weaknesses.

In the end, it was found that most of the learners are quite slow in using computers. Their ability in interacting with advanced interaction styles is quite low. Hence, they must be provided with a simple interaction style. The instruction has to be carefully designed.

Product Design

Having the data gathered, this study started designing the low-fidelity prototypes of the interactive learning material. Those paper-based design artifacts convey the concept and navigation styles. As this is the first design step, a few options were made available for users to select. For the purpose of gathering user feedback upon the low-fidelity prototypes, a workshop was conducted, housing the same participants during the data gathering step. In the workshop, participants (the users of the interactive learning material) were briefed on the purpose of the activity. Basically, the goal was to identify the most appropriate concept and navigation styles for the learning material. This benefits this study significantly because the workshop outcome crystalized requirements for the learning material. Eventually, the most appropriate concept for the learning material was obtained.

Design Validation

The gathered requirements that make the most appropriate concept obtained in the product design step was translated into a newly-formulated design. Then, the design was validated to ensure it meets common guidelines. For that, ten experts were involved. They are interaction design and instructional experts, who associate the proposed design with the users. It is more than sufficient for this study because the experts were able to come out with saturated data. This technique is adapted from Aziz, Mutalib, and Sarif (2015a). Based on their reviews, some recommendations for improvement were addressed. Basically, the proposed design was a bit complicated for the users.

Design Revision and Product Development
Based on the recommendations in the validation step, appropriate modifications were made. It included structure, layout, and navigation style. Eventually, the design shown in Figure 4 was finalized. It is seen that every sub-topic contains some indicators, certain purposes, the contents, pictures, and tests. The buttons are always available to allow users click t any time.

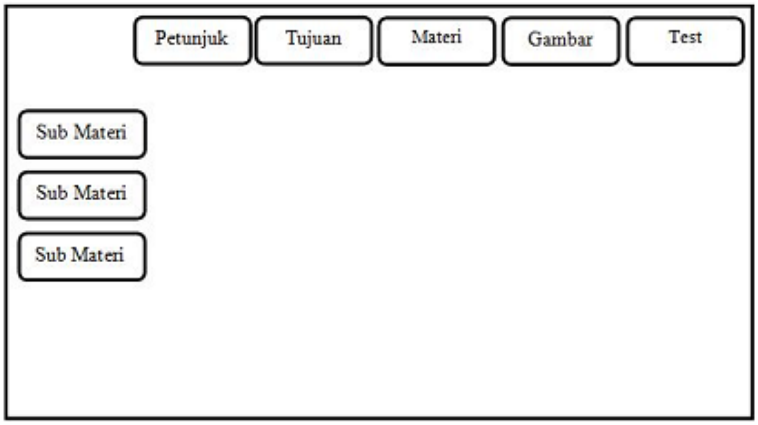

Figure 4: The design concept of the interactive learning material

Having the modified design ready, it was transferred into a working prototype, which closely functions as the final product. All functions were made working, leaving some contents unfilled. With that, users could interact to experience the actual product. Accordingly, they could express their perception while experiencing the learning material.

Product Testing
Once again, a workshop was conducted to let the users experience the learning material. It was carried out in their school, in a natural setting. In the workshop, every learner was provided with the learning material, and this study lets them use it as they like. To ensure they explore the learning material, they were provided with a list of tasks that they have to do. A sheet for them to locate their feedback was also provided, which really assists this study. On top of that, this study closely observed their interaction with the learning material. They were also interviewed to understand the symptoms observed in their interaction.

In the end, it was found that the prototype was easy for them. Very few mistakes were made in navigating the prototype. They learn about the prototype quickly and remembered the steps clearly after learning it.
When interviewed, they explain that the prototype is useful for them because they could access their intended contents efficiently. They were not afraid of making an error or recovering from errors because the interaction style has been made very straight-forward.

However, overall, they provided some suggestions to improve the prototype, which mostly is on the detailed physical design like the use of colors, visual representation, and terminologies.

Product Revision
The prototype was then revised based on the suggestions gathered in the testing step. The revision involved editing the colors, clarity of visual representation, and use of terminologies. When the terminologies, especially in the instructions, were rephrased, the instructions were clearer to the learners.

Implementation
Having the prototype fully revised, all contents were completed, making the product fully functioning, it was installed for implementation. It was intended to determine the product works well in its actual setting. It is very important because the finished product contains various graphics, videos, and animations. They are heavy, hence examining their smoothness is necessary. Figures 5 and 6 showcase snapshots of the interactive learning material.

Figure 7 shows the main page. It states the title very clearly. It makes use of attractive colors and meaningful buttons. While the page loads, the background music plays to stimulate learners' mood.

Figure 5: The main page

Further, Figure 8 shows the sub-topics in the learning material. They are divided into separated pages and provided with appropriate links to each sub-topic.

Figure 6: The sub-topics

Product Revision

In the actual setting, the interactive learning material may still contain errors, that distract the experience of learning. However, as it runs on CD, there was no distraction in terms of loading time or anything related to the network. As a result, this study discovered a very minimal error for actual implementation.

Product Installation

Eventually, the interactive learning material was installed in its actual setting. It was done very carefully, comprehensively, for all users' utilization.

Testing phase

The testing phase was focused on determining learners' practical competency in installing electrical motor among students of Vocational High School in Langkat District. Altogether, five content experts and five instructional experts involved. User test was carried out in two cycles, the sample as user randomly selected from 963 population by using the formula Slovin (1960) obtained a sample of 283 students in which involved in the user test 1 and user test 2. For experts, they were asked on aspects related to their expertise, either content or instructional aspect. An appropriate questionnaire with the scale format of a typical five-level Likert item, are strongly disagree=1, disagree=2, neither agree nor disagree=3, agree=4, and strongly agree=5 were used to gather data, adapted from (Aziz & Mutalib, 2016).

For the purpose of data analysis, the descriptive statistic method used by Sriadhi (2014) was adapted. The analysis was stressed to analyze the effectiveness of the interactive learning material towards learning the installation of the electric motor. The following steps were followed through in ensuring the analysis meets its objective.

- The gathered questionnaires were examined to ensure the answers were complete, then they were sorted according to respondent codes.

- The answers were coded into the quantitative measure, based on the predefined scores.
- Data were tabulated.
- Transformed into interval scores as outlined in Table 1.

Table 1: Assessment criteria interval

No	Interval Score	Interpretation	
1	0.00 - 2.49	Very Bad	Not Qualified
2	2.50 - 3.32	Bad	Less Qualified
3	3.33 - 4.16	Good	Qualified
4	4.17 - 5.00	Very Good	Excellence

(Sriadhi, 2014)

FINDINGS AND DISCUSSIONS

Validation by instructional experts

The application was examined by five experts in instructional multimedia. They were asked to evaluate the instructions, the interaction in the courseware, and the display. It was carried out using a scale between 1 and 5, in which 1 means very low and 5 means very high. The outcome of the validation is detailed in Table 2.

Table 2: Validation by instructional experts

	N	Mean	Std. Deviation	Agree (%)	Strongly Agree (%)
Instructions	8	4.75	0.46	25.0	75.0
Courseware Interactions	8	4.63	0.52	37.5	62.5
Display	8	4.88	0.35	12.5	87.5

In Table 2, it is seen that the experts are happy with all three aspects. In detail, the lowest mean score is 4.63 with 62.5% strongly agree, for the courseware instructions. The highest mean score is 4.88 with 87.5% strongly agree for the display. This means that the experts believe that the courseware could provide a positive learning experience to the learners. Hence, they believe that the courseware is ready for use.

Validation by Content Experts

Five content experts were involved in validating the contents from two key aspects; the instructions and real learning contents. In the end, the outcome as seen in Table 3 has been obtained.

Table 3: Validation by content experts

Aspects	N	Mean	Std. Deviation	Agree (%)	Strongly Agree (%)
Instructions	8	4.75	0.45	25.00	75.00
Real Content	8	4.63	0.52	37.50	62.50

With reference to the outcome in Table 3, it is seen that the content experts score very high for both instructions and the real content aspects. The mean scores are 4.63 with 62.5% strongly agree and 4.75 with 75% strongly agree respectively. This shows that the content experts believe that the application is ready for use.

User test

User test was carried out after the expert evaluation was carried out. It was aimed at determining whether the application meets the needs of the users. The application was distributed in a CD to learners. The test was carried out in two stages, (stage 1 and stage 2) involving 283 students. Data were gathered through a questionnaire, which focuses on three aspects; the instructions, the quality of the media used in the application, and the real content. Table 4 details the results of the user test, both descriptive statistics and inferential statistical of paired samples t-test.

Table 4. Descriptive Statistics of user test stage 1 and stage 2, and t-test for Equality of Means

Aspects	N	Mean		Std. Deviation		Agree (%)		Strongly Agree (%)		Paired Samples t-Test	
		Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	Stage 1	Stage 2	t	Sig.
Quality of Media	283	4.11	4.33	0.69	0.64	51.90	48.80	29.70	42.00	-5.81	0.00
Real Content	283	4.16	4.32	0.66	0.68	60.40	45.60	28.60	43.50	-6.78	0.00
Instructions	283	4.34	4.46	0.62	0.66	50.20	36.00	42.00	54.80	-5.16	0.00

In stage 1, the participants experienced the application themselves in their own convenience, because the application was distributed to them in a CD. Referring to the results shown in Table 4, it is seen that the lowest mean score is 4.11 and the highest mean score is 4.34 with interpretation are good or qualified. This means that the learners find the application is helpful in their learning activity. There are 51.90% and 29.70% of the participants agree and strongly agree with the quality of media, and there are 60.40% and 28.60% of the participants agree and strongly agree to the real content. Additionally, 50.20% and 42.00% of the participants agree and strongly agree with the instructions. However, they provided some comments for improving the application. Accordingly, some revisions were made to the application. The revision was focused on the interface aspects. Based on the recommendations, the colour was redesigned, to establish a contrast between foreground and background, pictures were enlarged, titles were made bold, and much more, without any content change.

After revision, stage 2 was carried out involving the same 283 learners again, testing the similar aspects (instruction, the quality of the media, and the real content). It was designed like so to prevent any bias. The results of the test are shown in Table 4. Referring to the table, it is seen that the lowest mean score is 4.33 and the highest mean score is 4.46 with the interpretation is very good or excellence. This means that the learners find the application is very potential in assisting them in their learning. Not only the content but also the interface is highly accepted by the learners. Specifically, 48.80% of the learners agree and 42.00% strongly agree with the quality of media. Meanwhile, 45.60% of the learners agree and 43.50% strongly agree with the real content, and 36.00% of the learners agree and 54.80% strongly agree with the instructions. Their comments were considered for improvement. Accordingly, the application was revised to entertain the learners' needs. The revision based on recommendations in user test stage 2 was addressed by focusing on the user interface. Similarly, with the revision after the user test stage 1, the modifications were made on colours, figures, layout, and typefaces. This is to ensure readability, visibility, and information retrieval.

Table 4 also shows the results of a paired samples t-test that was conducted to compare stage 1 and stage 2 for quality of media, real content, and instructions. For the three aspects, there is a significant difference between mean scores for quality of media in stage 1 (Mean=4.11, Std. Deviation=0.69) and in stage 2 (Mean=4.33, Std. Deviation=0.64) with $t = -3.88$, $p = 0.00$. Similarly, there is a significant difference between mean scores for real content in stage 1 (Mean=4.16, Std. Deviation=0.66) and in stage 2 (Mean=4.32, Std. Deviation=0.68) with $t = -2.82$ and $p = 0.04$. Also, there is a significant difference in mean scores for instructions between stage 1 (Mean=4.34, Std. Deviation=0.62) and stage 2 (Mean=4.46, Std. Deviation=0.66) with $t = -2.11$ and $p = 0.00$. These results explain that the application has improved significantly after the test in stage 1.

DISCUSSION

The results of user tests explain that the developed interactive learning media is ready for utilization especially for the installation of electrical motor course. As a courseware, it requires minimal technology, because it runs on any computer with CD or DVD ROM. For learners, this is not difficult.

From experts' views, Tables 2 and 3 exhibit that the developed interactive learning media is highly qualified for implementation in school. They believe that the interactive learning media is able to support the learning experience. With various media elements, the learning activity will be interesting, and it supports the content acquisition. Earlier, Navarro, Aguilar, Marchena, Ruiz, Menacho, and Luit (2012) and Nusir, Izzat, Al-Kabi, and Sharadgah (2013) found similar results.

Specifically, Table 4 exhibits an increase in the mean score of quality of media, real content, and instructions from tests in stage 1 to the tests in stage 2 (from 4.11, in stage 1 to 4.33, in stage 2; from 4.16, in stage 1 to 4.32, in stage 2; from 4.34, in stage 1 to 4.46, in stage 2). The differences are statistically significant with the results of t-test for Equality of Means is Sig. < 0.05. Majority of students evaluation on quality of media, real content, and instructions towards better outcomes. This improvement that shows when the interactive learning material is applaid in learning, students' learning outcomes and their retention can be improved.

Similarly, learners also believe that the developed learning material, with user control and various media elements, is able to intensify content acquisition and support positive learning experience. Such feedbacks were gathered after the developed learning material has been revised step-by-step. The revisions were made on the interface, not on the content because the contents in the interactive learning media are taken from the standardized syllabus. In terms of the interface, the revisions involve colours, graphics, animation, typeface, fonts, and layout.

Obviously, the findings in this study are consistent with findings in previous works, especially those handling

technical courses like mathematics (Huang, Liu, & Chang, 2012; Huang, Liang, Su, & Chen, 2012; Kurvinen, Lindén, Rajala, Kaila, Laakso, & Salakoski, 2012; Witte, Haelermans, & Rogge, 2014; Syah, Hamzaid, Murphy, & Lim, 2015). Not only that, it also supports the findings by Aryati, Hawaniah, Nazirahi, and AbuSafia (2014) who studied the needs of early childhood learning.

CONCLUSION

This study attempts to provide an alternative to learning from textbooks. In the beginning of the study, learners requested for a computer-based learning material, that allows them to learn actively, and show them some practical aspects on top of theoretical explanation. Accordingly, this study designs an interactive learning media, which incorporates various media elements in teaching the installation of an electrical motor. Research and DevelopmentMethodology drive this study, which involves a number of evaluations before the application is made available for distribution.

Through the testing sessions, which involved experts and users, the results show that the developed interactive learning material is highly qualified for utilization in schools officially.

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REFERENCE

Adelina, H. (2009). *The development model of civic education at secondary school.* Graduate Program of Jakarta State University.

Ahmadi, I. K., Amri, S., & Elisah, T. (2011). *Learning strategies integrated school.* Jakarta: Prestasi Pustaka.

Al-Aidaroos, A. S., Mutalib, A. A., & Zulkifl, A. N. (2013). A Study of Users' Perceptions Toward Mobile Dua and Zikr For Hajj (MDZ4H) Usability. *The International Conference on Advances in IT for the Holy Quran and its Sciences (NOORIC20.* doi:10.1109/NOORIC.2013.42

Ariani, N., & Haryanto. (2010). *Multimedia learning in school.* Jakarta: Prestasi Pustaka.

Aryati, B., Hawaniah, Z. N., Nazirahi, M. Z., & AbuSafia, A. H. (2014). A Conceptual model of Al-Furqan Courseware using persuasive system design for early learning childhood. *8th Malaysian Software Engineering Conference (MySEC), IEEE,* (pp. 336-341). doi: 10.1109/MySec.2014.6986040

Asyar, R. (2011). *Develop creative learning media.* Jakarta: GP Press.

Asyhar, R. (2011). *Developing creative learning media.* Jakarta: GP. Press.

Aziz, N., & A.A. Mutalib, S. M. (2016). Integrating multimedia learning theory in assistive courseware for low vision learners. *Jurnal Teknologi, 78*(2-2), 49–56. doi: http://dx.doi.org/10.11113/jt.v78.6928

Aziz, N., Eshak, N. R., & Mutalib, A. A. (2011). Assistive courseware for the visually impaired based on theory of multiple intelligence and SECI model. *American Journal of Economics and Business Administration, 3*(1), 150-156. doi**:** 10.3844/ajebasp.2011.150.156

Aziz, N., Hazwani, M. R., & Mutalib, A. A. (2009). Assistive courseware for visually impaired. In B. Z. Halimah, *Lecture Notes in Computer Science, Visual Informatics: Bridging Research and Practice* (pp. 905–915). Berlin, Germany: Springer-Verlag Heidelberg.

Aziz, N., Hazwani, M. R., & Mutalib, A. A. (2011). Visually impaired children's acceptances on assistive courseware. American Journal of Applied Sciences. *8*(9), 1019-106. doi**:**10.3844/ajassp.2011.1019.1026

Aziz, N., Hazwani, M. R., Shiela, E. E., & Mutalib, A. A. (2010). Assistive Courseware for the visually impaired based on theory of multiple intelligence. *Proceedings of the Knowledge Management International Conference*, (pp. 192-197). doi**:** 10.3844/ajebasp.2011.150.156

Aziz, N., Mutalib, A. A., & Sarif, S. M. (2015a). Expert review conceptual design and development model of assistive courseware for young low vision (AC4LV) learners. *International Journal of Conceptions on Management and Social Sciences, 32*(2), 35-39.

Aziz, N., Mutalib, A. A., & Sarif, S. M. (2015b). The design principles of assistive courseware for low vision (AC4LV) learners. *ARPN Journal of Engineering and Applied Sciences, 10*(3), 1447-1456.

Aziz, N., Mutalib, A. A., & Sarif, S. M. (2014). Conceptual design model of assistive courseware for low vision (AC4LV) learners. *International Conference on Advances in Educational Technology (ICAET '14),* (pp. 1–12).

Aziz, N., Mutalib, A. A., Sarif, S. M., & Jaafar, M. S. (2013). Preliminary Investigation on Creative Educational Content for Visually-impaired (VI) Learners. *Third International Visual Informatics Conference, IVIC 2013, Selangor, Malaysia, November 13-15, 2013,* (pp. 408-417). Selangor. doi. 10.1007/978-3-319-02958-0_37

Bactiar, S. B. (2009). *The development of computer-assisted learning materials to facilitate independent learning in the course of the design of the message on undergraduate of Educational Technology State University of Surabaya*. Surabaya: Tesis: Universitas Negeri Surabaya.
Borg, W. R., & Gall, M. D. (1983). *Educational research: An Introduction.* Longman Education.
Chinn, S. (2012). *Mathematics learning difficulties and dyscalculia. In L. Peer & G. Reid (Eds.), Special Educational Needs A: Guide for Inclusive Practice.* London: Sage Publication.
Churcill, D. (2011). Conceptual model learning objects and design recommendations for small screens. *Journal of Educational Technology & Society, 14*(1), 203–216.
Fatimah, W. A., Shahrina, M. N., & Syafiza, M. S. (2013). Development of a multimedia courseware for slow learner children with reading difficulties: MyLINUS. *In Lecture Notes in Computer Science: Switzerland: Springer In, 8237*, 371-382. doi. 10.1007/978-3-319-02958-0_34
Hanim, Z. Z., & Fatimah, W. A. (2011). Application of design and learning theories in multimedia courseware development, "Li2D.". *2011 National Postgraduate Conference*, (pp. 1–5). doi**:** 10.1109/NatPC.2011.6136268
Hoon, T. S., Chong, T. S., Ngah, N. A., & Kee, K. L. (2009). The effectiveness of an interactive courseware. *ICICTE 2009*, (pp. 530–541).
Huang, T., Liu, Y., & Chang, H. (2012). Learning achievement in solving word-based mathematical questions through a computer-assisted learning system Problem-Based Learning (PBL). *Educational Technology & Society, 15*(1), 248-259.
Huang, Y. M., Liang, T. H., Su, Y. N., & Chen, N. S. (2012). Empowering personalized learning with an interactive e-book learning system for elementary school students. *Educational Technology Research and Development, 60*(4), 703-722. doi:10.1007/s11423-012-9237-6
Joyce, B., Weil, M., & Calhoun, E. (2009). *Models of Teaching.* Pearson Education.
Kurvinen, E., Lindén, R., Rajala, T., Kaila, E., Laakso, M., & Salakoski, T. (2012). Computer-assisted learning in primary school mathematics using ViLLE education tool. *Proceedings of the 12th Koli Calling International Conference on Computing Education Research*, (pp. 39-46). doi.10.1145/2401796.2401801
Makmun, A. S. (1996). *Professional development and education personnel performance. (Guidelines and Digest Class - Handout).* Bandung: PPs UPI Bandung.
Mayer, R. E. (2009). *Multimedia learning principles and applications.* Yogyakarta: Pustaka Pelajar.
Mursid, R. (2010). *The development of competency-based learning model practice-oriented production in mechanical engineering education.* Jakarta: Graduate Program of Jakarta State University.
Musfiqon, H. M. (2012). *Media development, and learning resources.* Jakarta: Prestasi Pustaka.
Navarro, J. T., Aguilar, M., Marchena, E., Ruiz, G., Menacho, I., & Luit, J. E. (2012). Longitudinal study of low and high achievers in early mathematics. *The British Journal of Educational Psychology, 82*(Pt-1), 28-41. doi: 10.1111/j.2044-8279.2011.02043.x
Norshahila, I., Fatimah, W. A., & A'fza, S. (2014). Heuristic evaluation of malay folktales animated courseware for childhood education. *In The 3rd International Conference on User Science and Engineering (i-USEr 2014)*, (pp. 131–136). doi**:** 10.1109/IUSER.2014.7002690
Nusir, S., Izzat, A., Al-Kabi, M., & Sharadgah, F. (2013). Studying the impact of using multimedia interactive programs on children's ability to learn basic Math skills, 10(3), *E-Learning and Digital Media, 10*(13), 305–319.
Pilli, O., & Aksu, M. (2013). The effects of computer-assisted instruction on the achievement, attitudes, and retention of fourth-grade mathematics students in North Cyprus. *Computers & Education, 62*, 62-67. http://dx.doi.org/10.1016/j.compedu.2012.10.010
Prastowo, A. (2011). *Guide creative makes innovative teaching materials.* Yogyakarta: DIVA Press.
Pribadi, B. A. (2009). *Models of instructional systems design.* Jakarta: PPS-UNJ.
Sadiman, A., Rahardjo, R., Haryono, A., & Rahardjito. (2009). *Media Education (Definition, Development, and Utilization).* Jakarta: PT. Raja Grafindo Persada.
Schittek, M., Mattheos, N., Lyon, H., & Attström, R. (2001, Aug). Computer assisted learning. A review. *Eur J Dent Educ, 5*(3), 93-100.
Sidhu, M. S., & Manzura, E. (2011). An effective conceptual multisensory multimedia model to support dyslexic children in learning. *International of Information and Communication Technology Education, 7*(3), 34-50. doi: 10.4018/jicte.2011070104
Smaldino, S. E. (2008). *Instructional technology and media for learning* (Ninth Edition ed.). Colombus Ohio: Pearson.
Smaldino, S. E., Russell, J. D., Heinich, R., & Molenda, M. (2005). *Instructional media and the new technologies of instruction.* Upper Saddle River New Jersey: Pearson.
Sofiani, A., & Ahmadi, I. K. (2010). *Construction of learning development.* Jakarta: Prestasi Pustaka.
Spencer, L. M., & Spencer, S. M. (1993). *Competence at Work: Models for Superior Performance.* New York: John Wiley & Sons, Inc.

Sriadhi. (2014). Multimedia exploratory learning tutorial (CTL) to study electrical energy. *Proceeding KeTIK.* Medan: USU Press.

Sukmadinata, N. S. (2006). *Methods of educational research.* Bandung: Remaja Rosdakarya.

Supriatna, D., & Mulyadi, M. (2009). *The basic concept of instructional design (teaching materials for Training E-Training PPPPTK TK and PLB).* Jakarta: Depdiknas.

Syah, N. E., Hamzaid, N. A., Murphy, B. P., & Lim, E. (2015). Development of computer plays pedagogy intervention for children with low conceptual understanding in basic mathematics operation using the dyscalculia feature approach. *Interactive Learning Environments*, 1-20. http://dx.doi.org/10.1080/10494820.2015.1023205

Toto, R. (2011). *Curriculum and learning.* Raja Grafindo.

Trianto. (2010). *Designing innovative learning model-progressive.* Jakarta: Kencana.

Witte, K. D., Haelermans, C., & Rogge, N. (2014). The effectiveness of a computer-assisted math learning program. *Journal of Computer Assisted Learning*, 1-24. doi. 10.1111/jcal.12090

Yuheety, H., & Miarso, Y. (2009). *Synopsis of teachers competence.* Jakarta: Depdiknas.

Zulaiha, A. S., & Mutalib, A. A. (2015a). Exploring computer assisted learning for low achieving children: A comparative analysis study. *Jurnal Teknologi, 77*(29), 1-7. doi. http://dx.doi.org/10.11113/jt.v77.6803

Zulaiha, A. S., & Mutalib, A. A. (2015b). Preliminary study: An investigation on learning assistance requirement among low achievers in primary schools. *International Journal of Computer Application, 114*(2), 48-54. doi. 10.5120/19954-1783