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E-INSTRUCTIONAL MULTIMEDIA IN BASIC CONCEPTS OF ELECTRICAL AND ELECTRONIC LESSONS

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ABSTRACT

Interactive learning media facilitate students to be understand and comprehend certain contents of engineering subjects. Therefore, this study aimed to develop e-instructional multimedia for students in the subject of basic electronics and electricity using adobe flash CS 5.5. This subject was selected to support the teaching-learning process at the Vocational Secondary Schools. There were five stages during the development of the learning media, including (1) analysis, (2) design, (3) development, (4) implementation, and (5) evaluation (ADDIE). Furthermore, 30 students in total were selected to test the media practicability. The results revealed that this multimedia is acceptable based on five criteria: creativity, affectivity, efficiency, interestingly, and interactivity with the scores of 76.8, 76.8, 71.5, 77.4, and 74.4 respectively. This study suggested the implementation of the e-instructional multimedia for further understanding its empirical application.

Keywords: development, e-instructional, electrical and electronic, multimedia

INTRODUCTION

Learning is a system consisting of components that interact with the hope of achieving learning objectives [1]. Components that support the learning process are students, teachers, learning resources, and learning media [2]. Teachers need a learning medium to deliver knowledge to students. Instructional media helped add an element of reality, for example, including images or the use of computer simulations in the study. The general effects of instructional media can be divided into two main aspects that can represent reality and development of knowledge and skills [3]. However, the media used by teachers are often less attractive so that students cannot understand the material presented. If students are not interested in learning, it will affect the learning outcomes obtained by students. In the section of multimedia educational software serves as a (software) that provide learning facilities for students to learn the material.

The use of multimedia in learning will increase efficiency, motivation, and facilitating active learning, experimental learning, consistent with student-centered learning, and guide the students to study harder [4]. The application of multimedia teaching in schools can support the implementation of the curriculum, helping to increase interest in learning, and be complementary learning resources [5]. Besides multimedia interactive learning can bring clarity to certain content of the syllabus and can develop certain basic competencies that must be mastered students are difficult to achieve with other media [2]–[6] Interactive multimedia learning is suitable for use in Vocational Secondary School (SMK) [7]. Instructional media can support learning activities [8]. The multimedia learning is expected to improve students' learning ability and results.

Development of instructional media devoted to competence installation of electric power engineering expertise on the subjects of the application of the basic concepts of electricity and electronics in the first semester of the tenth grade. The interactive learning media is considered feasible for students [9]. Interactive multimedia with communicative language and interesting illustration can stimulate the student to learn independently [10]. Agree with that, Suyitno [11]described

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there is a positive and significant difference between the students treated with the developed interactive media and the students treated with the conventional media. It can improve learning outcomes, and the students can easily check their progress.

Selection of subjects the application of the basic concepts of electricity and electronics is because these subjects are supporting theory to practice electronics subjects that will be implemented in the next semester. Research subjects used in this study are SMK National Berbah students. The learning process on the subjects of the application of the basic concepts of electricity and electronics by the SMK National Berbah teachers done so far is the classical way or the theory that more use lectures and notes. To support the learning process more effective in creating an e-instructional media that is interactive, engaging, and motivating. With the e-instructional media, students are expected to understand the subject matter of learning by the teacher. To develop e-instructional multimedia needed steps that accordance with the condition of students [12]. The development of multimedia learning is very important to deliver the subject of basic electronics and electricity.

METHOD

ADDIE development method is used as a development model in this study. This model consists of five steps include Analysis, Design, Development or Production, Implementation, and Evaluation [13]. Steps ADDIE is shown in Figure1. Need analysis purports to identify the gap between the current situations and the ideal ones. It consists of identifying the current conditions, describes the ideal situation, explaining the existing gap between current conditions with ideal conditions, identify and describe the steps to fill the gaps, and list priorities [13]. Figure 2 shows the need assessment framework.

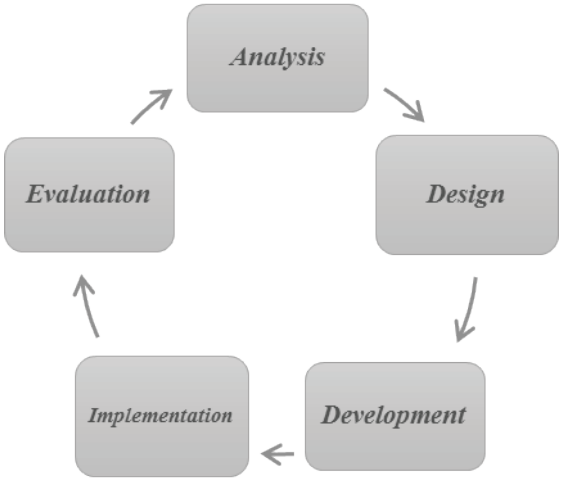

Figure 1. ADDIE Method

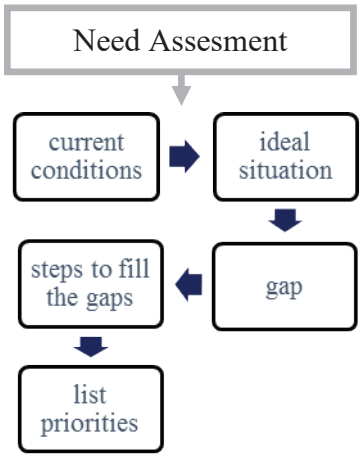

Figure 2. Need Assessment Framework

After the needs analyzing, the next stage is to make front-end analysis. Front-end analysis is the data collection techniques used to bridge the gap between reality and ideals to resolve the problem. Front-end analysis includes six stages: analysis of users, technology analysis, analysis of incidental crisis, state analysis, objective analysis, and analysis of media.

E-instructional media was designed based on the indicators and the learning objectives first. Media based indicators to identify the theory of atoms and electrons and the learning objectives at the end of the lesson students can explain the theory of atoms and electrons relating to electrical engineering correctly. Media will have an element of

animation, narration, and video. This is because the user analysis which shows that students tend audio-visual learners. The media is implemented to the 10th graders of Electrical Power Installation Techniques (TITL) membership program totaling 30 students. Evaluation stage is the final stage. This stage can be done at any stage in the top four. Evaluation happens at each of the four stages of a formative evaluation, because of the goal of the revised requirements.

RESULTS AND DISCUSSION

The initial stage of identifying the conditions currently obtained data is as follows: from the students who do not have a laptop, the level of student understanding of computer technology is low. They are pessimistic about the advent of technology and comfortable with the classical teaching, a willingness to try the low-tech, and students less enthusiastic in accepting the lesson of atomic theory, electro, and the occurrence of an electrical phenomenon.

From the side of the teacher is, almost no teachers who know about the e-instructional, motivation to upgrade teaching with e-instructional low, comfortable teaching classically, have a laptop, but not used to upgrade teaching, but only as data storage, teacher just explain the lesson of atomic theory, electro, and the occurrence of an electrical phenomenon with a lecture course, this affects multiple interpretations by students, because basically is needed imaging of the theory into an animation that can be understood by students. From the syllabus that is, the basic competencies describing the concept of electric circuits with core competencies that students can identify the atomic theory, electrons, and students can identify the occurrence of an electrical phenomenon is the theory lectures and difficult to describe if it relies on the oral delivery of content. Regarding media, namely; textbooks: images are colorless, explanations footnote for each picture is incomplete; student worksheets: less attractive concerning templates; power point: no animation, no videos, and no narrative, still use the board writes.

The second phase describes ideal conditions, it has been predicted by the researchers how the ideal conditions after made media e-instructional, i.e. from the students there is a willingness of the students to have a laptop, optimistic presence technology, and comfortable with the teaching of classical, high motivation to try the technology, enthusiastic students in a lesson about atomic theory, electro, and the occurrence of an electrical phenomenon, their impact on the enthusiastic involvement of the student to ask.

Regarding teachers, teacher motivation high to change the way of teaching classical to teaching tactics based e-instructional, teachers use one form of learning media e-instructional for teaching about atomic theory, electro, and the occurrence of an electrical phenomenon, it affects the similarity thinking by students and teachers of the subjects. From the syllabus that is, the basic competencies describing the concept of electric circuits with core competencies that students can identify the atomic theory, electrons and students can identify the occurrence of an electrical phenomenon can be explained through animation, narration, and video.

Regarding media, namely; Upgrade media use animation, narration, and video, each core competencies to be achieved consists of three aspects of supporting learning through their understanding of aspects of animation, their narrative aspect, and the aspect of video in each delivery of material. In terms of specific, namely; the education office e-instructional training for teachers, reward the teachers who implement e-instructional, use of e-instructional last a long time, and updated regularly.

The third stage describes the existing gap between current conditions with ideal conditions can be concluded as follows; from the students that the number of students who have multimedia technology such as laptop,

Android, or something very few compared to the number of students who already have, it adversely affects the willingness students to switch to e-instructional multimedia use as a medium of learning, and students need a tool to understand each core competencies to be achieved.

From the side of the teacher as an adult, a teacher should improve productivity at work, with digging capability to change views toward modernization, by applying multimedia e-instructional as a medium of learning, the use of laptops should be to increase productivity in work not to use that are redundant, sensitivity teacher against student activity when subjects receive a presentation of the application of the basic concepts of electricity and electronics is less sensitive, so that teachers simply abort teaching obligations, regardless of the extent to which students understand the material.

In terms of media, namely; learning classic that has been applied to switch to e-instructional multimedia use as a medium of learning. In terms of specific, namely; the need for leadership figures to raise awareness about the use of multimedia technology as instructional e-learning media. A teacher must be courageous and able to convince the education departments to conduct training as an instructional multimedia e-learning media that can support a study that is hard to explain through lectures.

The fourth stage to identify and describe the steps to address gaps can be planned in Table 1. The fifth stage to make a priority list obtained by the steps as follows, identifies instances of animation, video, and narrative spread across the Internet on the application of the basic concepts of electricity, make a list of what can be applied from the identification which is then synchronized with the syllabus, lesson plans, as well as books lesson, make the stuffing for homepages adobe flash. In the introduction is provided homepage that reflects the mindset of the contents of the multimedia e-instructional, so that students understand gradually, determines the background color, contrast, and font, as well as determine movement animation to be applied, the explanation of what the animation is applied.

Table 1. Analysis of Gap

Subject	Gap
Student	Introducing students to the system of e-learning that will be applied to the subjects of the application of the basic concepts of electricity and electronics, and explain what the impact will be acceptable if the system uses e-learning on the subjects of the application of the basic concepts of electricity and electronics.
Teacher	Obtain training for creating e-learning, a simple example that can be taught in a teacher is to maximize the use of powerpoint that combines animation, video, and narration to subject the application of the basic concepts of electricity and electronics, teachers manage the time of making learning media, in order to every day there is a target that is achieved, as well as teachers prepare existing subject that will be discussed in adobe flash, the subject refers to the syllabus, lesson plan and the textbooks used.
Media	Media is installed in accordance with the MS PowerPoint, and adobe flash is used, analyzed samples of animation, video, and narrative that had been there about the application of the basic concepts of electricity. In terms of specific, making the training proposal letter to the education department, and choose a reliable tutor training

Preparation of e-instructional media on the subjects of the application of the basic concepts of electricity and electronics in accordance with the lesson plan has been designed based on the syllabus. Achievement of core competence in the subjects the application of the basic concepts of electricity and electronics is electrical circuits analysis, and basic competence is to describe the concept of electrical circuits. Subjects the application of the basic concepts of electricity and electronics are taught to students in grade 1 in the 1st half of the first meeting. There is a special feature on the subjects of the application of the basic concepts of electricity and electronics is the teaching materials were first introduced by students fresh graduate from junior high school.

Subjects the application of the basic concepts of electricity and electronics, there are two indicators that identify the theory of atoms and electrons, and identify the occurrence of symptoms of electricity (power elektromotoris).

After knowing the indicator then the learning objectives at the end of the lesson is, students can explain the theory of atoms and electrons relating to electrical engineering. Media e-instructional is designed based on the indicators and the learning objectives first. At the end of the lesson, students can explain the theory of atoms and electrons relating to electrical engineering correctly. Front-end analysis in terms of user analysis is shown in Table 2.

Table 2. User Analysis

Aspect	User Analysis
Member of students	less than 30 students in first grade class of TITL
Language	everyday language that is in use by teachers and students is the local language
Culture	the culture of the region is very strong in the school environment,
Color	teachers and students interested in striking colors
Interested	reading interests of students are low so tend to like lectures, and image (audio-visual),
Job background parents of students	job background parents of students were laborers and farmers
Educational background parents of students	educational background of parents vary starting from just graduates elementary school, junior high school graduates, and high school
Teacher	the average teacher in SMK Nasional Berbah already been certified.

The results of this analysis can be concluded that in making e-instructional media at the SMK National Berbah is the development of existing materials; existing materials will be packaged in a modern way by using power point given the limitations that were already described in the needs.

Front-end analysis in terms of technology analysis that there is the internet, there is WIFI but is not intended for students, because the school was concerned about the impact of the abuse of the facilities provided, and there are rules attached which states students are allowed to bring mobile but when learning should not be used. The results of this analysis can be concluded that in order to implement e-instructional teacher plays an important role is as a presenter material, students can not have independent control of the e-instructional learning.

Front-end analysis from the incidental crisis analysis can know that a duration learning of each meeting is 2x45 minutes. It is not enough time in one meeting to the core competencies, students tend to be passive, and ashamed to ask, and because most students do not have a laptop so that the teacher gives a provision to re-learn to make a summary of the powerpoint that is already displayed. The results of this analysis can be concluded that in order to develop e-instructional media there are things that must be considered in terms of the analysis objective that has been concluded, there is the addition of media that will be given to students during the learning process ends considering the students do not have control of the self, then students equipped summary adobe flash. Front-end analysis the condition can be shown in Table 3.

Table 3. Analysis Condition

Aspect	Sub aspect	Condition
Classroom	Lightning	The classroom was dark, due to less exposure to direct sunlight
	Position	Located at the far end, near the practice room.
	Temperature	The room temperature is normal
	Noise	The noise heard when learning theory, this is because of the membership program the machine and automotive practice

The results of this analysis can be concluded that in order to develop media e-instructional there are things that must be considered in terms of the analysis of the state, namely; the manufacture of media e-instructional should contain bright colors, considering the classrooms were quite dark,

making the sound on the animation harder and sound considering the room adjacent to the practice room.

Front-end analysis in terms of objective analysis is taken from the aim of developing e-instructional media that students can explain the theory of atoms and electrons relating to electrical engineering correctly. The results of this analysis can be concluded that in order to develop e-instructional media, it shall be determined the ultimate goal to be obtained, the purpose is taken from the lesson plan which refers to the core competence and basic competencies contained in the syllabus. The learning objectives in the lesson plan on the first point that students can explain the theory of atoms and electrons relating to electrical techniques properly, the core competencies on the syllabus is to analyze the electrical circuits, and basic competence is to describe the concept of electrical circuits.

In terms of media analysis, namely the development of instructional media power point during the learning process can explain the subjects of the application of the basic concepts of electricity and electronics so that the learning objectives can be achieved by adjusting the result of user analysis, technology analysis, analysis of the crisis incidental, and state analysis. Instructional media selection is on the basis of the needs analysis that has been made.

Instructional media designed using adobe flash CS 5.5. Media will have an element of animation, narration, and video. This is because the user analysis which shows that students tend audio-visual learners. Template basic concept of electrical and electronic be applied to the adobe flash is shown in Figure 3. Then the evaluation of media is shown in Figure 4.

The media is implemented to the 10th graders of Electrical Power Installation Techniques (TITL) membership program totaling 30 students. The results of the implementation feasibility of the media in terms of five aspects: creative, effective, efficient, attractive, and interactive. It is shown in Figure 5. In addition, Results Feasibility Media is shown in Table 4.

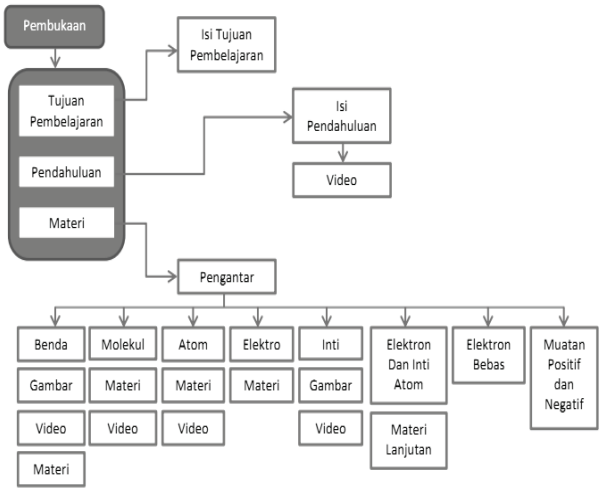

Figure 3. Material Application Template Basic Concepts of Electrical and Electronics

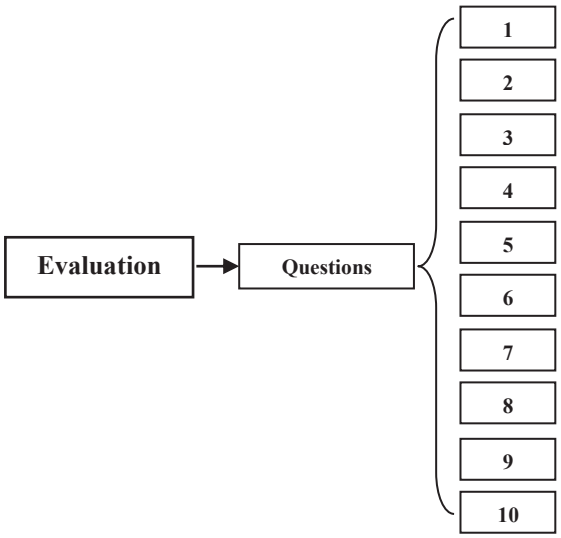

Figure 4. Evaluation Application Template Basic Concepts of Electrical and Electronics

Table 4. Results Feasibility Media

Aspect	Min	Ave	Max	Category
Creative	73.1	76.8	81.5	Very good
Effective	70.4	76.8	82.5	Very good
Efficient	63.6	71.5	75	Good
Interesting	71.3	77.4	82.4	Good
Interactive	69.4	74.4	78.7	Very good

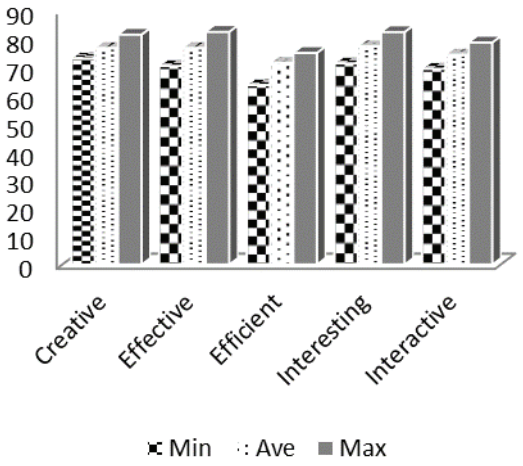

Figure 5. Percentage of Eligibility Media

Based on Table.4 can be explained that the e-instructional media fit for use in SMK. Aspects of creative and effective have the highest average score is 76.8. Aspects of efficient have a minimum value, and the lowest average value is 71.5. The use of interactive multimedia instructional design is expected to provide convenience to faculty and students in absorbing [14]. Agree with that, Komalasari & Sarifudin [15] described the implementation of interactive multimedia design significantly affects the formation of students' character. Effective implementation of the discussed factors of multimedia-based instruction could open a new era of learning practices and provide a new paradigm to learners in the days ahead [16]. With the e-instructional multimedia, it is expected that students can understand the lesson well.

Evaluation stage is the final stage. This stage can be done at any stage in the top four. Evaluation happens at each of the four stages of a formative evaluation, because of the goal of the revised requirements. Based on the results of the implementation is known that the e-instructional multimedia in basic concept electrical and electronic lesson feasible for students of SMK.

CONCLUSION

The results of the needs analysis and front-end analysis are the foundation for developing an e-instructional school. ADDIE method used as the basis for the development of this media. Media e-instructional selected is an interactive media based on Adobe Flash CS 5.5 as well as the subjects chosen is the application of the basic concepts of electricity and electronics. For e-instructional media, there are five very important aspects and acts as the main component of the completeness of interactive multimedia-based learning media. The fifth major component in question is text or font, image bor visual, animation, sound/audio, and video. The existence of multimedia instructional considered feasible to use for learning vocational students. With this multimedia, students can be expected to understand the lessons delivered.

REFERENCES

[1] O. Hamalik, *Proses Belajar Mengajar*. Jakarta: PT Bumi Aksara, 2003.

[2] C. Achjar and H. Latucosina, *Pembelajaran Berbasis Fitrah* -. Jakarta: PT Balai Pustaka, 2008.

[3] E. H. R. Hasan, "University of Twente," University of Twente, 2001.

[4] Suyanto, *Multimedia Alat untuk Meningkatkan Keunggulan Bersaing*. Yogyakarta: Andi Offset, 2003.

[5] W. Yogiyatno and H. Sofyan, "Pengembangan Multimedia Interaktif Kompetensi Dasar Mengoperasikan Software Basis Data untuk SMK Negeri 1 Seyegan," *J. Pendidik. Vokasi*, vol. 3, no. 3, pp. 391–404, 2013.

[6] Purwanto, "Pengembangan Model Pembelajaran Berbasis Teknologi Komunikasi dan Informasi untuk Pendidikan Dasar dan Menengah," in *Seminar Nasional Teknologi Pembelajaran " Menghadapai Tantangan Daya Saing SDM Nasional dan Internasional*, 2004.

[7] N. Nopriyanti and P. Sudira, "Pengembangan Multimedia Pembelajaran Interaktif Kompetensi Dasar Pemasangan Sistem Penerangan dan Wiring Kelistrikan di SMK," *J. Pendidik. Vokasi*, vol. 5, no. 2, pp. 222–235, Jun. 2015.

[8] Office of Distance Learning at Florida State University., "Instructional Media: Chalkboards to Video," in *Instruction at FSU Handbook*, Gainesville: Office of Distance Learning at Florida State University, 2011, pp. 103–112.

[9] E. S. Damarwan and M. Khairudin, "Development of an Interactive Learning Media to Improve Competencies," in *Proceedings of the International Conference on Technology and Vocational Teachers (ICTVT 2017)*, 2017.

[10] E. Sutarno and M. Mukhidin, "Pengembangan Model Pembelajaran Berbasis Multimedia Interaktif Pengukuran untuk Meningkatkan hasil dan Kemandirian Belajar Siswa SMP di Kota Bandung," *J. Pendidik. Teknol. dan Kejuru.*, vol. 21, no. 3, pp. 203–218, 2013.

[11] Suyitno, "Pengembangan Multimedia Interaktif Pengukuran Teknik untuk Meningkatkan Hasil Belajar Siswa SMK," *J. Pendidik. Teknol. dan Kejuru.*, vol. 23, no. 1, pp. 101–109, 2016.

[12] M. O. Martin *et al.*, "TIMSS 2007 International Science Report Findings from IEA's Trends in International Mathematics and Science Study at the Fourth and Eighth Grades," Boston, 2008.

[13] W. W. Lee and D. L. Owens, *Multimedia- Based Instructional Design : Computer-based Training Web based Training Distance Broadcast Training Performance based Solution*. New York: Pfeifier, 2004.

[14] S. Siagian, Mursid, and Y. Wau, "Development of Interactive Multimedia Learning in Learning Instructional Design," *J. Educ. Pract.*, vol. 5, no. 32, pp. 44–50, 2014.

[15] K. Komalasari and D. Saripudin, "Value-Based Interactive Multimedia Development through Integrated Practice for the Formation of Students' Character," *TOJET Turkish Online J. Educ. Technol.*, vol. 16, no. 4, pp. 179–186, 2017.

[16] J. Nazir, A. H. Rizvi, and R. V Pujeri, "Skill development in Multimedia Based Learning Environment in Higher Education: An Operational Model," *Int. J. Inf. Commun. Technol. Res.*, vol. 2, no. 11, pp. 820–828, 2012.