



Development of interactive multimedia on Kirchhoff's law using adobe flash cs6

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ABSTRACT

Graduates' standards of competency and content in the national curriculum explain the principle of learning should be done anywhere. Technology was using to improve the effectiveness and efficiency of learning. The education world still needs teaching materials that support the learning process. The purpose of this research was to produce a viable interactive multimedia product. The multimedia eligibility criteria were reviewed from the content and construct validation test, practicality test, and effectiveness test. This research was development research carried out in four main stages, namely preliminary studies, planning and development, field testing, and dissemination. The multimedia component consists of core competencies, essential competencies, text, sound, images, animation, material explaining in detail, and practice questions that could be adjusted to students' needs. The results showed that interactive multimedia teaching materials were valid in terms of content and constructed. They practically used as well as a solution to the impracticality of learning principles, as well as effectively increasing students' cognitive abilities.

Keywords: Interactive multimedia, Kirchhoff's law, teaching materials

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INTRODUCTION

One-way learning methods still dominate the learning process in schools; namely, the teacher delivers the lecture method, and students listen. These conditions do not support the interactive learning process. Based on Permendikbud (2016) the learning process in an educational unit should be organized interactively, inspirational, fun, challenging and motivating students to participate actively; provide sufficient space for students' initiative, creativity and independence, and by their talents, interests, abilities, and physical and psychological development of students. Also, ac-

ording to graduates' competency standards and national curriculum content standards, learning principles are directed at changing traditional orientation towards innovation such as: (1) from the teacher as the only source of learning into learning based on various learning resources; (2) from learning verbalism to applicative skills; (3) learning that takes place at home, at school, and in the community; (4) learning that applies the principle that anyone is a teacher, anyone is a student, and anywhere is a class, and; (5) the use of information and communication technology to improve the efficiency and effectiveness of learning (Permendikbud, 2016).

Based on the results of interviews and questionnaires filled out by 96 grade X students of SMKN 2 Bandar Lampung, it was shown that 64.58% of teachers only delivered material theoretically so as not to create a learning process that was by the 2016 Ministry of Education and Culture. Learning resources used in schools were still limited, namely only teachers and printed books, and teachers lack the use of information and communication technology to improve the efficiency and effectiveness of learning. Besides dynamic electrical material, including abstract physics material (Zaus, 2018), students tend to have difficulty visualizing the material presented by the teacher only theoretically. The use of learning methods that are not appropriate in the learning process will cause problems in improving students' cognitive abilities (Murtini, Aminah & Rahardjo, 2015) and produce low learning outcomes (Harsono, Soesanto & Samsudi, 2009).

These problems can be overcome by developing interactive multimedia materials to produce a more effective and efficient learning process. Computer Technology Research (CTR), states that people can only remember 20% of sight and 30% of hearing. But people can retain 50% of what is seen and heard and can remember 80% of what is seen, heard, and done at once (Munir, 2013). Several studies have shown that effective interactive multimedia is using in the learning process, research conducted by Krismadinata (2017) and Apriyanti (2017) shows that interactive multimedia is effective in improving student learning outcomes, Husein (2015) states that interactive multimedia is effective in enhancing mastery of students' concepts and critical thinking, Setyorini, Patonah, & Murniati (2016) state that interactive multimedia streamlines communication between educators and students. Interactive multimedia can foster students' creative thinking abilities (Sudianti & Shinta, 2018).

The use of interactive multimedia in the world of education will produce interactive and interesting learning (Anggraeni, Sul-ton & Sulthoni, 2019) and effective in improving students' cognitive abilities (Khoirah, Jalmo, & Abdurrahman, 2016). Besides interactive

multimedia harmonizing humans with technology so that it supports the world of education in the face of the industrial revolution era 4.0 (Lase, 2019). Interactive multimedia, which is mostly developed, is a learning media where students can only choose the material to be learned and answer the available questions. Interactive multimedia needs to be producing more innovatively to increase the effectiveness of the learning process. So the development of teaching materials has been done using interactive multimedia where students can interact more with teaching materials, including interactive multimedia that is developed equipped with simulations.

RESEARCH METHODS

The study was conducted at SMKN 2 Bandar Lampung in the odd semester of 2019/2020. This research is a development study with development procedures according to the stages of Borg & Gall (2003), which includes ten development procedures and is grouped into four main stages, namely preliminary studies, planning and development, field testing, and dissemination. In the preliminary study stage, a needs analysis is conducted (need assessment). The needs analysis is a literature study and field observations that identify potentials or problems using a questionnaire distributed to students to get a picture of the conditions of learning that occur (including completeness of administration, learning media, and infrastructure) well as student learning outcomes.

The planning and development process can be seen in chart 1. While the field test is carried out to obtain information about the effectiveness of the products that have been produced from this development research. The subject of expert validation consists of content experts and construct experts. The test subjects were students of class X SMKN 2 Bandar Lampung who had not yet received dynamic electrical material at the SMK, so the effectiveness of learning media would be obtained after being used in learning of students by comparing learning outcomes before using interactive multimedia on learning outcomes

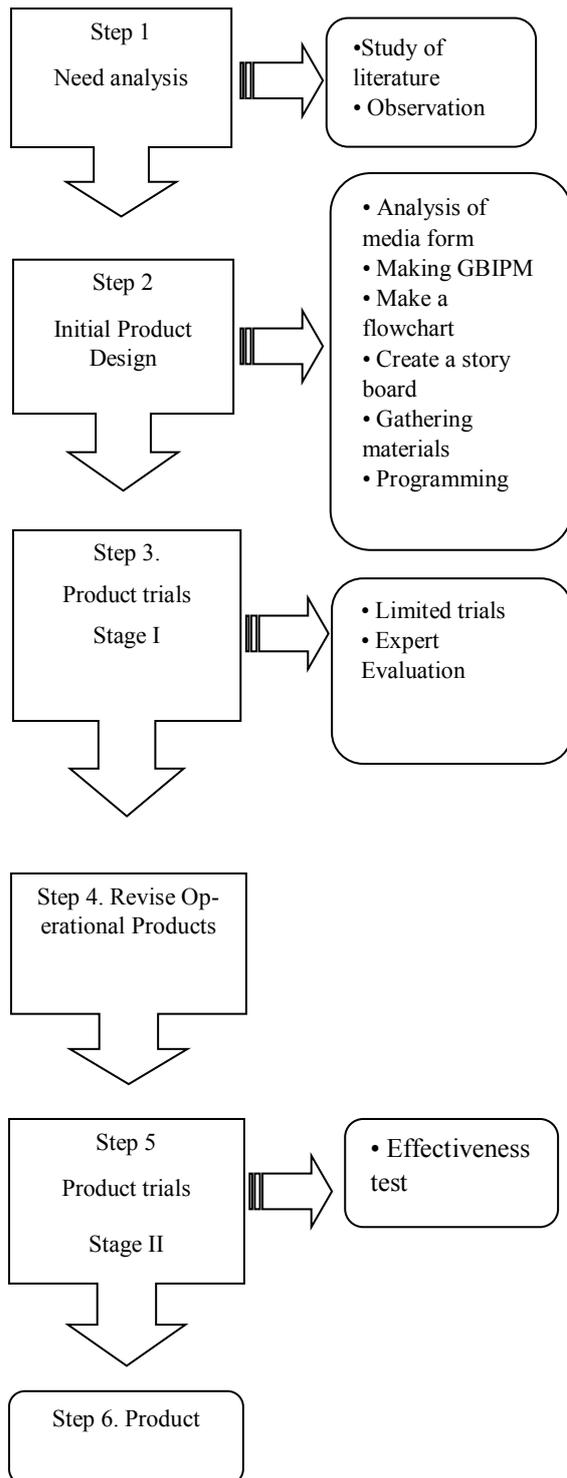


Figure 1. Research flowchart

after using interactive multimedia. This research development data collection technique was carried out through a questionnaire and test instrument. The questionnaire instrument given to students in the needs analysis stage consisted of 10 questions regarding the completeness of school facilities, the use of

school facilities, the use of multimedia learning, the effectiveness of learning methods, and and difficulties faced by students in developing material.

The expert validation questionnaire consisted of content experts who examined aspects of material presentation (conformity to curriculum, material accuracy, multimedia influence in stimulating curiosity, as well as supporting the performance of material) and construct elements that examined media interactivity, media display clarity, media appearance attractiveness, the practicality of the media, choice of words, linguistic elements, layout, and color choices for the components of multimedia. The questionnaire given to the validator consisted of 10 questions with answers following the Likert scale, which had four option of responses according to the content of the question. The students' test instrument consisted of 10 breakdown questions with different levels of difficulty ranging from C1 to C4.

Research data collection was carried out in several ways, namely questionnaire and test instruments. The product validation questionnaire instrument, which has four optional responses, is calculated on average, then interpreted in a qualitative form. While the effectiveness test is carried out through a written test with a one-group pretest-posttest experimental design (Sugiyono, 2001), which then looks at the effect of interactive multimedia in the effectiveness of learning through the average normalized gain obtained.

RESULTS AND DISCUSSION

The results of the research in the first stage are preliminary studies to obtain data related to the presence or absence of media used. The level of student needs for the product to be developed. The results of unstructured interviews conducted to teachers and students provide information that the quality of learning is not optimal; the learning resources used are teachers and printed books, printed the school still loan books. They are not allowed to be taking home. The method used

in learning is the lecture method, teachers only rely on verbal language, and students solely rely on audio skills. The lecture method has several shortcomings, including the material controlled by students, which will be limited to what is mastered by the teacher. This teacher lacks excellent communication skills results in the lecture method as a tedious learning method (Mahmudah, 2016). Besides, this lecture method can not be repeating, so students must pay attention when the teacher is explaining.

The results of the research in the second stage are developing initial products. The steps undertaken at this stage are: (1) Reviewing existing products; (2) Making an Outline of Media Program Content (GBIPM); (3) Development of Flowcharts; (4) Storyboard development; and (5) Collecting Materials; (6) Compiling interactive multimedia teaching materials; (7) Develop validity and practicality testing instruments by experts and teachers; (8) Develop student response questionnaires; and (9) Developing pretest and posttest instruments for testing the effectiveness of multimedia. At this stage, validates tests are also carried out by experts and limited trials.

Validation is carried out by experts and teachers, which include construct tests and content tests. There is a record of improvements to interactive multimedia, including various modes of representation needed. The facts and phenomena displayed must be more contextual. The material presented in the form of the latest technology, and the use of letters (size, shape, type, and color) are more varied. A limited trial involving thirty participants aims to test the practicality of interactive multimedia. Twenty questions cover the media's attractiveness, the ease of use of the media, and the media's benefits.

The third stage is the field test. The field test aims to obtain information about the effectiveness of the product is developing. The trial was conducted through a physics learning process using interactive multimedia teaching materials on Kirchhoff's law material with a learning cycle learning model. Learning be-

gins with a pretest to determine students' initial abilities. Then students are asked to explore the material through interactive multimedia. At the end of knowledge, students are given a posttest to see the effect of interactive multimedia in improving student learning outcomes. There are ten questions in the pretest and posttest.



Figure 2. Initial Display of Interactive Multimedia Products



Figure 3. Display of Material

The validity and practicality of interactive multimedia can be seen in Table 1- Table 3.

Table 1. Content Validation Results Data

| No | Descriptive Size | Score | Criteria |
|---------------------|---------------------|-------|-------------|
| 1 | Suitability | 3,20 | Worthy |
| 2 | Accuracy | 2,75 | Worthy |
| 3 | Stimulate curiosity | 3,50 | Very decent |
| 4 | Completeness | 3,30 | Very decent |
| Average Total Score | | 3,19 | Worthy |

In the class used as the treatment class, the calculation of the average value of students' pretest before using multimedia is 19.53, and the average posttest score of students after the use of media is 73.2. The normalized gain value of 0.66 or the classification of "medium" or the level of effectiveness is "effective." So it can be

Table 2. Data on Construction Validation Results

| No | Descriptive Size | Score | Criteria |
|---------------------|------------------|-------|-------------|
| 1 | Interactivity | 3,50 | Very decent |
| 2 | Clarity | 3,60 | Very decent |
| 3 | Victory | 3,30 | Very decent |
| 4 | Convenience | 3,75 | Very decent |
| Average Total Score | | 3,54 | Very decent |

Table 3. Data Results Questionnaire Student Response

| No | Descriptive Size | Score | Criteria |
|---------------------|------------------|-------|-------------|
| 1 | Victory | 3,35 | Very decent |
| 2 | Convenience | 3,30 | Very decent |
| 3 | Usefulness | 3,34 | Very decent |
| Average Total Score | | 3,33 | Very decent |

concluded that this interactive multimedia is effective in improving student learning outcomes in line with research Maulidita & Sukartiningsih (2018), which states that the learning outcomes of students who get learning with the help of multimedia are better than students who get learning without multimedia.

The purpose of this study is to develop interactive multimedia teaching materials to facilitate teaching materials in the learning process that supports graduate competency standards and content standards (Permendikbud, 2016) that the principles of learning can be carrying out anywhere and the use of information and communication technology to improve efficiency and effectiveness learning. The products developed in this study were describing from three aspects of quality, namely validity, practicality, and effectiveness. The fundamental difference between interactive multimedia products designed is interactive multimedia teaching materials developed with

a contextual approach and tested from three aspects: validity, practicality, and effectiveness. Besides, the material was delivered with a tutorial concept that made it easy for students to construct their understanding. The material developed in interactive multimedia teaching materials is Kirchhoff's law material with basic competencies that must be achieved, namely 3.13. Applying static electricity and dynamic electricity and 4.13. Conducting experiments related to static electricity and dynamic electricity.

Interactive multimedia products that are developed get very decent judgments based on validity tests that have been done. The product was considered attractive in terms of construct and content, with an average score of both experts at 3.31 or 82.75%. Assessment of product construct validity is assessed from the aspect of media interactivity, clarity of media appearance, conformity with learning media standards, and media efficiency. At the same time, the assessment of the validity of product content is assessed in terms of the suitability of the description of the Material with BC, the accuracy of the material, the tendency of the media in stimulating learning and supporting the presentation of the material.

The practicality of interactive multimedia is determined by calculating student response questionnaires on aspects of attractiveness, convenience, and usefulness. Nieveen in Akker (2013) states that the product developed is said to be practical if the user (students) states the product is easy to use. Based on the practicality test of interactive multimedia, the practicality value was 3.46 or 85.5%. The average cost is including in the classification is very good. Interactive multimedia equips with text, images, audio, and animation that aim to make students better understand concepts in everyday life and more so that students more easily visualize abstract things such as flows and loops.

In multimedia products, some questions can be accessed to practice knowledge, where there is feedback that students immediately know after working on the problem.

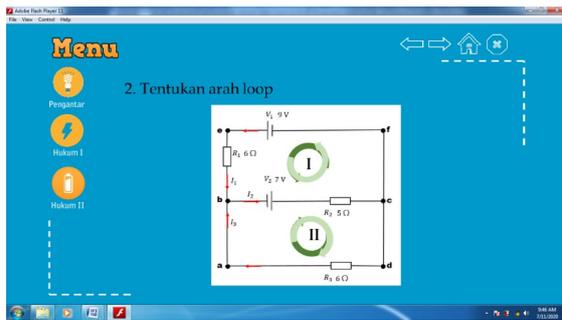


Figure 4. Visualization of current direction and loop direction



Figure 5. Feedback when students answer the questions correctly

Achievement of the effectiveness of interactive multimedia seen from the mastery of students in the cognitive aspects of students is determined based on a comparison between student learning outcomes. Besides, the learning process with interactive multimedia is doing with the learning cycle learning model. There are seven stages in the learning cycle learning model, namely: elicit (bring students' fundamental knowledge), engage (generate interest), explore (explore), explain (explain), elaborate (implement), evaluate (evaluate), and extend (expand). Interactive multimedia is using in the explore (explore) stage, at this stage, students are asked to understand and explore Kirchhoff's law material through Kirchhoff's law learning media. The learning media provided include material that is explained from simple to complex, concrete to abstract. It is also equipped with sample problems, illustrations, and evaluations so that students more easily understand the material presented. Brunner said children understand and remember concepts better when they discover ideas done by themselves through exploration (Roblyer & Doering, 2010: 36). Students construct their knowledge to build

mastery of the concept of critical thinking for students. This is in line with research Husein (2015), which states that interactive multimedia is effective in increasing the ability of students' concepts and critical thinking.

Students explore the material through interactive multimedia. Then, students get feedback in the form of a verbal and visual explanation of the material to be studied, abstract parts such as loop direction and current direction visualized in the way of animation. Besides, students get positive reinforcement when they succeed in answering questions contained in multimedia, and hints when they haven't been able to answer the question correctly. The material presented is equipped with audio, video, and animation makes students learn by integrating the sense of hearing and vision. Based on the principle of the dual-coding theory, which explains that the learning process carried out using the sense of sight and sense of hearing will form memories in long-term memory. Atkinson & Shiffrin in Levitin (2002: 296) explain that images, sounds, and words will enter into working memory. Then the received knowledge is constructed in working memory, which gives rise to mental images. The depiction is forwarding to long-term memory, so students remember the more extended subject matter. Therefore learning using interactive multimedia tends to increase the knowledge stored in long-term memory.

The combination of multimedia technology and appropriate learning design can create an excellent learning environment for practical learning. The results of this study are in line with research Novianto (2018), and Zainudin (2019) who show that interactive multimedia is very effective in improving student learning outcomes, Ardiansyah (2019) explains that the use of video media has a significant effect on student learning outcomes and increases student activity in the process learning. The use of instructional media can also realize better learning quality. Besides, that interactive multimedia is very helpful for students in the independent learning process, as stated by Dewi, Sukdata, & Sukmana

(2019). Students construct their knowledge so that it will build the mastery of the concept of critical thinking for students. This is in line with research Husein (2015), which states that interactive multimedia is effective in increasing the mastery of concepts and critical thinking of students. Students who tend to think critically will increase the effectiveness of communication between educators and students, so that triggers interactive learning as contained in the research Setyorini, Patonah, and Murniati (2016) states that interactive multimedia streamlines communication between educators and students. Besides, multimedia learning integrates the use of technology in education. This fully supports 21st-century skills demands, such as those found in Lase's research (2019).

CONCLUSION

The results showed that the interactive multimedia teaching materials met the eligibility criteria that included valid, practical, and useful. Accurately based on the expert judgment, which displays content validity reaches 3.19 or in the feasible category, and construct efficacy reaches 3.54 or in the possible group. Practically based on student responses that show a practicality score of 3.33 or in the excellent category. Effective based on the influence after learning with interactive multimedia with the acquisition of N-Gain value of 0.66 or in the practical type. Therefore, interactive multimedia teaching materials are appropriate for the learning process and support the principles of learning according to the Ministry of Education and Culture (2016).

REFERENCES

- Akker, J.V.D., Bannan, B., Kelly, A.E., Nieveen, N., dan Plomp, T. (2013). *Introduction to educational design research*. Enschede, The Netherlands: SLO
- Anggraeni, R.D., Sulton, & Sulthoni. (2019). Pengaruh Multimedia Tutorial terhadap Hasil Belajar Bahasa Indonesia. *Jurnal Kajian Teknologi Pendidikan*. Vol. 2. No. 2. <http://journal2.um.ac.id/index.php/jktp/index>
- Apriyanti, Netty dkk. (2017). The effectiveness of using multimedia in teaching physics to gauge student learning outcomes in the senior high school in Indonesia. *International Research Journal of Education and Science (IRJES)*. Vol. 1(2): 1114.
- Ardiansyah, Feri. 2018. Pengaruh Penggunaan Media Video Terhadap Minat dan Hasil Belajar Siswa Kelas Xi pada Pelajaran Pai di Sma YPI Tunas Bangsa Palembang. *Jurnal Kajian Teknologi Pendidikan*. Vol 2. No 1.
- Dewi, I.G.A.A.S.S., Sudatha, I.G.W., Sukmana, A.I.W.I.Y. 2019. Pengembangan Multimedia Pembelajaran Interaktif Berorientasi Pendidikan Karakter Mata Pelajaran Bahasa Bali. *Journal of Education Technology*. Vol. 3(3) pp. 190-195
- Gall, Borg & Gall. (2003). *Education Research*. New York : Allyn and Bacon.
- Harsono, B., Soesanto., & Samsudin. (2009). Perbedaan Hasil Belajar Antara Metode Ceramah Konvensional dengan Ceramah Berbantuan Media Animasi pada Pembelajaran Kompetensi Perakitan dan Pemasangan Sistem Rem. *Jurnal Pendidikan Teknik Mesin*.
- Husein, S., Herayanti, L., & Gunawan (2015). Pengaruh penggunaan multimedia interaktif terhadap penguasaan konsep dan keterampilan berpikir kritis siswa pada materi suhu dan kalor. *Jurnal Pendidikan Fisika dan Teknologi*, 221 -224. <http://dx.doi.org/10.29303/jpft.v1i3.262>
- Khoirian, Jalmo. T., Abdurrahman. (2016). The Effect of Multimedia-Based Teaching Materials in Science Toward Students' Cognitive Improvement. *Jurnal Pendidikan IPA Indonesia*. <http://journal.unnes.ac.id/index.php/jpii>
- Krismadinata, F. A. (2017). Pengembangan Media Interaktif Menggunakan Adobe Flash CS6 pada Mata Pelajaran

- Menganalisis Rangkaian Listrik. *Seminar Nasional Vokasi dan Teknologi*, 255. Bali : Program Studi Teknik Elektro, Universitas Negeri Padang.
- Lase, D. (2019). Pendidikan di Era Revolusi Industri 4.0. *Jurnal Sunderman*.
- Letivin, D.J. (2002). *Foundation of Cognitive Psychology Core Reading*. Cambridge: The MIT Press
- Mahmudah, Masruroh. (2016). Urgensi diantara Dualisme Metode Pembelajaran Ceramah dalam Kegiatan Belajar Mengajar untuk Siswa MI/SD. *Jurnal Cakrawala*. Vol. XI, No. 1
- Munir. (2013). *Multimedia Konsep dan Aplikasi dalam Pendidikan*. Bandung: Alfabeta.
- Murtini, L., Aminah, N.S., & Rahardjo. (2015). Eksperimentasi Pembelajaran Fisika Berbasis CTL Melalui Metode Eksperimen dan Demonstrasi pada Materi Alat Optik Ditinjau dari Kemampuan Awal Siswa di SMA. *Prosiding Seminar Nasional Fisika dan Pendidikan Fisika (SNFPF)*.
- Novianto, L.A., Degnt, I.N.S., Wedi, A. (2018). Pengembangan Multimedia Interaktif Mata Pelajaran IPA Pokok Bahasan Sistem Peredaran Darah Manusia Untuk Kelas VIII SMP Wahid Hasyim Malang. *Jurnal Kajian Teknologi Pendidikan*. Vol 1. No. 3
- Permendikbud. (2016). *Peraturan Menteri Pendidikan dan Kebudayaan No. 22 tahun 2016 tentang Standar Proses Pendidikan Dasar dan Menengah*. Jakarta: Kemendikbud.
- Roblyer, M & Doering, A.H. (2010). *Integrating Educational Technology Into Teaching*. Boston: Pearson.
- Setyorini. Patonah. & Murniati. 2016. Pengembangan media pembelajaran moodle, *Jurnal Penelitian Pembelajaran Fisika* 7. Vol.7, No.2, 156 160. <http://dx.doi.org/10.26877/jp2f.v7i2.1311>
- Sudiantini & Shinta . 2018. Media pembelajaran terhadap kemampuan berpikir kreatif, *Jurnal Penelitian dan Pembelajaran Matematika*. Vol. 11. No.1. <http://dx.doi.org/10.30870/jppm.v11i1.2996>
- Sugiyono. (2016). *Metode Penelitian Kuantitatif, Kualitatif dan R&D*. Bandung: Alfabeta.
- Zaus, M. Agni., dkk.(2018). Perancangan Media Pembelajaran Listrik Statis dan Dinamis Berbasis Android, *Journal of Information Technology and Computer Science (INTECOMS)*. Vol 1, No.1