Development of Android-Based Learning Multimedia on SMAW Welding Knowledge Competencies

Sudiyono Sudiyono *, Toni Agung Supriyadi, Rusiyanto Rusiyanto, Wirawan Sumbodo, Andri Setiyawan

Engineering Faculty, Universitas Negeri Semarang, Semarang, Indonesia
Email: sudiyono.tmesin@mail.unnes.ac.id

ABSTRACT

This research aims to develop Android-based learning multimedia that is suitable for use in learning and to determine the practicality of using this media based on student and teacher assessments. This research uses the ADDIE development method which consists of 5 stages, namely: Analyze, Design, Develop, Implement, and Evaluate. The ADDIE model is used because this method has systematic stages. The development of the ADDIE model only reached the evaluation stage without any deployment stage, so this research is in accordance with the research objectives. Based on the results of the media validity test carried out by 2 material experts, it was stated that the media was suitable for use in learning with an average percentage of 93% or entered the very appropriate criteria. Likewise, 2 media experts stated that media is very suitable for use in learning with an average percentage of 86%. Meanwhile, the practicality value of the developed multimedia obtained a practicality score of 96% by students and 96.5% by teachers, so it is included in the very practical category for use in learning. This is because, with multimedia, students can learn independently anytime and anywhere. Apart from that, the presence of multimedia can make it easier to convey material to students.

Keywords: *Android, Development, Multimedia, SMAW Welding*

1. INTRODUCTION

Government Regulation Number 5 of 2022 concerning Graduate Competency Standards at the vocational secondary education level in article 8 letter b, explains that "Vocational secondary education is secondary education which is focused on preparing students to become members of society who believe and are devoted to God Almighty and have noble character, instill character that is in accordance with Pancasila values, and prioritize skills to increase students' competence so they can live independently and participate in further education according to their vocation." According to the competency standards for graduates at vocational high schools or other equivalent forms, as referred to in paragraph (2), vocational secondary education aims to demonstrate students' skill abilities in accordance with their vocation, to strengthen their independence and readiness to enter the world of work.

Based on the decision of the Director General of Primary and Secondary Education Management regarding the Skills Spectrum for Vocational High Schools (SMK) in 2013, Vocational Schools have 150 skill competencies. The aim of issuing this decision is so that vocational schools do not all develop and create names for skills programs, but only develop programs that suit the needs of the world of work. Berqas Institute of Technology, states that the mechanical engineering skills program generally has 6 skill competencies, namely: machining engineering, welding engineering, metal casting engineering, industrial mechanical engineering, mechanical design and drawing engineering, and metal fabrication and manufacturing engineering.

At a time when technological growth is developing very rapidly, a lot of technology is being used to help and simplify various kinds of work, including in the world of education, technological developments can be used as a more sophisticated tool, to make the learning process

A. Kusumastuti et al. (eds.), *5th Vocational Education International Conference (VEIC 2023)*,
Advances in Social Science, Education and Humanities Research 813,
https://doi.org/10.2991/978-2-38476-198-2_195

easier to deliver. The use of technology has been proven to encourage educators and students to be more creative in creating active learning [1]. One of the technologies developed at Vocational Schools is welding technology. This welding technology in vocational high schools has various goals, one of which is producing graduates who are competent in the field of welding according to needs. This welding technology is studied in welding engineering subjects.

According to [2] welding is the process of joining two or more metals using heat energy which causes the metal around the weld to experience thermal circulation so that the metal around the weld experiences complex metallurgical changes, deformation, and thermal stress. According to [3], welding techniques are a joining process that results in the melting of materials, by heating them to welding temperature, by applying pressure alone, or by using filler metal alone. Welding is often used for the repair and maintenance of all metal tools, either as a crack-filling process, as a temporary joint or to cut metal parts.

The most popular types of welding are welding using an electric arc (Shielded Metal Arc Welding/ SMAW), carbide welding (Oxy-Acetylene Welding/ OAW), GTAW welding (Gas Tungsten Arc Welding), GMAW welding (Gas Metal Arc Welding), welding FCAW (Flux-Cored Arc Welding), and OFW (Oxyfuel Gas Welding) [3]. SMAW welding technology is a welding technology that is relatively cheaper compared to other welding technologies in the process of use. SMAW welding is carried out using AC and DC electrical energy, the electrical energy is converted into heat energy, by generating an electric arc through an electrode, resulting in a metal fusion process that results in the melting of the workpiece and electrode.

SMK Negeri 10 Semarang is one of the vocational schools that has a welding engineering major. One of the subjects in it is SMAW welding techniques. The location of this school is located on Jalan Kokrosono No. 75, Panggung Kidul, North Semarang District, Semarang City. Based on observations made at SMK Negeri 10 Semarang, show that the learning model currently implemented by teachers is by briefly explaining the material to be practiced, then students immediately carry out practical activities.

The method of explaining briefly (lecture) can 'shackle' or inhibit student creativity [4]. With this learning model, it is considered that it does not have a strong effect on students in mastering welding technical material, especially in carrying out SMAW welding practices, as a result, students are considered slow in completing the welding practical learning process. Based on data on student learning outcomes with the main material SMAW welding, it was found that of the 70 students, 71.42% got scores that did not reach the KKM (Minimum Completeness Criteria) (75) or 50 students, while the remaining 28.57% or 20 Students get grades that reach the KKM.

Based on this information, it is proven that by implementing learning using this method, students are not able to understand the material being taught, so student learning outcomes are less than optimal and cannot reach the Minimum Completeness Criteria score. Apart from that, it can also be seen that when students are doing practice, each meeting should be able to carry out at least one welding process, but what happens is that one welding process takes 2 to 3 meetings. If this continues, what will happen is that all the competencies required by students will not be delivered and will have an impact on low student learning outcomes.

Method of explaining briefly (lecture) can 'shackle' or inhibit students' creativity so that by applying the lecture method in the learning process, can cause students to have difficulty developing their creativity and potential [5]. The weaknesses of the lecture method include lack of opportunities to discuss problems and develop the courage to speak up, lack of space for students to be creative, teachers who are not creative cause a monotonous educational situation, it is very difficult to know the level of understanding of all students, students quickly forget what they were told, and not encouraging students to read [6].

Based on the opinions of experts and this background, research will be carried out through the development of Android-based learning multimedia. Multimedia is a combination of various types of data elements in the form of text, graphics, images, photos, animation, sound, and photos which can explain the objectives we are conveying so that it can make it easier for students to understand the material presented [7] [8]. This Android-based learning media is used to facilitate the teaching and learning process, in the form of ease in delivering subject matter in the Manual Arc Welding Technique subject. [9] explains that learning media is a very effective supporting tool to help make the learning process more active. The use of this learning media will make abstract learning material become real according to the context [10].

Android is an operating system used for Linux-based mobile devices, which includes several operating systems, applications, and middleware [11]. With Android, students can learn whenever they want and wherever they need [12]. The advantage of developing Android-based learning media is that it is equipped with various interesting buttons and features, to make it easier to operate. It is hoped that students can understand the learning material provided more quickly.

2. METHODS

2.1 Research Design

The research method used in this research is the research and development (R&D) method. The product designed in this research is an application-based learning multimedia that can be used on smartphones with the Android operating system. The learning media developed contains basic SMAW welding material for one semester.

R&D is a research method to produce certain products and test their effectiveness. This research refers to the ADDIE development model [13]. The development of the ADDIE model includes five steps, namely: 1) analysis, 2) design, 3) development, 4) implementation, and 5) evaluation. Researchers refer to the ADDIE development model [14].

2.1.1 Analysis

At this stage, the researcher carried out a needs analysis through direct observation during the SMAW welding knowledge competency learning process. Apart from that, the researchers also conducted interviews with teachers teaching SMAW welding subjects. This analysis is carried out to determine the material that will be included in learning multimedia. Furthermore, from the results of this analysis, it can also be seen that the content of the multimedia will be developed to suit the needs of teachers and students. This analysis is the basis for developing Android-based learning multimedia that will be developed.

2.1.2 Design

The second stage in the ADDIE model is design. The design carried out in making Android-based learning multimedia includes (1) software architecture, (2) data structure, (3) storyboard preparation, and (4) algorithms. The design is carried out with the aim that the media created is in accordance with students' needs and helps teachers carry out learning in the classroom.

The software architecture design contains the overall Android-based learning multimedia display design. Next, the data structure contains data that will be displayed in Android-based learning multimedia. This data includes material, supporting images, audio, video, and evaluation questions that will be used. After the data has been compiled, a storyboard is then prepared to determine the interface as a reference for creating learning multimedia. The final design stage is designing an algorithm to describe in detail the components contained in the Android-based SMAW welding knowledge competency learning multimedia.

2.1.3 Development

At the development stage, the process of creating Android-based learning multimedia based on SMAW welding knowledge competency was carried out. The application or software used to create this multimedia is Microsoft PowerPoint to design the material and interface. Next, the multimedia display is adjusted using the Ispring Suite 11 application and Website 2 APK Builder Pro v.50 to convert it into an application format so that it can be opened on smartphones based on the Android operating system. After the Android-based learning multimedia has been prepared, the feasibility test process is then carried out through validation tests by material experts and media experts. The eligibility criteria for the expert validation test can be seen in Table 1 below.

Table 1. Media Eligibility Criteria

Percentage (%)	Category
$P \geq 80$	Very eligible
$60 \geq P > 80$	Eligible
$40 \geq P > 60$	Quite Eligible
$20 \geq P > 40$	Less eligible
$P < 20$	Very ineligible

(Source: [16])

2.1.4 Implementation

Table 2. Media Practicality Criteria

Percentage (%)	Category
≥ 80	Very Practical
$60 \geq P > 80$	Practical
$40 \geq P > 60$	Quite Practical
$20 \geq P > 40$	Less Practical
$P < 20$	Very Impractical

(Source: [16])

After the Android-based learning multimedia product has been created and declared feasible by material experts and media experts, the next step is the application or trial phase in learning. This trial was carried out on class XI Welding Engineering students at SMK Negeri 10 Semarang. The trial was carried out to determine the response of students and teachers after using the developed Android-based multimedia, as well as to test the practicality of the multimedia according to teachers and students. The practicality criteria used can be seen in Table 2 above.

2.1.5 Evaluation

The evaluation stage is the stage of assessing multimedia learning development results after obtaining assessments from material experts and media experts, as well as by teachers and students. This evaluation stage is carried out to correct deficiencies found in the development product so that it can be further refined.

2.2 Data collection methods

The methods used to collect data in this research were observation, literature study, interviews, and questionnaires. Observations were carried out by

observing the conditions of the use of learning media in schools. Meanwhile, literature studies were carried out by collecting literature related to aspects of developing Android-based learning multimedia. The interview aims to collect data regarding student characteristics and use of learning media, so the object of the interview is the teacher who teaches SMAW welding engineering subjects. Meanwhile, questionnaires are used to collect data from material experts and media experts.

2.3 Research Instrument

The instruments used in this research are interview guidelines, questionnaires for material experts and media experts, as well as response questionnaires for teachers and students.

2.4 Data analysis technique

The data analysis technique used is qualitative descriptive statistics, where after the data is obtained, the data is then analyzed by presenting it in tabular form, then interpreted by calculating frequencies and percentages, and then interpreted with sentences as explanations. Qualitative descriptive statistics are used to analyze data by describing the data that has been collected..

3. RESULT AND DISCUSSION

3.1 Analysis

At this stage, the researcher carried out a needs analysis through direct observation during the SMAW welding knowledge competency learning process as well as interviews with subject teachers. Based on the results of these observations and interviews, the following data were obtained:

1. The main material that will be included in Android-based learning multimedia is the basics of SMAW welding, including the definition of SMAW welding, welding equipment, occupational health and safety, SMAW welding tools, SMAW welding positions, and SMAW welding procedures.
2. The content of the multimedia is equipped with learning videos so that the explanation can be more detailed and can be studied independently by students.
3. Learning multimedia is equipped with practice questions to measure students' understanding of the material provided.

3.2 Design

The second stage in the ADDIE model is design. The design was carried out in making Android-based learning multimedia. The design of this Android-based learning multimedia is arranged in a storyboard that describes the sequence of learning multimedia content. The Android-based multimedia learning storyboard can be seen in Table 3 below.

Table 3. Android-based multimedia learning storyboard design

Slide	Title	Content
1	Cover	Contains the multimedia title and identity of the author
2	Profile	Contains biodata of the author of learning multimedia
3	Main Menu	Contains information about shortcuts to go to each menu in learning multimedia
4	Instructions for use	Contains an explanation of the use of buttons or menus in learning multimedia
5-6	Competency Standards, Basic Competencies, and Core Competencies	Contains information about Competency Standards, Basic Competencies, and Core Competencies in accordance with the curriculum
7-45	Material	Contains SMAW welding learning materials, including images, animations, and learning videos
46-51	Evaluation	Contains practice questions for students to measure the increase in student understanding after using learning multimedia

3.3 Development

At the development stage, the process of creating Android-based learning multimedia on SMAW welding knowledge competencies was carried out. The application used to create this multimedia is Microsoft PowerPoint to design the material and interface. Next, the multimedia display is adjusted using the Ispring Suite 11 application and Website 2 APK Builder Pro v.50 to convert it into an application format so that it can be opened on smartphones based on the Android operating system. The initial design of the learning multimedia can be seen in the Figure 1 below.

Figure 1 shows the Android-based learning multimedia design. This cover contains information about the main material, namely SMAW welding, and illustrations depicting the SMAW welding process. The main menu section contains shortcuts or buttons to enter the main menus in learning multimedia. The color of each menu button is made different to clarify the menu that will be accessed by the user. The instructions section contains an explanation of the button images and their functions, while the material section contains the sequence of material displayed in the learning multimedia.

Figure 1. Android-based learning multimedia design

After the multimedia design has been prepared, the next step is to carry out a validation test by material experts and media experts. The material from Android-based multimedia learning is tested for suitability by material experts consisting of 2 examiners who are teachers and lecturers. This analysis is used to determine the suitability of Android-based multimedia material which is developed based on 3 assessment aspects, namely the quality of content and objectives, instructional quality, and content. Validation was carried out using a questionnaire instrument consisting of 10 statement items which were classified into five criteria, namely very good (5), good (4), sufficient (3), poor (2), and very poor (1). After testing, improvements were made according to the experts' suggestions, the research results from material experts are shown in Table 4.

Table 4. Validation results by material experts

Validator	Score	Max.Skor	%
Validator 1	49	50	98
Validator 2	44	50	88
Average			93
Category			**Very Eligible**

Based on the calculation of the feasibility percentage, the results of the feasibility of the learning material are 93% or included in the very suitable category for use in learning.

Based on the calculation of the feasibility percentage, the results of the feasibility of learning media are 86% or are included in the very suitable category for use in learning.

Table 5. Validation Results by Media Experts

Validator	Score	Max.Skor	%
Validator 1	68	75	90
Validator 2	62	75	82
Average			86%
Category			**Very Eligible**

The validation results of media experts and material experts show that the Android-based learning multimedia developed is very suitable for use in learning. Of course, this can help students and teachers to achieve learning goals. These results are in accordance with the opinion of [17], which states that appropriate media will be able to facilitate teachers and students while carrying out learning.

3.4 Implementation

After the Android-based learning multimedia product has been created and declared feasible by material experts and media experts, the next step is the application or trial phase in learning. This trial was carried out on class XI Welding Engineering students at SMK Negeri 10 Semarang. The trial was carried out to determine the responses of students and teachers regarding practicality after using the developed Android-based learning multimedia.

The practicality data in this research uses actual practicality data obtained from the results of questionnaires for students and teachers. The results of the SMAW welding competency practicality test using Android-based learning multimedia can be seen in Table 6 below.

Table 6. Results of Student Practicality Assessment

Criteria	Results
Number of Respondents	27
Obtained Score	1297
Maximum Score	1350

Based on the practicality test of Android-based learning multimedia through student questionnaire results, it can be concluded that the practicality result score is 96%, which means the media used is very practical and able to improve student learning outcomes.

Table 7. Practicality Assessment Results by Teachers

Criteria	Results
Number of Respondents	27
Obtained Score	193
Maximum Score	200

Based on the practicality test of Android-based learning multimedia through teacher questionnaire results, it can be concluded that the practicality result

score is 96.5%, which means the media used is very practical and able to improve student learning outcomes. This practical learning multimedia will be easy for students to use, so that learning can take place in a fun, interesting way, increase creativity, and be beneficial for students [18].

3.5 Evaluation

The final product produced is Android-based learning multimedia for SMAW welding knowledge competency. After validation and implementation, the multimedia is then evaluated for revision or improvement. This revision includes the addition of up-to-date pictures of welding work equipment, thereby providing the most up-to-date information for students. Apart from that, multimedia for students and teachers is also differentiated. The difference is that for the teacher model, the teacher is equipped with an answer key sheet for the formative test given, whereas for students there is no answer key. This is done so that teachers can more easily apply the multimedia learning. Another revision is the addition of learning videos related to various SMAW welding positions so that they can give students an overview of the wider SMAW welding process.

4. CONCLUSION

Based on the results of the development that has been implemented, the following conclusions can be drawn:

1. Android-based learning multimedia on the developed SMAW welding knowledge competency received a score of 93% which is included in the very suitable category for use according to material experts, while for validation media experts received a score of = 86% which is included in the very suitable category for use in learning.
2. Testing the practicality of Android-based multimedia learning on SMAW welding knowledge competency received a score of 96% from students and 96.5% from teachers, so it is included in the very practical category for use in learning.

ACKNOWLEDGMENTS

We would like to express our colleagues at Mechanical Engineering Department Universitas Negeri Semarang for their helpful feedback and support. We also want to thank our colleagues at SMK N 10 Semarang for their place to research. Finally, we would like to thank our family and friends for their encouragement and support throughout the research process. Without their love and support, we would not have been able to complete this research.

REFERENCES

[1] S. Nurfadhillah. Media Pembelajaran SD. Jawa Barat: CV Jejak, 2021.

[2] Y. M. Wirajaya, N. Y. Nugroho and B. Suwasono, Holding Time pada Sifat Fisik Pengelasan SMAW Baja ASTM-A36 melalui Uji Penetran, Jurnal Jaring SainTek (JJST), vol.3 (2), 2021, pp. 45-50. DOI: DOI: https://doi.org/10.31599/jaringsaintek.v3i2.716.

[3] L. Jeffus, Welding, and M. Fabrication, USA: Publisher Cengage Learning, 2015.

[4] N. Abudin, Perspektif Islam Tentang Strategi Pembelajaran, Jakarta: Kencana Prenda Media Group, 2009.

[5] M. A. Alex, Students' Perception About The Lecture As A Method Of Teaching In Tertiary Institutions, Views Of Students From College Of Technology Education, Kumasi (Coltek), International Journal of Education and Research, vol. 2 (6), 2014, pp. 601-612.

[6] R. Wirabumi, Metode Pembelajaran Ceramah, In Annual Conference on Islamic Education and Thought (ACIET), vol. 1 (1), 2020, pp. 105-113).

[7] E. R. Wati, Ragam Media Pembelajaran Visual, Audio Visual, Komputer, Power Point, Internet, Interactive Video, Kata Pena, 2016.

[8] H. D. Surjono, Multimedia Pembelajaran Interaktif, Yogyakarta: UNY Press, 2017.

[9] N. Widyasari and Ismawati, Perbandingan Kemampuan Representasi Matematis Siswa Sekolah Dasar pada Penggunaan Media Pembelajaran Augmented Reality dan Pasir Kinetik, Edumatika: Jurnal Riset Pendidikan Matematika, vol. 3 (1), 2020, pp. 63-70. DOI: https://doi.org/10.32939/ejrpm.v3i1.442.

[10] J. Kuswanto and F. Radiansah, Media Pembelajaran Berbasis Android pada Mata Pelajaran Sistem Operasi Jaringan Kelas XI, Jurnal Media Infotama, vol. 14 (1), 2018. DOI: https://doi.org/10.37676/jmi.v14i1.467.

[11] R. S. Putra, N. Wijayati and F. W. Mahatmanti, Pengaruh Penggunaan Media Pembelajaran Berbasis Aplikasi Android terhadap Hasil Belajar Siswa, Jurnal Inovasi Pendidikan Kimia, vol. 11 (2), 2017.

[12] P. S. Putra, N. B. Asi, M. E. Anggraeni and Karelius, Development of android-based chemistry learning media for experimenting, Journal of Physics: Conference Series, 1422 012037. doi:10.1088/1742-6596/1422/1/012037.

[13] Sugiyono, Metode Penelitian Kuantitatif, Kualitatif dan R&D, Jakarta: Alfhabeta, 2021.

[14] B. A. Pribadi. Model Desain Sistem Pembelajaran. Jakarta: Dian Rakyat, 2009.

[15] B. R. Maribe, Instructional Design: The ADDIE Approach, New York: Spinger Science & Business Media, LLC, 2009.

[16] E. P. Widoyoko, Evaluasi Program Pembelajaran. Yogyakarta: Pustaka Pelajar, 2009.

[17] A. D. Rahmadani, Prasetyo and M, Affandi, Development of Android-Based Learning Multimedia for Electrical Lighting Installation Courses in Vocational High School, Proceedings of the 6th Annual International Seminar on Transformative Education and Educational Leadership (AISTEEL 2021), Advances in Social Science, Education and Humanities Research, volume 591.

[18] H. F. Milala, J. Endryansyah and A. I. Agung, Keefektifan dan kepraktisan media pembelajaran menggunakan Adobe Flash Player, Jurnal Pendidikan Teknik Elektro, vol. 11 (2), 2022, pp. 195-202.