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Development of multimedia-based learning media on safety and occupational health and environment (K3LH) material

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Abstract

The problem found by researchers through observations on the learning process at SMK Negeri 1 Mandrehe Barat, namely the learning process using media is still not optimal. The purpose of developing learning media in class XI-DPIB Based on Multimedia in the subjects of Basics of Building Construction and Land Measurement Techniques to determine the Feasibility, Practicality, and Effectiveness of Media Products. This type of research uses the ADDIE model (Analize, Design, Develompment, Implementation, Evaluation). The instruments used in this study were validation questionnaires for feasibility tests, student response questionnaires for practicality tests, and test essays for testing the effectiveness of learning outcomes. The results of this research are in the form of animated video-based media in the subjects of Basic Building Construction and Land Measurement Techniques. Very Feasible criteria based on 90% material expert assessment. Based on the assessment of linguists 98%. Based on the expert judgment of 95% Design. Media practicality is categorized as very practical based on 93% individual trials and 93% field trials. The criteria are very effective with a media effective percentage of 93%. So it can be concluded that the multimedia-based learning media developed is very feasible, practical, and effective to be used in the learning process. Suggestions from researchers (1) for students are expected with the existence of multimedia-based media to increase effectiveness and critical thinking in visible image material, (2) for educators can add innovation in using media (3) for researchers, can use this research as the next research to determine the feasibility of the product.

Key Words: Multimedia, Learning Media

INTRODUCTION

The problem faced by many countries, including Indonesia, is how to improve the quality of education. As information technology becomes increasingly sophisticated, human resources that can respond to technological developments are very necessary. The development of science and technology has made education necessary to make the nation's life more intelligent as one of the ideals. national ideals. An intelligent nation is needed in the development of its country, both from an economic, social and cultural perspective.

The condition of the nation in the future is greatly influenced by the thinking patterns of its people which are formed through an educational process. A directed education process will lead this nation towards a better civilization. On the other hand, an education process that is not directed will only take up time, energy and funds without any results. Education includes teaching specific skills, and also something that cannot be seen but is more profound, namely the provision of knowledge, judgment and wisdom.

Education is a conscious effort to realize cultural inheritance from one generation to another. According to (Harefa, 2021), "Education is a factor that plays a very important role in making the nation's life intelligent." Education makes this generation a role model for the teachings of previous generations. Until now, education has no boundaries to explain the meaning of education completely because its nature is as complex as its target, namely humans. Its complex nature is often called educational science. Educational science is a continuation of education. Educational science is more related to educational theory which prioritizes scientific thinking.

Educational success is influenced by several factors, one important factor is the curriculum. The current curriculum adopted in Indonesia is the 2013 curriculum. This curriculum is a development of the existing curriculum, both competency-based curricula that have been initiate in 2004, as well as the education unit curriculum in 2006, the only thing that is the emphasis of the 2013 curriculum is the increase and balance of soft skills and hard skills which include aspects of attitudes, skills and knowledge. Apart from that, learning is more thematically integrative in all subjects, so it can be understood that the 2013 curriculum is a curriculum developed to improve and balance soft skills and hard skills in the form of attitudes, skills and knowledge.

This is also stated in PERMENDIKBUD No.69 of 2013 concerning the SMA-MA curriculum, namely: The 2013 curriculum was developed with improvements to the following mindset: (1) teacher-centered learning patterns become student-centered learning. Students must have choices regarding the material studied to have the same competence; (2) one-way learning patterns (teacher-student interaction) become interactive learning (interactive teacher, student, community, natural environment, other sources/media); (3) isolated learning patterns become networked learning (students can gain knowledge from anyone and anywhere they can contact and obtain via the internet); (4) passive learning patterns become active-seeking learning (students' active-seeking learning is further strengthened by the science approach learning model); (5) individual learning patterns become group learning (team-based); (6) single tool learning patterns become multimedia tool based learning; (7) mass-based learning patterns meet the needs of customers (users) by strengthening the development of the special potential of each student; (8) the pattern of learning from a single science (monodiscipline) becomes learning from multiple sciences (multidisciplines); and (9) passive learning patterns become critical learning.

Creating students who have good personalities and skills is a difficult task for every educational institution. Apart from important factors such as curriculum, preparing students who have good skills also requires good educators or teachers. Teachers are required to have good qualities, because teacher quality, in this case the teacher's ability, will influence student achievement. The competence of a teacher in the educational process is very vital, namely teaching, as well as guiding, directing and being a facilitator. Teachers play an important role in the learning process, where the process can be carried out optimally. This is contained in PERMENDIKBUD No. 22 of 2016 states that “"The learning process in educational units is carried out in an interactive, inspiring, fun, challenging and motivating way for students to participate actively, as well as providing sufficient space for initiative, creativity and independence in accordance with students' talents, interests and physical and psychological development."

Teachers become facilitators to help students transform their potential into abilities and skills which, when developed, will be beneficial for human life. In the learning process the main components are teachers and students. In order for the learning process to be successful, teachers must guide students in such a way that they can develop their knowledge in accordance with the knowledge structure of the field they are studying. To achieve this success, teachers must not only fully understand the material being taught, teachers are required to know exactly the position of students' knowledge at the beginning (previously) following the lesson. Furthermore, based on the media they choose, teachers are expected to be able to help students develop effectively.

According to Hamalik in Sumantri:

> Teachers as learners in the learning process must have sufficient knowledge and understanding of learning media, which includes: (a) media as a communication tool to make the teaching and learning process more effective, (b) the function of media in order to achieve educational goals, (c) the ins and outs learning process, (d) the relationship between teaching methods and learning media, (e) the value or benefits of educational media in learning, (f) selection and use of learning media, (g) various types of learning media tools and techniques, (h) learning media in each subject, and (i) innovation efforts in learning media.

The success of the learning process is the main thing that is desired, one effort to overcome this situation is the use of media in the teaching and learning process. Because the function of the media in these activities is apart from providing stimulus information, attitudes and so on, it is also to increase success in receiving information. Media also functions to regulate progress steps and to provide feedback on the teaching and learning process. The use of learning media that has not been utilized in teaching and learning activities makes the learning process monotonous and boring. According to (Arsyad, 2014), stated that:The use of learning media in the teaching and learning process can generate new desires and interests, generate motivation and stimulation of learning activities, and even have psychological influences.

Using learning media does not seem boring for students, because students not only listen to lectures from teachers, but by using learning media students will be more interested in the lessons delivered and students will be motivated to learn as well as clarify and simplify abstract concepts and increase learning absorption or retention. . Such learning experiences foster new thinking about how to design learning that can foster student motivation in learning so that it can improve learning outcomes.

Based on the results of a preliminary study conducted at SMK Negeri 1 Mandrehe Barat, in the process of teaching and learning activities teachers still tend to use textbooks or modules provided by the school. And the teacher uses the lecture method to explain the content of the material rather than using learning media so that in this case students only listen and listen and tend to be passive in the process of learning activities. This was also reinforced in the results of student interviews, many students found learning in class difficult to understand. During the learning process in the classroom, students still encounter problems, namely low understanding of students in mastering the material, limited learning media which only use books, modules, the internet and no other references, students are less active and less motivated because learning resources are limited. used only in the form of reading material without any learning media displayed directly so that students do not understand or understand the material presented by the teacher.

Based on this, teachers need to develop or design learning media that can improve student learning outcomes and the potential that exists in students. So the solution to this problem is to use multimedia-based learning media in a computer software application, which is expected to be able to help students increase motivation, exploration and students' understanding of the material taught by the teacher.

Learning media is anything that can be used to channel messages (learning materials), so that it can stimulate students' attention, interest, motivation, thoughts and feelings in learning activities to achieve learning goals. The use of media really helps students to understand and understand more easily. understand the material being studied. (Nurdyansyah, 2019) says that: Media in educational and educational experiences will generally be characterized as realistic, visual, or electronic devices for capturing, handling, and adapting

visual or verbal data. In simple terms, media is a tool that transmits or conveys learning messages.

The term multimedia has a broad impact on human life, along with the rapid development of information and communication technology, the term multimedia is increasingly popular. This term not only refers to topics, materials, subjects at school and courses at universities, but more than that it also refers to areas of expertise and professions. According to (Herman Dwi Surjono, 2017), etymologically multimedia comes from multi and media, multi means many or plural and media means a means of conveying messages or information such as text, images, sound and video. Terminologically, multimedia is a combination of various media such as text, images, sound, animation, video and others in an integrated and synergistic manner via computers or other electronic equipment to achieve certain goals.

Based on the problems above, the researcher is interested in conducting research with the title: "Development of Multimedia-Based Learning Media on Occupational Safety and Health and Environmental (K3LH) Procedure Material." It is hoped that this media can become a learning medium that has a good impact on students' interest in learning.

LITERATURE REVIEW

Vocational Education

Vocational education has many terms, including vocational education, technical education and occupational education. (Hamalik 1990) stated that vocational education is a basic education for skills and development of talents and habits carried out in the world of work which is seen as skills training. (Kuswana, 2013) vocational education is education that prepares students to enter the world of work, both formal and non-formal. Based on the opinions above, vocational education is education that prepares someone to do certain work.

In line with Law Number 20 of 2003 concerning the National Education System, vocational education in Indonesia is divided into three types, namely vocational, vocational and professional education. Professional education is education that prepares students to have jobs with special skill requirements. Vocational education is education that prepares students for work with certain applied skills, a maximum equivalent to a bachelor's program. Vocational education is education at the secondary education level which aims to prepare students to work in certain fields.

In line with the explanation above, vocational secondary education is education at the secondary education level which prioritizes developing students' abilities to carry out certain types of work. Vocational secondary education prioritizes preparing students to enter the workforce and developing professional attitudes. In accordance with its form, Vocational High Schools organize educational programs tailored to the types of employment opportunities (Government Regulation Number 29 of 1990).

Vocational High School (SMK) is a form of formal education unit that provides vocational education at secondary education level as a continuation of SMP, MTs, or other equivalent forms. Schools at educational levels and vocational types can be called Vocational High Schools (SMK) or Vocational Madrasah Aliyah (MAK), or other equivalent forms (Law Number 20 of 2003).

Vocational Schools have many skills programs. The skills programs implemented at Vocational Schools adapt to the needs of the existing world of work. Skills programs at the vocational school level also adapt to community and market demand. The main aim of vocational education is secondary education which prepares students primarily to be ready to work in a particular field. Students can choose the area of expertise they are interested in at vocational school. The vocational school curriculum is created so that students are ready to work directly in the world of work. The curriculum content in vocational schools is arranged in such a way as to suit the needs of the existing world of work. This is done so that students do not experience significant difficulties when entering the world of work. With a study period of around three or four years, vocational school graduates are expected to be able to work according to the skills they have acquired.

Based on Law Number 20 of 2003, the objectives of vocational education are divided into general objectives and specific objectives. The specific

objectives of vocational secondary education are as follows: (a) preparing students to become productive human beings, able to work independently, filling existing job vacancies as mid-level workers in accordance with the competencies in the skills program they choose, (b) preparing students to be able to choose a career, be tenacious and persistent in competence, adapt to the work environment and develop a professional attitude in the field of expertise they are interested in, (c) equip students with science, technology and art so that they are able to develop themselves in the future in a good way independently or through a higher level of education, and (d) equip students with competencies in accordance with the chosen skills program. Based on the explanation above, the demand for vocational education is to create middle-level skilled workers.

Study and learning

Learning can simply be interpreted as an effort to influence someone's emotions, intellectual and spirituality so that they want to learn of their own accord. Through learning there will be a process of developing students' religious morals, activities and creativity through various interactions and learning experiences. According to Nasution, learning is an activity of organizing or managing the environment as well as possible and connecting it with students so that the learning process occurs.

Organizing learning is the main task of a teacher where learning can be defined as activities aimed at student learning. Learning is intended to create conditions that allow learning to occur in students. In learning, there are two aspects, namely learning outcomes in the form of changes in behavior in students and the process of learning outcomes in the form of a number of intellectual, emotional and physical experiences in students.

According to Hudojo, learning is an activity for everyone. A person's knowledge, skills, habits, hobbies and attitudes are formed, modified and developed as a result of learning. Therefore, a person is said to be learning if it can be assumed within that person to be a process of activity that results in a change in behavior. According to Sadiman et al, "learning is a complex process that occurs in everyone and lasts a lifetime, from when he was a baby to the grave." One sign that someone has learned something is a change in their behavior. These behavioral changes involve both changes in knowledge (cognitive) and skills (psychomotor) as well as those involving values and attitudes (affective).

According to Gagne, learning is a series of activities designed to enable the learning process for students. Learning refers to all activities that have a direct influence on the student's learning process and learning must result in learning. Learning is a concept that cannot be eliminated in the teaching and learning process (learning). Learning refers to what a person must do as a subject receiving lessons (students).

Based on the opinions above, it can be concluded that learning is an active process, learning is the process of realizing all the situations that exist around the individual, learning is a process that is directed towards a goal, the process of doing through various experiences, and learning is the process of seeing, observing and understanding something. When we talk about learning, we are talking about how to change someone's behavior.

Instructional Media

Understanding learning medi

Literally learning media means intermediary or introduction. (Sadiman, 1993) suggests that the media is an intermediary or messenger of messages from the sender to the recipient of the message. In conclusion, media is a container for messages that the source wants to transmit to the target or recipient of the message, the material received is an instructional message, and the goal achieved is the achievement of the learning process.

According to (Heinich, 1993) media is a communication channel tool. Heinich gave examples of media such as film, television, diagrams, printed materials, computers and instructors. Examples of these media can be considered as learning media if they carry messages (massages) in order to achieve learning goals.

According to (Cahyadi, 2019), "media is an instrument that functions to convey messages from communicators to the audience". According to (Susanto and Akmal, 2019), "media is a tool that has the capacity to convey information from the source to the recipient". So, it can be concluded that media is an instrument that can be used to convey information from the sender to the recipient. To ensure that the objectives of the

learning process are achieved effectively and efficiently, the media used for learning, also known as teaching media, must be suitable for use in the learning process.

From the descriptions above, researchers can conclude that learning media is anything that can be used to convey learning information to students and can stimulate thoughts, feelings, attention and willingness to learn so as to encourage a learning process that functions to clarify the meaning of the message conveyed so that the objectives of the lesson well and perfectly. Learning media also functions as a carrier of information from the source (teacher) to the recipient (students), so that the teaching and learning process is not too rigid or opaque and can be easily understood by students who follow the teaching and learning process carried out by the teacher.

Multimedia Based Learning

Etymologically, multimedia comes from Latin, namely from the word"multi"which means many, variouskind and "medium"which means something used to convey or carry something. Multimedia is learning that is designed to use various media simultaneously such as text, images (photos), films (videos), and so on, all of which work in synergy with each other to achieve previously formulated learning objectives.

According to (Sanjaya, 2012)"Learning through multimedia uses various media such as text, images (photos), animation, film (video), audio and so on.n simultaneously".Meanwhile, according to (Darmawan, 2011) states that"Multimedia is a tool that can create dynamic and interactive presentations that combine text, graphics, animation, audio and video". Furthermore, according to (Darmawan, 2011) states that: Multimedia can be seen as the use of computers to create and combine text, graphics, audio, moving images (video and animation) by combining links and tools that allow users to navigate, interact , create, and communicate.

In learning, multimedia can be packaged interactively so that it is in line with its use in learning activities. So it can be concluded that, interactive multimedia learning is learning using various media which is equipped with control devices that can be operated and have reciprocity between the user and the media which involves many senses and body organs during the learning process which includes an empowerment process to control the environment. Study.

Multimedia Components

Multimedia and electronic devices in learning are very influential in improving the quality of learning. Multimedia provides changes to the communication process, for example in terms of sending and receiving information because of the interactive elements and components in multimedia so that in the learning process all students' senses can be used.

According to (Munir, 2012) Multimedia has 6 elements or components, namely text, graphics, images, video, animation, audio and interactivity. Text is a combination of letters that form sentences to explain information or subject matter that can be understood by the reader; graphics are presentations in the form of images that are suitable for students who are oriented towards visual objects (visual oriented); images are the delivery of information in the form of visual objects in various forms; video is a presentation in the form of moving visuals that provides a simulation or depiction of the reality of an event; animation is a collaboration between text, graphics and audio into a moving object; audio is the presentation of information in the form of sound, music, narration and so on in digital form; Interactivity is an element that is fully displayed by a computer device.

According to (Rusman, et all, 2012) it is understood that there are 4 important components of multimedia, namely:

(1). the existence of computers that coordinate what we see and hear when interacting with us. (2). There are links that connect us with information. (3). There are navigation tools that guide us, exploring interconnected networks of information. (4). Multimedia provides us with a place to collect, process and communicate our information and ideas. Alone.

Thus, the multimedia component combines all of the students' senses so as to support success in the learning process. From this description, 20 multimedia learning technologies summarize various media in one software in the form of interactive learning media.

Characteristics of Learning Multimedia

The characteristics of multimedia can be identified in its use for educational purposes. We can see the advantages it has compared to other media. According to (Munir, 2013), the advantages of multimedia for learning purposes are:

(a). Multimedia in computer-based education (b) Multimedia integrates various media (text, images, sound, video and animation) in one digital program. (c) Multimedia provides an interactive process and provides easy feedback. (d) Multimedia provides freedom to participants students in determining lesson material. (e) Multimedia provides ease of systematic control in learning.

In the context of multimedia learning, we can see clear differences because it has been able to provide various characteristics and principles so that learning can be said to use multimedia, if it contains certain characteristics of multimedia learning. These characteristics can be seen from the presentation shown, namely by combining all media in the learning process. The intended media combination is a combination of computer media, video, audio, images, text and animation into one link in one interactive digital presentation device. Thus, multimedia has the ability to activate all five senses of students

According to (Darmawan, 2012), the characteristics of multimedia learning include:

(a) Contains representative material content in visual, audio, audiovisual form. (b) Various media in its use. (c) Has the power of color language and object resolution language. (d) Various types of learning. (e) Learning responses and reinforcement vary. (f) Developing the principle of self-evaluation in measuring the learning process and results. (g) Can be used classically or individually. (h) Can be used offline or online.

In the characteristics of multimedia learning mentioned above, multimedia learning must be interactive, therefore an educator must have an understanding that multimedia must be rich in interactive processes and is expected to be able to interpret multimedia learning correctly.

Benefits of Multimedia in learning

Multimedia is a solution in improving the learning process. Multimedia provides a new nuance in learning because it combines all of the students' sensory functions to understand the lesson. The use of multimedia in learning, especially the use of interactive learning multimedia by educators, is not a requirement for it to always be used. However, it should be used for learning.

According to (Munir, 2013) the benefits of multimedia in learning include:

(a). Explaining abstract (unreal) learning material or objects into concrete (real) ones. (b) Providing real or direct experience. or objects. (e) Attract students' attention. (f) Help students learn individually, in groups or classically. (g) Learning material 22 is remembered longer and easier to express again quickly and precisely. (h) Makes it easier and easier to remember. speed up educators presenting learning material in the learning process. (i) Overcoming limitations of space, time and senses.

According to (Darmawan, 2012) stated that"LearningInteractive is able to increase students' learning with high motivation because multimedia displays text, images, sound,and animation." From severalThe quote above explains that multimedia has more benefits than other media. As in the previous explanation, multimedia is able to activate more of students' sensory functions. Multimedia-based learning can reach students who have different characteristics and ways of learning so that the learning process in the classroom becomes interactive. In addition, the use of multimedia-based learning facilitates feedback between educators and students in the learning process because it can reach all five senses and increase students' interest in learning. In this way, multimedia learning can help students learn individually, in groups and classically without being limited by time and space.

2.1.3 Canva Media

According to (Pelangi G. 2020), the Canva application is an online design tool that offers various types of output, including presentations, resumes, posters, pamphlets, brochures, graphics, infographics, flyers, notebooks and other items.

Some of the advantages of the Canva application are:

a. Has a variety of attractive designs
b. Able to increase the creativity of teachers and students in designing learning media because of the many features provided.
c. Practically saves time in learning
d. When designing you don't have to use a laptop, but can be done via a device/cellphone (Tanjung & Faiza, 2019)

Apart from the advantages found in the Canva application, there are also fundamental disadvantages found in this application, namely, if you want to use Canva, each user must have a data package to be able to connect and be able to use Canva, apart from that, there are several templates for the designs presented in the Canva application. paid, but this is not a problem, because there are many good templates that are free to use.

Kinemaster

According to (Adyanan, et all, 2020), Kinemaster is defined as a video editing application that is very complete and easy to use. Kinemaster can be operated on Android and iOS operating systems, and is available in various languages.

Another advantage of this application is the availability of features that can record, provide images, animations, transitions, text, voice recorders, and even provide sound effects (Indriana & Pangaribuan, 2020). This application also does not burden smartphone storage and performance because it is only 66 MB (megabyte) in size. Apart from that, this application provides various types of overlays, transition effects, animations, backgrounds, additional fonts, music, and even allows users to change the background (chroma key) so that the resulting display is more attractive.

According to (Nurlina & Fauzan, 2021) some of the advantages of this application are as follows the application is easy to get, the Kinemaster application can be downloaded from Playstore or Appstore on smartphone devices and the application is free or free, apart from being easy to get, this application also costs nothing or is free during the process of using it

Occupational Safety and Health and the Environment (K3LH)

A. Understanding Occupational Safety and Health

Work safety is defined as an effort to ensure that workers are safe in their workplace so as to avoid accidents, including saving equipment and production. The definition of occupational safety and health according to the Decree of the Minister of Manpower of the Republic of Indonesia No. Kep. 463/MEN/1993 is "occupational safety and health is a protective effort aimed at ensuring that workers and other people in the workplace/company are always safe and healthy, and so that every production source can be used safely and efficiently." Furthermore (Sihombing, Walangitan et al 2014) said that a work accident is something unexpected and unexpected which can result in property loss, loss of life/injury/disability or pollution. Basuki and Prasetyawati (2019:3) in general, the objectives of Occupational Safety and Health (K3), are:

1) Ensure the safety and health of other people in and around the work place.
2) Protecting workers' rights to safety in carrying out work for the welfare of life and increasing national production and productivity.
3) Ensure the maintenance of production sources and their utilization safely, efficiently and effectively.
4) Specifically from a health perspective, preventing and eradicating occupational diseases.

According to (Taryaman, 2016) said that occupational health is:

> A condition that is free from physical and psychological disturbances caused by the work environment. Health risks can occur due to factors in the work environment that exceed the specified time period and environments that cause stress or physical disturbances. Meanwhile, work safety is a condition that is safe or safe from suffering and damage or loss in the workplace in the form of the use of machines, equipment, materials and processing processes, work floor and work environment, and work methods. Safety risks can occur due to aspects of the work environment that can cause fires, electric shocks, cuts, bruises, sprains, broken bones and damage to members. body, sight and hearing.

Furthermore (Taryaman, 2016) also stated that occupational safety is:

> Safety related to human work activities both in the manufacturing industry, which involves machines, equipment, material handling, steam aircraft, pressure vessels, work tools, materials and processing processes, workplace foundations and the environment, as well as ways of doing work, as well as in the service industry, which involves sophisticated technological equipment, such as elevators, escalators, building cleaning equipment, transportation facilities and others.

So the definition of K3LH can be concluded that occupational safety and health is a condition where a worker feels safe when at the workplace, free from disturbances that can cause short and long term effects both spiritually and physically.

B. Main Goals of Occupational Health

According to (Basuki & Prasetyawati, 2019) stated that:

1) Prevention and eradication of work-related diseases and accidents.
2) Maintaining and improving the health and nutrition of workers.
3) Maintenance and labor efficiency and productivity.
4) Eradicating workforce fatigue and increasing enthusiasm and enjoyment of work.
5) Protection of the wider community from dangers that may be caused by health products. Two things are very important to obtain coverage and protection in relation to occupational safety and health, namely:
    a) Work safety risks are aspects of the work environment that can cause physical damage to the workplace, tools and people that can be felt in the short term.
    b) Occupational health risks are aspects of the work environment that can cause unhealthy conditions for workers which can cause physical and psychological damage or loss in the short and long term.

METHOD

Development Methods

ADDIE is an acronym for Analysis, Design, Development, Implementation and Evaluation. The ADDIE model concept is applied to build basic performance in learning, namely the concept of developing a learning product design. ADDIE is an instructional design centered on individual learning, has immediate and long-term phases, is systematic, and uses a systems approach to human knowledge and learning. Effective ADDIE instructional design focuses on implementing authentic tasks, complex knowledge, and genuine problems. Thus, effective instructional design promotes high fidelity between the learning environment and the actual work setting. The ADDIE learning model is based on an effective and efficient systems approach and an interactive process between students, teachers and the environment. The evaluation results of each learning step can take learning development to the next step or phase (Fitria Hidayat, 2021).

After knowing the meaning of the development model, the provisions will be given that this model produces a new product based on the five stages explained above, so this will make it easier for educators to follow the manufacturing process. The desired hope is to know the efficacy of being tested on the suitability and accuracy of a new result created.

Development Procedure

Researchers used the ADDIE procedure developed by two influential experts, namely Reiser and Molenda. Even though both of them actually have different formulas for visualizing ADDIE. According to Reiser, the ADDIE formulation uses verbs (Analyze, design, develop, implement, evaluate). The description explained by Reiser revises the steps or phases in the ADDIE model. Meanwhile, Molenda's description of the ADDIE components uses nouns (analysis, design, development, implementation, evaluation) regarding the ADDIE components. The picture given is shown with a dotted line as shown in the scheme below (Irawan, 2014).

The development method uses the ADDIE model which is a systematic learning design model. According to Dick, W & Carey, L., in (Setya Chendra Wibawa introduction, et all., the ADDIE model consists of five steps: (1) analyzing; (2) design; (3) development; (4) implementation; and (5) evaluation.

In general, there are five stages in the ADDIE model, namely Analyze, Design, Develop, Implement and Evaluate. Some of these stages or steps are carried out procedurally, there are instructional design models that are not procedural or cyclical or can start from a certain stage, and there are also integrative learning design models. The following is a table of procedural stages of developing the ADDIE model learning design:

1) Analysis

Analysis is carried out to obtain information about the competencies required by students. Analyze how students learn, knowledge and attitudes. Carry out an analysis related to competencies or materials used in school, to find out the characteristics of future students with appropriate learning media.

1) Design

The model design process/learning method design stage has two design stages, namely the first is designing learning. This activity is a systematic process that starts and sets learning objectives, designing storyboards or tutoring, designing learning tools (media), designing learning materials and tools for evaluating learning outcomes.

The second draft is a draft in the form of learning media where the researcher designs a media application using animated videos. After the media design process is complete, the media will be shown to the supervisor to validate first whether the media is suitable for using the media for research. The learning media design that has been validated is still conceptual, in other words, not perfect because it has not been tested directly in the subsequent research process. After the material is delivered using the learning media, students or learners will be given a questionnaire for evaluating the media that has been provided.

2) Development

In the context of media development, the development stage is carried out by reviewing the media content by the supervisor to obtain validation of the media draft. To determine the effectiveness of media in improving student learning outcomes. The activity continued with practice questions whose material was taken from the media.

3) Implementation

At this stage the design and methods applied have been developed in real situations in the classroom. During implementation, the media design that has been developed is applied to actual conditions. The material is delivered in accordance with the media developed. After adopting the media, an initial evaluation is carried out for member feedback on the application of the media to determine the impact on the quality of learning which includes the effectiveness and efficiency of learning for students.

4) Evaluation (Evaluation)

Formative evaluation is carried out at the end-face while summative evaluation is carried out after the intervention ends. Summative evaluation measures the final competency of a subject or learning objective. The results of the evaluation are used to provide feedback to users. Revisions are carried out according to evaluation of results or needs that cannot be met with this method.

RESULT

1. Development of Multimedia Based Learning Media

The research and development procedure is an adaptation of the ADDIE research and development steps developed by Dick and Carry in designing learning systems (Mulyantiningsih, 2012), namely: Analysis, Design, Development, Implementation, End Evaluations. The research results and media development process can be described by researchers as follows:

1) Analysis Stage (Analyze)

The analysis stage is the stage used by researchers to determine the competencies required of students. This stage aims to collect information that researchers use as a guide for researchers in product development. This stage includes needs analysis, analysis of student characteristics, material analysis in accordance with competency demands:

a) Needs Analysis

At this stage the researcher conducted interviews at SMK Negeri 1 Mandrehe Barat with teachers of Basics of Building Construction and Land Measurement Techniques and also with students regarding the material they had studied so far regarding occupational health and safety procedures for construction work. The following are the results of the researcher's interview:

a) Teacher

The teaching and learning process at school is carried out face to face where the teacher has provided teaching materials in the form of books about the Basics of Building Construction and Land Surveying Techniques. The media that are often used are books and blackboards, and less media can be used, such as technological media, due to limited time and teachers' ability to operate technology.

b) Student

Students learn only using books and blackboards as teaching materials, so students' understanding of the subjects Basics of Building Construction and Land Measurement Techniques is still not comprehensive.

b) Analysis of student characteristics

At this stage, after the researcher conducted a preliminary study, the results were obtained that in the target school the teaching materials used did not motivate students because the design and methods did not motivate students. So the media to be developed must be in accordance with students' interests and learning abilities. With the results of the characteristic analysis, the researcher concluded that multimedia-based learning media should be developed.

c) Curriculum Analysis

The curriculum analysis carried out aims to identify the curriculum used in schools. Researchers analyzed the curriculum used by subject teachers at SMK Negeri 1 Mandrehe Barat class X-DPIB using the 2013 curriculum where the learning process is more student-centered.

2) Design Stage (Design)

This stage is the stage of designing a product. The product designed is multimedia-based learning media which will be used as a learning medium for students. This design stage is carried out through several stages as follows:

1) Multimedia-based media design

This design was created as a media design and consists of the following elements:

a) Opener

This section begins with an introduction to the identity of the researcher (name, university of origin) and the objectives of the research being conducted.

b) Contents

This section consists of material that is described systematically in accordance with multimedia-based media.

c) Closing

Students complete practice questions (essays), as a test of how much they understand the material that has been presented.

3) Development Stage (Development)

The supervising lecturer directs the product that has been prepared by the researcher, to validate the product to three field experts in Media, namely material experts, language experts, and design experts:

1) The content and material expert validator in this research is a lecturer in the Building Engineering Education Study Program at Nias University.
2) The language expert validator in this research is a lecturer in the Indonesian Language and Literature Education Study Program at Nias University.
3) The design expert validator in this research is a lecturer in the Building Engineering Education Study Program at Nias University.

a) Material Expert Validation Result Data

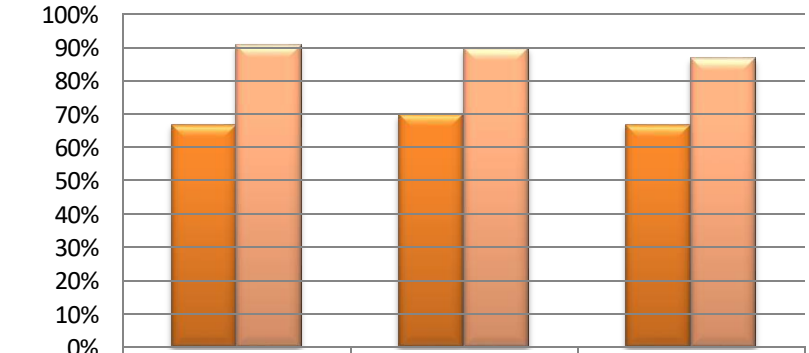
Validation of material expert, lecturer in the Building Engineering Education Study Program, Faculty of Teacher Training and Education, Nias University. Validation is carried out to obtain information that can be used as a guide to revise the product that has been produced. The assessment method is through a validation sheet. Media Validation was carried out twice. So the assessment from material experts can be seen in the following table:

Questionnaire Results for Assessment of the Feasibility of Multimedia-Based Learning Media by Material Expert Validators

NO	INDICATOR	Score	
		Revision I	Revision II
	STRAIGHT		
1	The type of font used is appropriate to the media	3	5
2	Text size used in learning media	4	5
3	The learning video display is clear	3	4
4	Learning media is clearly visible	4	4
5	Language is easy for students to understand	3	5
6	The learning media presented is clear	3	4
7	The animation used can explain the material	3	5
8	Fill in the slides according to the lesson	4	4
9	The sound background used is appropriate to the content	3	5
10	The learning media presented is in accordance with	4	4
11	Presentation of interesting learning slide shows	3	5
	Number of Each Aspect	**37**	**50**
	Total Score for Each Aspect	**67%**	**91%**
	MEDIA ASPECTS		
12	The duration of the media is appropriate to learning	3	4
13	The flow of learning media is interesting	4	5
14	Learning media is easy to operate	3	4
15	Learning media is simple to operate	3	5
16	Learning media can be reused at another time	4	4
17	Learning media can be developed for similar or other materials.	4	5
	Number of Each Aspect	**21**	**27**
	Total Score for Each Aspect	**70%**	**90%**
	BENEFIT ASPECTS		
18	Learning media makes it easier for students to understand the material	**3**	**4**
19	Learning media can be used at any time	**3**	**4**
20	Learning media can be used anywhere	**3**	**5**
21	Students are able to learn independently with learning media	**4**	**4**
22	Arouse curiosity	**4**	**5**

23	The material presented is clear so it is easy to accept	**3**	**4**
Number of Each Aspect		**20**	**26**
Total Score for Each Aspect		**67%**	**87%**
Total Score for All Aspects		**78**	**103**
Achievement Presentation		**68%**	**90%**

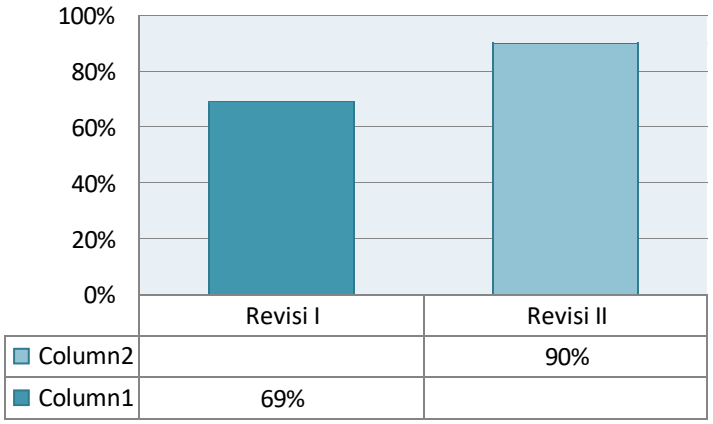
The results of the material expert's validation of the product in the form of multimedia-based media for the first revision after the calculation obtained a percentage of 68% from 3 aspects, namely the straightforward aspect 67% from 11 indicators, the media aspect 70% from 6 indicators, the benefits aspect 67% from 6 indicators. Meanwhile, the second revision after calculating obtained a percentage of 85% from 3 aspects, namely the direct aspect 91% from 11 indicators, the media aspect 90% from 6 indicators, the benefits aspect 87% from 6 indicators. The results of material expert validation from five aspects from revision I to revision II can be seen in the following graph:



Product Validation Results for Each Aspect by Material Experts

Information:
Straightforward : Revision I 67% and Revision II 91%
Material : Revision I 70% and Revision II 90%
Benefit : Revision I 67% and Revision II 87%

The average results of material experts on learning media products with an achievement of 90% can be seen in the following graph:



Average results of Revision I and Revision II by Material Experts

Information:
Revision I : 69%
Revision II : 90%

Complete validation results based on suggestions and comments from design expert validators can be seen in attachment 20.

b) Linguist Expert Validation Results Data

Validation by linguist, lecturer in the Indonesian Language and Literature Education Study Program, Faculty of Teacher Training and Education, Nias University. Validation is carried out to obtain information that can be used as a guide to revise the product that has been produced. The assessment method is through a validation sheet. Media Validation was carried out twice. So the assessment from material experts can be seen in the following table:

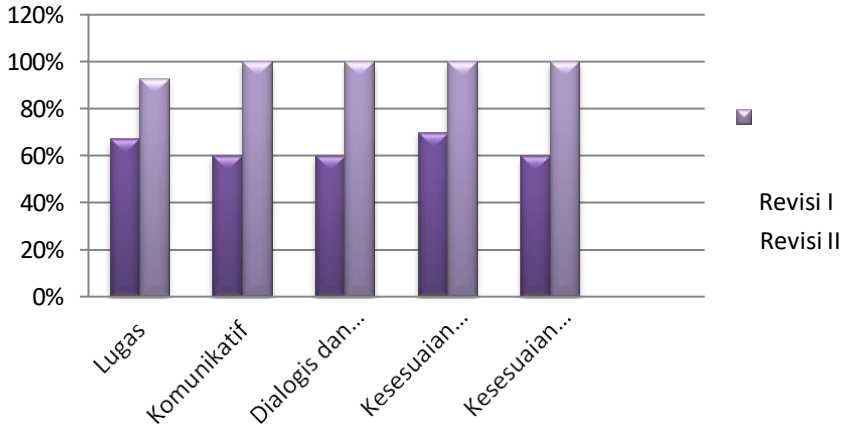
Questionnaire Results for Feasibility Assessment of Multimedia-Based Learning Media by Language Expert Validators

NO	INDICATOR	SCORE	
		Revision I	Revision II
	STRAIGHT		
1	The accuracy of the sentence structure to represent the message and information to be conveyed	**3**	**5**
2	The effectiveness of the sentences used	**3**	**5**
3	The standard of the terms used is in accordance with the function	**4**	**4**
Number of Each Aspect		**10**	**14**
Total Score for Each Aspect		**67%**	**93%**
	COMMUNICATIVE		
4	Makes it easier to understand messages or information	**3**	**5**
Number of Each Aspect		**3**	**5**

Total Score for Each Aspect		**60%**	**100%**
DIALOGICAL AND INTERACTIVE			
5	Able to motivate students	**3**	**5**
6	Able to encourage students to think critically	**3**	**5**
Number of Each Aspect		**6**	**10**
Total Score for Each Aspect		**60%**	**100%**
COMPATIBILITY WITH STUDENT DEVELOPMENT			
7	Suitability to students' intellectual development	**3**	**5**
8	Appropriateness to the emotional level of participants	**4**	**5**
Number of Each Aspect		**7**	**10**
Total Score for Each Aspect		**70%**	**100%**
CONFORMITY TO LANGUAGE CONCERNS			
9	Accuracy of grammar used	**3**	**5**
10	Accuracy of grammar used	**3**	**5**
11	Use terminology that is correct and does not change	**3**	**5**
12	Use symbols or icons that are appropriate and do not change	**3**	**5**
Number of Each Aspect		**12**	**20**
Total Score for Each Aspect		**60%**	**100%**
Total Score for All Aspects		**38**	**59**
Achievement Presentation		**63%**	**98%**

The results of the linguist's validation of the product in the form of multimedia-based media for the first revision, after calculating, obtained a percentage of 63% from 5 aspects, namely the straightforward aspect 67% from 3 indicators, the communicative aspect 60% from 3 indicators, the dialogical and interactive aspect 60% from 2 indicators, the aspect of conformity with student development is 70% from 2 indicators, the aspect of conformity to language rules is 60% from 4 indicators, while the second revision after calculating gets a percentage of 92% from 6 aspects, namely the Straightforward aspect 93% from 6 aspects, namely aspect Straightforward 67% of 3 indicators, Communicative aspect 100% of 3 indicators, dialogical and interactive aspect 100% of 2 indicators, aspect of suitability to student development 100% of 2 indicators, aspect of conformity with language rules 100% of 4 indicators.

Linguist validation results from five aspects can be seen in the following graph:

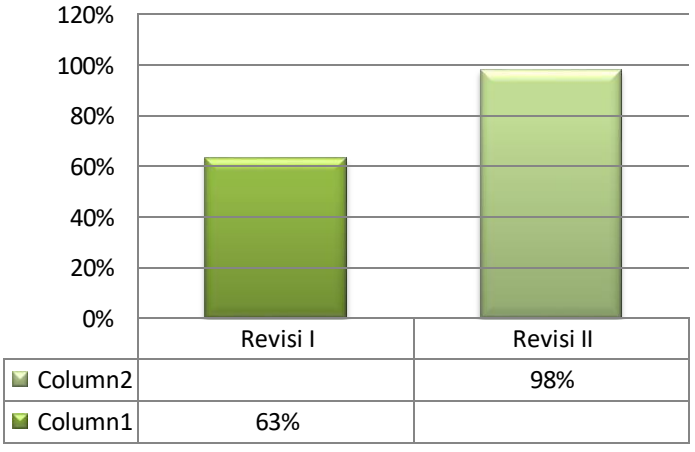


Product Validation Results for Each Aspect
By Linguists

Information:

Straightforward	: Revision I 67% and Revision II 93%
Communicative	:Revision I 60% and Revision II 100%
Dialogic and Interactive	:Revision I 60% and Revision II 100%
Suitability to students	: Revision I 70% and Revision II 100%
Conformity to Language Rules	: Revision I 60% and Revision II 100%

The average results of linguists on learning media products with Revision I achievement of 63% and revision II of 98% can be seen in the following graph:



Average results of revisions I and II by language experts

Information:
Revision I : 63%
Revision II : 98%

Complete validation results based on suggestions and comments from design expert validators can be seen in attachment 21.

c) Design Expert Validation Results Data

Validation of design experts, lecturers in the Building

Engineering Education Study Program, Faculty of Teacher Training and Education, Nias University. Validation is carried out to obtain information that can be used as a guide to revise the product that has been produced. The assessment method is through a validation sheet. So the assessment from design experts can be seen in the following table:

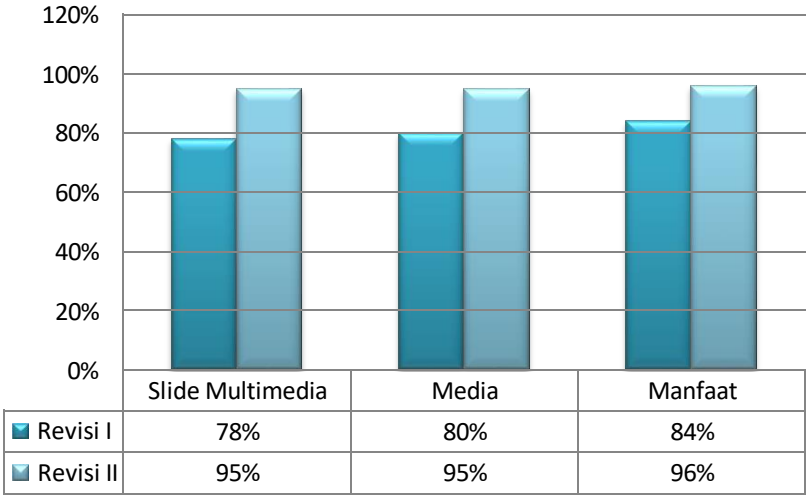
Questionnaire Results for Feasibility Assessment of Multimedia-Based Learning Media by Design Expert Validators

NO	INDICATOR	Score	
		Revision I	Revision II
	SLIDES		
1	Accurate selection of font size and type	**4**	**5**
2	Clarity of display and sound quality on videos	**5**	**5**
3	Suitability of language selection to content	**3**	**4**
4	Clarity of video flow	**4**	**5**
5	Appropriate use of animation with content	**3**	**4**
6	Accurate use of voice	**4**	**5**
7	Suitability of video display to student characteristics	**4**	**5**
8	The attractiveness of media presentation	**4**	**5**
Total Score for each Aspect		**31**	**38**
Number of Presentations for Each Aspect		**78%**	**95%**
	MEDIA ASPECTS		
9	Suitability of media duration	**4**	**5**
10	Interesting video flow	**3**	**4**
11	Learning media is simple to operate	**4**	**5**
12	Can be developed and used in the future	**5**	**5**
Total Score for each Aspect		**16**	**19**
Number of Presentations for Each Aspect		**80%**	**95%**
	BENEFIT ASPECTS		
13	Makes learning easier	**4**	**5**
14	Media can be used anywhere and anytime	**5**	**5**
15	The material presented is clear so that it is easily accepted by students	**3**	**4**
16	Students' independence in using learning media	**4**	**5**

17	Arouse curiosity	**5**	**5**
Number of Each Aspect		**21**	**24**
Total Score for Each Aspect		**84%**	**96%**
Total Score for All Aspects		**68**	**81**
Achievement Presentation		**80%**	**95%**

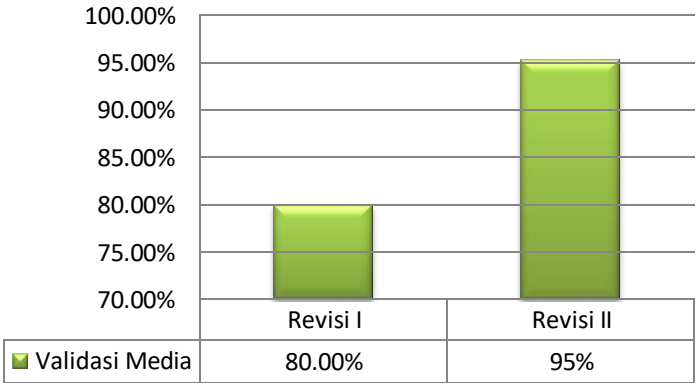
The results of the design expert's validation of products in the form of Multimedia Based Media received the first revision percentage after being calculated to get a percentage of 80% from 3 aspects, namely the Multimedia Slide aspect 78% from 8 indicators, the Media aspect 80% from 4 indicators, the Benefits aspect 84% from 5 indicators, while revision II after the calculation got a percentage of 95% from 3 aspects, namely the Multimedia Slide aspect 95% from 8 indicators, the Media aspect 95% from 4 indicators, the Benefits aspect 95% from 5 indicators

The validation results of design experts from three aspects from revision I to revision II can be seen in the following graph:



Product Validation Results for Each Aspect by Design Experts

The average results of design experts on learning media products with an achievement of 95% can be seen in the following graph:



Graph 4.6. Average Results by Design Experts

Complete validation results based on suggestions and comments from design expert validators can be seen in attachment 22.

4) Implementation Stage (Implementation)

At the implementation stage, the product trials that will be carried out at SMK Negeri 1 Mandrehe Barat are divided into two stages, namely individual trials and field trials, the aim of which is to determine the practicality and effectiveness of multimedia-based learning media that have been validated.

a. Individual Trial

At the individual trial stage, the researcher selected 3 students from class After the three students studied the learning media that had been developed, the researcher gave response questionnaires to the three students as a response to the learning media that had been studied. The following are the results of individual trials based on the response questionnaire that has been given.

INDIVIDUAL TRIAL RESULTS

No	Student	Total Score	Percentage	Criteria
1	hanks to Gulo	91	83%	Very Practical
2	eymond Hia	92	84%	Very Practical
3	evelation Hia	95	86%	Very Practical
Total score			**278**	
Average percentage results			**93%**	
Criteria			**Very Practical**	

Based on the table, the average percentage result is 93%, so learning media is in the criteria of being very practical and suitable for use. Based on the questionnaire provided, there were several comments, namely that this learning media was good and could attract attention.

b. Field Trials

The final stage in developing this learning media is the field testing stage. After the learning media is declared very valid and practical, the next stage is that the learning media is tested in one class. The class chosen by the researchers was class X DPIB to serve as test subjects. Research activities were carried out face-to-face at the West Mandrehe 1 Vocational School, with a total of 10 people. At this stage, researchers also looked at the level of effectiveness

of the learning media that had been developed. The effectiveness of learning media is measured from the assessment of learning outcomes given to students after participating in learning process activities using the learning media developed. The learning outcomes tests given to students are learning outcomes tests that have been declared valid and have been validated by material experts. Furthermore, the researchers also gave student response questionnaires to determine the level of practicality of the learning media in this field test.

Table. 4.5 FIELD TRIAL RESULTS

No	Student's name	Score	Percentage	Practicality Criteria
1.	Adi Putra Harefa	21	95%	Very Practical
2.	Thanks to Erwin Daeli	21	95%	Very Practical
3.	Jakris Effendi Gulo	21	95%	Very Practical
4.	Calvin Jon Gulo	20	91%	Very Practical
5.	Kariusman Harefa	21	95%	Very Practical
6.	Lean Ricarda Hulu	21	95%	Very Practical
7.	Rahmat Kurnian J. Harefa	21	95%	Very Practical
8.	Renol Famohouni Gulo	21	95%	Very Practical
9.	Sama Aware Gulo	21	95%	Very Practical
10.	Yasman Gea	21	95%	Very Practical
Total score				**209**
Percentage				**93%**
Practicality Criteria				**Very Practical**

5) Evaluation Stage (Evaluation)

Evaluation Stage: The activities carried out at this stage are evaluating responses to media test questions given to students at the end of the material, as well as filling out student response questionnaires and answering the test questions given. In this evaluation, all students completed a total of 10 people. These scores were obtained from the test given at the end of the lesson, namely the competency test.

Product Trial Results

Practicality of multimedia-based interactive learning media based on student and teacher responses.

Student

Product trials were carried out at West Mandrehe 1 Vocational School, individual trials were carried out in class X-DPIB and field trials were carried out in class X-DPIB. Individual trials used 3 respondents and field trials were carried out in class X-DPIB with a total of 10 students. The aim of this trial is to determine students' responses to Multimedia-Based Learning Media through an assessment sheet in the form of a questionnaire.

Trial results can be obtained by assessing students' response questionnaires. The student questionnaire assessment can be seen in the following table:

Table 4.6
MEDIA PRACTICAL ASSESSMENT

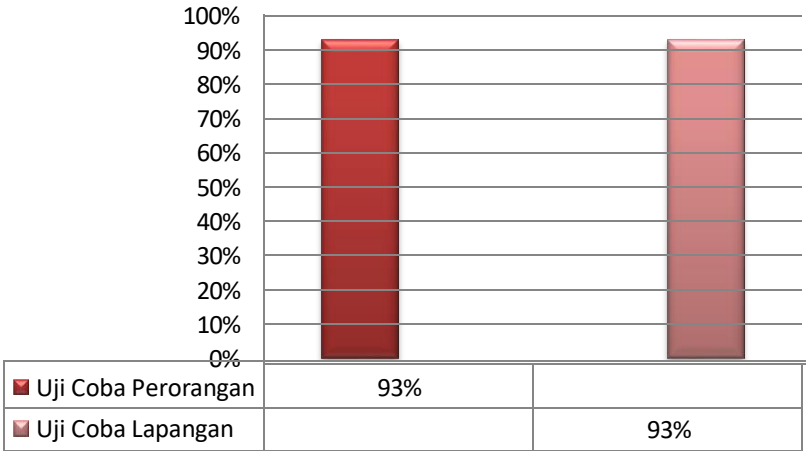
No	Product Trial	Many Samples	Earned Score	Maximum Score	Achievement Level	Category

1	Individual trials	3 Person	278	300	93%	Very Practical
2	Field trials	10 People	209	210	93%	Very Practical

Source. Researcher 2023

Product testing has been carried out in individual trials and field trials. In individual trials, the achievement level was 93% in the very practical category, then the researchers conducted field trials and achieved an achievement level of 93% in the very practical category.

After carrying out two trials of multimedia-based media products, including individual trials and field trials. So the achievement results were obtained with each being categorized as "Very Practical". The results of product trials that have been tested on students can be seen from the following graph:



Average Results of Individual Trials and Field Trials

Subject Teacher Responses

The teacher for the Basics of Building Construction and Land Measurement Techniques by Mr. Steven Gulo, S.Pd is a teacher at SMK Negeri 1 Mandrehe Barat. The following assessments from subject teachers can be seen in the table below:

Table 4.7
PRACTICAL RESPONSE QUESTIONNAIRE BY TEACHERS

No	Indicator	Score
1	Clarity of learning flow	5
2	Ease of understanding the material	5
3	Media can be used repeatedly by teachers and students.	5
4	Suitability of time available for learning with ease of media operation.	4

No	Indicator	Score
5	Media helps students understand information in the learning process.	5
6	Media in triggering student creativity.	4
7	The ability of media to activate students in building their own knowledge.	5
8	The suitability of the media to the world of the students being taught.	5
9	Students fluently operate multimedia-based media	4
10	The learning process uses media in accordance with student activities	5
11	The media is appropriate to the content of the learning material	5
12	The atmosphere of the learning process is conducive and enjoyable.	5
13	Students understand material more quickly with media.	4
14	Ease of use	5
15	Students complete individual and group assignments more quickly with media learning resources	5
Total Score		**70**
Percentage		**93%**
Practicality		**Very Practical**

Discussion

Results of Development Procedures

The research results and media development process can be described by researchers as follows:

A. Analysis Stage (Analyze)

The analysis stage is the stage used by researchers to determine the competencies required of students. This stage aims to collect information that researchers use as a guide for researchers in product development. This stage includes needs analysis, analysis of student characteristics, material analysis in accordance with competency demands:

1) Needs Analysis

At this stage the researcher conducted interviews at SMK Negeri 1 Mandrehe Barat with teachers of Basics of Building Construction and Land Measurement Techniques and also with students regarding the material they had studied so far regarding occupational health and safety procedures for construction work. The following are the results of the researcher's interview:

a) Teacher

The teaching and learning process at school is carried out face to face where the teacher has provided teaching materials in the form of books about the Basics of Building Construction and Land Surveying Techniques. The media that are often used are books and blackboards, and less media can be used, such as technological media, due to limited time and teachers' ability to operate technology.

b) Student

Students learn only using books and blackboards as teaching materials, so students' understanding of the subjects Basics of Building Construction and Land Measurement Techniques is still not comprehensive.

2) Analysis of student characteristics

At this stage, after the researcher conducted a preliminary study, the results

were obtained that in the target school the teaching materials used did not motivate students because the design and methods did not motivate students. So the media to be developed must be in accordance with students' interests and learning abilities. With the results of the characteristic analysis, the researcher concluded that multimedia-based learning media should be developed.

3) Curriculum Analysis

The curriculum analysis carried out aims to identify the curriculum used in schools. Researchers analyzed the curriculum used by subject teachers at SMK Negeri 1 Mandrehe Barat class X-DPIB using the 2013 curriculum where the learning process is more student-centered.

Based on this, multimedia-based learning media can solve one of the problems in the learning process, namely learning resources so that it has an impact on both students and teachers because multimedia can make it easier for teachers to convey material, this was also pointed out by (Munir, 2013) regarding the benefits of multimedia namely making it easier and faster for educators to present learning material in the learning process and overcoming the limitations of space, time and senses. In the same vein, according to (Arsyad, 2014), using media in the teaching and learning process can arouse new desires and interests in students, as well as generate motivation and stimulation for learning activities, and even bring about psychological influences in students. That is why the success of this research solves one of the problems, namely learning resources that can increase and generate learning motivation in students.

Feasibility of learning media

1) Material Expert Validation

The results of the assessment of the feasibility of learning media by experts are divided into three aspects, namely, the straightforward aspect, the material aspect, and the benefits aspect. The level of change in the percentage of achievement in revision 1 obtained a total percentage of 69% and in revision 2 there was a total increase of 90% with the criteria Very feasible. This shows that the learning media created by researchers has been improved in accordance with suggestions and comments from validators so that the learning media is feasible used.

2) Linguist Validation

Conformity of language with good and correct Indonesian language rules, reaching a percentage in revision II of 98% with very decent criteria, with a total score of 59 from 5 aspects each getting a score of 93% Straightforward, 100% Communicative, 100% Dialogical and Interactive, Conformity with students is 100%, and conformity with language rules is 100%.

From the results of the language expert validator, it shows that multimedia-based interactive learning media in terms of language use is very feasible.

3) Media Expert Validation

The results of the assessment of the feasibility of learning media by media experts for the Straightforward aspect, Media aspect, Benefit aspect obtained a percentage level after revision of 95% with very feasible criteria with a total score of 106 from 3 aspects, each of which received a straightforward aspect score of 95%, a Media aspect score of 95 %, Benefit aspect score 96%. From the results of the media expert validator which has been revised twice, it shows that the learning media created by the researcher has been improved according to the validator's suggestions and comments so that the learning media is suitable for use.

Practicality of Learning Media

The learning media developed is assessed for the level of practicality based on the results of the response questionnaire that has been given to students and teachers. Student response data was obtained from the results of student response questionnaires at the individual test and field test stages. Teacher response data was also obtained from the results of teacher response questionnaires when researchers carried out the individual test evaluation stage.

1) Individual Test

Student responses in individual trials were carried out at the West Mandrehe 1 Vocational School, in class X by taking a

sample of 3 respondents covering straightforward aspects, media aspects and useful aspects. The results of individual trials show that the media can be used in learning, based on the results of the response questionnaire, students received a score of 298 out of a maximum score of 300 with a percentage level of 99% in the category (Very Practical).

2) Field Test

Field trial student responses at West Mandrehe 1 Vocational School in class The results of the field trials show that learning media can be used in learning, the results of the student response questionnaire obtained a score of 209 out of a maximum score of 210 with a percentage level of 93% in the category (Very Practical).

Based on the two trials above, it shows that there is an increase in results in each practical test. Based on the assessment range, the percentage is 81-100% in the very practical category. So the achievement at the field test stage with a percentage level of 93% is very practical for use in the learning process.

Effectiveness of Learning Media

The effectiveness of developing learning media is obtained from learning outcomes tests given to students after studying learning media. Learning media was given to 10 class X DPIB students. After students studied the learning material with the title Understanding Occupational Safety and Health and the Environment (K3LH) which was published in multimedia-based interactive learning media, researchers distributed learning outcome test questions to students with a total of 5 questions. From these results, the percentage of students' learning completeness is obtained, which can be seen in the table below:

Table 4.8 Percentage of Effectiveness

No	Trials	Amount Completed	Incomplete Amount	The number of students
1	Individual	3	0	3
2	Field	10	0	10
Completion Percentage				**93%**
Effectiveness				**Very effective**

Source: Researcher 2023

Based on the table above, the completeness of the student learning test results in class Researchers evaluate the material that has been taught to students, the product is said to be effective if the student's grades meet the predetermined KKM completeness. 10 students had scores above the KKM and were declared complete, while those students had scores below the KKM and were declared incomplete. From the results of the data, the percentage of effectiveness results was 93% with the criteria (Very Effective)

CONCLUSIONS

Based on the results of research and development of multimedia-based learning media in the subjects Basics of Building Construction and Land Measurement Techniques, the researchers drew conclusions namely:

1. The results of developing learning media in class XI-DPIB can be carried out so that students' understanding of the material presented can be comprehensive.
2. Multimedia-based media on K3LH material, by material experts obtained 90% of very feasible criteria, by language experts obtained 98% of very feasible criteria, and by design experts obtained 95% of very feasible criteria.
3. Multimedia-based media on visible drawing material, in individual tests obtained 93% of very practical criteria, and in field trials 93% of very practical criteria.
4. The effectiveness of multimedia-based media in drawing material appears to reach

very effective criteria with a completion percentage of 93%.

So it can be concluded that the development of multimedia-based learning media for class and effectively used in the learning process at school.

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