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DEVELOPMENT OF DIGITAL TEACHING MATERIALS ON SOUND WAVES TOPIC TO PRACTICE STUDENT'S PROBLEM SOLVING SKILLS

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ABSTRACT

it is very important to provide students learning support materials, both at school or anywhere, particularly to train students' problem solving skills. In general, this study aims to describe the feasibility of digital teaching materials on sound wave materials developed to practice ; problem solving skills. In particular, this study aims to describe; (1) The validity of digital teaching materials, (2) The practicality of digital teaching materials, and (3) The effectiveness of digital teaching materials. Its digital teaching materials in the form of teaching materials, lesson plans, student worksheet, and study result test. The research was developed using the ADDIE model. The test subjects were 14 students of class XI MIPA 1 SMA Negeri 10 Banjarmasin. The sampling technique was carried out based on consistency in the pre-test, post-test, and list of attendance. The research data were obtained from validation test sheets, learning outcomes tests, and student response questionnaires. The data were analyzed descriptively-qualitatively, the average, and the minimum completeness criteria. The results showed that; (1) The validity of teaching materials is in the very good category, (2) the practicality of teaching materials is in good category, and (3) the effectiveness of teaching materials is 86% of students having a minimum completeness criteria score and an N-gain of 0.71 so that digital teaching materials can be said to be good. The conclusions of the research obtained are the development of digital teaching materials on Sound Wave material to practice problem solving skills which are declared suitable for use in learning activities. With the existence of digital teaching materials, sound waves digital teaching materials can be a decent source of learning for students and practice problem solving skills.

Keywords: digital teaching materials; problem solving skill; sound waves.

INTRODUCTION

Humans in the 21st century are required to have many skills, there are four groups of skills that are important to have in the 21st century: ways for working, ways for thinking, tools for working, living in the world (Hidayat *et al.*, 2017). Ways of thinking is a part of thinking skills, some of which are creative, innovative and problem solving (Hidayat *et al.*, 2017). Therefore, it is important to focus on students' problem solving skills.

Problem solving skills are very important to train as a provision for students in life. Problem solving can be interpreted as a person's ability to solving a problem, also interpreted as a person's attitude to face the actual situation with the expected situation (Ince, 2018). Problem solving occurs when a person is solving a situation where he never and did not know about the actions to be taken to deal with the previous situation (Docktor *et al.*, 2016).

Problem solving is important to have. It because with problem solving skills, a person is asked to assemble his own theory, test it, test other people's theories, sort out theories that can be used and not used anymore. (Hidayat et al., 2017). In physics, problem solving is an important skill to have (Adams and Wieman, 2015). Problem solving skills are important to have because with problem solving skills a person is asked to assemble his own theory, test it, test other people's theories, sort out theories that can be used and which are no longer used (Hidayat *et al.*, 2017). Problem solving also enables a person to solve the situation at hand in a systematic, well-planned manner and with proper and correct execution.

However, the problem solving skills found in the field are still low. Supported by research (Yulianawati, Novia and Suyana, 2016) if none of the 30 participating students can answer the question correctly. Researchers conducted an initial test of problem solving for students of a Senior High School Banjarmasin class X MIPA 1 with 35 students. The results obtained if 0% of students visualized or illustrated problems, 80% were able to describe the problem, only 3% wrote a problem solution plan, 53% can solve the problem and no one evaluates the results of the answers. It can be said that students are still low in problem solving skills.

Based on interviews and observations, there are not many teaching materials for students. Also, the teaching materials that can be used by students to study are still limited, especially with learning activities at home which also affects the problem solving skills of students. Teaching materials that can provide motivation are needed by students to improve problem solving skills so that they can be actively involved in the learning process.

In addition to printed teaching materials that are often found, digital teaching materials can be another choice of teaching materials. The choice of digital media as teaching materials provides many choices. According to (Rahmawati, Wahyuni & Yushardi, 2017) one of the digital media that can be chosen as teaching material is flipbook. This will be used by students anytime and

anywhere, so that they can practice problem solving skills more optimally.

Flipbook appears with a digital display, combining text, video, images, sound, and navigation. Make the display into an interactive simulation and can also be combined with animation. Fun learning can take place and attract the interest and attention of students (Diani & Hartati, 2018). The results of the study (Rahmawati, Wahyuni, & Yushardi, 2017) show the results if the flipbook learning media is included in the very valid and very effective category with a percentage of 80.39%.

In the first learning stage to practice problem solving skills, the direct learning model is a learning model that has a teaching approach that can help students process information step by step (Faturrohman, 2017). The stages in direct teaching include conveying learning objectives and preparing students, demonstrating knowledge or skills, guiding students in training, checking understanding and providing feedback, and providing opportunities for practice and application (Indariani, Amami Pramuditya and Firmasari, 2018). The use of direct learning models has been proven to improve students' problem solving abilities (Amrita, 2016).

Sound wave material is closely related to everyday life. There are many problems in everyday life related to sound waves. Curriculum demands are in line with this. Digital teaching materials developed with the topic of sound waves should be able to train students' problem-solving skills by loading learning materials, examples of physics exercises with solving problem-solving steps, and practice questions that can be used as material for evaluating student development. Digital teaching materials packaged in flipbook form are expected to be accessible and all students can read them, and with the recommendation to study from home digital teaching materials can be used to study at home by smart phone.

Based on the importance and necessity of this teaching materials, this research is aims to describe the feasibility of teaching materials on the topic of sound waves developed for training students' problem solving skills. This research will describe the validation of teaching materials, the practicality of teaching materials, and the effectiveness of digital teaching materials on the topic of sound waves.

METHOD

This research is a type of development research, the ADDIE model is used to develop the device. The course of development research consists of the stages of analysis, design, development, use and evaluation. Students of class XI MIPA 1 SMA Negeri 10 Banjarmasin are subjects of research, with the object of research in the form of the feasibility of digital teaching materials.

The data were collected through the test method (study outcome test) and non-test (student response questionnaire). Using research instruments for data collection in the form of validation sheets consisting

of teaching materials, lesson plans, student worksheets and study result test.

Table 1 Criteria for Validity and Practicality of Teaching Materials

Interval	Criteria
$X > 3{,}4$	Very good
$2{,}8 < X \leq 3{,}4$	Good
$2{,}2 < X \leq 2{,}8$	Enough
$1{,}6 < X \leq 2{,}2$	Poor
$X \leq 1{,}6$	Not good

(Widoyoko, 2016)

The validity of teaching materials for all aspects is carried out by the validator using a validation instrument, with a validator consisting of 3 validators (academics and practitioners) will be averaged. The practicality of teaching materials comes from student response questionnaires given after the learning ends.

To find out the extent to which the developed device can be trusted, a reliability test is carried out. The reliability of the validation results is calculated using Cronbach's Alpha (Ratnawulan & Rzusdiana, 2014).

Table 2 Instrument Reliability Criteria

Reliability Coefficient	Kriteria
r_{11}< 0,20	Very low
0,20 < r_{11} 0,40	Low
0,40 < r_{11} 0,70	Enough
0,70 < r_{11} 0,90	High
0,90 < r_{11} 1,00	Very high

The effectiveness of the device is assessed from the test of student learning outcomes in the form of minimum completeness criteria from the post-test score. The minimum completeness criteria used is 70, according to the setting by the school. The criteria for the effectiveness of the device from the student learning outcomes test according to Sudijono (2010) in (Syafrina, Farhan, & Ropisa, 2016) the criteria for the effectiveness of the device can be seen in Table 3.

Table 3 Criteria for Device Effectiveness

Scor (%)	Criteria
00-20	Not good
21-50	Poor
51-75	Good
76-100	Very good

Arikunto (2010) in (Syafrina, Farhan, & Ropisa, 2016)

To strengthen the results, the effectiveness of the device will be tested using the Normalized gain (N-gain) whose criteria are listed in Table 4.

Table 4 Criteria for Device Effectiveness

Grade	Criteria
$\langle g \rangle \geq 0{,}7$	High
$0{,}3 \leq \langle g \rangle \leq 0{,}7$	Enough
$\langle g \rangle < 0{,}3$	Low

(Hake, 1998)

RESULTS AND DISCUSSION

Developed Products

Product development in the form of digital teaching materials on the topic of Sound Waves to practice problem solving skills. The developed digital teaching materials contain materials and questions based on the characteristics of students in class XI MIPA 1 SMAN 10 Banjarmasin and the characteristics of the Sound Wave topic. Teaching materials contain

content that refers to several sources of textbooks which researchers then develop according to the characteristics of the material and students. This teaching material consists of several parts, namely: (1) Front Cover; (2) Preface; (3) Table of Contents; (4) Description of Teaching Materials; (5) Instructions for Use; (6) Learning Implementation Plan; (7) Concept Map; (8) Material Description; (9) Sample Questions; (10) Practice Questions; (11) Bibliography.

The topic of sound waves in digital teaching materials is to practice students' problem solving skills, the selection of direct learning models has been adjusted to the characteristics of students.

These teaching materials are arranged for three meetings in which each meeting uses a direct learning model. Each meeting on teaching materials will provide practice questions and discussions. The material taught at the first meeting is the characteristics of sound waves. The material taught at the second meeting discussed the symptoms of sound waves and resonance in strings and organ pipes. Then, at the third meeting the material taught was about the level of intensity and the application of sound waves.

Digital teaching materials are adapted to the characteristics of students, at the three meetings the researchers used a direct learning model. With the learning model, it is hoped that students will better understand basic skills and obtain information that is taught step by step. The developed digital teaching materials discuss Sound Waves so that the cover is equipped with a picture of a violin.

Figure 1. Cover of Teaching Materials

The introductory section is an initial introduction to teaching materials, and is equipped with a table of contents and instructions for using teaching materials. These instructions explain the parts of teaching materials so that students can use teaching materials independently. Then there are indicators and learning objectives as well as lesson plans that can be accessed in digital teaching materials which are designed for three meetings by adjusting student characteristics and material characteristics. Next, there is a concept map which provides a general overview of the material that students will study.

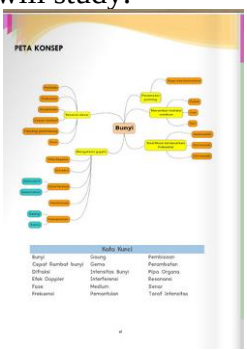


Figure 2. Concept Map

In the the material that contains various kinds of information about sound waves. At the first meeting, a video related to sound waves was presented, and there were questions that would be a reference for learning at this meeting.

Teaching materials are also equipped with sample questions, each example question is equipped with methods or steps to practice students' problem solving skills. The Material was demonstrated by using video for students to watch. Completion of sample questions with Heller's problem solving stages. Students will be taught to describe problems, describe problems into physical equations, develop solutions, plan solutions, and finally review the results of problem solving. Soundwave digital teaching materials are also equipped with guided and advanced practice questions. Students are asked to work on problems using problem-solving indicators that have been studied.

Figure 3. Introduction and video

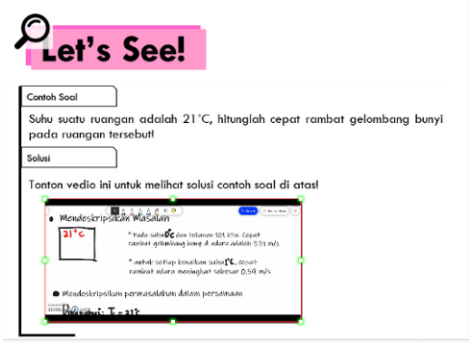


Figure 4. Completion of sample questions

These digital teaching materials also consist of accessible lesson plans and learning outcomes tests. The plan for digital teaching materials is designed for three meetings by adjusting to the characteristics of students and the characteristics of the material. The learning outcomes test is equipped with instructions in the form of instructions for filling out the test and procedures for taking the test. This will make it easier for students to understand how to take the test. It is hoped that the learning outcomes tests that have been created can be used as learning material for students. Student learning results can be accessed anytime and anywhere.

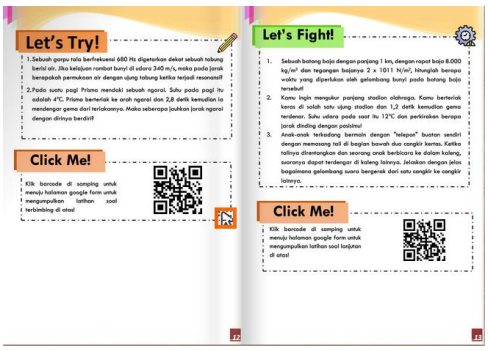
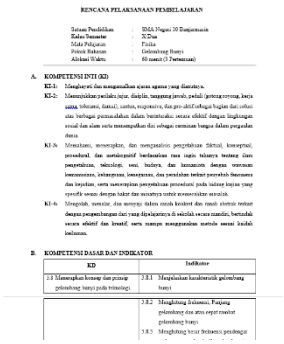


Figure 5 Guided practice questions and advanced practice questions



RENCANA PELAKSANAAN PEMBELAJARAN

Satuan Pendidikan : SMA Negeri 10 Banjarmasin
Kelas/Semester : X/Dua
Mata Pelajaran : Fisika
Pokok Bahasan : Gelombang Bunyi
Alokasi Waktu : 60 menit (2 Pertemuan)

A. KOMPETENSI INTI (KI)

KI-1: Menghayati dan mengamalkan ajaran agama yang dianutnya.

KI-2: Menunjukkan perilaku jujur, disiplin, tanggung jawab, peduli (gotong royong, kerja sama, toleransi, damai), santun, responsif, dan pro-aktif dalam bagian dari solusi atas berbagai permasalahan dalam berinteraksi secara efektif dengan lingkungan sosial dan alam serta menempatkan diri sebagai cerminan bangsa dalam pergaulan dunia.

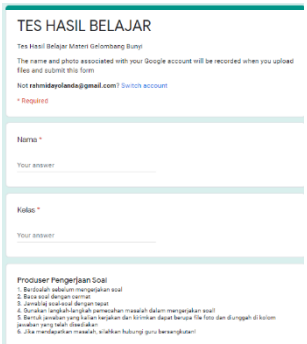
KI-3: Memahami, menerapkan, dan menganalisis pengetahuan faktual, konseptual, prosedural, dan metakognitif berdasarkan rasa ingin tahunya tentang ilmu pengetahuan, teknologi, seni, budaya, dan humaniora dengan wawasan kemanusiaan, kebangsaan, kenegaraan, dan peradaban terkait penyebab fenomena dan kejadian, serta menerapkan pengetahuan prosedural pada bidang kajian yang spesifik sesuai dengan bakat dan minatnya untuk memecahkan masalah.

KI-4: Mengolah, menalar, dan menyaji dalam ranah konkret dan ranah abstrak terkait dengan pengembangan dari yang dipelajarinya di sekolah secara mandiri, bertindak secara efektif dan kreatif, serta mampu menggunakan metode sesuai kaidah keilmuan.

B. KOMPETENSI DASAR DAN INDIKATOR

KD	Indikator
3.8 Menerapkan konsep dan prinsip gelombang bunyi pada teknologi.	3.8.1 Menjelaskan karakteristik gelombang bunyi
	3.8.2 Menghitung Kelajuan, Panjang gelombang dan atau cepat rambat gelombang bunyi
	3.8.3 Menghitung besar frekuensi pendengar

Figure 6 Learning implementation plan direct learning model



TES HASIL BELAJAR

Tes Hasil Belajar Materi Gelombang Bunyi

The name and photo associated with your Google account will be recorded when you upload files and submit this form

Not rahmidayolanda@gmail.com? Switch account

* Required

Nama *

Your answer

Kelas *

Your answer

Produser Pengerjaan Soal

1. Berdoalah sebelum mengerjakan soal
2. Baca soal dengan cermat
3. Jawablah soal-soal dengan tepat
4. Runutkan langkah-langkah pemecahan masalah dalam mengerjakan soal!
5. Berilah jawaban yang kalian berikan dan kirimkan dapat berupa file foto dan diunggah di kolom jawaban yang telah disediakan
6. Jika mendapatkan masalah, silahkan hubungi guru bersangkutan!

Figure 7 Study result test

Validation

The results of the validation of digital teaching materials as a whole are valid, based on the results of assessments by academics and practitioners who are categorized as at least good. Digital teaching materials consist of book covers, introductions, instructions for using digital teaching materials, table of contents, concept maps, teaching materials, sample questions, worksheets, practice questions, and a bibliography. The results of the reliability of digital teaching materials show a good category, the results of the validation of digital teaching materials and the reliability of digital materials can be seen in Table 5.

Good teaching materials can be said to have gone through the validation stage before being used (Ismail et al., 2020). Two aspects of the assessment on the instrument of validation of teaching materials are aspects of the content of teaching materials and aspects of assessment and appearance. For the content aspect, there are 3 aspects that are reviewed, namely software engineering, organization, and problem solving skills.

When teacher try teach to practice problem solving skills must be taught systematically, making it easier for students step by step in understanding problem solving so that problem solving skills are trained. Aspects of problem-solving skills in digital teaching materials get a good category. According to (Lestari et al., 2019) problem-solving ability is the ability to think or reason, apply the knowledge gained to be used to solve problems that will be faced in the future. As for the content aspect of teaching materials, the overall category is good

Table 5 Test the Validity and Reliability of Digital Teaching Materials

No	Assessment Aspect	Average Score	Category
1	Software engineering	3,55	Very good
2	Organization	3,67	Very good
3	Language	3,50	Very good
4	Problem Solving Aspect	3,00	Good
5	Visual Communication	3,50	Very good

No	Assessment Aspect	Average Score	Category
6	Format	3,83	Very good
7	Attractiveness	3,75	Very good
8	Font Shape and Size	3,80	Very good
9	Language	4,00	Very good
Validation		3,63	Very good
Reliability		0,66	Good

Furthermore, the aspects reviewed in the assessment and display aspects consist of five aspects including visual communication, attractiveness, format, shape and size of letters, and linguistic aspects. In the aspect of appearance, teaching materials are designed as attractive as possible by combining colors and layouts, attracting the attention of students when reading. It paying attention to the numbering system, size and typeface that is clear and appropriate, namely using the *Tw Cen MT* and *Cream Demo* fonts with a font size of 16 which makes the display of the letters not monotonous and comfortable to read. Digital teaching materials are presented in the form of flipbook which are then hosted online on a web host so that teaching materials can be accessed via url links so that they can be opened easily by students. In (Alperi, 2019) digital teaching materials are electronic media in the form of reading and can be accessed via mobile devices.

The attractiveness aspect of teaching materials gets a very good category. By presenting material and loading images, it is interesting and informative to make it easier for students to understand the content of the material and have an interest in studying the material presented. Teaching materials are well structured so that they can attract and increase the interest of students (Fauziah, 2015). In line with what was stated by (Komikesari et al., 2020), digital teaching materials contain media that can support learning such as images, videos, animations and others.

The language aspect of the teaching materials used is categorized as very good based on good and correct Indonesian writing rules. Attention is also given to the level of thinking and social emotional development of students. The language preparation is packaged interactively and easily understood by readers or students. According to (Wicaksono & Tanjungpura, 2018) language is very important in learning communication and facilitates students in receiving information. The results of the validation of the developed teaching materials show that overall aspects get a very good category with a good degree of reliability.

Table 6 Validation and Reliability of Lesson Plan Design

No.	Assessment Aspect	Average score	Category
1	Lesson plan design format	3,78	Very good
2	Language	3,67	Very good
3	Content of the lesson plan design	3,66	Very good

No.	Assessment Aspect	Average score	Category
Validation		3,70	Very good
Reliability		0,64	Good

The implementation of learning activities follows the flow that has been prepared in the learning implementation plan, which is usually for one or more meetings. With the standards that have been set and based on the 2013 curriculum, learning implementation plan is made based on the syllabus in order to achieve basic competence and as a standard of competence, namely mastering knowledge, skills and attitudes. The results of the validity and reliability are presented in Table 6. The the learning implementation plan format is prepared by referring to the rules (Permendikbud no 22 Tahun 2016, 2016) which are prepared in accordance with the 2013 curriculum. The learning implementation plan format made is categorized as very good. has been developed well and students can use it.

Guided by the rules of the Indonesian language, the language is made simple with terms that are easy for students to understand, there is no double interpretation of command sentences. With the acquisition of the language aspect of the lesson plan with a very good category, it shows that the lesson plan is good and can be used.

The content aspect of the The learning implementation plan gets a good category, in the aspect of the content of the The learning implementation plan by including core competencies and basic competencies by following the rules in ((Permendikbud no 22 Tahun 2016, 2016)). the content of the lesson plan contains the syntax of the learning model in this case direct learning. The content aspect of the lesson plans is categorized as very good, the developed lesson plans have good The learning implementation plan characteristics and can be used. The results of the The learning implementation plan validation that have been developed show that all aspects as a whole get a very good category with a good degree of reliability so that the The learning implementation plan validation results show that the The learning implementation plan can be used.

Table 7. Validation and Reliability of The Study Result Test

No.	Assessment Aspect	Average Score	Catagory
1	General Construction	3,32	Good
2	Language	3,67	Very good
Validation		3,50	Very good
Reliability		0,76	Good

One of the tools to evaluate is a test of learning outcomes in which students are after the learning process. According to Gagne and Briggs (in Firmansyah, 2011) that the test of learning outcomes as a means to describe the ability of students after following the learning process. The published study result test consists of questions with C2-C4 domains. The compiler theory used in preparing the study result test

validation instrument consists of 2 assessments, namely the general construction aspect and the linguistic aspect. The study result test made by the researcher consists of 7 questions.

The overall general construction aspect for each item has a good category. Among the criteria for study result test is the use of clear interrogative sentences or commands. The linguistic aspect is also considered and gets a good category, choosing the right language so that it is easily understood by students when reading the questions. The results of the validity of the study result test show that the overall aspect gets a very good category and a good degree of reliability. So that study result test is good and can be used in physics learing.

Student worksheets are activity sheets for the learning process to find concepts either through theory, demonstration, or investigation accompanied by clear directions and work steps to familiarize thinking skills and process skills (Firdaus & Wilujeng, 2018). The validation results in Table 8. show that the overall validation of the student worksheets has a good category. So it can be said that the developed student worksheets have met the aspects of content, language, and format of student worksheets.

In the aspect of content, student worksheets contain systematic work procedures and can provide an overview of the problems presented. Student worksheets serve as guidelines for students to obtain information. By including the stages of work in student worksheets. Student worksheets are also an exercise for students to add media to the problem solving skills presented.

In the aspect of language assessment, paying attention to the correct Indonesian language rules and using simple language and sentences that are easy to understand and in accordance with the thinking abilities of students so that sentences do not arise that cause multiple interpretations.

Aspects of the format of the student worksheets include the formulation of indicators, numbering system, type and size of letters, layout, text and picture illustrations and activity procedures. Pictures or illustrations on student worksheets must be appropriate and can motivate students. The results of student worksheet validation have a good degree of reliability. This indicates that the developed student worksheets are reliable.

Practicality

The assessment of the practicality of teaching materials is obtained by averaging the scores obtained from the questionnaires filled out by students. According to Riduwan in (Afrizon & Dewi, 2019) the practicality of teaching materials can be stated in the very practical, practical, quite practical, and impractical categories. The average score becomes a reference to determine the practicality of the teaching materials developed. In Table 9. the practicality of teaching materials gets a good category.

The indicator contained in the aspect of the benefits of teaching materials is that the presence of digital teaching materials in learning can lead to independence in students.

Aspects of the benefits of teaching materials obtained a good category which indicates that students respond positively to aspects of the benefits of digital teaching materials that students use

Table 9. Practicality of Teaching Materials

No	Assessment Aspect	Average Score	Category
1	Benefit Aspect	3,29	Good
2	Efficiency Aspect	3,10	Good
3	Convenience Aspect	3,32	Good
Practicality		3,24	Good
Reliability		0,57	Enough

Aspects of the efficiency of learning time, getting a good category, the average student responds if learning using digital teaching materials is efficient in learning, but there are also some students who do not agree. Difficulties in students are still in the problem of not understanding the concepts/materials being taught. With online learning, students learn more independently and there is no direct interaction between students and teachers.

In the aspect of ease of use of digital teaching materials, the use of sentences that are easily understood by students helps students understand the material. In the design of digital teaching materials, they are arranged in attractive colors and appearances so that students do not get bored so that the teaching materials can be said to be clear and interesting. Problem solving skills are presented in sample questions, students will be helped by sample questions that contain problem solving steps in teaching materials.

Obtaining the average score of all aspects of the student response questionnaire becomes a reference for whether digital teaching materials can be classified as good or not. The average results of the student response questionnaire scores show that digital teaching materials have met good standard characteristics, even though there are shortcomings in the aspect of time efficiency. Digital teaching materials on Sound Waves to practice problem solving skills are good for students to use as learning resources and can practice problem solving skills.

Effectiveness

Table 10. Descriptive Statistics of Student Learning Result

Description	***Pretest***	***Posttest***
Highest score	32	88
Lowest score	9	67
Average Score	20,43	77,00
Standard Deviation	8,13	6,62
The number of students	14	14
The number of students passed (%)	0 (0)	12 (86%)
Gain score (catagory)	0.71 (high)	

The learning result of students are presented in Table 10. It shows that the average pre-test scores of students are still low and far from the minimum completeness score. The problem solving ability of students is still relatively low. According to (Tina Sri Sumartini, 2017) in her research, the low problem solving ability of students is known through how students work on pre-test questions, students will immediately work on questions and enter scores without any stages such as steps in problem solving. In accordance with the stages of solving briefly, namely describing the problems presented, describing problems in physical equations, planning solutions, carrying out plans, and evaluating the results of the completion.

Table 10 shows that the average post-test score of students has reached and exceeded the minimum completeness score. It can be said that students' problem solving skills are increasing, starting from describing problems, describing problems into physical equations, planning problem solving solutions, implementing solutions, and evaluating the results of the settlement. The improvement of students' problem solving skills as seen from the minimum completeness criteria (Kurniyawati et al., 2019). In line with research (Murnaka et al., 2019) in which students experienced an increase in problem-solving skills from achieving minimum completeness criteria.

In Table 10, of the 14 students who took the post-test, as many as 86% of the percentage of students who got a score more than the minimum completeness criteria , so that by referring to the effectiveness of teaching materials with the minimum completeness criteria score, the category was very effective with the acquisition of 85.71%.

Competency-based assessment on the principle of assessment using reference criteria, taking into account the graduation criteria of students, namely by achieving the minimum completeness criteria (Badawi & Qaddafi, 2015). This result is also supported by the acquisition of N-gain which gets a value of 0.71 in the high category. So it can be said if the teaching materials developed have been effective.

By using the direct learning model, it can be seen from the pre-test and post-test scores how the problem solving skills of students. According to Suyidno (in Habibi et al., 2017) in the direct teaching model, procedural and declarative knowledge is specifically designed for the development of student learning. In addition, with direct teaching the delivery of information will be transformed by the teacher to students (Faturrohman, 2017).

In the analysis of the proportion of students' correct answers, there are two number questions that get a proportion of less than 0.70 contained in questions number 2 and number 5 which are type C4 questions or analyzing questions, students are still not finished in the process of solving problems and evaluating the results of the completion . Based on these results, students' analytical skills still need to be improved. Practice questions are one way to improve analytical skills, by providing practice questions that require analysis in their solution. By (Setyorini et al., 2018) with students working on practice questions, it is expected that students' analytical skills will increase because students must improve their analytical skills. From research (Diniyah et al., 2018), students' reasoning abilities increase by practicing questions, and added by (Aini, R.N., Siswono, 2014) students who are trained to work on questions that require high-level analysis will be accustomed to solving problems.

Digital teaching materials on sound wave material to practice problem solving skills are published in the form of a flipbook. With online learning, students can access teaching materials through their smart phones and can learn independently by reading or paying attention to the

completion of practice questions using the stages of problem solving.

SIMPULAN

The validity of teaching materials with an average score of 3.63 is in the very good category. The practicality of teaching materials with an average of 3.24 gets a good category. The effectiveness of teaching materials using the minimum completeness criteria is declared effective with 86% of students having a score of minimum completeness criteria and N-gain are 0.71 so that digital teaching materials can be said to be good. The students' solving ability of SMA Negeri 10 Banjarmasin class XI MIPA 1 has increased after studying with sound wave digital teaching materials.

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