

# Development of Guided Inquiry Model Tools Assisted Palm Fiber Composite Media in Sound Wave Material

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# Development of Guided Inquiry Model Tools Assisted Palm Fiber Composite Media in Sound Wave Material

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**Abstract:** This study aims to determine the feasibility, practicality, and effectiveness of the development of inquiry model learning devices guided by palm fiber composite media in sound wave material. The research method used is the research and Development (R&D) method with a 4D model consisting of definition, design, development, and dissemination stage. Learning tools developed in the form of syllabus, Learning Implementation Plan, students Worksheet, test instruments, palm fiber composite media, and learning video. Validation results show the learning device components in the category are so valid that they are feasible for use in learning. Reliability of silabus, Learning Implementation Plan, Students Worksheet, test instruments, palm fiber composite media, and learning video above 75% show all components assessed to be in the reliable category. The results of teacher and student response, and learning implementation are in the very practical category. Learners' learning outcomes increased with a gain of 0.63 in the medium category. Based on these results, it can be concluded that the learning device of the guided inquiry model assisted by palm fiber composite media in sound wave material is feasible, practical, and effective.

**Keywords:** Development; Learning tools; guided inquiry learning model; palm fiber composite media; Sound waves.

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## Introduction

The 21st century has brought some changes principally to science and technology that continue to develop very rapidly. One of the efforts made to keep up with the current developments in education is to implement the 2013 curriculum. Educational goals are largely determined by the curriculum that is used as a reference in the learning process (Doyan, et al, 2020). The enactment of the 2013 curriculum in Indonesia gives students access to play an active role in learning. (Trianto, 2014) revealed that curriculum development in 2013 could produce productive, creative, innovative, effective Indonesian people, through strengthening attitudes (know why), skills (know-how), and knowledge (know what) are integrated.

The curriculum 2013 provides access to learning experience for learners in developing themselves in various aspects both cognitive, affective, and psychomotor aspects. While (Susilawani, et al, 2019) revealed that often the learning process is currently taking place to improve learning outcomes in the form of knowledge or cognitive aspects alone. As a result, students only understand the concept and are less able to implement the concepts that have been obtained in their daily lives. This is an important concern for all subject teachers, especially in physics learning.

Physics is one part of natural sciences. Physics science learning applied by teachers in schools based on observations at SMAN 1 Narmada found that learning still tends to be aspects of knowledge only. The teacher only focuses on understanding the

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concept and how the learner can solve the problems contained in the package book, the learner is not trained in developing skills in experimenting and analyze the data. Besides, the current Covid-19 pandemic condition two sizes of students to follow the online learning process.

Limited internet access is certainly one of the obstacles in online learning that causes students not to fully understand the material taught by teachers. In online learning, teachers tend to provide a summary of the material as well as provide tasks that must be completed within a certain period. Teachers need to use the right methods so that the material remains well delivered and learning objectives can be achieved. These problems can be overcome by developing innovations in the use of learning models and media. One of the learning models that can be used is the Inquiry learning model.

The inquiry learning model is one of the observation-based learning models. Nurdyansyah & Fahyuni (2016) said that the inquiry model is learning that involves learners in finding and understanding knowledge through investigations that begin with observation, asking questions, planning and experimenting, collecting data, analyzing data, making conclusions, and communicating the results.

Basuki, et al (2015) states that experience from facts of a theory is obtained through the use of an inquiry model. However, considering that students are not accustomed to conducting inquiry activities, students at the high school level can use the guided inquiry model. In the guided inquiry learning model, the teacher provides guidance and instructions for students during learning activities. According to (Susilawati, et al, 2019) the role of the teacher as a facilitator provides greater opportunities for students to build their own conceptual skills and understanding. Furthermore, Sumiyarti, et al, (2019) states that guided inquiry-based learning provides direct experience by looking for facts so that students can learn to look for a theory and practice their skills.

Simbolon (2015) states that the guided inquiry learning model is a student-centered learning model where the teacher acts as a guide for students to solve problems through questions, helping students find ideas, concepts, and skills to gain new knowledge. The use of this model requires students to carry out a series of investigations, explorations, searches, experiments, and research using various media or visual aids.

The use of media is expected to have a great influence on the learning process such as the effectiveness of learning, supporting facilities, and efficiency of learning time. (Gunawan, 2015) revealed that learning media is defined as everything that is

used as an intermediary for learning information to achieve educational objectives in general as well as learning objectives in schools in particular. One of the learning media that can be used is palm fiber composite media. According to Khotimah, et al (2015) a composite is a type of new material that is engineered from two or more materials whose properties of each material differ from one another, both chemical and physical properties, and remain separate in the final product of the material (composite. Material). Composite constituent consists of reinforcing material and adhesive material (matrix). According to Taufik, et al (2020) composite reinforcing materials can be particles or fibers from natural fibers and synthetic fibers. While the adhesive (matrix) functions to bind the fibers into one structure, protects the fiber from damage to environmental conditions, loads to loads, and provides properties such as stiffness, resistance, and electrical resistance.

In the manufacture of composite media as well as palm used natural fibers in the form of palm fibers as reinforcing materials. According to Doyan, et al (2018) this is because natural fibers are easy to obtain, biodegradable or can be decomposed if it has been damaged and the manufacturing process is not complicated and economical. This is in line with Hapiz, et al (2018) statement that natural fibers are more beneficial to develop when compared to synthetic fibers because natural fibers are easy to find. In the manufacture of composites, natural fibers not only serve to increase strength and rigidity but can also reduce the weight of the resulting composite material. The cylindrical and long geometric shape of the palm fibers makes the composite stronger and able to absorb sound at certain frequencies. While the adhesive material is used in the form of Polyvinyl Acetate (PVAc).

Palm fiber composite media is one of the right media as a sound suppressor. According to Madlan, et al (2017) silencers work by converting some of the energy that occurs into heat energy by causing motion in the silencer that absorbs the material when the sound passes through the silencer. Sound absorbers are needed to solve environmental problems related to sound requirements or loudness. According to Nurtanto, et al (2020) loud noise can affect human life psychologically and biologically. Noise disturbs the hearing system, interferes with the respiratory system, and reduces concentration. Therefore we need a material that can absorb sound (silencer).

The presence of palm fiber composites as a learning medium is expected to increase the curiosity of learners to the concept of sound attenuation described in sound wave material. According to Dwipangestu, et al (2018) sound waves are physical

materials that are always in everyday life, but in the learning process, it is very difficult to explain these concepts. The presence of palm fiber composite media is expected to provide convenience for teachers to explain sound wave material and can increase the interest in learning of learners that will have an impact on the learning outcomes of better learners.

The success of the learning process is inseparable from learning tools that can help learners in understanding or mastering the material well. According to Ayuningtyas, et al (2015) learning tools are a set of media or facilities that help teachers in the teaching process, achieve predetermined goals, and create quality learning. The learning device that will be developed in this research is a guided inquiry model learning device assisted by palm fiber composite media. The advantage of this learning device is the learning implementation plan transforms the synth of the guided inquiry model with the help of palm fiber composite media as a learning medium to explain the concept of sound waves.

Previous research conducted by Chodijah, et al (2012) showed that the results of learning devices developed using guided inquiry models are very valid, effective, and practical. Thus, researchers suspect that inquiry model learning devices assisted by palm fiber composite media can allow learners to be active in the learning process. That reason prompted researchers to develop a guided inquiry model learning device assisted by palm fiber composite media in sound wave material.

**Method**

This research uses the research and development method or called Research and Development (R&D). This research uses a 4D model development design consisting of define, design, development, and disseminate. Learning tools developed in the form of syllabus, Learning Implementation Plan, Students Worksheet, test instruments, palm fiber composite media, and learning video. The subject of this study was students of SMAN 1 Narmada class XI MIPA 5 the school year 2020/2021 consisting of 27 people.

Data collection instruments are needed to measure the feasibility, practicality, and effectiveness of developed learning devices. The data retrieval instruments used in this study were validation sheets, response questionnaires, and test sheets.

Validation results from experts have calculated percentage by using the following equation:

$$\%Validation = \frac{\text{number of scores from assessors}}{\text{maximum number of scores}} \times 100\%$$

Eligibility criteria are determined based on the following Table 1.

**Tabel 1.** Instrument Validation Criteria

No	Validation Percentage Value Range	Validation Level
1	0-20	Highly invalid
2	21-40	less valid
3	41-60	quite valid
4	61-80	Valid
5	81-100	Very valid

(Arikunto, 2010).

The reliability of learning device assessment results is based on an agreement between validators. Agreements between validators are analyzed using a percentage of agreement (Borich, 1994). Learning devices are said to be reliable when the percentage of agreement ≥ 75%. The percentage of agreement (PA) formula is as follows:

$$PA = 1 - \frac{A-B}{A+B} \times 100\%$$

Where:

- PA = percentage of agreement
- A = frequency of assessment by experts who provide high scores
- B = frequency of assessments by experts who provide low scores

Data on the practicality of learning devices is obtained from learning implementation sheets, teacher response questionnaires, and student questionnaires, which will then be analyzed to determine the average percentage with the following equations:

$$Value = \frac{\text{Number of scores from assessors}}{\text{Maximum number of scores}} \times 100\%$$

After being analyzed, it will be done interpretation of data based on practical criteria. The level of practicality of the instrument is determined based on Table 2 below.

**Tabel 2.** Practicality Criteria

No	Percentage Value Range	Practicality Level
1	0-20	Highly impractical
2	21-40	Less practical
3	41-60	Quite practical
4	61-80	Practical
5	81-100	Very practical

(Arikunto, 2010).

Analysis of the effectiveness of the device consists in the analysis of increased learning outcomes. To analyze the increase will be used analysis of normalized N-gain value. This analysis aims to determine the increase in pretest and posttest values. (Gunawan, 2015) in anticipation of misinterpretation of the gain score of each student, also calculated the amount of N-gain by using the formula:



$$N - gain = \frac{S_{post} - S_{pre}}{S_{max} - S_{pre}}$$

With the following N-gain categories.

**Tabel 3.** N-gain criteria

No.	Interval	Criteria
1	0.70 < g < 1,00	High
2	0.30 < g < 0,70	Middle
3	0.0 < g < 0,30	Low

(Sundayana, 2014).

## Result and Discussion

### 1. Define

The definition stage aims to determine the problems experienced during the learning process. Activities in this stage are initial analysis, analysis of learners, analysis of tasks, analysis of concepts, and specifications of learning objectives. The initial analysis was conducted by interviewing a physics teacher in grade XI SMAN 1 Narmada. Based on the results of the interview obtained information that the basic knowledge of learners is still low, especially in mathematical calculations. Then the outbreak of the Covid-19 virus resulted in face-to-face learning turning to online learning. There are several obstacles faced by teachers in delivering physical materials during online learning such as limited student learning quota so that the level of attendance and participation of learners to follow the learning process is reduced. Time constraints are also an obstacle faced by teachers wherein one meeting is only given 60 minutes. This causes teachers to be unable to deliver the material more broadly and has an impact on the learning outcomes of low learners.

The analysis of learners aims to analyze the characteristics of learners who cover the background of knowledge and cognitive abilities of learners. Furthermore, task analysis will provide the information needed to compile all the draft assignments to be worked on. Concept analysis aims to analyze and develop relevant concepts in a subject matter that is then used as a reference in the preparation of learning objectives to be achieved during the learning process. The specific fiction of learning objectives aims to describe Basic Competencies (KD) into more specific indicators in the form of learning objectives that are adjusted to the results of material analysis and analysis of tasks carried out previously.

### 2. Design

The planning stage (design) is the stage of designing the initial draft of learning devices that will be used in sound wave material. The learning device is guided by palm fiber composite media and data

collection instruments which are then validated by expert validators and practitioner validators. The resulting drafts are syllabus, RPP, LKPD, test instruments, palm fiber composite media, and learning videos.

### 3. Develop

The purpose of the development stage is to produce a guided inquiry model learning device assisted by palm fiber composite media in sound wave material.

#### a. Feasibility of Learning Devices

The feasibility of learning devices is obtained based on validation results by 3 expert validators from physics education lecturers and 3 practitioner validators from physics teachers using an assessment scale of 1 to 5. The validation results of learning devices can be seen in Table 4.

**Tabel 4.** Learning Device Validity Analysis Results

No	Products	Percentage	Category
1	Syllabus	89.2 %	Very Valid
2	Learning Implementation Plan	89.0 %	Very Valid
3	Learner Worksheet	84.0 %	Very Valid
4	Test Instruments	87.4 %	Very Valid
5	Palm Fiber Composite Media	87.3 %	Very Valid
6	Learning Videos	87.3 %	Very Valid

Table 4 shows the validation results of learning devices in the form of syllabus, RPP, LKPD, test instruments, palm fiber composite media, and learning videos are categorized as very valid. So that learning devices are worth using in learning.

The validation results of the learning device are then analyzed to achieve the reliability value of the learning device validation. The reliability of learning devices is based on agreements between validators. Validator avatar agreements are analyzed using the percentage of agreement (Borich, 1994)(Borich,1994). The validation result of the learning device is said to be reliable if the percentage value of the agreement (PA) ≥75%. The reliability test results of learning devices are presented in Table 5.

**Tabel 5.** Reliability of Learning Device Validation Results

No	Device	Percentage of Agreement	Category
1	Syllabus	94.5 %	Reliabel
2	Learning Implementation Plan	93.8 %	Reliable
3	Learner Worksheet	92.4 %	Reliable
4	Test Instruments	93.0 %	Reliable
5	Palm Fiber Composite Media	93.0 %	Reliable
6	Learning Videos	93.7 %	Reliable

Based on Table 5, it is known that syllabus, RPP, LKPD, learning test instruments, palm fiber composite media, and learning videos are categorized as reliable.

**b. Practicality of Learning Homework**

Practicality analysis aims to find out if the learning tools developed to meet the practical criteria. Rahayu, et al (2019) stated that practicality is carried out to test the wearability of learning devices by teachers and learners by implementing learning using revised learning tools based on an assessment by validators. The practicality of learning tools in this study was obtained based on teacher response questionnaires, student response questionnaires, and learning implementation sheets. The results of practicality analysis of learning devices based on teacher response questionnaire can be seen in Table 6.

**Tabel 6.** Results of Teacher Response Questionnaire Analysis

No	Device	Average	Category
1	Syllabus	88.3%	Very Practical
2	Learning Implementation Plan	88.7 %	Very Practical
3	Learner Worksheet	86.7 %	Very Practical
4	Test Instruments	85.7 %	Very Practical
5	Palm Fiber Composite Media	82.7 %	Very Practical
6	Learning Videos	90.0%	Very Practical

Based on Table 6, all learning tools developed are in a very practical category. This shows that inquiry model learning devices assisted by palm fiber composite media in sound wave material can support teachers in learning activities.

Furthermore, the results of the analysis of student response questionnaire data can be seen in Table 7 below.

**Tabel 7.** Results of Student Response Questionnaire Analysis

No	Device	Average	Category
1	How to Teach	80.1%	Very Practical
2	Learner Worksheet	80.0 %	Very Practical
3	Test Instruments	82.4%	Very Practical
4	Palm Fiber Composite Media	82.5%	Very Practical
5	Learning Videos	81.9%	Very Practical

Based on Table 7 results of practicality analysis obtained for how to teach, LKPD, Learning result test instruments, palm fiber composite media, and learning videos are in a very practical category.

The implementation of learning is used to measure the success of teachers to complete each phase or stage in the developed learning model(Iffah &

Sunarti, 2019). In this study, the implementation of learning at the first, second, and third meetings was assessed by three observers. The results of the analysis of learning implementation can be seen in Table 8 below.

**Tabel 8.** Results of Learning Implementation Sheet Analysis

No	Observer	Average	Category
1	I	95.31%	Very Practical
2	II	94.89%	Very Practical
3	II	85.49%	Very Practical

Based on Table 8 the overall meeting of the observations of the three observers found that learning tools are very practical to use in physics learning, seen at each meeting can take place well.

**c. Effectiveness of Learning Tools**

The effectiveness of inquiry model learning devices guided by palm fiber composite media in sound wave material can be seen from the improvement of learner learning results obtained from the calculation of gain value. The result of the gain value calculation can be seen in Table 9.

**Tabel 9.** Analysis of Average Learning Outcomes through N-gain Test

$\bar{X}$ Pretest	$\bar{X}$ Posttest	$N - gain$
39.4	77.8	0.63

Based on Table 9, the gain value obtained is 0.63 with the medium category. This indicates that the use of inquiry model learning devices assisted by palm fiber composite media in sound wave material is effectively used in learning. This result is in line with Sudiarman, et al (2015) which concluded that inquiry-based physics learning devices are guided effectively to improve learner learning outcomes.

**4. Disseminate**

The Disseminate stage is the final stage of this research. At this stage, researchers disseminate the results of research in the form of scientific articles submitted in the e-journal.

**4 Conclusion**

Based on the results of research and discussion, it can be concluded that the inquiry model learning device is guided by palm fiber composite media in sound wave material which includes syllabus, RPP, LKPD, test instruments, palm fiber composite media, and learning video worthy, practical and effectively used in learning.

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