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| Development of Guided Inquiry Model Tools Assisted Palm Fiber Composite Media in Sound Wave Material | | | |
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| **Article Info**  Received :...........,2021  Revised :...........,2021  Accepted:............,2021 | | **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 (RPP), Learner Worksheet (LKPD), 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 syllabus, Learning Implementation Plan (RPP), Learner Worksheet (LKPD), 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 response, 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 assisted by 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. 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.

Curriculum 2013 provides access to learning experience for learners in developing themselves in various aspects both cognitive, affective, and psychomotor aspects. While Susilawani, Doyan, & Ayub (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 (SCIENCE). Physics 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 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 2 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.

One type of inquiry model is a guided inquiry learning model. In the guide inquiry model, teachers provide guidance and guidance for learners during learning activities. According to Simbolon (2015), the guide inquiry learning model is student-centered where teachers act as a guide for learners in solving problems through questions, helping students find ideas, concepts, and skills to gain new knowledge. The use of this model requires learners to conduct a series of investigations, explorations, searches, experiments, and research using various media or props.

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. Maryanti, Sonier, & Wahyudi (2011) states that composites are defined as a combination of two or more materials in which one material serves as an amplifier and the other material as a binder to maintain the unity of its elements.

The cylindrical and long palm fiber geometric shapes make composites stronger and capable of absorbing sound at a certain frequency. Palm fiber composites become one of the right media as silencers. 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, Mayub, & Rohadi (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, Soegimin, & Supardi (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 (RPP) transforms the synth of the guided injury 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, Fauzi, & Wulan (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.

**Methode**

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 (RPP), Learner Worksheet (LKPD), 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:

Eligibility criteria are determined based on the following Table 1.

**Tabel 1.** Instrument Validation Criteria

|  |  |
| --- | --- |
| Validation Percentage Value Range | Validation Level |
| **0-20** | Highly invalid |
| **21-40** | less valid |
| **41-60** | quite valid |
| **61-80** | Valid |
| **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:

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:

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

|  |  |
| --- | --- |
| Percentage Value Range | Practicality Level |
| **0-20** | Highly impractical |
| **21-40** | Less practical |
| **41-60** | Quite practical |
| **61-80** | Practical |
| **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:

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.

1. **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.

1. **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

| **Products** | **Percentage** | **Category** |
| --- | --- | --- |
| Syllabus | 89,2 % | Very Valid |
| Learning Implementation Plan | 89,0 % | Very Valid |
| Learner Worksheet | 84,0 % | Very Valid |
| Test Instruments | 87,4 % | Very Valid |
| Palm Fiber Composite Media | 87,3 % | Very Valid |
| 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). 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

|  |  |  |
| --- | --- | --- |
| **Device** | ***Percentage of Agreement*** | **Category** |
| Syllabus | 94,5 % | Reliabel |
| Learning Implementation Plan | 93,8 % | Reliable |
| Learner Worksheet | 92,4 % | Reliable |
| Test Instruments | 93,0 % | Reliable |
| Palm Fiber Composite Media | 93,0 % | Reliable |
| 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, Eliyati, & Festiyed (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

|  |  |  |
| --- | --- | --- |
| **Device** | **Average** | **Category** |
| Syllabus | 88,3% | Very Practical |
| Learning Implementation Plan | 88,7 % | Very Practical |
| Learner Worksheet | 86.7 % | Very Practical |
| Test Instruments | 85,7 % | Very Practical |
| Palm Fiber Composite Media | 82,7 % | Very Practical |
| 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

|  |  |  |
| --- | --- | --- |
| **Device** | **Average** | **Category** |
| How to Teach | 80,1% | Very Practical |
| Learner Worksheet | 80,0 % | Very Practical |
| Test Instruments | 82,4% | Very Practical |
| Palm Fiber Composite Media | 82,5% | Very Practical |
| 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

|  |  |  |
| --- | --- | --- |
| **Observer** | **Average** | **Category** |
| I | 95,31% | Very Practical |
| II | 94,89% | Very Practical |
| 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

|  |  |  |
| --- | --- | --- |
|  |  |  |
| **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 Sudirman Soegimin & Susanti research (2015) which concluded that inquiry-based physics learning devices are guided effectively to improve learner learning outcomes.

1. **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.

**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.

**References**

Arikunto, S. 2010. *Manajemen Penelitian*. Jakarta: Rineka Cipta

Ayuningtyas, P., Soegimin,W.W., & Supardi,I. 2015. Pengembangan Perangkat Pembelajaran Fisika Dengan Model Inkuiri Terbimbing Untuk Melatihkan Keterampilan Proses Sains Siswa SMA pada Materi Fluida Statis. *Pendidikan Sains Pascasarjana Universitas Negeri Surabaya*. Vol 4(2), 636-647.

Borich, G.D. 1994. *Observation Skill for Effective Teaching*. New York: Macmillan Publishing Company.

Chodijah, S., Fauzi, A., & Wulan, R. 2012. Pengembangan Perangkat Pembelajaran Fisika Menggunakan Model *Guided Inquiry* Yang Dilengkapi Penilaian Portofolio Pada Materi Gerak Melingkar. *Jurnal Penelitian Pembelajaran Fisika.* Vol 1(2012),1-9.

Dwipangestu,R., Mayub, A., & Rohadi, N. 2018. Pengembangan Desain Media Pembelajaran Fisika SMA Berbasis Video pada Materi Gelombang Bunyi. *Jurnal Kumparan Fisika*. Vol 1(1), 48-55.

Gunawan, G. 2015. *Model Pembelajaran Sains Berbasis ICT*. Mataram: FKIP UNRAM.

Iffah, N., & Sunarti, T. 2019. Keterlaksanaan Model Inkuiri Terbimbing Untuk Melatihkan Keterampilan Penyelesaian Masalah Peserta Didik Kelas X SMA. *Inovasi Pendidikan Fisika.* Vol 8 (20),623-626.

Maryanti, B., Sonier, A., & Wahyudi, S. 2011. Pengaruh Alkalisasi Komposit Serat Kelapa-Poliester Terhadap Kekuatan Tarik. *Jurnal Rekayasa Mesin*. Vol 2(2),123-129.

Nurdyansyah, N & Fahyuni, E. F. 2016. *Inovasi Model Pembelajaran.* Nizamial Learning Center: Sidoarjo.

Rahayu, C., Eliyati, E., & Festiyed, F. 2019. Kepraktisan Perangkat Pembelajaran Berbasis Model *Generative Learning* dengan Pendekatan *Open-ended Problem. Berkala Ilmiah Pendidikan Fisika*. Vol 7 (3),164-176.

Simbolon, D. H. 2015. Pengaruh Model Pembelajaran Inkuiri Terbimbing Berbasis Eksperimen Rill dan Laboratorium Virtual Terhadap Hasil Belajar Fisika Siswa. *Jurnal Pendidikan dan Kembudayaan.* Vol 21 (3),299-315.

Sudiarman,S., Soegimin, W.W., & Susanti,E. 2015. Pengembangan Perangkat Pembelajaran Fisika Berbasis Inkuiri Terbimbing Untuk Melatih Keterampilan Proses Sains dan Meningkatkan Hasil Belajar Pada Topik Suhu dan Perubahannya. *Pendidikan Sains Pascasarjana Universitas Negeri Surabaya.* Vol 4 (2), 658-671.

Sundayana, R. 2014. *Statistika Peneliian Pendidikan*. Bandung: Alfabeta.

Susilawani, S., Doyan, A., & Ayub, S. 2019. Pendekatan Keterampilan Generik Sains Antara Model Pembelajaran Berbasis Masalah dengan Inkuiri Terbimbing Ditinjau dari Kemampuan Berpikir Kritis Siswa SMA. *Jurnal Pendidikan Fisika dan Teknologi.* Vol 5(1),16-23.

Trianto, T. 2014. *Mendesain Model Pembelajaran Inovatif-Progresif*. Jakarta:Kencana Prenada Media Group.