# Development of science learning devices using the assisted inquiry model as aid of real media to improve process skills and the mastery concept

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**Submission date:** 14-Jun-2023 02:55AM (UTC-0500)
**Submission ID:** 2115813648
**File name:** Lamp._C-44_Prosiding_2023_2.pdf (1.07M)
**Word count:** 3269
**Character count:** 18238

RESEARCH ARTICLE | APRIL 28 2023

# Development of science learning devices using the assisted inquiry model as aid of real media to improve process skills and the mastery concept

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*AIP Conference Proceedings* 2619, 090001 (2023)
https://doi.org/10.1063/5.0122552

# Development of Science Learning Devices Using the Assisted Inquiry Model as Aid of Real Media to Improve Process Skills and the Mastery Concept

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**Abstract.** Science learning tools have been developed to improve science process skills and mastery of concepts using guided inquiry models and real media on optical devices for junior high school students in class VIII. Learning tools (Dick and Carey) have been prepared in the form of syllabus, lesson plans and student worksheets, science process skills, and concept understanding. The results of expert validation stated that the device was suitable for use for learning. The test of the effectiveness of science process skills obtained an N-gain of 0.72 and a conceptual understanding of 0.59. These two results state that learning tools can improve students' science process skills and conceptual understanding.

## INTRODUCTION

Students are expected to be able to build their potential with spiritual strength, independent personality, emotional control, a noble character so that they can build families, schools, communities, and countries [1].

In the era of globalization to be able to progress and appear independent, a student must have the skills to find concepts, have connections and competencies so that they can achieve the best educational quality [2].

Learning activities are one part of the educational process aimed at leading students towards a better life. Learning is a quality learning process that consists of quality components, namely teachers, students, teaching materials, methods, approaches, facilities, time, environment, and evaluation [3]. The teacher takes an essential role in creating a learning atmosphere so that the maximum possible achievement of learning outcomes and must pay attention to the obstacles faced in learning activities that can affect other components. So that the government pays great attention to teachers by paying attention to teacher professionalism to become quality teachers [4].

The phenomenon that occurs at Junior High Schools A and B in Mataram when learning science takes place is that learning is mostly filled using the lecture method, learning activities are completely controlled by the teacher so that students typically remember material but do not comprehend it, and they do not have a pleasurable learning experience. This phenomenon certainly has an influence on students' low learning outcomes, understanding of concepts, and even scientific skills possessed by students tend to be lower. One alternative is to create real learning media that can be used as a forum for teaching students materials that require learning experiences, conceptual understanding, and science process skills [5].

The teacher as the main actor who controls learning is of course required to create a pleasant learning atmosphere, namely by creating learning media that is able to attract students in learning. The learning media used, of course, must pay attention to the conditions of students and the development of science and technology.

*The 1st International Conference on Science Education and Sciences*
AIP Conf. Proc. 2619, 090001-1–090001-7; https://doi.org/10.1063/5.0122552
Published by AIP Publishing. 978-0-7354-4446-1/$30.00

One of the media that can be used is real media that is able to provide direct experience and learning to students so that it can enhance the understanding quality and learning attractiveness of students [6].

Learning media plays a vital part in helping students develop their knowledge and abilities by providing a learning environment. The use of real media has emotional and visual advantages that can provide learning meaning to students about the material being studied so that it can be easily remembered [7]. Real media can be documented in the form of pictures or videos which can then be used as learning media [8].

According to Onasanya, using real media in the classroom may allow teachers to communicate more effectively [9]. Arsyad argues that using real media in the classroom might increase students' enthusiasm for learning, inspire them, and influence their learning psychology [10].

Learning becomes fun when in learning activities the teacher can present phenomena that can be directly observed by students and involve them in learning. The selection of a learning model is one of the most determining parts of efforts to find innovative learning alternatives that can improve mastery of science process concepts and skills. One of the models recommended by education experts is the guided inquiry model [11].

Guided inquiry is a learning model designed to teach students how to research problems or questions about the facts that occur [12], [13]. Inquiry learning needs an environment that provides space for students to work, express opinions, make conclusions, and make hypotheses. This is needed because the success of learning depends on the thinking of students [14], [15]. Guided inquiry learning is student-centered so that it will actively be involved in the process of observing, measuring, and collecting data to be able to draw conclusions.

Agustina states that the mastery of the concept of science lessons is better than students who learn using other learning models [16]. Sabahiyah, Marhaeni, and Suastra conducted a study using a guided inquiry learning model to determine its effect on science process skills [5], [17] and conceptual mastery [18]. The findings revealed that using this guided inquiry model improved students' scientific process skills as well as their comprehension of topics.

According to the above description, the researcher created science learning tools that included real learning media to increase students' comprehension of concepts and science process skills on Light and Optical Equipment at Junior High Schools A and B in Mataram.

### Context and Review of Literature

Guided inquiry learning is a learning model that allows students to be analytical in identifying and finding their own solution to a problem asked based on student inquiry so that they can become scientific concept builders. The inquiry learning model can be defined as a learning model that invites students to solve problems they find themselves. Inquiry is a process of obtaining information by observing or formulating problems using critical and logical thinking skills. Theoretically, the guided inquiry learning model is an effective solution for science learning activities because students are actively exploring, observing, and studying throughout the learning process [11, 20, 23].

## METHOD

Metode pengembangan Dick and Carey menggunakan kognisi, behaviorisme, konstruktivisme dalam perspektif pembelajaran yang dibagi dalam sepuluh tahapan berupa; mengembangkan tujuan pembelajaran, menganalisis siswa dan konteks, menganalisis instruksi, mengidentifikasi tujuan pembelajaran, merumuskan alat atau instrumen, membuat strategi pembelajaran, memanfaatkan bahan ajar, merancang dan mengimplementasikan evaluasi formatif, merevisi draf program pembelajaran, merancang, mengevaluasi sumatif [22, 23].

**TABLE 1**. Scoring questionnaire instruments.

| Answer | Score |
|---|---|
| Very Less | 1 |
| Less | 2 |
| Enough | 3 |
| Good | 4 |
| Very Good | 5 |

In addition, the validation score is determined using the formula:

$$P_{(k)} = \frac{S}{N} \times 100\% \quad (1)$$

Where:
N = Maximum number of scores
P(k) = Percentage of components
S = The total score of the research results component

The resulting percentage is then translated into the intervals as given in Table 2.

**TABLE 2.** Percentage ranges and qualitative criteria.

| Percentage (%) | Criteria |
|---|---|
| 20-36 | Very Less |
| 37-52 | Less |
| 53-68 | Enough |
| 69-84 | Good |
| 85-100 | Very Good |

The indicators used in this study, if the validator gives sufficient judgment, then the learning tools can be used. To observe the improvement in students' understanding of the concepts and process skills of the science process, the N-Gain formula is used as follows [24], [25].

$$\mathrm{N-gain} = \frac{\mathrm{S_{post}} - \mathrm{S_{pre}}}{\mathrm{S_{max}} - \mathrm{S_{pre}}} \times 100\% \quad (2)$$

The N-Gain score criteria table can be seen in Table 3 below.

**TABLE 3.** Criteria for gain score

| **Gain Score Classification** | **Category** |
|---|---|
| $\boldsymbol{g \leq 0.3}$ | Low |
| $\boldsymbol{0.3 < g \leq 0.7}$ | Middle |
| $\boldsymbol{0.7 < g \leq 1}$ | High |

## RESULT AND DISCUSSION

Three media and material experts validated the developed media. General and special appearances, as well as media presentation, are the three key components that are used to validate a product. Table 4 below shows the validator's final validation data.

**TABLE 4.** Summary of the results of portable auto design microscope validation

| Sistem of Assessment Aspects | Score (%) |
|---|---|
| Sistem of General View | 97.09 |
| Sistem of Special Look | 98.78 |
| Sistem of Presentation of Media | 96.33 |
| Average | 95.78 |
| Criteria | Strongest |

The portable auto-design digital microscope developed in this study see in Figure 1.

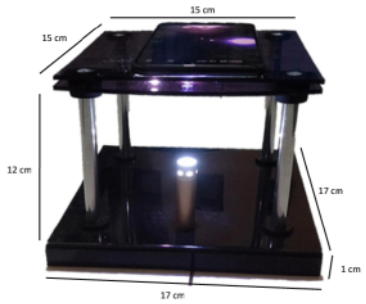


**FIGURE 1.** Design of digital Microscope Portable Auto

The findings of test validity instrument analysis are demonstrated in Table 5.

**TABLE 5.** The results of the learning device validity test.

| Assessment aspects | Score (%) | Criteria |
|---|---|---|
| Sistem of Syllabus | 92.44 | strongest |
| Sistem of Lesson plan | 92.59 | strongest |
| Sistem of Student worksheets | 96.00 | strongest |
| Concept Mastery Assessment Instrument | 85.71 | strongest |
| Scientific Creativity Assessment Instruments | 85.71 | strongest |
| Average | 89.14 | strongest |

The generated learning tools are then applied to learning with the objective of assessing students' capacity to master concepts and science process skills. The parameters for determining the efficacy of this learning device are improvements in pretest and posttest scores on the conceptual mastery and science process skills. Table 6 shows the outcomes of the pretest and posttest.

**TABLE 6.** Concept mastery test results.

| School | pretest | posttest | N-gain |
|---|---|---|---|
| Junior High School A | 50 | 79 | 0.58 |
| Junior High School B | 48 | 82 | 0.65 |
| Average | 49 | 80.5 | 0. 62 |

Figure 2 shows a comparison of the pretest and posttest findings based on the data from Table 6.

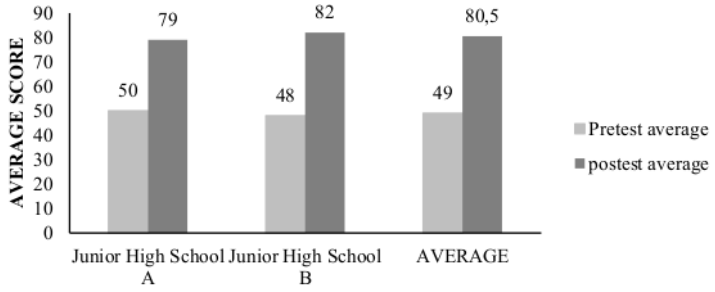


**FIGURE 2.** Average of concept mastery pretest and posttest.

Learning tools with guided inquiry models may assess students' science process skills in addition to their ability to master subjects. Table 7 shows the study's findings.

**TABLE 7.** Science Process Skills Test Results

| School | Pretest | Posttest | N-Gain |
|---|---|---|---|
| Junior High School A | 42.74 | 80.91 | 0.67 |
| Junior High School B | 39.61 | 86.48 | 0.78 |
| Average | 41.17 | 83.70 | 0.72 |

Figure 3, is results of assessments pretest and postest

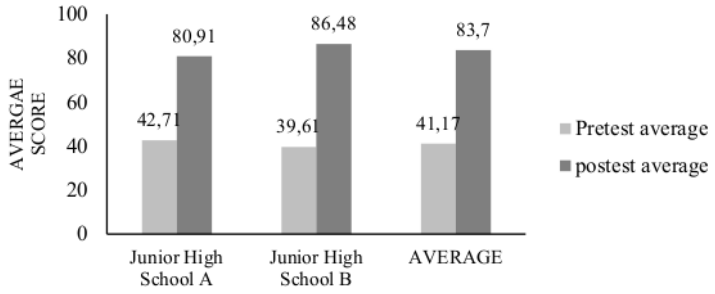


**FIGURE 3.** Average pretest and posttest Science Process Skills.

## Discussion

The validation results from material and media experts suggest that the media should be given the title of description, how to use and maintain. The validation process uses the main criteria of general and special appearance and data presentation. The results of the device validity test conducted by 4 expert validators were categorized as very suitable for use were demonstrated in Table 5. Rajabi, Ekohariadi, and Buditjahjanto argue that learning tools that have appropriate criteria are used if the tools developed have consistency between the indicators and the learning goals to be accomplished [26]. Mustami and Irwansyah state that the learning device is said to be feasible if the assessment of the expert validator shows that the learning device is developed according to strong theory and has consistency, namely the interrelationship between its components [27].

The number of participants was 144 people which were divided from 80 students of SMP A and 64 students of SMP B. The average N-gain value of 0.6 obtained from the results of the concept mastery test showed that the learning tools were quite good, which can be seen from table 6. [28,29].

The findings of this study are similar to those of Kurniawan's research which found that the use of guided inquiry learning models with real media could improve students' understanding [30]. Ristanto in his research states that learning using real media will help students understand the environmental situation and the problems they face, making it easier for them to understand the concept of learning. This expert opinion is in accordance with the research results shown in Figure 2, using a guided inquiry model based on real media to increase students' knowledge of bright ideas.

Guided inquiry learning encourages students to search for knowledge and ideas from a variety of sources to get a better grasp of issues and topics [32]. Bell also stated that the guided inquiry learning model can help students improve their investigative skills by teaching them how to gather and analyze information so that they can create their own conclusions to solve questions or problems posed by the teacher (the teacher provided research question) [33]. As a result, the guided inquiry learning model may be considered to increase students' conceptual mastery.

The pretest and posttest assessments are shown in Figure 3. Table 7 shows a significant mean score for the pretest and posttest of science process skills, describing how the guided inquiry learning model in real media is very helpful for students in learning [34].

The acquisition of an improvement in science process skills is strongly influenced by the steps of the learning activities carried out. Students who have never previously done experiments are now accustomed to doing experiments and observing what is being done, so they are able to formulate problems that must be resolved and draw conclusions from what has been done [35].

According to Trianto, the guided inquiry learning model requires students to think methodically, rationally, and critically to the maximum extent possible so that they may articulate and reach their own conclusions. Students

may be taught to solve issues via scientific investigation using this learning model [36]. Based on the findings of Smith, Desimone, Zeidner, Dunn, Bhatt, and Rumyantseva's research, guided inquiry demonstrates active learning activities such as observing, questioning, collecting information, planning research, utilizing tools and materials, analyzing and interpreting data, and communicating the obtained data [11], [37].

## CONCLUSION

The learning tools developed are very helpful in the science process skills of students in the two schools which can be seen from the improvement of science process skills and concept understanding

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