The implementation of guided inquiry model on the subject matter harmonious vibration

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Abstract. The low level of science process skills and scientific attitudes of students is because students are accustomed to getting information from teachers and learning that takes place only in one direction. Therefore, this study aims to improve students' scientific attitudes and process skills through a guided inquiry model. The specific purpose of this study was to describe the implementation of lesson plans, science process skills, scientific attitudes, and learning outcomes of students. This study was a class action research model Kemmis and Mc Taggart consisting of 2 cycles. The subjects of this study were 34 students of class X-3 SMA Negeri 4 Banjarmasin. Data obtained through observation, tests, and documentation. The results showed: 1) the implementation of the lesson plan was categorized very well with a percentage of 90% and 96%; 2) students' science process skills increase from an average score of 2.60 with a skilled category to 3.28 with a highly skilled category; 3) the scientific attitude of students also increased from an average score of 2.04 with a good category to 2.63 with a very good category; 4) student learning outcomes increase from classical completeness 50% to 85%. It was concluded that the science process skills and scientific attitudes of students increased after applied guided inquiry learning models on harmonious vibration material.

1. Introduction
Science becomes a process, including the skills and attitudes that exist in the scientist in working scientifically [1]. Science process skills must be possessed by students to face competition in the globalization era, which requires students to be able to solve specific problems [2]. Science process skills are able to optimize cognitive abilities and various other competencies [3]. The development of these skills will train students to be able to discover and develop their own facts and concepts as well as to improve and develop the attitudes required so that for effectiveness in learning physics, students must have science process skills[4]. Therefore, it is important for students to have science process skills in learning physics.

Student success in learning apart from being influenced by external factors is also influenced by internal factors, including scientific attitude [5]. Physics learning is conducted by using scientific inquiry to develop the ability to think, work, have scientific attitude, and communicate which are the life skills aspect [6]. Scientific attitude is the attitude shown by scientists when they carry out various scientific activities related to their profession as a scientist [5]. Students with high scientific attitude, have a great curiosity and are motivated in learning [7]. Therefore, scientific attitude must be possessed by students in learning physics.
However, in fact, scientific process skills and scientific attitudes have not been optimized in the learning process. Based on the results of the scientific attitude questionnaire at one of the high schools in Banjarmasin, 60% of students were curious, open thinking 57%, respect for data 55%, perseverance 58%, critical thinking 53%, and student cooperation 65%. The average scientific attitude of these students is 58%. So it can be concluded that the scientific attitude of students is still lacking and needs to be improved again. The results obtained through worksheets obtained by students' scientific process skills are only 25% students who can formulate problems, 26% students can formulate hypotheses, 26.4% students can determine the identification of variables, 25% students can analyze and students who can conclude the results of experiments by 27%. The average of the science process skills is 25.8%; this condition shows that the students' science process skills are still lacking. Based on the results of an interview with one of the Physics subject teachers, it was found that students were not accustomed to using practicum tools and were often confused when filling students' worksheets related to science process skills procedures and steps for practicum, because that had an impact on attitudes students' scientific knowledge is still lacking.

The guided inquiry learning model is one of the learning models that can increase students' active participation in the learning process [8]. In the guided inquiry model, teachers and students collaborate with each other and work together to develop ideas of knowledge [4]. The inquiry model means a series of learning activities that maximally involve all students' abilities to search and investigate systematically, critically, logically, and analytically so that students can formulate their own findings with confidence [9]. Guided inquiry learning model makes students able to freely develop concepts that are found and studied so that it is not just material that is only rewritten then memorized, but students are given the opportunity to brainstorm in solving problems faced [1,8]. Thus, this model fosters scientific attitudes and students' science process skills, and longer learning imprints because students are directly involved in the learning process and knowledge becomes long-lasting and easy to remember.

Previous research using the guided inquiry model can improve students' science process skills [10–13]. Other research also shows that the guided inquiry model is able to train students' scientific attitudes [6,14,15]. Therefore, this study not only measures the science process skills but also the scientific attitude of students by applying the guided inquiry model to class X-3 students of SMA Negeri 4 Banjarmasin. The focus of this research is to describe the improvement of science process skills and scientific attitudes of students through guided inquiry learning models on harmonious vibrational material in class X MIPA 3 of SMA Negeri 4 Banjarmasin.

2. Method
This research was a class action research. This research consisted of two cycles, each cycle consisting of four steps, namely planning, implementing actions, observing, and reflecting [16]. The research subjects were 34 students of class X MIPA 3 of SMA Negeri 4 Banjarmasin consisting of 11 men and 23 women. Data analysis collection techniques used were observation and tests. The science process skills of students were analyzed on the average system. The average score obtained was then interpreted into a category [17]. Achievement of scientific attitudes was obtained from the observer sheet filled by two observers during the learning process. The mean score obtained was then adjusted according to category [18]. An indicator of the success of this study was the increase in science process skills and scientific attitudes of students at each meeting. This was also supported by 1) The implementation of lesson plan was at least categorized as good, 2) The science process skills of the students were at least categorized quite skilled, 3) The scientific attitude of the students was at least categorized quite good, and 4) Classical completeness is achieved, i.e., at least 75% of students complete individually.

3. Result and Discussion

3.1. Observation Results on the Implementation of Lesson Plans
The phase of the inquiry model used consists in orienting students to the academic problem (M1), preparing the experiment and explaining the steps of the experiment (M2), guiding students to experiment (M3), guiding students to do abstraction (M4), guiding students to reflect (M5), and concludes learning and reminds students to learn the next material (M6). The results of the implementation of the lesson plan for each cycle can be seen in Table 1.

| Learning Phase | Cycle I  | Cycle II |
|----------------|---------|---------|
|                | Learning I | Learning II | Learning I | Learning II |
| M1             | 92% (Very Good) | 96% (Very Good) | 98% (Very Good) | 100% (Very Good) |
| M2             | 85% (Very Good) | 100% (Very Good) | 95% (Very Good) | 100% (Very Good) |
| M3             | 86% (Very Good) | 90% (Very Good) | 84% (Very Good) | 89% (Very Good) |
| M4             | 79% (Good) | 79% (Good) | 94% (Very Good) | 100% (Very Good) |
| M5             | 67% (Good) | 88% (Very Good) | 84% (Very Good) | 88% (Very Good) |
| M6             | 96% (Very Good) | 63% (Good) | 100% (Very Good) | 100% (Very Good) |
| Reliability    | 0.81 (High) | 0.88 (High) | 0.83 (High) | 0.87 (High) |

This increase occurs because the teacher has been able to optimize lesson time, and students are also familiar with the guided inquiry learning model so that the learning process is easier to do.

3.2. Science Process Skills

Recapitulation of students' science process skills data based on student worksheets and observer observation sheets in cycle I can be seen in Table 2.

| Science Process Skills | Cycle I Learning I | Cycle I Learning II | Cycle II Learning I | Cycle II Learning II |
|------------------------|-------------------|-------------------|-------------------|-------------------|
| Observe                | 3.07              | 3.67              | 2.89              | 3.13              |
| Formulate the Problem  | 3.14              | 3.72              | 3.63              | 3.44              |
| Experiment             | 3.36              | 3.61              | 3.20              | 3.45              |
| Analyzing Data         | 0.73              | 2.61              | 3.19              | 3.05              |
| Summing up Data        | 0.08              | 2.50              | 3.30              | 3.50              |
| Communicating          | 2.10              | 2.60              | 3.20              | 3.39              |
| Average                | 2.08              | 3.12              | 3.24              | 3.33              |
| Category               | Simply Skilled    | Skilled           | Very Skilled      | Very Skilled      |

Improved science process skills occur because of using the guided inquiry learning model. This is because this model can create a learning environment that allows the development of students' science process skills. This is consistent with previous research, which states that the application of guided inquiry learning models can improve and provide a significant influence on students' science process skills [10–13,19–24].
Inquiry-based science education, children become engaged in many of the activities and thinking processes that scientists use to produce new knowledge [25]. Students in learning become more active in conducting activities of observation, clarifying, predicting, measuring, and concluding. So students engage in learning and get hands-on learning experiences [26]. This is consistent with Bruner's theory, which suggests that students learn actively to develop concepts and principles. Besides that through experimental activities can increase students' knowledge and skills in real terms [27]. The guided inquiry learning model is a learning model that directs students to activities that can develop science process skills. Students are guided to investigate themselves about a science concept so that the knowledge and skills possessed by students are not the results of remembering a set of facts but rather the results that students themselves investigate [28].

3.3. Scientific attitude

Recapitulation of students' scientific attitude data based on student worksheets and observer observation sheets in cycle I can be seen in Table 3.

| Scientific attitude              | Cycle I | Cycle II | Cycle I | Cycle II |
|---------------------------------|---------|----------|---------|----------|
|                                 | Learning I | Learning II | Learning I | Learning II |
| Curious attitude                | 1.63    | 2.30     | 2.60    | 2.67     |
| The attitude of discovery       | 1.49    | 2.41     | 2.63    | 2.69     |
| Critical thinking attitude      | 1.07    | 1.81     | 2.56    | 2.49     |
| Firm attitude                   | 1.97    | 2.45     | 2.63    | 2.79     |
| Average                         | 1.54    | 2.24     | 2.61    | 2.66     |
| Category                        | Quite Good | Good     | Very Good | Very Good |

The guided inquiry model directs students to find knowledge through scientific work processes. The habit of scientific work is expected to foster the habit of thinking and acting to reflect the mastery, skills, and scientific attitudes students possess. This is in line with previous research, which concluded that the guided inquiry learning model could improve students' scientific attitudes [23,29,30]. Students become more motivated when learning to find something by themselves, rather than listening to what the teacher says [7]. Also, scientific attitudes are fostered and developed through guided experiments conducted by students [15]. It can train and encourage students 'scientific attitudes such as curiosity, critical thinking, cooperation, respect for friends' findings, and others.

3.4. Learning outcomes

Recapitulation of student learning outcomes data based on learning outcomes tests can be seen in Table 4.

| Learning outcomes | Cycle I | Cycle II |
|-------------------|---------|----------|
|                   | Clear   | Not Clear| Clear   | Not Clear|
| The number of students | 17 | 17 | 29 | 5 |
| Classical completeness | 50% | 85% |

The advantage of using the guided inquiry learning model is that in the delivery of guided inquiry learning materials, direct activities and experiences are used. Improving student learning outcomes in accordance with Piaget's theory of development that applied-learning is able to encourage students to build knowledge for themselves through observation and experimentation [31]. Guided inquiry learning is group learning where students are given the opportunity to think independently and help one another.

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with other friends [26]. This is also supported by the results of previous studies known that the application of guided inquiry learning in science lessons can improve student learning outcomes [10,19,22,24,32]. This learning will be more meaningful if students can investigate for themselves the concepts to be learned through the scientific process. Thus the knowledge obtained by students will be remembered longer and have a positive impact on student learning outcomes. Students are able to relate concepts learned, so they have skills that enable them to solve life's problems and challenges [30].

4. Conclusion
The conclusion of this study is that the application of guided inquiry learning models can improve the science process skills and scientific attitude of students of X MIPA 3 in SMA Negeri 4 Banjarmasin. To improve students 'scientific process skills and scientific attitudes done in the following way (a) the teacher designs learning tools and instruments using guided inquiry learning models on harmonious vibrational material to improve students' scientific process and scientific attitude skills; (b) the teacher carries out each phase of the guided inquiry learning model that has been designed; and (c) based on the reflection of cycle I, in cycle II there are several phases that are more optimized namely the phase of guiding students to do an experiment, the phase of guiding students to do abstraction and guiding students to reflect on activities that train science process skills.

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