The implementation of guided discovery learning model to improve students' characters of responsibility and academic skills

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Abstract. The low level of responsibility and academic skills can hinder students in developing all their potentials to obtain more meaningful information and stay on one’s memory. Thus, research was conducted to improve the character of responsibility and the academic skills of Grade XI Science 1 students at SMA Negeri 12 Banjarmasin. This type of research is a class action model adapted from Kemmis and Mc Taggart, consisting of 2 cycles. Each cycle includes planning, implementation/observation, and reflection. The research subjects involved were 23 pupils. Observation and tests were conducted to collect the data needed. The instruments used were observation sheets on the implementation of the Learning Implementation Plan. Observation sheets were utilized to analyze student responsibility characters, science process skills tests, and cognitive ability tests. Data were analyzed descriptively. The findings of the research instruments from cycle I to cycle II stated: (1) the implementation of the Learning Implementation Plan in the first cycle of the first meeting obtained a score of 79.43% (good), and the second meeting received 85.36% (very good). In the second cycle, the first meeting got 91.73% (excellent) and the second meeting achieved 93.17% (very good); (2) The average level of student responsibility in cycle I and cycle II increased from 65.81% (high) to 81.42% (very high); (3) Students' science process skills in cycle I and cycle II also increased from 0.58 (quite skilled) to 0.92 (very professional); (4) The classical cognitive ability of students in cycle I and cycle II increased from 78.26% (completed) to 100% (completed). It was concluded that the guided discovery learning model helped improve students' responsibility and academic skills.

1. Introduction

Learning must be comprehensive, covering all aspects of affective, psychomotor, and cognitive. Responsibility is one branch of the affective element that schools must teach [1–3]. Humans who have a responsible character can be aware of their behavior and actions, whether intentional or unintentional [4,5]. Therefore, the nature of responsibility is a person's attitude and efforts to do what should be done for oneself, society, environment, the State, and God Almighty. Hence, the character of responsibility is needed by every individual in everyday life [6].

One aspect directly related to the learning process that greatly determines student success in school is cognitive development. Cognitive development relates to the perception, way of thinking, memory, language skills, and information processing which all enable a person to acquire knowledge, solve
problems, and plan for the future- in other words; it is all psychological processes related to how individuals learn, pay attention, observe, imagine, estimate, assess, and think about the environment [7].

Learning in schools is not only taught by delivering information from teachers or other learning resources, such as books. However, it must also be integrated through activities that emphasize actual activities, including observations, experiments, or trials. These activities are a means of transferring information/knowledge and training various process skills. Science process skills are used to understand what phenomena have occurred. These process skills are needed to acquire, discover, develop, and apply scientific concepts, principles, laws, or theories [8–10].

In general, the primary source of information during the learning process in the classroom tends to be dominated by the teacher, which results in students becoming less actively involved in the learning process [11]. As a result, students have difficulty understanding the concepts and principles of physics (cognitive domain). In addition, students' lack of courage to take the opportunity to ask questions is also a problem that causes them to have difficulties in understanding the lesson. It can be seen from the results of the physics tests given to students of grade XI Science 1 SMA Negeri 12 Banjarmasin in the 2016/2017 academic year during the odd semester. The tests showed that as many as 82.60% of students obtained scores below the minimum completeness criteria that have been set, which was 75. In addition, the average final exam scores of the 23 students in grade XI Science 1 SMA Negeri 12 Banjarmasin was 58.76. These results indicated that students' cognitive abilities in XI Science 1 SMA Negeri 12 Banjarmasin are still relatively low.

The absence of attention on character education (affective domain) in learning activities raises concerns regarding the long-term impact on students. This is supported by the results of the researcher's observations on the level of student responsibility when the teacher teaches. The data indicated that: 2 people were categorized in the very high category, four people were in the high category, six people were included in the reasonably high category, nine people in the low category, and two were categorized in the deficient category. This indicates that the character of student responsibility at the time of learning is still relatively low. Therefore, the researchers aim to increase student responsibility during the learning activities.

Another problem in learning physics that was not focused on was the weakness of students' science process skills. This was reflected in the results of TIMSS (Third International in Mathematics and Science Study), which indicated the ability of Indonesian students in the science field to rank 45th out of 48 countries [12]. One of the reasons is that science learning has been more oriented to the content of science materially rather than the process of science itself. Based on the initial data collection results carried out in grade XI Science 1, the students' science process skills were very low, with an average of only 20%. Therefore, this research also aimed to improve students' science process skills. Thus, to overcome the problems above, an appropriate learning model is needed to develop character and improve science process skills and students' cognitive abilities. One of the learning models that can be used is the guided discovery learning model.

Several existing studies have proven that discovery learning models could develop responsibility, effectively improve students' cognitive learning outcomes, and improve students' science process skills [13–15]. Therefore, research was conducted on applying the guided discovery learning model to enhance students' character of responsibility and academic skills. This study aimed to describe the application of the guided discovery learning model to improve students' character of responsibility and academic skills.

2. Method
The type of this research is Classroom Action Research which was adapted from the Kemmis and Mc Taggart model. The model consists of 2 cycles, in which each cycle is carried out in 2 meetings. Each cycle consists of three stages, namely planning, implementing and observing, and reflecting.

The research subjects involved in this study were 23 students of grade XI Science 1 SMA Negeri 12 Banjarmasin. The techniques used to collect data in this study were observation and tests. Observations were conducted to obtain data on the implementation of guided discovery learning model lesson plans and the character of students' responsibility. Partner teachers and one research colleague carried out
observations of the performance of the lesson plans. Three research colleagues carried out words of the character of responsibility. The test was conducted to collect data on science process skills and cognitive abilities.

The tools and instruments used in this research are Learning Implementation Plans, teaching materials, Student Activity Sheets, observation sheets, science process skills tests, and cognitive ability tests.

The lesson plan implementation data were analyzed descriptively quantitatively with the percentage technique. The percentages obtained are further categorized according to the criteria [16] shown in Table 1. To calculate the reliability of the lesson plan implementation between two observers, Cronbach's Alpha formula is used (Ratumanan and Laurens, 2011).

| No. | Percentage | Criteria  |
|-----|------------|-----------|
| 1.  | \( P \leq 20 \) | Very Poor |
| 2.  | \( 20 < P \leq 40 \) | Poor      |
| 3.  | \( 40 < P \leq 60 \) | Fair      |
| 4.  | \( 60 < P \leq 80 \) | Good      |
| 5.  | \( P > 80 \)   | Very Good |

The assessment of the level of student responsibility observed during the learning process is expressed in a percentage. The percentages obtained are further categorized according to the criteria shown in Table 1.

The data of students' science process skills were analyzed descriptively quantitatively. The data were expressed in the form of scores. The science process skill scores obtained were further categorized according to the criteria [16] in Table 2.

| No. | Score  | Criteria         |
|-----|--------|------------------|
| 1.  | \( P \leq 0.2 \) | Poor Skilled     |
| 2.  | \( 0.2 < P \leq 0.4 \) | Low Skilled     |
| 3.  | \( 0.4 < P \leq 0.6 \) | Quite Skilled   |
| 4.  | \( 0.6 < P \leq 0.8 \) | Skilled         |
| 5.  | \( P > 0.8 \)   | Highly Skilled  |

Cognitive ability test data were analyzed individually and classically. Mastery learning individually seen from the achievement of scores obtained according to the Minimum Completeness Criteria set by SMA Negeri 12 Banjarmasin was \( \geq 75 \).

This action research is considered successful if the implementation of the lesson plans at least results in the excellent category, the character of the minimum responsibility are categorized in the reasonably high category, the science process skills are at least included in the quite skilled in the category, and the classical completeness of the cognitive ability test is at least 75%.

3. Result and Discussion

3.1 The Implementation of the Lesson Plan

The data recapitulation of the lesson plan implementation for each meeting is based on the observation sheet as shown in Figure 1.
Figure 1. Implementation of the Learning Implementation Plan for each meeting

Overall, the implementation of the lesson plan has increased from the good category to the outstanding category. Although each phase has been carried out under the very good category, in phase 1, during Stage 3 and 4, Meeting 1, which focused on motivating students and reminding students of previous learning, was still categorized as good. This was due to the lack of preparation made before the learning activities took place. In addition, phases 2 and 3 were not following the time allocation previously determined in the Lesson Plan. The teacher took too much time in phases 2 and 3 to guide students who were still having difficulties collecting data, analyzing data based on experimental data obtained, and making conclusions based on the results of data analysis. Students were still in the adjustment phase with learning activities that integrated the guided discovery learning model, which was the first time it was applied in the class. Actions taken by the researchers as an effort to improve in cycle II, namely preparing as well as possible, during the time of motivating and reminding students of the previous meeting, researchers should pose problems related to the material discussed through simple questions related to everyday life. In addition, the researchers should try to improve their time management, primarily during phases 2 and 3. Each stage in the Lesson Plan could be carried out by the time allocation that was previously planned in the Lesson Plan and enable the learning activities to run smoothly.

Overall, the average score of the implementation of the lesson plans in cycle II increased from 91.72% (meeting 1) to 93.16% (meeting 2), which was categorized in the outstanding category. All phases in cycle II were carried out under the scale of the outstanding category, following the time allocation specified in the lesson plan, and met the indicators of success. The average implementation of the lesson plans as a whole in cycle I and cycle II have increased. Thus, the efforts made by researchers according to the results of the reflection of the cycle I succeeded in expanding the implementation of the lesson plan cycle II as a whole, and the performance of all phases in the lesson plan in cycle II had met the indicators of success.

The efforts made by the researchers in preparing the lesson plans in cycle II were based on the results of the reflection conducted during the process I. It resulted in an increase in the implementation of each phase in the lesson plan and helped to achieve the established success indicators. This was in accordance with the statement of Suprihatiningrum [17], in which the learning process would run smoothly, learning objectives could be achieved optimally, and the success of learning itself could be described if it is planned as well as possible. Sumantri [18] also stated that good learning planning would result in a good learning process. The description above showed that the implementation of the lesson plans always
increases at each meeting in the research cycle. In addition, in cycles, I and II, all phases in the lesson plan had been implemented in an excellent category and met the indicators of research success.

### 3.2 Character of Responsibility

The data recapitulation based on the student responsibility level observation sheet in each cycle is shown in Figure 2.

![Figure 2. The Student Responsibility Level in Each Cycle](image)

The recapitulation of the achievement of each responsibility criterion in cycles I and II is shown in Table 3.

| Responsibility Characteristic | Cycle 1 Percentage (%) | Category | Cycle 2 Percentage (%) | Category |
|------------------------------|------------------------|----------|------------------------|----------|
| Self-discipline              | 100.00%                | Very high| 100.00%                | Very High|
| Compliance                   | 57.61%                 | Quite High| 78.26%                | High     |
| Persistent                   | 100.00%                | Very High| 100.00%                | Very High|
| Giving the best effort       | 44.93%                 | Quite High| 55.07%                | Quite High|
| Applying Self-control        | 76.09%                 | High     | 97.83%                 | Very High|
| Thinking before acting       | 91.30%                 | Very High| 100.00%                | Very High|
| Responsible towards choices  | 78.26%                 | High     | 91.30%                 | Very High|

Based on Table 3, it appears that the achievement of all responsibility criteria meets the indicators of success. In addition, the description above shows that learning by applying the guided discovery learning model has succeeded in increasing the character of students' responsibility, following several research results that state that using physics learning tools oriented to the guided discovery learning approach is proven to develop the level of commitment [14,19,20]. In addition, this was also by the opinion of Carin [21], which stated, "...through discovery learning students are guided and encouraged to become more independent, self-directed, and responsible for their learning...".

### 3.3 Students' science process skills

The recapitulation of the students’ science process skills achievement in cycles I and II for each category is shown in Table 4.

| Students’ Science Process Skills | Cycle 1 Percentage (%) Categories | Cycle II Percentage (%) Categories |
|---------------------------------|----------------------------------|----------------------------------|
|                                 | HS | S | FS | LS | PS | HS | S | FS | LS | PS | S | FS | LS | PS |
| Formulating Hypotheses          | 4.35 | 69.56 | 26.09 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Identifying Variable            | 30.43 | 43.48 | 26.09 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Analyzing Data                  | 0.00 | 0.00 | 0.00 | 100.00 | 0.00 | 17.39 | 78.26 | 4.35 | 0.00 | 0.00 | 0.00 |
| Drawing Conclusion              | 47.83 | 8.69 | 0.00 | 43.48 | 0.00 | 95.65 | 4.35 | 0.00 | 0.00 | 0.00 | 0.00 |
| Formulating Hypotheses          | 4.35 | 69.56 | 26.09 | 0.00 | 0.00 | 100.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |

Note: HS = Highly Skilled; S = Skilled; FS = Fairly Skilled; LS = Low Skilled; PS = Poorly Skilled
Based on Table 4 above, it appears that the achievement of all aspects of students' science process skills in cycle I for each category has met the indicators of success, namely at least categorized in the category of quite skilled, except for the skills of analyzing data and making conclusions. There are still skills classified as less experienced, namely analyzing data and making conclusions, which received 100% and 43.48%, respectively.

Based on the deficiencies that occur, the efforts made by researchers as improvements in cycle II are needed to improve students' abilities in analyzing data and concluding experimental data. These efforts provided guidance and emphasized the steps that students must consider and carry out before studying and completing experimental data. Skills in analyzing data, the teacher said, was what needs to be done to investigate the practical data table, describe the experimental data into sentences that explain the influence of the manipulation variable on the response variable following the problem formulation, hypothesis formulation, and guiding questions that have been provided, relate the data description using the appropriate mathematical equation, and explain the mathematical equation while connecting it to the manipulation, response, and control variables. Skills in concluding data, the teacher conveys, were that the data is completed to data analysis and the formulation of hypotheses. It must answer the formulation of the problem.

Aspects of science process skills that have met the indicators of success need to be further improved. Therefore, in cycle II, the researcher reduces the guidance when students formulate hypotheses and identify variables. It aims to make students more proficient in developing hypotheses and identifying variables.

Based on Table 4, the achievement of all aspects of students' science process skills in cycle II for each category has met the indicators of success. In addition, the percentage of achievement of all aspects of students' science process skills in cycle II for each category also increased.

Based on the results obtained, it indicates that the efforts made by the researchers by trying to guide the form of direction and emphasis on the steps that must be taken by students before analyzing data and making conclusions inflicted a positive impact, namely the achievement of aspects of data analysis skills and making conclusions, that have finally met the indicators of success. Biggs [22], which states if teachers want students to understand the information they have learned, teachers must help students build their meanings from the information they have learned. This is following the results of research, which states that through discovery learning, students are encouraged to order to be able to find information or knowledge based on the materials that have been provided. The teacher acts as a facilitator to guide until the students can use the ideas, ideas, and skills learned to find new information or knowledge [23].

Efforts made by researchers by reducing guidance when students formulate hypotheses and identify variables also positively impacted students. Students become more proficient in developing ideas and identifying variables, as seen from the increase in the percentage of skill aspect achievement. This is following Lev Vygotsky's constructivist learning theory, namely scaffolding, which describes that students are given a large amount of guidance and assistance during the early stages of learning, then reduce the advice and assistance to provide opportunities for students to take on greater responsibility as soon as they can do something. The task independently [24].

Referring to the above explanations, it can be concluded that the application of the guided discovery learning model has succeeded in improving students' science process skills. This is aligned with the research results, which states that the application of physics learning tools oriented to guided discovery learning has proven to improve students' science process skills [13,25–28].

3.4 Student cognitive abilities
The recapitulation of student cognitive abilities for each cycle is shown in Figure 3.
Figure 3. The Student Cognitive Abilities for Each Cycle

The mastery of students' cognitive abilities in the first cycle can be seen in Figure 3. The cognitive abilities of students in cycle II have met the indicators of success with the percentage of students who completed classically at 100%. The classical students' cognitive skills in cycle I and cycle II increased from 78.26% (completed) to 100% (completed). Thus, the application of the guided discovery learning model succeeded in improving students' cognitive abilities. This follows Bruner's opinion, which states that through discovery learning, a person has broad opportunities to build their knowledge so that their intellectual potential will increase. Bruner claims that students are not mere listeners. He believes that children learn best when they are actively involved in hands-on and mind-on activities. The discovery approach provides broad opportunities for students to organize and manage the information found through their investigations so that the information obtained or the concepts built are more meaningful, which ultimately affects students' cognitive abilities [21].

Thus, through discovery learning, students are allowed to learn deeper so that the facts/concepts/principles/theories/laws learned through the discovery process become more meaningful and can be understood in-depth to ensure that they can last a long time in the students' memories. The learning process using the guided discovery learning model effectively improved cognitive learning outcomes [15]. Several other studies also show that the application of discovery learning impacts student learning outcomes that are getting better [29–32].

The researchers' efforts to immediately share the results of cognitive ability tests to students, provide feedback and reinforcement, and distribute prizes to students who have passed contribute positively to improving students' cognitive ability test results. In accordance with the results of research by Dwiantoro and Kartiko [33]) which states that gift-giving has a significant effect on student learning outcomes. In addition, Hosnan [34] suggests that informing student learning outcomes and giving awards in the form of prizes or praise is one of the efforts to increase student learning motivation.

Efforts to provide feedback and reinforcement are intended to acknowledge and remember which steps are proper and which actions are wrong to avoid making the same mistakes in cycle II. According to Sabriani [35], giving feedback aims to make students realize the strengths and weaknesses of their tasks. In addition, Sulistyaningsih and Cahyani [36] stated that reinforcement seeks to make students follow or not follow specific behavior.

4. Conclusion

It can be concluded that the application of the guided discovery learning model can be used to improve the character of responsibility and academic skills of students in Grade XI Science 1 SMA Negeri 12 Banjarmasin. This statement was supported by the findings of the research on the application of guided discovery learning models in Grade XI Science 1 SMA Negeri 12 Banjarmasin as follows: (1) The
implementation of the guided discovery learning model lesson plans at the first meeting of the first cycle was carried out with the score of 79.73% which belonged in the excellent category, the second meeting of the first cycle was carried out at 85.36% in the very good category, the first meeting in the second cycle was 91.72% in the very good category, and the second meeting in the second cycle was 93.16% in the very good category; (2) The level of student responsibility after the guided discovery learning model was applied had met the indicators of success and increased from cycle I to cycle II; (3) Students’ science process skills applied by guided discovery learning model met the indicators of success and increased from cycle I to cycle II; and (4) classical students’ cognitive abilities in cycle I and cycle II increased from 78.26% to 100%.

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