The contribution of science process skill towards students cognitive achievement through guided inquiry-based learning

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Abstract. Students need science process skills (SPS) to they investigate in learning. Teachers at senior high schools in Manokwari have measured student skills, but are not specific to science process skills. The contribution of SPS towards student cognitive achievement became the focus in this research. 88 participant research was taken from X MIA class of SMA Negeri 01 Manokwari. Measurement of SPS and cognitive achievement of students used the test. The results of the data analyzed used a simple regression found that $P < 0.05$, it means that there was a contribution of SPS towards student cognitive achievement. The contribution of SPS towards student cognitive achievement was 55.7%. It can be concluded that the SPS has a contributed towards cognitive achievement of students when the teacher applies guided inquiry-based learning in his class.

1. Introduction

Today, the 2013 curriculum has been implementing in Manokwari. At the beginning of the implementation of this curriculum, many schools in Manokwari have not implemented it. This is because influenced by many factors, one of them is the ability of teachers in designing the 2013 curriculum-based learning design. Many research results show that the use of inquiry-based learning has towards developing students' attitudes, cognitive and skills. Many students are successful in academic when their teachers teach using inquiry-based learning. Students are given the opportunity to observe and explore [1]. Throughout the world, inquiry in science learning is an important topic [2].

Impressive learning makes students become learning that masters concepts and these concepts can be applied in their real life. Here, it can be seen that students who get inquiry-based experience encourage mastery of the learning objectives that the teacher wants to achieve [3]. Teachers who use inquiry-based learning activities effectively improve the ability of student inquiry, science process skills (SPS), achievement, attitude, and become a creative thinker [4,5], added local wisdom to increase SPS and science attitude [6]. Development of science process skills and learning achievement is the primary goal, and it is crucial [7]. Inquiry-based teaching effectively affects students' scientific process skills [1,8].

Based on the results of research several previous studies have shown that inquiry-based learning influences the various achievements of students in learning. There it appears that learning achievement called student achievement and science process skills are two important things. Inquiry-based learning is reported to influence knowledge of content and science processes. Two variables increase when
measured in two action cycles [9]. Learners who master skills well, they will be able to solve problems in their real life [10].

Student achievement and student process skills are two variables that are widely to develop in inquiry learning. It is a pedagogical approach that encourages students to acquire their process and science skills [11]. In science learning, including biology learning, process skills development needs to be done, because it is an element in science. Attitudes, creativity, applications, worldview, and concepts are domains that influence student learning [12].

Inquiry learning is closely related to the acquisition of thinking patterns and science process skills, but knowledge of material content is also an important result because it has relevance to science process skills [13]. There is significant and a positive correlation between science process skills towards student achievement [14,15]. The effect of science process skills towards learning outcomes is 57.5%, but it is limited to the cognitive aspect of understanding (C2), apply (C3) and analyze (C4) [16]. Science process skills affect students' conceptual understanding of 22.6% and are limited to 26 students [17]. For future research, it is advisable to improve students' conceptual understanding and science process skills of students with appropriate learning methods that relate to daily life, because it supports student thinking, reasoning and inquiry [18,19].

Overall, the results of previous research, two things being the focus of the research is inquiry-based learning has an effect on student achievement and their process skills, and these two variables are related to each other. Other researchers revealed a significant but limited influence on a C4 cognitive process, and on the other hand, when applying to small groups, science processing skills had a low effect. Thus, it is necessary to investigate the use of inquiry learning in large numbers of students, and use the cognitive process to C6. Correlation and influence of science process skills towards student achievement will be discussed.

2. Experimental Method

The correlational research was used in this research. The relationship between the variables of science process skills (SPS) and cognitive achievement of students was investigated. A total of 88 participant research was taken from X_MIA class of SMA Negeri 01 Manokwari. Measurement of SPS and cognitive achievement of students used the test. The SPS indicator measured was observing, formulating problem, formulating hypotheses, measuring, communicating, and making conclusions.

| Number of SPS questions was six items, and the number of cognitive achievement questions was nine items. SPS assessment uses an assessment rubric. Three experts and three practitioners validated all instruments used and focus group discussion (FGD). Data analysis was descriptive to determine the average achievement of each SPS indicator (0.00 - 0.80 was poor, 0.81 - 1.60 was less, 1.61 - 2.40 was sufficient, 2.41 - 3.20 was good, and 3.21 - 4.00 was excellent). and the achievement of student cognitive achievement (0 - 39 was poor, 40 - 59 was less, 60 - 69 was sufficient, 70 - 79 was good, and 80 - 100 was excellent). Inferential analysis was using simple regression. The results of the following normality test are the requirements for regression analysis. |

| Table 1. One-Sample Kolmogorov-Smirnov Test |
|---------------------------------------------|
| N               | 88 |
| Normal Parameters<sup>a,b</sup> | Mean | 0E-7 |
|                 | Std. Deviation | 11.57822804 |
|                 | Absolute       | 0.046 |
|                 | Positive       | 0.032 |
|                 | Negative       | -0.046 |
| Kolmogorov-Smirnov Z | 0.431 |
| Asymp. Sig. (2-tailed) | 0.992 |
Table 1 showed that $0.855 > 0.05$, it means that the science process skill and cognitive achievement of students was normality.

3. Result and Discussion
This article presents data in the form of average and percentage of each achieved of science process skill, cognitive achievement of students, and regression analysis results. The data analysis results are presenting in the below:

![Figure 1](image1)

**Figure 1.** Graph of mean of science process skill; (1) observe, (2) formulate problems, (3) formulate hypotheses, (4) measure, (5) communicate, and (6) make a conclusion

Based on the graph in figure 1, the author found that the overall indicators of science process skills in inquiry learning reached good and very good categories. There are not found in less or sufficient categories. The mean student process skills obtained were 74 and included in the good category. The results obtained show that inquiry-based learning can be training students' process skills well.

![Figure 2](image2)

**Figure 2.** Graph of percentage of cognitive achievement of students; (1) poor, (2) less, (3) sufficient, (4) good, dan (5) excellent

Figure 2 shows that as much as 37.50% of students obtained cognitive achievement in the less and poor categories, but students who achieved sufficient, good and very good category cognitive achievement were 62.50%. This shows that more than 50% of students achieve sufficient cognitive achievement. The average overall learning outcome is 63. It can be said that students' cognitive achievement of students in inquiry learning gets sufficient results. This is in line with previous research found by Kokskal & Berberoglu (2014) that in inquiry teaching has a low impact on learning outcomes compared to science process skills [4]. The next analysis results show the correlation between process skills and cognitive achievement.
Table 2. ANOVA Summary of the correlation between science process skill and cognitive achievement of students

| Model       | Sum of Squares | df | Mean Square | F     | Sig. |
|-------------|----------------|----|-------------|-------|------|
| Regression  | 14645.547      | 1  | 14645.547   | 107.994 | .000 |
| Residual    | 11662.817      | 86 | 135.614     |       |      |
| Total       | 26308.364      | 87 |             |       |      |

a. Dependent Variable: cognitive student achievement
b. Predictors: (Constant), science process skill

Table 3. Regression coefficient of the correlation between science process skill and cognitive achievement of students

| Model | Unstandardized Coefficients | Standardized Coefficients | t  | Sig. |
|-------|-----------------------------|---------------------------|----|------|
|       |                             |                           |    |      |
| (Constant) | -10.400                    | .746                      | -1.457 | .149 |
| science process skill | .984                        | .746                      | 10.392 | .000 |

a. Dependent Variable: cognitive achievement of students

Table 4. Regression summary of the correlation between science process skill and cognitive achievement of students

| Model | R | R Square | Adjusted R Square | Std. Error of the Estimate |
|-------|---|----------|-------------------|---------------------------|
| 1     | 0.746^a | 0.557 | 0.552 | 11.64535 |

Regression analyst results show that there is a correlation between science process skills (SPS) and students cognitive achievement P < 0.05 (sig = 0.000, see Table 2), and that is significant P < 0.05 (sig = 0.000, see Table 3). Science process skill predictor for the cognitive achievement of students. The regression equation model is y = - 10.400 + 0.984x, which means that each value of the increment of SPS enhances cognitive achievement of students value for 0.865.

The results found by the authors indicate that in inquiry-based learning, science process skills correlate with student cognitive achievement. Science process skills contribute to the cognitive achievement of students of 55.7% with a strong level of correlation, namely r = 0.746 (see Table 4). The results obtained contradictions found by previous researchers namely, Khairi, Sarong, & Abdulla (2016) they find out very strong correlations [20], Nirwana & Maharta (2014) which found a large contribution was 57.5% [16], but measurements were limited to cognitive processes C4. Raj & Devi (2014) which found that the level of correlation was very low at r = 0.230 [21]. In research conducted by the author, a strong correlation between science process skills and cognitive achievement of students, where students' cognitive measurements reach C6 levels.

In inquiry-based learning that has been carried out, the material taught is ecosystem material. Students are given problems about the ecosystem that exists around them. Students are given the opportunity to find answers to questions that have been asked. They obtain knowledge and answers through the process of observing nature around the school. Inquiry learning helps them to develop their work skills in complex environments [22], inquiry-based learning involves students to investigate and collect data to build evidence-based explanations of a phenomenon in the natural world [23].

In making observations, the indicator capability of observing from SPS also works well. Investigation activities through observation can directly develop science process skills (SPS) in students, Increased SPS followed by an increase in the achievement of completeness of student learning outcomes [9]. In addition to the data collection process, students take measurements by calculating and adding up the biotic and abiotic components in the school environment. Here their measuring skills are trained. Students also conduct communication in the form of investigative reports
in the field. The overall activities carried out to make their process skills well-trained. The results of student investigations are new knowledge for them. Here they are involved in constructing the knowledge they obtain. It is making their knowledge meaningful. Inquiry learning makes students 'scientific and cognitive process skills good. After analysis, Author is found that science process skills have a strong correlation to students' cognitive achievement.

4. Conclusion
The results obtained and exposure to the discussion indicate that science process skills have contributed to students' cognitive achievement. Two variable correlate is strong, and process skills as a factor that contribute more than 50% of students 'cognitive achievement, even though students' cognitive achievement in this research only achieve sufficient results. Future research can make innovations in inquiry learning to improve student learning outcomes, by improving students' process skills in learning.

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