How Elementary Science Teachers' Understand Perform Science Process Skills and HOTS

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Abstract. One potential reason for the strong performance could be that the performance test items were given in a realistic setting, which may have aided the elementary science instructors in addressing them due to their familiarity with the situations. The inadequate conceptual comprehension exhibited by the elementary science teachers in our study is a significant cause for concern and necessitates immediate action from science teacher education and professional development programmes. Therefore, we suggest implementing a direct intervention in teacher education programmes for primary science teachers to specifically focus on science process skills and higher-order thinking (HOTS) abilities. This intervention aims to enhance the conceptual knowledge of science processes and HOTS among teachers. This study investigated the conceptual comprehension of science process skills and HOTS among science teachers. The sample consisted of 17 elementary science instructors from institutions in Magelang Regency. The participants consisted of primary school science teachers from the fourth, fifth, and sixth grades who were registered for the study. Information was gathered via a questionnaire. The findings indicated that elementary science teachers possessed a restricted conceptual comprehension of science process skills and HOTS. Conversely, they exhibited superior performance in science process skills and HOTS. Most participants were unable to accurately define the science process abilities and HOTS. The findings have ramifications for the fields of science education, pedagogy, and teacher training.

Keywords: Conceptual Understanding, Teacher Performance, Science Process Skills, HOTS

1 Introduction

Process skills in science are thinking skills that can be used in any scientific field [1]. The skills of the scientific process are divided into two groups; basic skills and integrated skills [2]. Observing, drawing inferences, calculating, speaking, sorting, guessing, using numbers, space-time relationships, and inferring are some of the basic process skills [3]. Controlling variables, defining them operationally, generating theories

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and models, interpreting data, and experimenting are all part of integrated process skills [4].

Higher order thinking skills (HOTS) are required to better understand things, solve problems, apply concepts, and produce advanced thinking products [3]. With the addition of HOTS, science literacy (skills to be able to understand, use, and assess science in everyday life) becomes wider. People who use HOTS can apply scientific ideas in everyday life and learn how to make choices, solve problems, and be critical of information. This is not only important for teaching people about science, but also giving them the tools, they need to understand and solve problems in the field. HOTS is a major way to improve science literacy because it helps people think critically about problems and come up with smart solutions. The use of HOTS can help one understand the ideas of science better and find ways to use them in everyday life [5].

Some research suggests that basic science teachers do not quite understand process skills, although process skills are an important part of teaching through inquiry and emphasized in science education reform [6].

The finding that elementary school science teachers don't fully understand how science works is in line with the findings of other studies. One important addition to the study was that elementary school science teachers did well on tests that put them in new situations where they had to use process skills, even though they could not provide a correct description of those skills. One reason for this good performance may be that performance test questions are based on real-life events. This can help elementary school science teachers solve problems because they already know the situation.

The elementary school science teachers in our study didn't have a good understanding of big ideas. This is a big problem that needs to be fixed through teaching programs and help teachers improve their skills. To help teacher candidates get a better picture of how science works, we recommend that teacher education programs include specific lessons on science process skills and HOTS.

Many studies have shown that prospective teachers do not really understand process skills in science, even though HOTS and process skills are an important part of inquiry-based teaching and emphasized in the change of science education. For example,[7] looking at how high school students in Botswana who will become science teachers in the future understand science process skills and HOTS. Emereole's research shows that prospective high school science teachers do not have a good mental understanding of HOTS and science process skills. In addition, many studies have looked at how teachers understand inquiry and found that they did not understand it well enough [8]. In 2010, Mbewe, Chabalengula, and Mumba found that most primary school teachers were unable to properly define and explain basic and combined science process skills. On the contrary, most of them give partially correct and false answers [9], on the contrary, say that the teaching of knowledge of science subjects and scientific inquiry requires the teaching of science process skills.

Many studies have been conducted on teachers' conceptual understanding of HOTS and science process skills, but almost none have looked at how well elementary school science teachers can apply their conceptual understanding to new and normal situations involving science process skills. However, it is important for people who want to become teachers to show that they understand big ideas and do well on exams that include new questions. It basically creates the conditions for their growth among its students.

So, the purpose of this study was to see how well science teachers understand concepts and perform science process skills.

2 Method

This research was conducted in an educational institution in Magelang Regency. The sample consisted of 34 elementary science teachers registered in two ministries of education and the ministry of religious affairs. The research procedure used in this study adapts the explanatory designs approach, where the mix-methods design is the initial capture of quantitative data, then continued with qualitative data collection.

The data collection technique in quantitative research is a questionnaire on teachers' perceptions of HOTS and SPS filled out by 52 teachers and 172 students, from 61 elementary schools selected using multi-level mix-methods sampling [10]. The instrument used is a questionnaire sheet that measures students' understanding and teachers' perceptions of HOTS (analysis, evaluation, creation) and SPS (observation, interpretation, classifying, forecasting, communicating, and hypothesizing). Data is analyzed with descriptive statistics with SPSS application version 25 and presented using tables, graphs, and diagrams.

To group categories using minimum and maximum scores fromthe results of the study. Next determine the mean (mean) and standard deviation of the score obtained. The results of obtaining the mean and standard deviation are categorized in standard scores with the tendency of teacher and student perception variables towards SPS and HOTS [11], as follows:

$X > Mi + SDi\ 1.5$	:	Very High
$Mi + 0.5\ SDi < X \leq Mi + 1.5\ SDi$	:	Tall
$Mi - 0.5\ SD < X \leq Mi + 0.5\ SDi$	:	Enough
$Mi - 1.5\ SD < X \leq Mi - 0.5\ SDi$	:	Less
$X \leq Mi - 1.5\ SDi$	:	Very Lacking

If the results of the calculation of mean and standard deviation are included in the above provisions, then the interpretation of the trend score will be as follows:

≥110.5	:	Very High
85 – 110,5	:	Tall
59,5 - 85	:	Enough
≤ 59.5	:	Low

Next determine the percentage by:

$$P = \frac{n}{N}\ x\ 100\%$$

Description:
P = Percentage
n = value obtained in the questionnaire
N = Number of respondents

Data collection techniques in qualitative research are interviews supported by HOTS and SPS document studies with respondents of 9 (nine) elementary school principals selected by purposive sampling that represent school criteria geographically (urban and rural). The data analyzed are factors that influence the application of HOTS and KSP in science learning.

3 Results and Discussion

Data collection on teachers 'perceptions of HOTS and SPS was conducted using questionnaires that explored the opinions, views, and assessments of principals, teachers and students. Based on the results of the questionnaire analysis, statistical description data of students' perceptions of HOTS and SPS were obtained which were presented in Table 1.

Table 1. Statistical description of teachers 'perceptions of HOTS and SPS

Descriptive Statistics								
	N	Minimum	Maximum	Sum	Mean		Std. Deviation	Variance
	Statistics	Statistics	Statistics	Statistics	Statistics	Std. Error	Statistics	Statistics
HOTS	52	41,00	66,00	2837,00	54,5577	,72730	5,24466	27,506
SPS	52	25,00	56,00	2409,00	46,3269	,84049	6,06087	36,734
Valid N (listwise)	52							

Based on Table 1 showing descriptive statistical results with 52 valid samples, the average value of teacher perception of HOTS was 54.55 and SPS was 46.32. This achievement shows that teachers' perception of HOTS is higher than SPS, meaning that teachers tend to analyze, evaluate, and create during learning IPA. This is different from research [12] which revealed that there are still many teachers who still feel confused about how to integrate HOTS in their teaching and learning activities.

After statistical descriptive analysis using SPSS 25, then the data was processed to determine the percentage of teacher perception categories towards HOTS and SPS obtained percentage data in Table 2.

Table 2. Percentage of teacher perception category towards HOTS and SPS

Category	HOTS		SPS	
	Frequency	Percentage	Frequency	Percentage
Very High	14	26,92%	0	0
Tall	35	67,31%	36	69,24%
Enough	3	5,77%	15	28,84%
Low	0	0%	1	1,92%

Based on Table 2, it is known that the distribution of the frequency of teachers' perceptions of HOTS from 52 respondents obtained a very high category of 26.92%, a high

category of 67.31% and a sufficient category of 5.77%. This shows that teachers have high HOTS skills. Meanwhile, the HOTS data obtained the high category of 69.24%, the sufficient category of 28.84% and the low category of 1.92%. It can be interpreted that teachers' perception of SPSs is high. The percentage comparison of teacher perception categories towards HOTS and SPS is presented in Fig. 1.

However, this is back in line with the results of research [13] which shows that it is still found that the ability of teachers to make HOTS questions is still very poor , namely around 1.1% only. In addition, research [12] reveals that teachers who do not understand well what HOTS is, how to integrate it in learning, and how to assess it. Teachers also experience diverse barriers in improving students' HOTS both regarding themselves, curriculum, and students. Therefore, the need for further workshops or training related to HOTS is needed so that the implementation of integrating HOTS in learning can really be realized by Ok.

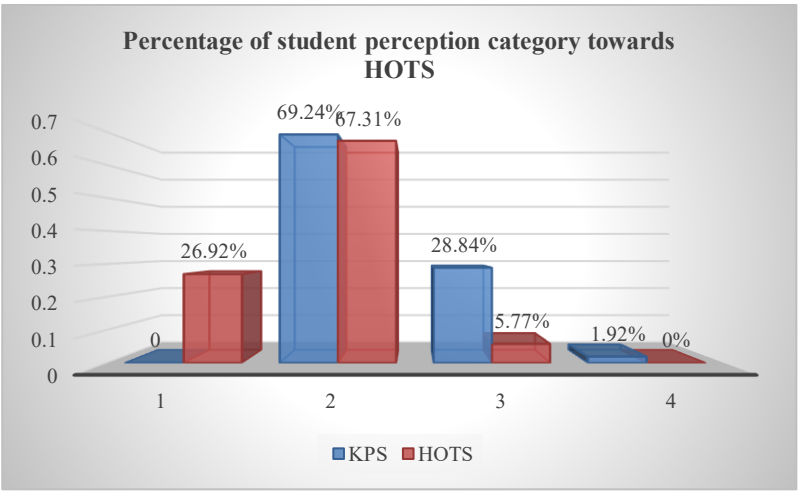

Fig. 1. Percentage of student perception category towards HOTS and SPS

Therefore, it is agreed with the results of research [14] [15] [16] [17] [18] [19] that [15][16][17][18][19] higher order thinking skills (HOTS) among students must be developed optimally in the education system so that students are ready facing the conditions of the 21st century.

Based on qualitative data, three out of nine school principals stated that they had never conducted socialization about the implementation of HOTS and SPS in elementary schools. However, the socialization of RPP containing HOTS and SPS has been conveyed to all elementary teachers through KKG. The principal's follow-up in carrying out RPP monitoring is carried out weekly, monthly and semesterly. Although the teacher actually has prepared the lesson plan at the beginning of the semester. The characteristics of RPP that have been prepared prioritize HOTS (analysis, evaluation, creation) and SPS (observation, interpretation, classifying, forecasting, communicating, and hypothesizing). In line with the results of research conducted [20] which revealed that

teachers have made lesson plans that integrate science process skills into the learning process, according to the author's qualitative analysis. Teachers plan all the basic components of science process skills, including observing, classifying, measuring, predicting, drawing conclusions, and communicating. This certainly correlates with teacher and student perceptions of HOTS and SPS which refer to tables 2 and 4.

4 Conclusion

This research shows new things about how teachers feel about HOTS and SPS. HOTS and SPS will be used if the principal organize socialization and supervises its use by making lesson plans and showing them to teachers along with student test results given in each science class. The findings of this study show that elementary school leaders have a significant influence on the use of HOTS and SPS in science classes. So, the principal can be said to be very important to invite teachers to use HOTS and SPS. Because teachers need to have a positive view of them in order to have an effect on students. As a suggestion for further study, HOTS and SPS assessment tools can be made. Further studies can also look at how instruments and applications are made to help revolution 4.0.

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