



Analysis of Science Subject Evaluation Instruments in Elementary Schools based on Stimulus Types and Cognitive Process Dimensions

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ABSTRACT

Students' critical thinking skills in Indonesia are still low, even though these skills are needed in the 21st century. Critical thinking skills must be learned at an early age. One of the ways to teach it is through subject evaluation instruments that are arranged based on higher-order thinking skills. So it is important to know the quality of the evaluation instrument made by the teacher. This study aims to analyze the evaluation instrument made by the teacher based on the type of stimulus and dimensions of cognitive processes. This was quantitative and qualitative descriptive research. Sampling data used the purposive sampling technique. Data was presented in the form of a percentage and then described. A qualitative test was conducted to identify the form of stimulus used in each item. Identifying the dimensions of cognitive processes used sheets based on Bloom's taxonomy. The results of this study indicate that most of the questions do not use a stimulus (> 75%) and are at the level of remembering (> 55%). Based on the results of the analysis, it is concluded that the teacher evaluation instrument is still poor. Training to formulate evaluation instruments for teachers needs to be done.

Keywords: Evaluation instrument, Stimulus type, Cognitive process, Science

INTRODUCTION

One of Indonesia's educations focuses today is to equip students with 21st-century skills. These skills include critical thinking, communication, collaboration, and thinking and acting or being creative (Asrizal et al., 2022). Critical thinking skills need to be trained as early as possible for students so that they grow and become habits in thinking. Students' critical thinking skills can be trained, starting from applying certain learning models (Shoddiq et al., 2022) to getting them used to solving questions that sharpen higher-order thinking skills (Hadzhikoleva et al., 2019; Karim & Marzita, 2019; Widarta & Wiwit, 2021).

Teachers are expected to be able to develop quality learning evaluation instruments. One indicator of the quality of learning evaluation instruments is that they can grow and train students' high order thinking skills (Ulhaq et al., 2023). Haryati (2020) emphasizes the importance of designing learning evaluation instruments focusing on higher-order thinking skills. Two aspects that can be used to measure the quality of the evaluation instrument are the type of stimulus item and the level of cognitive process dimensions. Learning evaluation instruments should use variations in the form of stimulus questions and test various levels of

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dimensions of students' cognitive processes. Hence, they effectively identify variations of student learning strategies (Ansari & Saleh, 2021).

Several research results reveal that students in Indonesia have low thinking skills (Akhiralimi et al., 2022). The teacher's ability to present quality learning is one of the causes. On the other hand, teachers' misconceptions about science material are still prevalent (Nursafiah et al., 2022). Teachers have not been able to present learning that fosters and trains students' higher-order thinking skills (Ichsan & Rahmayanti, 2020; Musdalifah & Nursalam, 2020).

Previous researchers have widely reported the inability of teachers to present quality learning. Bawaneh et al. (2020) state that the pedagogical skills of science teachers are still low. The learning evaluation instruments that have been prepared are not good, so it is necessary to carry out training and coaching on an ongoing basis. Krell et al. (2020) reveal that science teachers' scientific reasoning competencies still need to be improved to deliver higher-quality science learning.

This study aims to analyze the science learning evaluation instruments prepared by the teacher. This research focuses on analyzing learning evaluation instruments based on the type of stimulus and level of dimensions of cognitive processes. The research subjects are science teachers at Madrasah Ibtidaiyah Negeri in West Aceh.

METHODS

This research was conducted from December 2022 to February 2023. It used descriptive quantitative and qualitative methods by providing an overview of the actual conditions of the analyzed research object (Gelo & Benetka, 2008; Nassaji, 2015). Quantitative data were presented in the form of percentages while qualitative data described the type of stimulus used in the questions and the level of dimensions of the cognitive processes tested.

The subjects of this study were science teachers at Madrasah Ibtidaiyah. The research object is a science learning evaluation instrument. The population of this study consisted of all instruments for evaluating science learning by teachers at Madrasah Ibtidaiyah, West Aceh District, Aceh Province. A purposeful sampling technique was used in determining the research sample. It was decided to use the final semester exam documents for grades 4, 5, and 6 for the 2022–2023 school year.

The research was started by collecting all science learning evaluation instruments from the teachers. Furthermore, Final semester exam document selection was carried out in grades 4, 5, and 6. It was decided to use only the latest evaluation instruments produced by the teacher. Then an analysis of each item was carried out. The analysis was limited to the type of stimulus item used and the level of cognitive process dimensions tested.

Data analysis was carried out quantitatively using percentage techniques. Each item was analyzed quantitatively and qualitatively to determine the type of stimulus used, such as pictures, tables, case questions, story questions, and examples. Analysis regarding the level of cognitive process dimensions tested on each item referred to the revised Bloom's taxonomy, including remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C6).

RESULTS AND DISCUSSION

Results

Analysis of Question Stimulus Types

Based on the results of the analysis of the type of stimulus in the 4th-grade science evaluation instrument, it is found that 85% of the items in the evaluation instrument are

prepared without using a stimulus, 12% use a stimulus in the form of an example, and the remaining 3% use a stimulus in the form of an image. The percentage of stimulus type obtained in the evaluation instrument for science subjects for grade 4 elementary school is presented in Figure 1.

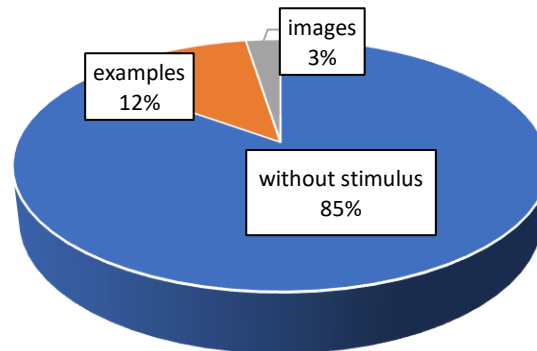


Figure 1. Stimulus Types in Grade 4 Elementary School Evaluation Instruments

The results of the analysis of the science subject evaluation instrument in grade 5 SD find a more varied form of stimulus. Different from the findings of the grade 4 SD evaluation instrument, which only had two forms of stimulus, namely in the form of examples and pictures, the grade 5 SD evaluation instrument uses five forms of stimulus, namely in the form of tables (3%), images (5%), examples (10%), stories (3%), and case questions (12%). The obtained percentage of the stimulus form used in the evaluation instrument for science subjects for grade 5 elementary school is presented in Figure 2.

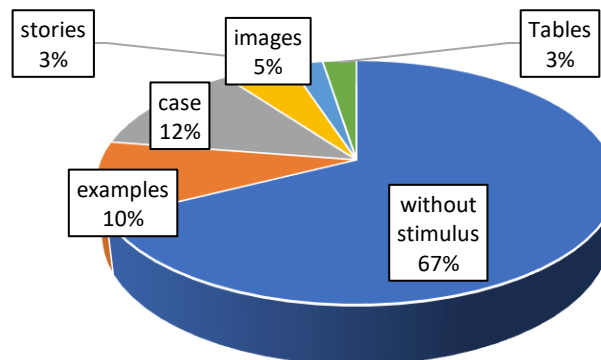


Figure 2. Stimulus Types in Grade 5 Elementary School Evaluation Instruments

Different from the findings in grades 4 and 5 of the elementary school above, the instrument for evaluating science subjects in grade 6 has a larger proportion of items that use a stimulus in the form of an image, namely 17% of the total questions. Then, it is followed by a stimulus in the form of examples and tables, which both get 3%, and questions in the form of stories, as much as 2%. While the largest portion is still in the form of questions that are prepared without using any stimulus, namely 75%. This finding is unfortunate, grade 6 students should be given a larger portion of questions that can train higher-order thinking skills. The types of stimuli that should be given to grade 6 students are case problems, tables or graphs, and pictures. The obtained percentage of the stimulus form used in the evaluation instrument for science subjects for grade 6 elementary school is presented in Figure 3.

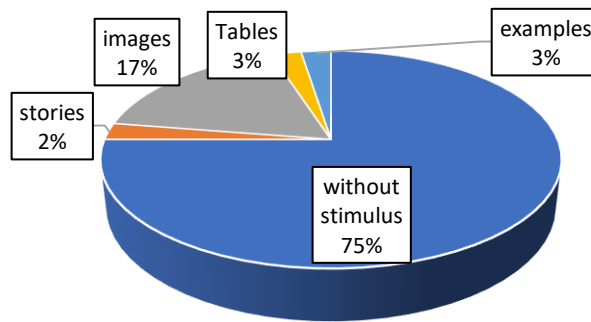


Figure 3. Stimulus Types in Grade 6 Elementary School Evaluation Instruments

Analysis of Cognitive Process Dimensions

The analysis of the 4th-grade science subject instrument finds that all items are at the level of remembering (57%) and understanding (43%). The results of the distribution of dimensions of cognitive processes in the evaluation instrument for science subjects in grade 4 elementary school are presented in Figure 4.

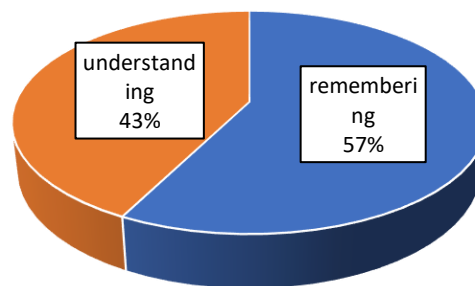


Figure 4. Distribution of Cognitive Levels in Grade 4 Elementary School Evaluation Instruments

Items in the grade 5 elementary school evaluation instrument are at four different cognitive levels (Figure 5), namely remembering (52%), understanding (28%), applying (5%), and analyzing (15%).

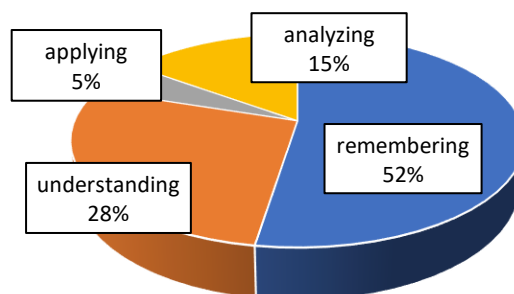


Figure 5. Distribution of Cognitive Levels in Grade 5 Elementary School Evaluation Instruments

Similar to the evaluation instrument for grade 5 elementary school, the evaluation instrument for science subjects for grade 6 elementary school is also at four different levels of cognitive process dimensions, namely remembering (72%), understanding (10%), applying (13%), and analyzing (5%). However, the portion of the items in the lowest domain of Bloom's

taxonomy, that is remembering, is still very large (72%) (Figure 6).

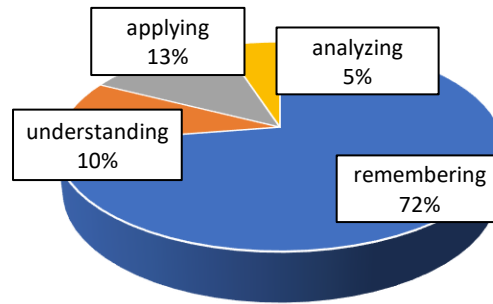


Figure 6. Distribution of Cognitive Levels in Grade 6 Elementary School Evaluation Instruments

Discussion

In general, the study results show that the evaluation instruments formulated by science teachers are still not good. Problems are still minimal using various forms of stimulus. There are also many ambiguous questions, so it confuses students to understand the meaning of the questions. Even though some previous research results explain that various forms of stimulus and variations in the level of cognitive dimensions are found in various texts on national final exam questions. The forms of stimulus that are commonly used are tables, pictures, examples, and fragments of cases (Haryati, 2020; Ansori, 2020; Prasetyo & Nurhidayah, 2021).

The results of the analysis of the use of stimuli in the science learning evaluation instrument for grade 4 elementary school are very unfortunate (Figure 1). Ideally, teachers do more variations of the stimulus, especially pictures, so that students become more interested in answering questions. The proportion of questions that does not use a stimulus is too large (85%), while using a stimulus in the form of an image is very small (3%). Stimulus in the form of pictures can help students who are not yet fluent in reading, so the stimulus in the form of an image is very good for the low grade.

Items without a stimulus are generally in the form of short sentences that directly ask about something. The results of the analysis find that the questions without stimulus only touched the lowest cognitive level, namely remembering (C1). The questions given are only about the definition of a particular term or concept. Questions like that cannot train students' higher-order thinking skills. Teachers should take special time to formulate learning evaluation instruments. In addition to adjusting the questions to the learning indicators that have been studied, the teacher also needs to adjust the choice of words and language to suit the age of the students. Another thing that is no less important is using various forms of stimulus in the evaluation instrument.

The cognitive level tested on the 4th-grade learning evaluation instrument is also still low, only reaching the remembering (C1) and understanding (C2) levels (Figure 4). Grade 4 elementary school students can already be given questions that hone their ability to analyze something, for example, by presenting certain images and asking them to analyze these images. Questions can also be asked, asking them to determine the correct order of a particular stage or process.

The findings above are relevant to the findings of Nurtanto et al. (2021), stating that teacher readiness for learning tools in the learning evaluation component is only 36.8%. This shows the teacher is unprepared to formulate a good learning evaluation instrument. This readiness may be related to low competence or the teacher's lack of seriousness in formulating learning evaluation instruments. If the low teacher readiness is caused by a lack of teacher

knowledge and skills in formulating good evaluation instruments, then training and coaching are necessary (Bawaneh et al., 2020).

This may be understandable when looking at the findings of Widarta et al. (2021), reporting that some of the basic teaching skills of prospective teacher students are still low. They find that the skill of providing a variation of stimulus and the skill of asking the teacher is in the fair category. In addition, Krell et al. (2020) also reveal that the scientific reasoning competence of science teachers still needs to be improved. A number of the problems above might be able to answer the question of why the quality of the learning evaluation instruments that the teacher produces has not been able to test students' higher-order thinking skills.

A well-formulated evaluation instrument can measure students' success in mastering several learning indicators and shape and hone their thinking skills (Rahielanamy & Kamaludin, 2022). Another thing that needs to get the attention of teachers is that a well-organized evaluation instrument can foster students' motivation and curiosity (Widarta & Artika, 2021). Various stimuli may be a little inconvenient for teachers when compiling evaluation instruments. Still, the results of these efforts will have a major impact on developing students' thinking skills.

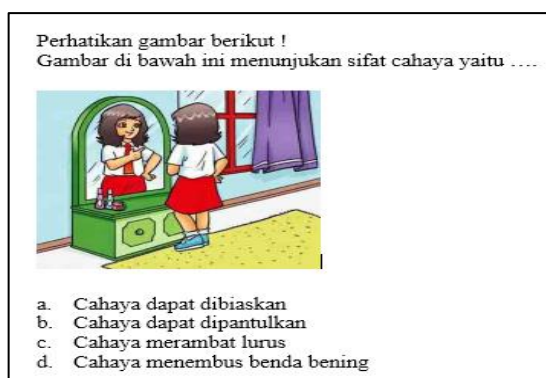


Figure 7. Examples of Stimulus in the form of Images

Figure 7 is an example of a question on an evaluation instrument that uses a stimulus in the form of an image. The picture has indirectly directed students to the answers to the questions given. Elementary school students like this type of stimulus the most because besides containing a variety of colors that can increase interest in learning, pictures can also help those who are still not fluent in reading. The use of a stimulus in the form of an image also indicates that the teacher masters the teaching material well so that he can provide examples of the application of concepts in the daily lives of students.

Perhatikan Tabel berikut !

NO	Kegiatan	Perubahan wujud
1.	Meletakkan es krim diatas meja	Padat ke cair
2.	Meletakkan kamper di lemari pakalan	Gas ke padat
3.	Menyimpan susu cair di dalam freezer	Gas ke cair
4.	Menyemprotkan minyak wangi	Cair ke gas

Pasangan kegiatan dan perubahan wujud benda yang tepat adalah ...

a. 1 dan 2
b. 2 dan 3
c. 3 dan 4
d. 1 dan 4

Figure 8. Example of Stimulus in the form of a Table

Another form of stimulus found in the science teacher's work evaluation instrument is a table (Figure 8). The table contains information about various forms of activity and changes in the state of matter. This stimulus can be given to students who are already fluent in reading (grades 4, 5 and 6). The stimulus in the form of tables trains students' literacy skills. They must be able to understand any information provided properly. Students must also understand various concepts of changes in the state of matter to be able to choose the right pair of activities and changes in form. Questions in the form of a table train students to read and draw meaning from the data presented.

Untuk memenuhi kebutuhan industri logam, manusia melakukan kegiatan yang mengakibatkan perubahan permukaan bumi. Tanah yang semula datar dipenuhi aneka pepohonan menjadi tanah yang penuh lubang-lubang besar dan tandus, kegiatan yang di maksud adalah...

- a. penebangan hutan
- b. pembuatan sawah tadah hujan
- c. penambangan sumber daya mineral
- d. pembakaran hutan

Figure 9. Examples of Stimulus in the form of Stories

The stimulus in the form of word problems is also found in the teacher's science learning evaluation instrument (Figure 9). Teachers need to pay attention to the right choice of words (diction) in compiling questions in the form of stories. Choose words that are appropriate to students' cognitive development so they can easily understand them. The compiled stories should be able to represent more than one question so that the stories read by students provide more in-depth and comprehensive information or knowledge. Problems in the form of stories can also train students' literacy skills. They need to understand the message implied in the story to be able to answer questions appropriately.

The results of the analysis of cognitive process dimensions in the science teacher's work evaluation instrument are relevant to the results of research by Bibi et al. (2020) presenting that the teacher's asking method has a convergent type, where the questions focus on the level of remembering and understanding (C1 and C2). Questions at the analysis, evaluation, and synthesis levels are rarely asked. This study's findings also show that teachers' capacity and creativity in formulating evaluation instruments for science subjects is still low (Widarta & Artika, 2021). In addition, the skills of science teachers in explaining various science concepts are also found to be lacking, especially for young science teachers (Usman et al., 2021).

Halim et al. (2021) reveal that science teachers do not explore various strategies and approaches to implementing higher-order thinking skills. Science teachers' high competence in knowledge and attitudes higher must be realized through learning that combines various approaches, questions with various cognitive levels, and activities that challenge students' thinking. However, science teachers in Indonesia are reported to be able to develop evaluation instruments that contain scientific literacy, with an average of 76.4% of all indicators of scientific literacy (Qadar et al., 2022). Kurniawan et al. (2022) also report that teachers respond favorably to the use of WEB-based assessments, which are used to assess students' attitudes toward science subjects.

The pedagogical competence of science teachers still needs serious attention. Some research results reveal that science teachers' pedagogic content knowledge on certain materials still needs to be improved (Becerra et al., 2022). Education activists have carried out

some ways to continue improving teachers' pedagogic competence in elementary schools. One of them is through practicum activities which are claimed to improve teachers' abilities in developing learning media, preparing lesson plans, and understanding concepts and science process skills (Sunardi & Suchyadi, 2020). In addition, students' scientific literacy, which is also considered indispensable in 21st-century learning, can be developed by integrating local wisdom into the science learning process, for example, when preparing lesson plans and worksheets (Hastuti et al., 2020).

Students' higher-order thinking skills can be trained by providing stimulus in the learning process and measuring learning outcomes using evaluation instruments based on higher-order thinking skills (Ariyanto et al., 2020); (Rahielanamy & Kamaludin, 2022). You can also use worksheets based on Project Based Learning (Wulandari & Novita, 2018). Developing a good evaluation instrument takes time, knowledge, and skills. The teacher needs to take the time to compile the questions that will be tested on students, not only measuring the success of student learning but also focusing on the quality of the questions produced so that they can reach various levels of students' thinking skills.

The prospective teachers have also been equipped with several knowledge and skills related to preparing and developing good evaluation instruments. An evaluation instrument can measure three educational domains: attitudes, knowledge, and skills (Ramdani et al., 2019). Knowledge and skills in compiling these evaluation instruments should be honed and updated by teachers. The way that can be taken is to read various related literature and take part in training to improve teacher competence, especially in terms of formulating quality learning evaluation instruments (Bawaneh et al., 2020).

CONCLUSION

The results show that most science learning evaluation instruments formulated by teachers are not good. More than 75% of the evaluation instrument does not use a stimulus. The evaluation instrument is dominated by questions at the remembering (C1) level, with a percentage of more than 55%. It is necessary to continue training and coaching teachers in formulating evaluation instruments.

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