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Analysis of Biology Daily Assessment According to Cognitive Process Dimension and Higher Order Thinking Skills Question

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Abstract

Daily assessment plays an important role to monitor students' learning achievement. The daily assessment also reflects teachers' ability in composing items. The presence of HOTS questions in the daily assessments is very important to train students in developing higher-order thinking skills. This study aims to determine the distribution of cognitive process dimension and HOTS questions on biology daily assessment items in odd semester 2019/2020. This study also wants to uncover factors that influence biology teachers in presenting HOTS questions. The subjects of this survey study were biology teachers at MAN 1 and MAN 2 Lamongan. Data obtained through documentation and questionnaire techniques. Data in the form of question sets were analyzed with descriptive statistics (percentage). Questionnaire data was treated through the process of collecting, reducing and categorizing, displaying, and drawing conclusions. The results show that the cognitive process dimension of remembering and understanding dominate the daily assessment item in both schools, the percentage of HOTS questions is very low, and the teacher internal factors are hampering the presence of HOTS questions in the daily assessment.

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INTRODUCTION

Development of 2013 Curriculum is intended to equip high school students with critical thinking skill and problem solving. Critical thinking is more demanding than previous time (Sendag & Odabasi, 2009), requiring in a work place (Barry, 2012), a human character needed to be able to compete in 21 century (*Partnership for 21st Century Skills*, 2014). The use of technology in daily life and work place also ask for students to equip critical thinking (Lamb, Maire, & Doecke, 2017). Critical thinking becomes the most important skill in industrial revolution 4.0 (Lee *et al.*, 2018). In fact, Indonesian students' performance in Programme for International Student Assessment (PISA) ranked 71 out of 79 countries (OECD, 2019).

Teacher's assessment plays an important role to train and practice students in dealing with certain ability or skill. Actually, the assessment implemented mirrors of both cognitive process dimension and Higher Order Thinking Skills (HOTS) question contained. Brookhart (2010) defines HOTS as transfer process, critical thinking, and problem solving. HOTS embraces critical, logical, metacognitive, and creative thinking (King, Goodson, & Rohani (2017). In Islamic school, daily assessment becomes the only one kind of assessment held by teacher (Dirjen Pendis. 2018). Therefore, the daily assessment is very important for both the teachers and students. Items constructed reflect the quality of the teachers' ability in constructing the assessment tools itself (Jihad & Haris, 2008). For the students, embeded cognitive process dimension and HOTS question in the item bring them in testing their ability.

Items developed by teachers remains questionable in term of cognitive process dimension distribution and HOTS question. The distribution of cognitive process dimension is not too proportionate. The first three dimension, they were remembering, understanding, and applying, still dominated in assessment made by the teachers (Arti & Hariyatmi, 2015; Pratiwi & Hariyatmi, 2015; Utami & Aryeni, 2018). The number of HOTS question in biology national examination from 2014-2016 were around 29.16% (Guchi, 2017; Putra, 2017). On the other hand, the presence of HOTS question made by senior high school biology teacher varied. Biology teachers' ability in constructing HOTS question was around 21.2% (Arti & Hariyatmi, 2015) and 1.1%. (Pratiwi & Hariyatmi, 2015). Utami & Aryeni (2018) found that the number of HOTS question in final examination made by teacher was less than 6%.

There are two main factors affecting teachers in proposing HOTS question in daily assessment. Internal factors cover teachers's ability to judge, experience in composing item, awareness that arranging test instrument is part of competence they have to master (Sudijono, 2009). External factors include rule demands, supervision by headmaster, and intensity of teacher' involvement in training related to instrument development. The research aimed to describe the distribution of cognitive process dimension and HOTS question in biology teachers' daily assessment. The research also tried to discover factors that affect the teachers in delivering HOTS question in their daily assessment.

RESEARCH METHOD

This research was descriptive quantitative using survey method. The research subjects were all biology teachers at two State of Islamic Senior High Schools in Lamongan, namely School A and School B. There was three biology teachers at each school. The object of research were multiple choice items presented in daily assessment at the odd semester in the academic year 2019/2020. The documentation technique was used to collect the daily assessment question set. The questionnaire was applied to obtain further information related to teachers' knowledge about HOTS question, presence of HOTS question in daily assessment, difficulties encountered in compiling HOTS questions, and school policy about the use of HOTS question in daily assessment.

A cognitive process identification sheet according to revised Bloom's taxonomy (Anderson & Krathwol, 2001) was used to determine the cognitive processes dimension of item. A HOTS question identification sheet with four indicators was practiced to classify an item (Widana, 2017). The indicators are the item has an interesting stimuli, the stimuli is contextual, the item measures students' reasoning (knowledge transfer, processing and applying information, looking for an interconnection of various information, using information to solve problem, and examining idea and information critically), and the answer implied in the stimuli. The researcher would put a

thick on certain cognitive process dimension based on thinking process needed to answer the question. The same technique was implemented in categorizing a HOTS question. An item has to fulfill all prescribe indicators to be a HOTS question. Data related to cognitive processes dimension and HOTS question were treated and presented in the form of percentage (Fraenkel & Wallen, 2009). Questionnaire data is treated descriptively.

RESULTS AND DISCUSSION

The researcher collected eight daily assessment question sets with 215 items from School A and ten daily assessment question sets with 250 items from School B. The results related to distribution of cognitive process dimension in both schools is presented in Table 1.

Table 1. Percentage of cognitive process dimension according to school and grade

Cognitive Process Dimension	School A				School B			
	Grade			Average	Grade			Average
	X	XI	XII		X	XI	XII	
C1	73.33	44.00	33.75	50.36	28.57	48.33	29.17	35.36
C2	26.67	50.00	51.75	42.81	61.43	50.00	57.50	56.31
C3	0.00	6.00	4.25	3.42	10.00	1.67	11.67	7.78
C4	0.00	0.00	10.25	3.42	0.00	0.00	1.67	0.56
C5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
C6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

It can be seen from Table 1 that remembering (C1) dominates cognitive process dimension on daily assessment items at School A by 50.36%. The second most dominant is understanding (C2) with 42.81%. On the contrary, understanding is more dominant than remembering at School B. The percentage of their appearance were 56.31% and 35.56%, respectively. These findings are in line with previous research findings (Mustara, 2013; Iskandar & Senam, 2015; Utami & Aryeni, 2018). Whereas, an ideal proportion of cognitive process dimension at high school is 30%, 40%, and 30% for C1 and C2, for C3 and C4, and for C5 and C6, respectively (Guchi, 2017; Putra, 2017).

These phenomena show that the items developed by the biology teachers in both schools only test students' ability to remember and understand. Remembering relates to the ability to restate what has been learned from learning resources without change. While understanding relates to the ability to think where the knowledge possessed has been processed from its original form but has not changed in meaning. Both remembering and understanding bring rote learning as learning outcome (Anderson & Krathwohl, 2001) and decrease students' curiosity (Oktavianti, 2017).

Table 1 also reveals a comparison of cognitive processes of applying (C3) and analyzing (C4). In School A, applying and analyzing are following had the same percentage of 3.42%. While in School B there were 7.78% and 0.56%, respectively. In this case, students in School A have a greater opportunity to test their ability to use the knowledge they have learned to group an information that they do not yet know and determine the relationship between one part with another or with the whole group or information. It is demanded to reinforce students' analytical thinking so they can make a conclusion (Muhartati, Isnaeni, & Ridlo, 2019). Therefore, meaningful learning as learning outcomes occur (Anderson & Krathwohl, 2001).

Figure 1 reveals that the number of HOTS question is only 0.75% compared with 99.25% for LOTS at School A, on average. At School B, the number of HOTS question is even lower. That is only 0.28%. It means that LOTS question dominates daily assessment item in both schools. These result are quite similar with Budiman & Jailani (2014), McNeill, Gosper, & Xu (2012), Pratiwi & Hariyatmi (2015), and Arti & Hariyatmi (2015). Therefore, there is no significance change of the HOTS question presence in assessment made by teacher. On the other hand, the number of HOTS question in National Examination varies from 10% to 35% (Guchi, 2017; Putra 2017).

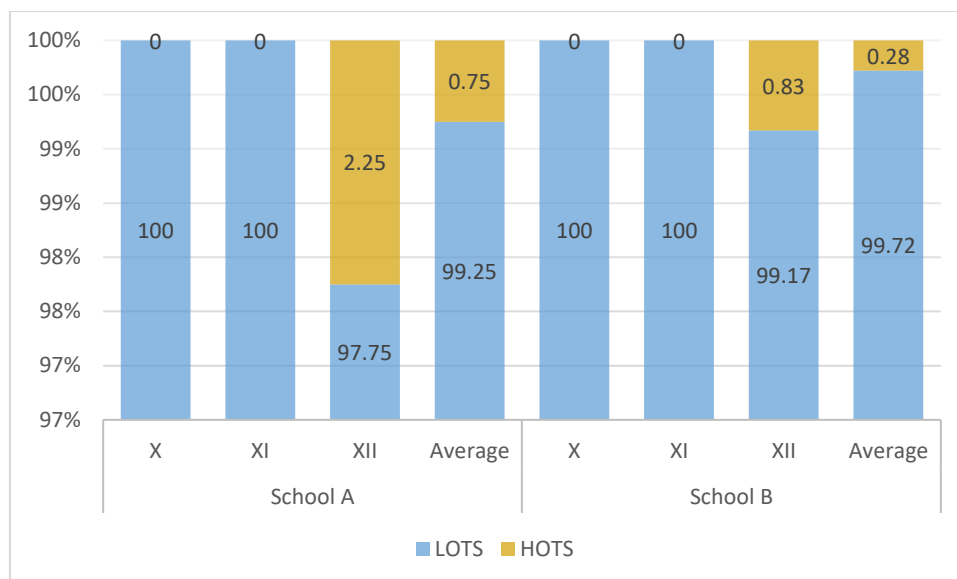


Figure 1. Percentage of HOTS question according to school and grade

Hasrudin (2011) states that teacher's question constitutes important part in developing students' critical thinking. So, the teacher demands to stimulate students to think critically (Sajidan & Afandi, 2017). Therefore, the students could apply knowledge they have learned. Jensen, McDaniel, Woodard, & Kummer (2014) found that HOTS assessment makes students having more understanding about the lesson, to be able to apply, analyze, and evaluate, and be better to remember knowledge. Minimum number of HOTS question in daily assessment leads the students have less opportunity to deal with the type of question which continues to be accommodated in National Examination. Students' claim that HOTS question was too hard (BSNP, 2018) could happen in the next National Examination.

Some findings relate to factors affected the teacher in presenting HOTS question are below. Related to the first question, six teachers stated that they already heard about HOTS. The second question relates to teachers' knowledge about HOTS question. The teachers' answer show that they have understanding about HOTS question. Teacher 1 at school A stated that

"HOTS question is characterized by its level of C4 to C6, using daily life implementation, and solving the current problem".

Teacher 1 at school B said that

"HOTS question demands students to use higher order thinking".

The third question tested teachers' knowledge about characteristic of HOTS item. Teacher 2 at school A asserted that

"HOTS item measure higher order thinking skills, contextual based problem, using interesting stimuli, unfamiliar, and actual".

Another answer presents by Teacher 2 at school B. She replied that

"HOTS item is starting with a stimuli and it has minimum cognitive level of C4 (analysis)".

The results above is consistent with Ramdiah, Abidinayah, Royani, & Husamah (2019) that teachers have enough understanding about HOTS question.

All teachers claim that they ever compose HOTS question. Teacher 2 and 3 at school A asserted that they always presented HOTS item in their daily assessment, but Teacher 1. This phenomena also found at school B in which Teacher 3 said that he did not always deliver HOTS question in his daily assessment, but two others.

All teachers said that composing stimuli was a handicap for them, except Teacher 2 at school B. The reason proposes as stated by Teacher 3 at school A below.

"The difficulty of arranging HOTS question is on making exposure or problem that should be analyzed by student".

Teacher 2 at school B replied as below.

“The difficulties are looking for stimuli that are suitable with learning material being studied and synchronize basic competence which is low level (C1, C2, C3) becoming high level (C3, C4, C5)”.

The findings above correspond with Ansori (2019) in which biology teachers face difficulty in composing a proper stimuli. FitzPatrick & Schulz (2015) stated that the success of HOTS as a learning outcome is determined by assessment implemented. Actually, teachers already have sufficient knowledge about HOTS question. However, difficulty in developing stimuli causes the teachers deliver a small number of HOTS question in the daily assessment. This finding is in line with Sulaiman et al. (2017) that the teacher was aware of the importance of HOTS questions in assessment, however, the knowledge and skills of teachers become a barrier to its implementation. In this case, the teachers in both schools need more practice in developing HOTS question, especially in constructing stimuli. Furthermore, all teachers in both schools said that the schools authority oblige them to deliver HOTS question in daily assessment. It means that the schools authority execute the recommended assessment standard (Dirjen Pendis, 2018).

CONCLUSION

Based on research findings, data analysis, and discussion, it can be concluded the distribution of cognitive process level in daily assessment items in both schools is not equal yet. Remembering and understanding are the top of two. The presence of HOTS question in the daily assessment is still low. Teachers' difficulty to arrange a stimuli becomes the biggest handicap for them to present HOTS question in their daily assessment. Thus, strengthening competency of biology teachers in developing HOTS items is demanding.

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