

## Profile of high order thinking skills (HOTS) in create level of SMA students on biology learning material at Banten Province

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Article information	ABSTRAK
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Received April 27, 2021	abad 21. Penelitian ini bertujuan untuk mengetahui profil kemampuan
Revised Nov 22, 2021	berpikir tingkat tinggi level mencipta mata pelajaran biologi siswa SMA se-
Accepted Dec 20, 2021	Provinsi Banten dan perbandingan kemampuan mencipta siswa setiap
Kata kunci:	kabupaten/kota se-Provinsi Banten. Metode penelitian yang digunakan
Banten	dengan pendekatan fenomenologi dan pengambilan sampel sekolah dengan
Mencipta	teknik <i>random sampling</i> di 8 kota atau kabupaten Provinsi Banten pada
Fenomenologi	bulan Maret-Oktober tahun 2020. Pengumpulan data dilakukan dengan
Bberpikir tingkat tinggi	teknik angket. Instrumen oengumpulan data adalah angket. Teknik analisis
	data menggunakan model Miles & Huberman. Berdasarkan hasil penelitian
	menunjukkan bahwa kemampuan berpikir tingkat tinggi siswa level
	mencipta di Provinsi Banten adalah 6,8 yang termasuk dalam kategori
	sangat kurang. Proses pembelajaran yang belum melakukan pendekatan
	HOTS dan belum terbiasa memberikan siswa dengan soal-soal berpikir
	tingkat tinggi membuat siswa merasa kesulitan untuk menyelesaikan
	permasalahan dari soal yang dihadapi.
	ABSTRACT
Keywords:	Higher order thinking skills are needed in 21st century learning. This study
Banten	aims to determine the profile of higher order thinking skills at the level of
Create	creating biology subjects for high school students in Banten Province and a
Phenomenology	comparison of students' creative abilities in each district/city in Banten
Thinking skills	Province. The research method used was a phenomenological approach and
	school sampling with random sampling technique was used in 8 cities or
	districts of Banten Province in March-October 2020. Data were collected
	using a questionnaire technique. The data collection instrument is a
	questionnaire. The data analysis technique uses the Miles & Huberman
	model. Based on the results of the study, it was shown that the higher-
	order thinking ability of students at the creative level in Banten Province
	was 6.8 which was included in the very poor category. The learning process
	that has not taken the HOTS approach and is not used to providing students
	with high-level thinking questions makes students find it difficult to solve
	the problems they face.



## INTRODUCTION

The era of globalization and the demands of the ASEAN Economic Community (MEA) require quality education. Quality control of education is basically the control of quality human resources. One of the factors that affect the quality of human resources is education. Education has an important role in preparing human resources for the development of a nation (Hidayati, 2017). Education in the 21st-century uses a curriculum that requires students to have the ability to solve problems, critical thinking skills, communication skills, collaboration, and creativity. The problem of measuring higher-order thinking skills of Indonesian students can be seen from the Program for International Student Assessment (PISA) test (Pratiwi, 2019).

Indonesia's educational achievement is measured periodically through the Program for International Student Assessment (PISA) measurement, the results of which are then compared with other countries' achievements. Reports of international institutions on education issues state that Indonesia's educational achievement index is ranked 110th out of 180 countries in the world (Kemendikbud, 2019). Based on data from the Education for All (EFA) Global Monitoring Report in 2011 issued by UNESCO, Indonesia's education development index is ranked 69<sup>th</sup> out of 127 countries. Data from the Ministry of Education shows that the average score for the national biology exam is 50.61 for high school level and Banten Province has an average score of 49.47. Banten is ranked 12<sup>th</sup> out of 34 provinces (Kemendikbud, 2019). One of the causes of low student achievement is due to the weakness of the learning process in Indonesia. The learning process of students is less encouraged to develop their thinking skills (Prasetyani et al., 2016).

Thinking ability is the ability to combine attitudes, knowledge, and skills that allow a person to be able to change his environment to be more effective. Anderson & Krathwohl (2010) states that higher-order thinking skills (HOTS) are one of the components in creative thinking skills and critical thinking. Bloom's taxonomy has six levels of thinking, namely remembering, understanding, applying, analyzing, evaluating, and creating. Higher-order thinking skills include three levels, namely analyzing, evaluating, and creating, while the other three levels, such as remembering, understanding, applying, include lower-order thinking skills (Ariyana et al., 2018).

Higher-order thinking skills are thought processes that are not just memorizing and relaying known information. Higher-order thinking skills are the ability to connect, engineer, and change existing knowledge and experience to think critically and creatively in an effort to determine a decision and solve problems at hand (Anderson & Krathwohl, 2010). Higher-order thinking skills are not only verbalistic abilities but also understand and interpret the intentions contained therein. This ability is much required by students, because it relates to the needs of students to solve problems they face in everyday life. Higher-order thinking ability is the ability to think at the reasoning stage, namely being able to understand information but also be able to use the knowledge gained in everyday life (Sucipto, 2017).

One of the thinking skills that must be possessed by students is the ability to create. The ability to create is the ability of students to combine separate parts to form a whole and new structure. The ability to create is at the highest level in the cognitive realm (Heong et al., 2011). According to Agustina et al., (2016) the ability to create is an important ability possessed by students because it plays an important role in the learning process. Students who have less creative ability will find it difficult in the learning process. This is in line with research by Ariani (2014) which states that the ability to create students in the learning process obtains a result of 6.48% in the very low category, so that the ability to create is needed by students.

The ability to create affects learning outcomes. Students who have the ability to create will get good learning outcomes. Based on research conducted by Handayani & Priatmoko (2013), stated that higher-order thinking skills at the creative level contributed 25.79% to learning outcomes. Correspondingly, research by Suwarsi et al. (2018) shows that the ability to create HOTS can produce student learning completeness as much as 56%. The ability to create is an

important ability possessed by students because with this ability students will be able to overcome the problems they face.

Higher-order thinking skills need to be applied to biology subjects. Science is needed in everyday life to meet human needs through problem-solving. The process of learning science such as biology requires higher-order thinking skills because by using those skills, students will use the potential of their minds to the fullest to solve problems so that scientific attitudes will also be formed in students. Higher-order thinking is also needed in improving language skills well and developing creativity in the learning process (Slameto, 2018).

Students at the high school level should have higher-order thinking skills (HOTS) at the creative level. The ability to create is important to be able to solve a problem in life. However, often the higher-order thinking skills are still not achieved properly. Therefore, researchers conducted research on the profile of high-level creative thinking skills in senior high schools in Banten Province because data on students' creative abilities in Banten Province were not yet available, and this research is very important so that students' creative abilities can be increased.

## METHOD

The method used in this research is a phenomenological approach. The research design used the phenomenological approach proposed by Bandur (2016). The focus of this research is the ability to think at the creative level obtained from the HOTS level of creation. The subjects used in the study were students of class XII SMA/MA in Banten Province. The time of the research was carried out in March - October 2020 and took place in each district and city, covering one public and private school. Sources of data used in the study were 320 students as respondents. The school sample was selected using a simple random sampling technique.

Data collection techniques used are test and non-test. The test is through HOTS level creation questions and non-test through teacher questionnaires, student questionnaires, literature studies, and documentation (photos). The research data used are quantitative and qualitative data. Quantitative data were obtained from the HOTS level creating questions. Qualitative data was obtained from teacher questionnaires, student questionnaires, and literature studies. In this study, the validity of the data was tested through the triangulation of sources. The data analysis using Miles & Huberman's (2014) technique includes data reduction, data presentation, and verification/conclusion.

## RESULTS AND DISCUSSION

This study aims to determine the profile of higher-order thinking skills at the level of creativity in biology subjects for high school students in Banten Province. The research data was obtained through the data from the HOTS level description test "to create" (C6). Higher-order thinking skills include the ability to analyze, evaluate, and create. The level of creating is the highest level in higher-order thinking skills. At this highest level, students organize various information using different ways or strategies than usual. Students are trained to combine the parts to form something new, coherent, and original. Anderson & Krathwohl (2010) emphasized that creativity shows not only unique product designs but also combines various sources of information to produce new products, perspectives, strategies, meanings, and understandings (Nugroho, 2018).

The ability to create in this research is obtained through the data of the HOTS level description test. Descriptive questions used as many as three questions. The results of the average value of HOTS level created in the province of Banten are shown in Table 1.

**Table 1.** The Average Higher-Order Thinking Ability at The Creative Level (C6)

Level	Average Score	Category
Create (C6)	6.8	Very Less

Based on Table 1, the higher-order thinking ability of students at the creative level overall shows an average value of 6.8 with a very poor category. The high-level thinking ability of

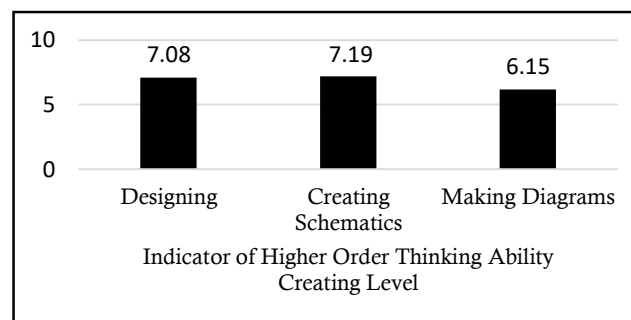
students at the creating level is not supported by the results of the questionnaire of biology teachers in eight schools in Banten Province. Teacher's questionnaire concluded that in the learning process teachers use the 50% discovery learning model, 37.5% inquiry, problem-based learning 50%, and project-based learning 12.5%, but the teacher does not take a HOTS approach to students, especially at the level of creating. The cognitive level that is often given in the evaluation of learning 87.5% is the cognitive level C1-C5 while the cognitive level of creating is only 12.5%. Beside that, teachers find it difficult to make higher-order thinking questions themselves.

The learning process that familiarizes students to solve problems is only 37.5% applied in every school in the district/city of Banten Province. That learning process causes students have lack high-level creative thinking skills and are unable to answer creation-level questions because students are not used to finding them in the learning process. In line with this, based on students' questionnaires, the learning process that is often carried out in schools is 92.5% using the lecture and discussion method, but for questions that require problem-solving only 37.5% are found in learning, and 66.25% students still do not know and are lazy with creating high-level thinking questions. Based on these data, students are not accustomed to honing their higher-order thinking skills.

The high-level thinking ability of students at the level "to create" in Banten Province is very lacking because school learning has not been maximal in getting students to hone their thinking skills in solving a problem at hand. The learning process that does not hone students' thinking skills to solve problems makes students' thinking only limited to basic concepts and unable to solve problems from the questions given. This is in accordance with the statement by Widana (2017) that, in general, students are very low in (1) understanding complex information; (2) theory, analysis, and problem-solving; (3) use of tools, procedures, and problem-solving; and (4) conduct an investigation. In addition, this is also supported by research by Haryanto et al. (2018), which states that high-order thinking skills are very lacking because biology teachers do not develop and hone students' higher-order thinking skills in learning. The learning process that is not familiar with the HOTS approach makes it difficult for students to answer high-level questions. These also the reason of the average HOTS level of creating (to create) students' in Banten Province is in the very poor category. In the education system, the learning process is related to teachers and students, both of which are mutually exclusive influence each other.

A good and appropriate learning process will be seen in the achievement of learning outcomes. One way that can be done in the learning process to train and improve higher-order thinking skills in solving problems is using project-based learning. This is also in accordance with the research by Leksono et al. (2020), which states that the learning of mini-research projects has a positive effect on the ability to analyze problems. Project Based Learning model is a learning model that is oriented so that students can learn independently in learning solve the problem at hand so that it can produce a real project or work (Niswara et al., 2019).

Higher order thinking skills at the creative level are in the very poor category. This can be seen in the average score for each question indicator. Overall, the average value of each question indicator is in the very poor category. The results of obtaining the average HOTS level for each indicator are shown in Figure 1.



**Figure 1.** The Acquisition of The Average Value of The HOTS Level Creates in Each Indicator

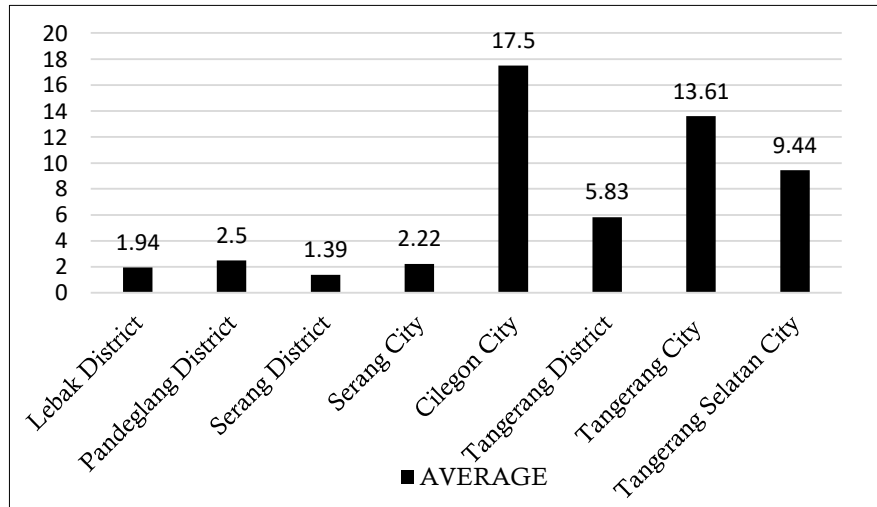
The indicators of higher-order thinking at the creative level that used in this research are designing, making schemas, and making diagrams. The average score on the design indicator is 7.08 in the very poor category. Problem number 1 (indicate design indicator) requires students to be able to design a flow chart for the accumulation of synthetic pesticides (DDT). Based on the average score, it shows that students are still not able to design a flow chart, because based on working on the questions, 83.75% of students are unable to answer the indicator of question number 1 and 16.25% of students design a flow chart, but there are several stages that are reversed. Even though in the design indicator instruments there was already a discourse before the question was given, students still had difficulty answering the question. This illustrates that students do not yet have a mature conceptual understanding and do not yet have aspects of higher-order thinking skills, one of which is higher-order thinking skills as problem-solving. (Kurniati et al., 2016). Students have not been able to use their knowledge to solve the problems at hand.

The average value of making a scheme indikator is 7.19 in the very poor category. The makes the scheme indicator have a higher score than other indicators. Problem number 2 (indicate making schemas indikator) requires students to make a scheme for the process of glucose into adenosine triphosphate (ATP). The score shows that 83.44% of students have not been able to make the stages of the ATP formation process, and 16.56% of students in making student schemes only mention the names of the stages without explaining the processes that occur in these stages and in making schemes there is an inverse order. This shows that students do not yet have the ability to make a thing or product to answer and solve the problems they face (Sari et al., 2019). Students are less able to make a product as a solution to the problem at hand because students are unable to organize a number of previously owned information to produce a new product.

The average value obtained on the indicators makes a diagram of 6.15 in the very poor category, where the achievement of this indicator is the lowest among the other two indicators. Question number 3 (indicate making diagrams indikator) requires students to be able to make diagrams of blood flow in the heart, but 89.69% of students have not been able to draw a picture of the heart properly, and without an explanation of the picture, 10.31% of students make a picture of the heart that is not suitable and flow blood that is out of sequence with the actual cycle. The difficulty experienced by students in answering these questions is because students are not trained to design something/project. According to Winarni (2019), one of the learning processes that can hone thinking skills is using project-based learning because in this learning, students are asked to organize various information in a creative way of thinking so that they are able to produce a thing or product.

The high-level thinking ability of students at the creative level is in the very poor category seen from the results of working on these 3 questions. It happened because in the learning, students are not trained to design a thing or product that can solve a problem. Besides that, the teacher does not provide practice questions that are identical to questions in the form of pictures, discourses, schematics, and graphs (Sari et al., 2019). This is in accordance with the results of teacher appointments in schools in every district or city in Banten Province. It states that on the learning activities, teachers still have difficulty in providing habituation to high-level practice questions even though they have been given in practice questions, but in learning evaluation, only 12.5% of schools that provide HOTS level questions create. This causes students to be unaccustomed to solving higher-order thinking questions. In line with this, Fanani (2018) argues that the more often students are trained with questions that require higher-order thinking skills, the more their ability to solve a problem will be honed.

Apart from being seen from the HOTS scores, the researchers also distributed an open student questionnaire. Based on the results obtained, students stated that in learning, the discussion method had been carried out, but for the practice of higher-order thinking questions, the level of creating was only 12.5% given in the learning evaluation. The ability to create by the students in Banten Province, which is very lacking, is an illustration that students in every district or city in Banten Province still have very poor creative abilities. The results of obtaining the average HOTS level for each district or city in Banten Province are shown in Figure 2.



**Figure 2.** The acquisition of the average HOTS level for each district/city

Based on Figure 2, the average score for higher-order thinking ability (HOTS) for the level of creation in Banten Province in each city and district shows a score below 20. Based on the acquisition of the HOTS value for creating-level, all cities or districts are in the very poor category. The ability to think at the high level of creating each district/city in Banten Province shows various scores. The highest score is Cilegon City at 17.5, while the lowest is Serang Regency at 1.39.

The average score for the HOTS level of creation in Cilegon City is higher than other districts/cities because in the learning process teachers often provide HOTS-based practice questions, although the level of creativity is still in very poor category. This is in accordance with the results of the questionnaire obtained from the biology teacher at the school, which states that the teacher uses the discovery learning model in the learning process, once giving students practice questions that require high-level skills and questions that require the ability to solve problems even in giving questions. The HOTS level creates only 12.5% of its adoption.

Apart from the results of working on the HOTS questions and the teacher's questionnaire, there are results of an open student questionnaire which states that the learning process has been carried out with a discussion method that can train students' thinking skills to make students active in learning activities. Students are also given HOTS questions as an evaluation at the end of the activity teaching and learning even though the percentage is small, as well as 60% of students who already know how the high-level questions are. These learning activities are able to train students' higher-order thinking skills. This is similar to the results of the study of Gradini et al. (2018), which argues that to be able to train higher-order thinking skills, students need to be accustomed to learning activities, honing students' thinking skills is considered an important educational goal and teachers have an important role in stimulating students' higher-order thinking. Cognitive processes involved with higher-order thinking strategies are directly related to the use of knowledge for problem-solving.

The average value of higher-order thinking skills at the lowest level of creativity is found in Serang Regency, which is 1.39, including the very poor category. The cause of the low score is the teacher does not take the HOTS approach in biology learning and does not familiarize students with practice questions that require the ability to solve a problem. This is in accordance with the statement of the biology teacher in the teacher's questionnaire, which stated that in the learning process, teachers use the discussion method, and only 10% provide students with practice questions that require high-level skills to create/questions that require the ability to solve problems. In line with that, statements from student questionnaires also show the same thing, 50% of students feel less capable when given high-level thinking questions because they are not used to practicing these questions, and students are less active in learning biology. According to

Widiawati et al. (2018), students will be able to develop their thinking skills if they are often used to practicing high-level thinking questions in the learning process.

The score for this student's higher-order thinking ability, although it looks different in the number of achievement scores, is still in the very poor category. This indicates that the high-order thinking ability of students at the creating level is still very low in every district or city in Banten Province and needs to be improved again. High-level creative thinking skills in Banten Province are included in the very poor category because based on the narrative in the teacher's questionnaire in school only 12.5% of schools familiarize learning with the HOTS approach, school learning does not stimulate students' higher-order thinking skills, students are still poorly trained to work on HOTS-based questions at the level of creating, and 62.5% of teachers are still not able to make HOTS-based questions. This is in line with Mardiana (2019), which states that students' higher-order thinking skills are low if the learning only emphasizes the cognitive aspect, rarely associates concepts independently, and the form of the test that is trained is only in the easy category. The implementation of learning so that students have HOTS abilities is based on the implementation of the curriculum; almost all schools in Banten Province have implemented the 2013 curriculum teach learning towards HOTS (Rapih & Sutaryadi, 2018).

This learning situation is the same with the research at SMAN 18 Palembang which stated that in giving daily test questions, students were still rarely trained in higher-order thinking skills, resulting in low higher-order thinking skills (Prasetyani et al., 2016). Apart from being seen from the HOTS scores, the statement in the student's open questionnaire concluded that the discussion method had been applied in the learning process, but for practical questions that required higher-order thinking skills and problem-solving, they were still rarely found. This is because students are still not able to manipulate and transform information that has been obtained previously to solve the problems of the problems at hand, because for the level of creating, these abilities are needed (Fazira et al., 2019). A similar study was conducted by Ariani (2014), which stated that the ability to create was obtained by 6.48%. These results indicate that students' creative skills are still very low (Rahman et al., 2019). In line with Ariani, research (Sobirin et al., 2016) shows that only 12.5% of students successfully complete the HOTS category questions. The lack of high-level thinking skills for students at the creative level in Banten Province is due to the fact that students have not been able to understand and answer questions in accordance with the expected indicators (Angraini & Sriyati, 2019). Higher-order thinking skills really need to be familiarized in learning at school because they will be needed in life to respond to and overcome the problems they face.

## CONCLUSION

Based on the research that has been done, it can be concluded that the average score for the HOTS level of creation in Banten Province is 6.8. This figure shows that the higher-order thinking ability (HOTS) at the level of creating Banten Province is in the very poor category. All schools in the district/city of Banten Province are included in the very poor category because students are still not able to solve the problems they face.

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