TWO-TIER MULTIPLE CHOICE (TTMC) INSTRUMENT FOR MEASURING STUDENTS' COMPLETE ABILITY QUESTION EVALUATED LEVEL (C5)

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ABSTRAK

Data hasil Programme for Internasional Student Assessment (PISA) menjelaskan bahwa kelemahan peserta didik Indonesia adalah ketidakmampuan mereka ketika dihadapkan pada permasalahan yang memerlukan keterampilan, kritis, kreatif. Penelitian ini bertujuan untuk mendeskripsikan kemampuan siswa dalam menyelesaikan soal C5 yang merupakan level kognitif dalam menyelesaikan soal HOTS (High Order Thinking Skills) dengan menggunakan instrumen Two-Tier Multiple Choice. Jenis Penelitian ini menggunakan pendekatan kuantitatif dengan metode deskriptif.Hasil penelitian menunjukkan kategori jawaban siswa yang memahami rata-rata 4,2 %, siswa yang miskonsepsi rata-rata 13%, siswa yang menebak rata-rata 26% dam siswa yang tidak mehamami memiliki rata-rata 56%, angka tersebut menunjukkan bahwa rata-rata tertinggi siswa tidak memahami atau tidak bisa menyelesaikan dengan baik soal dengan level kognitif mengevaluasi atau C5, sehingga hal tersebut menjadi sumber penilaian atas pemahaman konsep pembelajaran siswa, dan dapat menumbuhkan motivasi dalam belajar.

Kata Kunci: Kemampuan Siswa, High Order Thinking Skills (HOTS), C5 (Mengevaluasi), Two-Tier Multiple Choice (TTMC)

ABSTRACT

Data from the Program for International Student Assessment (PISA) explains that the weakness of Indonesian students is their inability when faced with problems that require skills, are critical, and creative. This study aims to describe students' ability to solve C5 questions, which is a cognitive level in solving HOTS (High Order Thinking Skills) questions using the Two-Tier Multiple-Choice instrument. This type of research uses a quantitative approach with a descriptive method. The results showed that the answer categories of students who understood an average of

4.2%, students who misconceived an average of 13%, students who guessed an average of 26% and students who did not understand had an average of 56%, this figure shows that the average The highest average of students did not understand or could not solve well the questions with the cognitive level of evaluating or C5, so that it became a source of assessment for understanding student learning concepts, and could foster motivation in learning.

Keywords: Student Ability, High Order Thinking Skills (HOTS), C5 (Evolution) Two-Tier Multiple Choice (TTMC)

INTRODUCTION

Data from the Program For International Student Assessment (PISA) results show that the abilities of Indonesian students in a row for science, reading, and mathematics are ranked 62, 61, and 63 out of 69 countries that evaluated the weaknesses of Indonesian students, namely their inability when faced with problems that require skills, critical, creative, and high-order thinking [1]. In line with that, Indonesia made the 2013 curriculum as a solution to this problem, where the 2013 curriculum has an assessment aspect that is not only limited to assessing knowledge and skills, but also considers assessing higher-order thinking knowledge. So, in learning students must face problems that require high-order thinking skills or High Order Thinking Skills (HOTS).

High Order Thinking Skills (HOTS) is part of the revised Bloom taxonomy in which one of the operational verbs evaluates (C5) which can be used in the preparation of questions. Cognitive level C5 (Evaluating) is expected that students are able to make a judgment about a condition, method, or idea [2] whose operational verbs in Bloom's Taxonomy include: checking, criticizing, assessing, proving, defending, evaluating, interpreting, and recommending.

Undoubtedly, the various forms of questions in a HOTS test kit (question) are highly desirable. It aims to obtain detailed information on the overall ability of students [1], High Order Thinking Skills (HOTS) is defined as the process of transferring from a problem so that the problem is

finding solutions using critical thinking[3]. HOTS questions cover aspects of critical thinking skills, creative thinking, and problem-solving skills. Critical thinking is the ability to analyze, create and use criteria objectively and evaluate data [4].

Therefore, the teacher needs to develop HOTS questions according to Bloom's taxonomy, especially questions at levels C4, C5, and C6. It is intended that students get used to solving questions that develop these high-level critical thinking skills [5].

The form of the questions used in this study is the Two-Tier Multiple Choice question form, which is a form of question/questions whose questions at the second level resemble the format of an ordinary multiple-choice question but aim to encourage thinking and reasoning at higher order thinking skills [3].

The Two-Tier Multiple Choice question instrument has several advantages, including; reducing the possibility of guessing and allowing the combining several aspects of one phenomenon, where the first tier is the technological domain, while the second tier is the conceptual domain, it is easier

to manage and calculate compared to other methods, so it is very useful for use in class [8]. In addition, the Two-Tier Multiple-Choice instrument is able to measure students' understanding at a high cognitive level [9].

Biology subject is one of the disciplines that require critical and creative skills so that students are able to solve questions/questions at the cognitive evaluating level (C5) well. So that in learning there must be an evaluation of students' abilities to complete C5 (Evaluate).

The results of interviews with the biology teacher said that the coordination system material was taken on the grounds that students had never been evaluated using cognitive level questions C5 (Evaluating) using a two-tier multiple-choice instrument and the coordination system was classified as a chapter that had three sub-chapters with little time allotted.

Ahmad Mujahid's research with the title Analysis of students' mathematical thinking abilities based on the revised Bloom taxonomy, said that only a small number of students were unable to answer properly. In answering question C5 students tend to use the

principles of memorization and understanding of questions, so questions C5 (Evaluate) show differences in how to understand problems by using material principles and structured answer ideas [4].

Ratna Sari, et al with the title Study of high-level thinking skills in high school physics says that the answer category for question C5 (Evaluating) is in the moderate category because a fairly good average score is obtained, so it can be concluded that students already have high-level abilities. on evaluating indicators [5].

The difference between this research and previous research is that previous research did not use a two-tier multiple choice (TTMC) instrument as an instrument in knowing students' abilities to solve High Order Thinking Skills (HOTS) questions.

The purpose of this study is to describe the ability of students to complete C5 questions using the Two-Tier Multiple Choice instrument in Biology Subjects and the benefits of this research are expected to be a source of learning evaluation of student abilities, and provide information to schools so that they become a source of evaluation in improving the quality of learning at school.

RESEARCH METHOD

This research was conducted in September 2021, carried out at MAN 4 Aceh Besar, with a population of 73 students/students majoring in Science/MIA at MAN 4 Aceh Besar and the class that was used as the sample, namely class XI MIA III totaling 24 students/people on the Coordinating system material. This study uses a quantitative approach, with a descriptive research method.

The data collection technique is by administering High Order Thinking Skills (HOTS) tests/questions using a two-tier multiple choice instrument on the coordination system material.

Data analysis techniques begin by categorizing student answers if correct then students understand, if true then students guess, if true-false then students have misconceptions and if wrong-wrong then students do not understand at all, then percentage categories of student answers with the formula:

1. $\% \, student \, B-B = \dfrac{Total \, B-B}{Total \, Students} \times 100\%$

2. $\% \, student \, S-B = \dfrac{Total \, S-B}{Total \, Students} \times 100\%$

3. $\% \, student \, B - S \ = \dfrac{Total \, B-S}{Total \, Students} \times 100\%$ known   that   the   criteria   for

4. $\% \, student \, S - S \ = \dfrac{Total \, S-S}{Total \, Students} \times 100\% \, [6].$ misconceptions in students are:

After categorizing the results of the percentage of students' abilities, it is

Tabel 1. Interpretation of Misconception

No.	Interpretation of Misconception	Misconception Criteria
1	0 < Misconceptions ≤ 30%	Low
2	30 < Misconceptions ≤ 70%	Medium
3	70 < Misconceptions i ≤ 100%	High [7].

RESULTS AND DISCUSSION

Research Results

This research was conducted at MAN 4 Aceh Besar in the Odd Semester of 2021/2022 in class XII MIA III with a total of 24 students. This study aims to find out students' ability in solving High Order Thinking Skills (HOTS) questions, namely C5 (Evaluate) using the Two-Tier Multiple Choice (TTMC) instrument on the Coordination System Material at MAN 4 Aceh Besar by using 5 items questions with evaluate (C5) cognitive level.

Learning High Order Thinking Skills (HOTS) is divided into three namely HOTS as transfer, HOTS as critical thinking and HOTS as a problem solver. [10] Basically to produce new knowledge and problem-solving skills can be obtained with a learning process that is learned with understanding. [9] The results of research on students' ability to complete High Order Thinking Skills questions at the evaluate (C5) cognitive level using the Two-Tier Multiple-Choice instrument can be seen in Table 2.

Table 2. Percentage of Students Understanding C5 (Evaluating) Cognitive Level Questions

Cognitive Domain	Question Number	Student Answers Category			
		Understand (B-B)	Misconception (T-S)	Guessing (S-B)	Not understand (S-S)
C5	2	0	3	5	16
Percentage		0%	13%	21%	67%
C5	5	0	1	9	14
Percentage		0%	4%	38%	58%
C5	8	4	6	3	11
Percentage		17%	25%	13%	46%
C5	11	0	2	6	16
Percentage		0%	8%	25%	67%
C5	14	1	4	9	10
Percentage		4,2%	17%	37,5%	42%
Total mean		4,24%	13,4%	26,9%	56%

Based on the table above, it can be seen that the percentage of students' abilities on each of the questions tested has various percentages.

The highest understanding ability is in question no. 8 with sensory system with a percentage of 17% in the same number the highest student

misconceptions also occur, namely 25% with lots of first level B answers and second level answers is second. Misconception occurs in the reaction of light when in a dark room is responded by rod cells or cone cells. Question no. 14 and question no. 5 has the highest guessing ability, namely at a percentage of 38% in the material on the hormone system and nerve cells. Questions no. 2 and 11 have a percentage of 67% of students who do not understand the concept of the questions being tested.

Discussion

Based on the results of research about the ability of students to solve High Order Thinking Skills (HOTS) questions using the Two-tier Multiple Choice (TTMC) Instrument at MAN 4 Aceh Besar in class XII MIA III showing different percentages, it can be seen from the answers to the first level questions and second-level answers that still have misconceptions, guessing, really understand or don't understand.

High Order Thinking Skills require students to be able to manipulate existing information and ideas by providing new implications and understanding, for example when students are able to combine facts and ideas in the process of synthesizing, generalizing, explaining, and analyzing, so that students reach a conclusion.

The factors that cause students to be mistaken in solving high order thinking skills questions include: never having solved any HOTS-based questions, students' lack of understanding of the questions, less careful in the process of working on the questions and not being optimal during the learning process.

The implementation of questions at level C5 (evaluating) consisted of two indicators, that way students are able to re-examine answers and students being able to give an assessment of problems or criticize answers. The C5 Cognitive Domain Question (Evaluating) consists of 5 items, namely question numbers 2, 5, 8, 11, and 14 with the nervous system, sensory system and hormone system materials.

> 2. Nadia dan mona berasal dari negara tropis, 2 tahun lalu nadia pindah ke Jepang untuk menyelesaikan Studi nya, dan tahun ini Mona menyusul nadia ke negeri 4 musim itu untuk keperluan pekerjaan, dan ia sampai kesana pada musim salju, sehingga membuat kondisi tubuh Mona pada hari pertama diluar dari biasanya. Berdasarkan kasus diatas, bagaimana respon adaptasi tubuh Mona dalam menangani nya …
> A. terjadi pembesaran pori-pori kulit
> B. percepatan peredaran darah
> C. menurunnya produksi keringat
> D. suhu tubuh akan naik
> E. aktivitas enzim dalam tubuh akan terganggu
>
> Alasan saya memilih jawaban diatas adalah …
> 1) respon terhadap perbedaan suhu tubuh diatur oleh hipotalamus
> 2) respon terhadap perbedaan suhu tubuh diatur oleh kelenjar hipofisis
> 3) respon terhadap perbedaan suhu tubuh diatur oleh pancreas
> 4) respon terhadap perbedaan suhu tubuh diatur oleh tiroid

Figure 1. C5 (Evaluating) Question

Question No. 2 has the highest percentage of not understanding 67%, with an average first level answer choosing E and an average second level answer choosing 4, students said that when the editorial question read they never thought about what the body's response is related to which material, so that the answer selected only based on the belief of luck, with low misconception criteria. This is in accordance with Regina Nabila's research, which said that the mistakes that were often found in students in solving comparison problems were mistakes in understanding concepts and translating story problems [9].

> 5. Kondisi ionik dari sel saraf dan cairan ektraseluler ketika sel saraf tidak mengahantarkan rangsang, dijelaskan dengan rumus …
> A. [K+] sitoplasma > [K+] ekstraseluler; [Na+] sitoplasma > [Na+] ekstraseluler
> B. [K+] sitoplasma = [K+] ekstraseluler; [Na+] sitoplasma > [Na+] ekstraseluler
> C. [K+] sitoplasma > [K+] ekstraseluler; [Na+] sitoplasma < [Na+] ekstraseluler
> D. [K+] sitoplasma = [K+] ekstraseluler; [Na+] sitoplasma > [Na+] ekstraseluler
> E. [K+] sitoplasma = [K+] ekstraseluler; [Na+] sitoplasma = [Na+] ekstraseluler
>
> Alasan saya memilih jawaban diatas adalah
> 1) ketika sel saraf istirahat dan tidak menghantarkan rangsang : jumlah Na+ lebih banyak diluar akson, sedangkan K+ lebih banyak didalam akson.
> 2) ketika sel saraf istirahat dan tidak menghantarkan rangsang : jumlah Na+ lebih banyak didalam akson, sedangkan K+ lebih banyak diluar akson.
> 3) ketika sel saraf istirahat dan tidak menghantarkan rangsang : jumlah Na+ diadalam akson sama dengan jumlah K+ didalam akson
> 4) ketika sel saraf istirahat dan tidak menghantarkan rangsang : jumlah Na+ lebih banyak diluar akson, sedangkan K+ didalam akson dan diluar sama.

Figure 2. C5 (Evaluating) Question

Question No. 5 has a percentage of 38% of the answers that are guessed and 58% of the answers of students who do not understand. According to students about this problem, they said that did not understand and had never solved this problem, and the percentage of misconceptions in the category of misconceptions was low.

11. Perhatikan gambar berikut ini !

Struktur sel saraf tersebut memiliki bagian dan fungsinya masing-masing. Bayangkan jika dendrit mengalami kerusakan parah. Maka manakah prediksi dan penjelasan yang terjadi pada tubuh seseorang tersebut ...
A. tubuh akan mengalami ganguan fisik secara berlahan-lahan.
B. gerak tubuh tidak terkontrol
C. neuron tersebut tidak mempengaruhi kerja dan fungsi tubuh.
D. tubuh akan mati rasa.
E. bagian neuron yang rusak akan langsung digantikan fungsinya oleh bagian neuron yang lain, sehingga tubuh tidak mengalami perubahan apa-apa.

Alasan saya memilih jawaban diatas adalah ...
1) karena neuron berhenti berfungsi sebagai isolator pelindung akson.
2) karena neuron tersebut akan mempercepat jalannya impuls.
3) karena kerusakan pada bagian tersebut tidak mempengaruhi kerja struktur neuron.
4) karena neuron akan mengalami perlambatan atau tidak menerima sama sekali reseptor

Figure 3. C5 (Evaluate) Question

Question No.11 has a variety of student answer choices, but no one answered correctly, and the most student answer category is not understanding as much as 67%. This question contains the structure of nerve cells under certain conditions, by expecting students to be able to make decisions from related ideas or knowledge.

Figure 4. C5 (Evaluating) Question No.8

Question No. 8 has the highest percentage of not understanding 46%, and 25% misconceptions, students said that they have solved the questions above, but do not proceed to the reasons for the answers chosen, so that on average students answer wrongly in the second-choice answer, and other students also said that they did not remember the material or the solution to the questions above. The above question belongs to the category of low misconceptions, but among the 5 items evaluating (C5) the question above includes questions with the highest percentage of misconceptions, namely 25%, in line with Sarhim's research which says the reason for misconceptions at the cognitive level Evaluating (C5) describes students' thinking levels, the higher the cognitive level the more difficult the category of questions. Every increase in the cognitive level below it (Low Order Thinking Skills), means that a person cannot understand if he does not know (at the cognitive level of knowledge first) [8].

14. Seseorang yang menderita diabetes melitus memerlukan insulin yang disuntikkan ke dalam tubuhnya setiap hari seumur hidup, hal ini disebabkan ...
    A. insulin yang dihasilkan tubuh tidak sempurna
    B. insulin tidak dapat diserap oleh epitel usus
    C. produksi insulin tidak cukup
    D. insulin tidak dapat dicampur denga makanan
    E. saluran dari pulau langerhans tersumbat.

Alasan saya memilih jawaban diatas adalah ...
    1) berfungsi untuk menaikkan kadar gula dalam tubuh
    2) berfungsi untuk menurunkan kadar gula dalam tubuh
    3) berfungsi untuk mencukupi kadar gula dalam tubuh
    4) berfungsi untuk mengendalikan kadar gula dalam tubuh

Figure 5. C5 (Evaluating) Question

Question No.14 has the highest percentage of not understanding 42% and guessing 37.5%. In this question students are expected to be able to make decisions from certain body conditions, with a second-level choice of functions from the part of the body, this question belongs to the low misconception category. Students said that they understand the meaning of the question but in these circumstances, students are confused in determining the correct answer.

Level C5 (Evaluating) belongs to the highest percentage in the category of student answers that do not understand, namely 56%, students state that questions C5 look easy because of information about questions based on everyday life but students also said that they do not understand what is being asked, coupled with answer options that are very similar sentences. In line with Ratnasari's research which says that the evaluating indicator (C5) is successful if students are able to formulate hypotheses, assess, justify or blame, with indicators measuring them including: students can provide an assessment of solutions, ideas or ideas, students are able to formulate hypotheses, criticize, and students are

able to accept and reject a statement based on set criteria. Thus, all students are said to be able to solved C5 (Evaluate) question if the indicators above are fulfilled by judging at the categories of student answers.

Measuring students' ability to solve High Order Thinking Skills (HOTS) questions using the Two-Tier Multiple Choice instrument can be a source of assessment in increasing learning motivation, and increasing the achievement of learning outcomes so that teachers or students can measure the extent to which material is conveyed to students or to what extent understanding of subject matter in class with real-world contexts so that learning is more meaningful, as well as training students to think creatively and critically, namely the ability to think that does not just remember, restate, or refer to without processing so that students are able to compete nationally and internationally [1].

CONCLUSION

Based on the results of research and data processing, it can be concluded that students' ability to solve cognitive level C5 (Evaluate) questions has the highest average percentage of not

understanding as much as 56%. Contains conclusions from the research that has been done and suggestions related to the results of research that have been obtained.

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