23 (2), 2022, 633-641

Jurnal Pendidikan MIPA

e-ISSN: 2550-1313 | p-ISSN: 2087-9849

http://jurnal.fkip.unila.ac.id/index.php/jpmipa/

Items Analysis of Midterm Exam Test on Difficulty Level and Discrimination Index Based on Bloom Taxonomy: A Case of Junior High School Mathematics Problems

Nur Kholifah*, Mamik Suhendarti, Hawa Liberna

Deparment of Mathematics Education, Universitas Indraprasta PGRI, Indonesia

Abstract: The purpose of this study was to find out how the level of difficulty on the Middle Semester Assessment of Mathematics class VII SMP Negeri 5 Cibitung for the 2021/2022 academic year was based on Bloom's taxonomy. This research was conducted at SMP Negeri 5 Cibitung. The type of research is descriptive research with a quantitative approach. The data collection technique used is the documentation method, while the data analysis technique uses Microsoft Excel with formulas to test validity, reliability, difficulty level, discriminatory power, and calculate the percentage level of difficulty of questions based on Bloom's taxonomy. Based on the results of the analysis, it can be concluded that there are 18 items (90%) which are declared valid, and the items are declared reliable with a reliability coefficient of 0.83. The results of the analysis of questions based on Bloom's taxonomy, obtained questions belonging to the ability to understand (C2) as many as 5 items (25%), belonging to the ability to apply (C3) as many as 10 items (50%), and belonging to the ability to analyze (C4) as many as 5 items (25%). There are no questions belonging to the ability to remember (C1), evaluate (C5), and create (C6), then the questions are classified based on the students' thinking criteria, and the questions that are classified as Higher Order Thinking Skills (HOTS) are 5 items (25%) and questions that are classified as Medium Order Thinking Skills (MOTS) as many as 15 items (75%).

Keywords: difficulty level, mid-semester assessment, Bloom's taxonomy.

Abstrak: *Tujuan penelitian ini untuk mengetahui bagaimana tingkat kesulitan pada soal Penilaian Tengah Semester pelajaran matematika kelas VII SMP Negeri 5 Cibitung tahun ajaran 2021/2022 berdasarkan taksonomi Bloom. Penelitian ini dilakukan di SMP Negeri 5 Cibitung. Jenis penelitian yaitu penelitian deskriptif dengan pendekatan kuantitatif. Teknik pengumpulan data yang digunakan adalah metode dokumentasi, sedangkan teknik analisis data menggunakan Microsoft Excel dengan rumus-rumus untuk uji validitas, reliabilitas, kemudian menganalisis soal PTS buatan guru dengan mengelompokkan kategori soal berdasarkan taksonomi Bloom dan menghitung persentasenya, serta menilai soal PTS buatan guru berdasarkan kriteria LOTS, MODS, dan HOTS. Berdasarkan hasil analisis, maka dapat disimpulkan bahwa terdapat 18 butir soal (90%) yang dinyatakan valid, dan butir soal tersebut dinyatakan reliabel dengan koefisien reliabilitas 0,83. Hasil analisis soal berdasarkan taksonomi Bloom, diperoleh soal yang tergolong kemampuan memahami (C2) sebanyak 5 butir soal (25%), yang tergolong kemampuan mengaplikasikan (C3) sebanyak 10 butir soal (50%), dan yang tergolong kemampuan menganalisis (C4) sebanyak 5 butir soal (25%). Tidak terdapat soal yang tergolong kemampuan mengingat (C1), mengevaluasi (C5), dan mencipta (C6), kemudian soal digolongkan berdasarkan kriteria berpikir peserta didik, dan diperoleh soal yang tergolong Higher Order Thinking Skills (HOTS) sebanyak 5 butir soal (25%) dan soal yang tergolong Medium Order Thinking Skills (MOTS) sebanyak 15 butir soal (75%).*

Kata kunci: *tingkat kesulitan, penilaian tengah semester, taksonomi Bloom.*

Nur Kholifah
*Email: nkholifah2698@gmail.com

DOI: http://dx.doi.org/10.23960/jpmipa/v23i2.pp486-495
Received: 28 April 2022
Accepted: 06 June 2022
Published: 09 July 2022

▪ INTRODUCTION

Mathematics is an important lesson because it is needed by humans in everyday life when they are active and doing their jobs. Mathematics has benefits for other disciplines, especially in the fields of science and technology or mathematics itself (Siagian, 2016). In the modern era, creative, critical, and logical thinking human resources are needed. By studying mathematics, humans can train their thinking patterns to be more creative, critical and logical. For example, when humans use mathematical calculations in designing, building, estimating, and creating things.

Given the importance of mathematics, mathematics is used as one of the compulsory subjects in school. Starting from Elementary School (SD), Junior High School (SMP), High School (SMA), up to Universities. Mathematics lessons in schools are taught with the aim of preparing students to be able to use mathematics and a mathematical mindset in studying science and applying it to everyday life. Most problems can be solved using mathematical calculations and logic. To achieve this, a person must have various kinds of abilities such as reasoning skills, critical thinking, logical thinking, the ability to understand mathematical concepts and higher order thinking skills. Based on the results of interviews with Mrs. Salsya who is one of the mathematics teachers at SMP Negeri 5 Cibitung, the understanding of concepts that students currently have is still lacking. Mathematics is an important lesson because it is needed by humans in everyday life when they are active and doing their jobs.

Based on the PTS score data that has been obtained from the seventh grade mathematics teacher at SMP Negeri 5 Cibitung, it is evident that the Middle Semester Assessment (PTS) score for students' mathematics lessons is still low below the KKM. This is because the abilities of students in solving mathematical problems are still lacking. Therefore, the researcher wants to overcome this by analyzing the level of difficulty of the questions. The level of difficulty or difficulty (difficulty level) of a question is the proportion or percentage of subjects who answer certain test items correctly (Kholis, 2017).

To find out the abilities of students, teachers must evaluate learning. Evaluation aims to assess the achievement of students' competencies and abilities, as well as improve learning and guidelines for preparing reports on learning progress (Septiana, 2016). Learning evaluation can be in the form of giving test questions. The test is a tool used in the assessment and selection process to what extent the level of achievement of student learning outcomes (Susanna, Ani, & Hamid, 2020). The test as a measuring tool to obtain some information about the development of students must be of good quality, and developed from the curriculum used, taking into account the core competencies and basic competencies available to be used as the basis for improving the learning system (Pandra, Sugiman, & Mardapi, 2015). The test instrument is the most important part in measuring the ability of students. The test instrument is a tool used to collect information or data, and find or measure something through a predetermined strategy and decision (Arzfi, Ananda, & Fitria, 2022). Therefore, in the preparation of test instruments must pay attention to the conditions that have been set. The tests used in schools can be in the form of Daily Assessment (PH), Mid-Semester Assessment (PTS), and Final Semester Assessment (PAS).

Based on the facts of research conducted by Fadhillaturrahmi & Ananda (2018) it was found that the tests used were made without paying attention to the cognitive level

of students, but were mostly made with low cognitive levels, namely only the level of remembering. Good test questions are questions that can measure the abilities of students. This is in line with the opinion of Pratomo & Nur (2021) which says that if the test instrument is prepared properly it will have a good impact, and will provide information on the extent to which a program has been successfully implemented, knowing the weaknesses of students and the causes of these weaknesses, as well as how to overcome them, detecting participants. students who have or have not mastered the learning objectives and so on. The maximum results shown by students can share information about the abilities or mastery of students (Lubis, Syarifuddin, & Dongoran, 2017). Therefore, analyzing the questions is very necessary before being tested on students. In line with the opinion of Azizah, Hanifah, & Sumardi (2021) that item analysis is needed to improve the quality of the test by revising or discarding ineffective questions, and to find out whether or not students have understood the material that has been given during learning

One way to determine the quality of the questions is to analyze the questions. Bloom's Taxonomy can help classify the criteria for questions whether the questions fall into the criteria of easy, medium or high difficulty. Bloom's Taxonomy itself is a collection of Operational Verbs (KKO) used in the preparation of questions. According to Anderson & Krathwohl (in Ahmad & Sukiman, 2019) said that in the aspect of assessment, Bloom's taxonomy of cognitive domain helps teachers in determining the instrument to be used and the selection of verbs used in compiling the questions. This is in accordance with the opinion of Gunawan & Palupi (2012) that Bloom's Taxonomy in the cognitive domain is one part of the foundation in categorizing educational goals, curriculum, and preparation of test instruments. As we know that the distribution of criteria in Bloom's taxonomy has been determined based on a collection of word groups from C1 to C6. C1 is classified for the easy difficulty category, C2 and C3 for the medium category, C4, C5 and C6 for the high difficulty category.

Based on the description above, the researcher is interested in analyzing the level of difficulty of the Mid-Semester Assessment (PTS) questions based on Bloom's Taxonomy, in which there are already several main subjects in mathematics.

▪ METHOD

Location and Time Research

The location of this research was carried out at SMP Negeri 5 Cibitung. The time of this research was carried out in the 2021/2022 academic year.

Research Subject

The subjects in this study were the questions and all answers to the seventh grade Middle Semester Assessment (PTS) mathematics questions for the 2021/2022 academic year in the form of a Google Spreadsheet, totaling 249 participants. For the research sample, this analysis amounted to 84 participants using a sampling technique, namely simple random sampling.

Research Procedure

Collecting data and information obtained from mathematics teachers at SMP Negeri 5 Cibitung in the form of Mid-Semester Assessment (PTS) questions that have been

tested on students along with students' answers. Then the data is processed and analyzed using Microsoft Excel to determine the validity, reliability. Analyze the items based on the cognitive level of the revised Bloom's taxonomy by matching the Operational Verbs used in the questions by 3 mathematicians or teachers to draw conclusions. Counting the number of questions at each cognitive level. Calculate the percentage of questions at each cognitive level. Make conclusions and suggestions.

Research Instruments

The research instruments used in this study were questions and answer keys, student answer sheets, classification sheets and question analysis checklists.

Data Analysis Techniques

Calculating the validity and reliability of the PTS questions made by the teacher. Calculations using Microsoft Excel software with the biserial product correlation formula (r_pbis) for the validity test, and the Kuder Richardson formula (KR-20) for the reliability test. Analyze the questions by grouping the categories of questions that fall into C1 to C6 (cognitive level), and calculate the percentage of each cognitive level of Bloom's taxonomy. Assess teacher-made PTS questions based on the criteria for Lower Order Thinking Skills (LOTS), Medium Order Thinking Skills (MODS), and Higher Order Thinking Skills (HOTS).

▪ RESULT AND DISSCUSSION

Validity Test

Based on the results of the calculation of the validity test using the biserial product correlation formula (r_pbis) with the help of Microsoft Excel software, it was found that the items for the Middle Semester Assessment of mathematics for class VII SMP Negeri 5 Cibitung for the 2021/2022 academic year which were declared valid amounted to 18 questions (90%), with a value r_pbis>r_tabel, it means that these questions can be said to have measured the ability of students. In line with the opinion of Antari, Susanta, & Siagian (2021) that questions that have a good validity value indicate that the question is unquestionably accurate and correct in measuring the skills of students, while items that have a very low validity value indicate that the question is not valid. Therefore, action is needed on this matter.

It means that these questions can be said to have measured the ability of students. In line with the opinion of Antari, Susanta, & Siagian (2021) that questions that have a good validity value indicate that the question is unquestionably accurate and correct in measuring the skills of students, while items that have a very low validity value indicate that the question is not valid. Therefore, action is needed on this matter.

Questions that are declared valid can be maintained by being stored in a question bank and can be reused when needed. While the items that are declared invalid can be corrected so that they can be used in the next test. Improving the questions is done by asking for suggestions from teachers and expert validators and based on the results of the analysis of test trials that still do not meet the criteria as good test questions (Taufiq, 2015).

Reliability Test

Based on the results of the reliability test calculation using the Kuder Richardson (KR-20) formula with the help of Microsoft Excel software, it is obtained that the items for the Middle Semester Assessment of mathematics for class VII SMP Negeri 5 Cibitung for the academic year 2021/2022 have a reliability value of 0.83 so that it can be stated that the items are reliable and can be trusted to be used in a test or assessment. This is in line with Ambiyar's statement (Sari, 2020) which says if a test is reliable, then the test consistently measures. The higher the reliability of the test, the better the quality of the test (Sari, 2020).

Analysis of the Difficulty Level of PTS Questions at SMP Negeri 5 Cibitung Based on Bloom's Taxonomy

The mid-semester assessment questions were analyzed to determine the level of difficulty based on Bloom's Taxonomy, which was categorized into six levels, namely knowing (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C5). C6). The following is an analysis of the Middle Semester Assessment questions for grade VII mathematics at SMP Negeri 5 Cibitung for the 2021/2022 academic year from 3 math experts or teachers based on Bloom's Taxonomy. The questions were analyzed based on Operational Verbs used in the problem, and categorized as presented in Table 3.

Tabel 2. Results of analysis of the difficulty level of middle semester assessment of mathematics subjects for class vii smp negeri 5 cibitung for the 2021/2022 academic year based on bloom's taxonomy

Cognitive Level	Expert 1	Expert 2	Expert 3	Average Amount Question	Percentage
C1	-	6	-	-	0%
C2	5	7	4	5	25%
C3	10	5	13	10	50%
C4	5	2	3	5	25%
C5	-	-	-	-	0%
C6	-	-	-	-	0%
Total				**20**	**100%**

Tabel 3. Categorization of difficulty levels of middle semester assessment of mathematics subjects class vii smp negeri 5 cibitung academic year 2021/2022 based on bloom's taxonomy

Number Question	Difficulty Level Question (Cognitive Level)						Operational Verbs
	C1	C2	C3	C4	C5	C6	
1			√				Determine
2			√				Sort
3			√				Sort
4			√				Operate

5	√			Exemplify
6			√	Solve
7		√		Apply
8	√			Count
9			√	Solve
10			√	Solve
11	√			Categorize
12	√			Detail
13	√			Exemplify
14		√		Determine
15		√		Determine
16		√		Determine
17		√		Operate
18		√		Operate
19			√	Analyze
20			√	Analyze

Tabel 4. Recapitulation of difficulty level of middle semester assessment of mathematics subject class vii smp negeri 5 cibitung for the 2021/2022 academic year based on bloom's taxonomy

Difficulty Level (Cognitif Level)		**Question Points**	**Amount Question**	**Percentage**
Remembering (C1)	LOTS	-	0	0%
Understanding (C2)	MOTS	5, 8, 11, 12, 13	5	25%
Apply (C3)		1, 2, 3, 4, 7, 14, 15, 16, 17, 18	10	50%
Analyze (C4)	HOTS	6, 9, 10, 19, 20	5	25%
Evaluate (C5)		-	0	0%
Create (C6)		-	0	0%
Total			**20**	**100%**

Based on the table above, the results of the analysis of the difficulty level of the Middle Semester Assessment items for class VII mathematics at SMP Negeri 5 Cibitung for the 2021/2022 academic year based on Bloom's Taxonomy, it was found that the questions were dominated by questions classified as Medium Order Thinking Skills (MOTS), namely 15 items. questions (75%) consisting of questions with the ability to understand (C2) totaling 5 items (25%), and the ability to apply (C3) totaling 10 items (50%). These questions do not contain items that are classified as Lower Order Thinking Skills (LOTS). Based on the results of research by Wahyuni, Khaldun, & Sulastri (2017), it is stated that the higher the cognitive aspect (in Bloom's taxonomy) is measured, the higher the quality of the test.

The difficulty level of questions based on Bloom's taxonomy is a cognitive level of questions that are usually used to formulate the objectives of a test. Based on the results of the researcher's interview with Mrs. Salsya as a mathematics teacher, basically the teachers already understand Bloom's taxonomy. However, in preparing the items,

most teachers pay less attention to the cognitive level of the questions, because the teacher must continue to adjust the level of difficulty of the questions to be tested with the abilities possessed by students.

Basically, the questions that will be tested on students must cover cognitive levels ranging from low level (remembering – C1) to high level (creating – C6). Because the questions given will be used to test students' thinking skills, and find out to what extent students' abilities after following the learning process. This is in line with the opinion of Giani, Zulkardi, & Hiltrimartin (2015) which states that to produce graduates who are well competent, student assessment must require understanding, application, analysis, evaluation, and creativity so that students are accustomed to having knowledge at that level.

According to Anderson & Krathwohl (in Saragih, 2019) the levels of Bloom's Taxonomy are divided into three parts, namely Lower Order Thinking Skills (LOTS), Medium Order Thinking Skills (MOTS), and Higher Order Thinking Skills (HOTS). The ability to remember (C1) is classified as a Lower Order Thinking Skill (LOTS), the ability to understand (C2) and apply (C3) is classified as Medium Order Thinking Skills (MOTS), the ability to analyze (C4), evaluate (C5), and create (C6) are classified as Higher Order Thinking Skills (HOTS). So, the PTS questions made by teachers at SMP N 5 Cibitung are classified as Medium Order Thinking Skills (MOTS). or questions with a moderate level of difficulty. In order to improve the ability of students, teachers should pay more attention to the level of difficulty and variety in making questions. This is in line with the results of Effendi's research (2017) which states that teachers need to develop questions in accordance with Bloom's taxonomy revision, especially at levels C4, C5, C6 so that students are more accustomed to solving problems that develop higher-order thinking skills.

▪ CONCLUSION

From the results of the analysis of the difficulty level of the questions based on the level of difficulty and Bloom's Taxonomy on the questions used in the Mid-Semester Assessment at SMP Negeri 5 Cibitung for the 2021/2022 academic year in the form of multiple choice and totaling 20 items, it can be concluded that based on the results of calculations, multiple choice questions which consists of 20 items, there are 18 items (90%) which are declared valid and declared reliable with a high reliable coefficient of 0.83. This means that the items can be trusted to be used in the assessment of students. Based on the results of the analysis of questions in terms of Bloom's Taxonomy, there are 5 questions belonging to the ability to understand (C2) (25%), which are classified as the ability to apply (C3) as many as 10 items (50%), and those belonging to the ability to analyze (C4). as many as 5 items (25%). There are no questions that are classified as the ability to remember (C1), evaluate (C5), and create (C6). Based on the students' thinking criteria, the questions are classified into three parts. From the questions analyzed, there are questions that are classified as Higher Order Thinking Skills (HOTS) as many as 5 items (25%) and questions that are classified as Medium Order Thinking Skills (MOTS) as many as 15 items (75%). From the conclusions above, it is evident that the PTS questions made by teachers at SMP Negeri 5 Cibitung are classified as good, with high validity and reliability, and the

questions are classified as Medium Order Thinking Skills (MOTS) questions or questions with a moderate level of difficulty.

▪ REFERENCES

Ahmad, I. F., & Sukiman, S. (2019). Analisis Higher Order Thinking Skills (Hots) Pada Soal Ujian Akhir Siswa Kelas 6 Kmi Dalam Kelompok Mata Pelajaran Dirosah Islamiyah Di Pondok Modern Tazakka Batang. Jurnal Pendidikan Agama Islam, 16(2), 137-164.

Antari, B., Susanta, A., & Siagian, T. A. (2021). Analisis Soal Penilaian Akhir Semester Matematika SMA Negeri 8 Kota Bengkulu Tahun Ajaran 2020/2021. JEMS: Jurnal Edukasi Matematika dan Sains, 9(2), 299-312.

Arzfi, B. P., Ananda, R., & Fitria, Y. (2022). Analisis Kesulitan Level Kognitif pada Evaluasi Sumatif Mata Pelajaran Sains di Sekolah Dasar. Jurnal Basicedu, 6(1), 129-137.

Azizah, N., Hanifah, H., & Sumardi, H. (2021). Analisis Kualitas dan Tingkat Kognitif Soal Matematika Penilaian Akhir Semester Ganjil Kelas IX di SMP N 10 Kota Bengkulu Tahun 2020/2021. Journal Mathematics Education Sigma, 2(2), 51-60.

Effendi, R. (2017). Konsep revisi taksonomi Bloom dan implementasinya pada pelajaran matematika SMP. Jurnal Ilmiah Pendidikan Matematika, 2(1).

Fadhilaturrahmi, F., & Ananda, R. (2018). Evaluasi Pembelajaran IPS Berbasis Taksonomi Bloom Dua Dimensi di Sekolah Dasar. Jurnal Basicedu, 1(2), 12-21.

Giani, G., Zulkardi, Z., & Hiltrimartin, C. (2015). Analisis tingkat kognitif soal-soal buku teks matematika kelas VII berdasarkan taksonomi Bloom. Jurnal Pendidikan Matematika, 9(2), 78-98.

Gunawan, I., & Palupi, A. R. (2016). Taksonomi Bloom–revisi ranah kognitif: kerangka landasan untuk pembelajaran, pengajaran, dan penilaian. Premiere educandum: jurnal pendidikan dasar dan pembelajaran, 2(02).

Kholis, R. A. N. (2017). Analisis Tingkat Kesulitan (difficulty level) soal pada buku sejarah kebudayaan Islam Kurikulum 2013. Jurnal Pendidikan Agama Islam, 14(2), 305-315.

Lubis, S. S., Syarifuddin, S., & Dongoran, H. Analisis Butir Soal Dan Kemampuan Siswa Menjawab Tes Un Dan Uas Ganjil Mata Pelajaran Biologi Kelas Xi Sman/Man Di Kota Medan. Jurnal Pelita Pendidikan, 5(3).

Pandra, V., & Mardapi, D. (2017). Development of Mathematics Achievement Test for Third Grade Students at Elementary School in Indonesia. International Electronic Journal of Mathematics Education, 12(3), 769-776.

Pratomo, R. H. S., & Nur, S. M. (2021). Identifikasi Soal Tes UTS dan UAS Mata Pelajaran Biologi Berdasarkan Taksonomi Bloom Revisi Anderson terhadap Pemahaman Konsep Pembelajaran. Syntax Literate; Jurnal Ilmiah Indonesia, 6(1), 407-417.

Sari, L. Y. (2017). Analisis Soal Ulangan Harian Pada Materi Ekologi Kelas X SMA Negeri 2 Lembang Jaya Kabupaten Solok. Saintifik, 1(2).

Saragih, F. A. (2019). Penerapan Metode HOTS (Higher Order Thinking Skill) Dalam Pembelajaran Bahasa Jepang Di SMA. Journal of Japanese Language Education and Linguistics, 3(2), 147-166.

Septiana, N. (2016). Analisis butir soal ulangan akhir semester (UAS) biologi tahun pelajaran 2015/2016 kelas X dan XI pada MAN Sampit. Edu Sains: Jurnal Pendidikan Sains dan Matematika, 4(2).

Siagian, M. D. (2016). Kemampuan koneksi matematik dalam pembelajaran matematika. MES: Journal of Mathematics Education and Science, 2(1).

Sumardi, M. (2020). Teknik Pengukuran Dan Penilaian Hasil Belajar. Deepublish.

Susanna, S., Ani, P., & Hamid, A. (2020). Analisis Tingkat Kesulitan Soal Try Out Fisika SMA Negeri 5 Banda Aceh. Jurnal Pendidikan Fisika dan Teknologi, 6(2), 193-197.

Taufiq, A. U. (2015). Pengembangan Tes Kognitif Berbasis Revisi Taksonomi Bloom pada Materi Sistemreproduksi untuk Siswa SMA. Jurnal Biotek, 3(2), 1-17.

Wahyuni, E. S., Khaldun, I., & Sulastri, S. (2017). Analisis Soal-Soal Ujian Materi Stoikiometri SMA Negeri Kota Banda Aceh. Jurnal Pendidikan Sains Indonesia, 5(2), 73-79.