

The Science Teacher's Knowledge of Junior High School To Constructing Questions Based- Bloom's Taxonomy

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Abstract—This study aims to describe the level of knowledge of middle school science teachers in compiling questions based-Bloom's taxonomy. This type of research is quantitative descriptive; data collection techniques are carried out by a survey method using a questionnaire instrument in the form of a semantic scale questionnaire model developed. The population in this research is all of the Natural Sciences teachers of State Junior High Schools in Aceh Province, and the sample is 95 of the Natural Sciences teachers of middle Schools selected randomly from 13 districts / cities. Categorization is done in five levels, namely: very high, high, medium, low, and very low. The number of teachers in each categorization was analyzed as a percentage. The results showed that most of the science teachers at state junior high school already had high knowledge in compiling questions C1, C2 and C3. But for questions C4, C5 and C6 most of the teachers still have low knowledge.

Keywords— knowledge; preparation matter; and bloom's taxonomy.

I. INTRODUCTION

Teacher competence in the learning process largely determines students' academic and non-academic progress because the teacher's ability in the learning process is one of the main pillars of improving the quality of education [1]. The most important stage in the learning process is assessment and evaluation. A teacher needs to know the process of evaluating learning outcomes in learning because evaluation is an inseparable part of the overall learning organization [2]. Evaluation has a relationship that is interrelated with the learning objectives and the learning process [3]. To find out the achievement of students' competencies, materials for preparing reports on the progress of learning outcomes, and improving the learning process, an assessment is conducted [4]. Assessment basically aims to get information about the development of the process and learning outcomes of students and the results of teaching teachers. According to Setiadi [5] Assessment is one of the important aspects in the education process.

Assessment is carried out by the teacher of learning outcomes to measure the level of achievement of students' competencies, and is used as material for preparing progress reports on learning outcomes and improving the learning

process [6]. Therefore, teachers as managers of learning are required to be able to prepare and conduct assessments with the correct procedures so that the learning objectives set are achieved [7].

Arranging questions to determine the level of academic ability in each even semester can certainly be interesting whether students have mastered the basic competency indicators or not. The fact that happens in schools is that teachers rarely compile tests. Usually using existing tests and then invincible with teaching materials [8]. This situation also occurs in Cluster 02 Sumbermalang Sub district, so there is often an inaccuracy between the tests and the basic competencies required in the Education Unit Level Curriculum (KTSP). On the other hand, most of the teachers were not yet able to compile tests, so they often looked for a number of existing questions [9]. Every final semester test can be seen again in the following semester. Seeing this condition, the teacher does not yet have the ability to compose tests and has never compiled a test result of his own work. In this connection, this research needs to be carried out. The author found that in the field after observations in the final semester learning outcomes test notes, most of the teachers still experienced difficulties or problems in preparing professional tests. Thus, the ability of teachers needs to be improved, especially in preparing professional tests for even the final semester. The problems in preparing professional tests are as follows: 1. the teacher has not been able to compile test items with the aim of learning, 2. the teacher has not been able to measure the behavior level of the Bloom Taxonomy difficulty level, and 3. the teacher is not yet able to use correct and good Indonesian

Measurement of success often uses evaluation tools in the form of tests [10]. The test instrument or commonly called a question is one of the measuring instruments used to detect the ability of students [11]. The test is a form of evaluation tool to measure how far the teaching objectives have been achieved [12]. Cognitive is one of the domains used to develop learning objectives. A'yun and Sutrisno [13] add that in cognitive thinking there are levels that direct students to think from low to high levels (C1-C6).

Evaluation or evaluation activities are not new for teachers or education practitioners because designing and implementing assessments is a set of main tasks and functions of teachers [14]. However, the reality shows that many of the science teachers of the Aceh Provincial in Middle School have not been able to compile Bloom's taxonomy based questions. According to Gunawan and Palupi [15], the level of Bloom's Taxonomy is used as a basis for the preparation of educational goals, test preparation, and curriculum. This can be seen based on the results of the National Examination (NE) at the Junior High School which are not yet satisfactory. For the junior level, one of the subjects that is nationalized is Natural Sciences (IPA). The results of the National Examination for the 2017/2018 Academic Year showed that the average value of natural science lessons for the level of state junior high schools in Aceh Province was 39.96. The highest IPA score for State Junior High School is 90.0, while the lowest IPA score is 2.5 [16].

The low of National Examination results are certainly due to several reasons. One of the reasons is because the students in Aceh State Junior High School are less trained in solving problems that demand reasoning in solving them, where the questions are questions constructed among others based on Bloom's taxonomy. Many teachers are trapped only in operational verbs, so questions made only at the level of remembering or understanding, do not make test questions in accordance with Bloom's taxonomic understanding which also has a high order thinking skills or HOTS (C4, C5, and C6). In terms of learning materials provided to students are required to have cognitive competence up to C6.

The purpose of this study is to determine the level of knowledge of State Junior High School science teachers in compiling Bloom's taxonomy-based questions. The results of this study are very important for the District / City Government, especially the Kabupaten / City Education Office in the Province of Aceh to improve the quality of science teachers teaching at State Junior High Schools in constructing or compiling Bloom's taxonomy-based questions. Teacher's knowledge regarding Bloom's taxonomy-based question making process is very closely related to efforts to improve the quality of Aceh's education. According to Azhary [17] Efforts to improve the quality of education can be pursued through improving the quality of learning and the quality of the assessment system.

II. METHODS

This research is a descriptive research and carried out by survey method. This method is considered appropriate because this research was conducted to collect factual information through the use of questionnaires [18]. The purpose of descriptive research is to describe systematically, factually and accurately about the facts and characteristics of the population in a particular area. The population is all of the natural science teachers of state junior high schools in Aceh Province, and the sample is 95 IPA teachers of randomly selected junior high schools from a number of state junior high schools from 13 regencies/cities. The study was conducted from April to December 2018.

This research is conducted in two steps. The first is to develop instruments to measure the knowledge and understanding of science teachers at State Junior High Schools in compiling Bloom's taxonomy-based questions by using the document analysis sheet which contains a table with the format column number, question code, question, and level type Bloom's cognitive taxonomy. Second, use the results of development instruments in the form of a scale questionnaire model to determine the level of knowledge and understanding of science teachers at State Junior High Schools in compiling Bloom's taxonomy-based questions. The process and steps for developing non-cognitive instruments to determine the level of knowledge and understanding of science teachers at State Junior High School in Bloom taxonomy-based questions refer to the steps of developing affective instruments [19, 20].

To test the instrument to measure the knowledge of junior high school science teachers in compiling Bloom Taxonomy-based questions the item-total correlation technique was used to determine validity [21], and Cronbach's alpha formula to calculate its reliability [22]. Based on validity and reliability tests there are 27 valid items with the results of the reliability coefficient of 0.977.

To provide an interpretation of the science teacher's knowledge in compiling Bloom Taxonomy-based questions categorization used by Azwar [23], namely:

$X \leq 32$	Knowledge-based composing matter Taxonomy Very Low
$32 < X \leq 48$	Knowledge compose about Bloom's taxonomy-based Low
$48 < X \leq 64$	Knowledge compose about Bloom's taxonomy-based Medium
$64 < X \leq 80$	composing Knowledge about Bloom's taxonomy-based High
$X > 80$	Pengetahuan compose about Bloom's taxonomy-based Very High

Meanwhile, to determine the number of teachers in each categorization the percentage (%) was used.

III. RESULTS AND DISCUSSION

The following presents the results and discussion of the level of knowledge of the State Junior High School science teachers in compiling Bloom Taxonomy-based questions.

A. Knowledge of Compiling C1 Bloom Questions

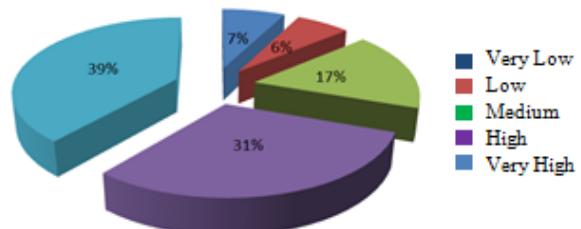


Fig. 1. Knowledge of teacher science to compiling C1 Bloom questions

Based on figure 1 shows the level of knowledge of junior high school science teachers in compiling C1 questions based on Bloom's Taxonomy. The number of teachers who have knowledge arranging questions in the category is very high and the high category is 66 people or 70%. While those who have knowledge in the low and very low categories are 13 people or 13%. The rest who have knowledge in the medium category are 17%. Although the number of teachers who have knowledge in the very high category and in the high category is more than those who have the knowledge in the low category and the category is very low, it is still a concern because there are still junior high school teachers whose knowledge is in the low and very low category in compiling C1 questions (knowledge). Knowledge is the most basic level in Bloom's Taxonomy. Although knowledge is the most basic level, it is an important component [24]. In addition Anderson and Krathwohl [25] stated that the ability to remember is the ability measured in terms of taking knowledge from long-term memory.

B. Knowledge of Compiling C2 Bloom Questions

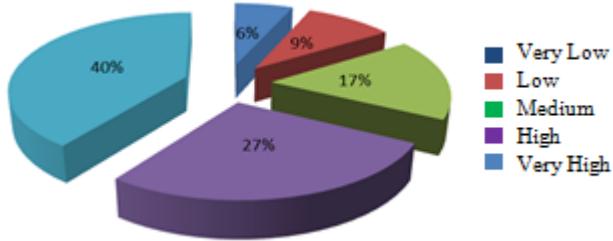


Fig. 2. Knowledge of teacher science to compiling C2 Bloom questions

Based on Figure 2, it can be seen the level of science teacher's knowledge in compiling C2 questions, which is as follows. As many as 64 people (67%) junior high school science teachers already had very high levels of knowledge, and high categories in compiling C2 questions. Not much different from the knowledge of teachers in compiling C1 questions, the knowledge of teachers in compiling C2 questions still found as many as 15 people (16%) of science teachers who had knowledge in the low category and in the very low category. In the second case the first aspect of Bloom's Taxonomy is called low-level cognitive and the next four aspects include high-level cognitive [26]. According to Bloom (1979) questions made on aspects of knowledge (C1) and understanding (C2) are classified as low-level thinking skills in the learning process.

C. Knowledge of Compiling C3 Bloom Questions

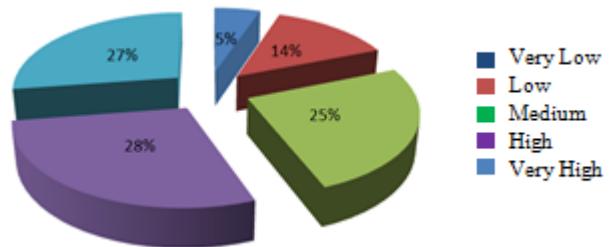


Fig. 3. Knowledge of teacher science to compiling C3 Bloom questions

From Figure 3 the level of science teacher's knowledge is shown in compiling C3 questions. It can be seen that as many as 53 people (55%) of science teachers already have knowledge in the very high category and in the high category. Furthermore, there are as many teachers who have knowledge in the low and very low categories. 19% of teachers. This number is more than the number of low and very low categories in compiling C2 questions (16%) and C1 questions (13%). This gives information that the higher the cognitive level of the questions, the less knowledge the science teacher has to compile them. According to Prasetya [27] one of the competencies that teachers must possess is developing assessment instruments, evaluating processes and learning outcomes. As evaluators teachers are required to be able to make an assessment of the entire learning process, both the achievement of student competencies and the progress of learning outcomes [28]. Indeed, to be able to arrange tests that meet the requirements is quite difficult because preparing tests requires quite a high level of knowledge, skills and accuracy [29].

D. Knowledge of Compiling C4 Bloom Questions

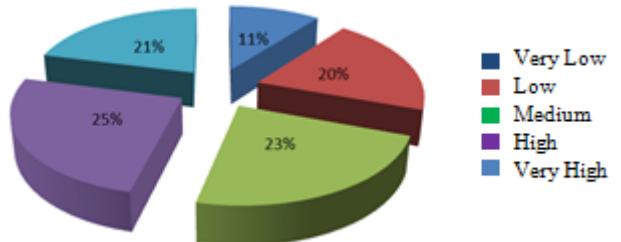


Fig. 4. Knowledge of teacher science to compiling C4 Bloom questions

Furthermore, from Figure 4 it can be seen the level of science teacher knowledge in compiling C4 questions based on Bloom's Taxonomy. As many as 44 people (46%) of science teachers already had knowledge in the very high category and in the high category. While the percentage of teachers who have knowledge in the low and very low categories is 29 people (31%). This number is greater than the percentage of teachers who have knowledge in the low category and are very low in compiling C3 questions, which is only 19%. This gives a clue that C4 (analyzing) questions for science teachers are increasingly lacking in the knowledge to arrange them. In this case the teacher must always train students to be able to think at a high level in the learning process. Problem C4 is included in the high-level questions (HOTS). According to Awaliyah

Problem HOTS are at the level of analyzing, evaluating, and creating [30,31].

According to Krathwohl that indicators to measure the ability to think at a higher level include analyzing (C4), the ability to separate concepts into several components and connect with each other to gain an understanding of the concept as a whole, evaluate (C5), namely the ability to determine the degree of something based on norms, certain criteria or benchmarks, and create (C6), namely the ability to combine elements into something new, complete and broad, or make something original.

E. Knowledge of Compiling C5 Bloom Questions

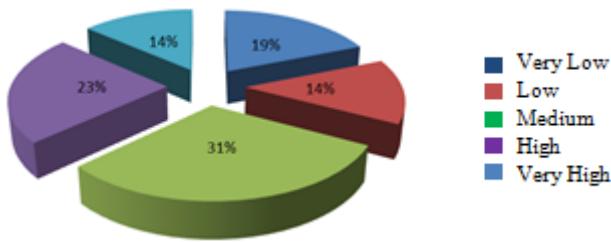


Fig. 5. Knowledge of teacher science to compiling C5 Bloom questions

Based on figure 5 provides information that the teacher's knowledge in compiling C5 questions is still low and very low, and the number of these two categories is 31 people (33%). This is not much different from the number of teachers who are categorized as very high and high knowledge, as many as 35 people or 37%. This means that the teacher's knowledge to compile questions C4 and C5 is very alarming. Although questions C4 and C5 are included in the Higher Order Thinking Skills (HOTS) level, teachers must have knowledge in compiling them, because this assessment activity is part of the teacher's pedagogical competence. According to Salirawati, et al that in evaluating, especially assessments related to cognitive aspects, a teacher is required to be able to develop a variety of adequate assessment instruments that are able to comprehensively reveal the ability of students [32-34].

F. Knowledge of Compiling C6 Bloom Questions

To compile the C6 problem which is a matter of the highest cognitive level in Bloom's Taxonomy can be seen from Figure 6, which is as follows.

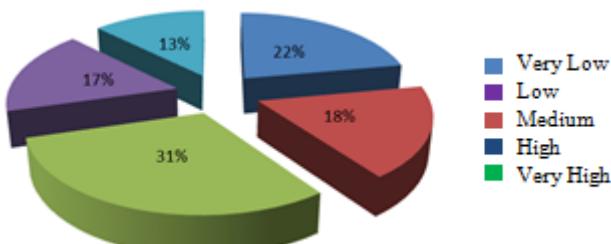


Fig. 6. Knowledge of teacher science to compiling C6 Bloom questions

Based on figure 6, there are only 18 people (20%) of science teachers who have very high knowledge categories and

have a high level of knowledge. On the contrary, there were 38 teachers (40%) who had low and very low categories of knowledge. This means that the teacher's knowledge in compiling the dominant C6 questions is very low and low.

Based on the description above, it can be seen that the level of science teacher's knowledge in compiling questions varies, meaning that if at first the knowledge to compile C1 questions was 39% people of science teachers, then continued to increase for questions C2 and C3 to 39% and for C4 to as much as 40%. The level of knowledge of science teachers starting from C4 which dropped 27% to 21% for C5 questions and continued to decline in C5 questions to only 13%. On the other hand, the level of knowledge possessed by the Natural Science teacher in C1 questions is only 7% and C2 is 6%, and C3 is 5%, up to 11% of the Natural Science teachers in C4 questions, to 19% of the Natural Science teachers to compile C5 questions and increase to as much as 22% to arrange C6 questions. This means that the higher the cognitive level of the questions, the less the level of science teacher's knowledge in the preparation. From this analysis it can be interpreted that the questions are included in the high-level category or called HOT questions (C4, C5 and C6) science teachers have not been able to compile or construct them. This is because the HOTS problem has its own characteristics in its preparation. According to Fanani Characteristics of HOTS assessment are: measuring the ability to think at a high level, based on contextual problems, not routine (not familiar), and using various forms of questions [35, 36]. This is in line with the results of research conducted by Osnal, Suhartoni, and Wahyudi in improving the teacher's ability to compile end-of-semester learning outcomes tests through the Workshop found that: "teachers have not been able to measure the behavioral aspects (skills) of high-level knowledge based on Bloom's Taxonomy" [37]. The following is a follow-up to the overall results of the six aspects of the Bloom Taxonomy level.

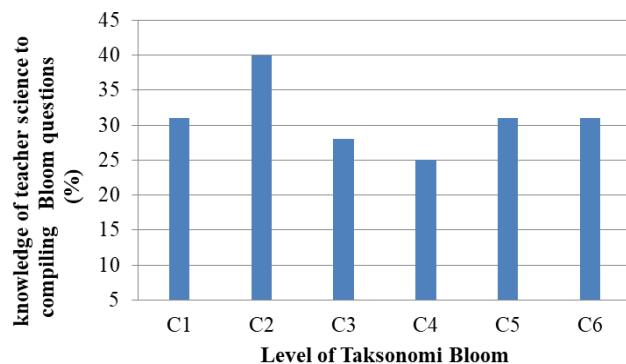


Fig. 7. Knowledge of teacher science to compiling Bloom questions

IV. CONCLUSION

Based on the results of the discussion above, it can be concluded that (1) most of the teachers Sciences at state junior high school already have high knowledge in compiling questions C1, C2 and C3. (2) However, for the questions C4, C5 and C6 most of the teachers still have low knowledge.

Based on the conclusions, it is suggested as follows: (1) The Regency / City Government in Aceh Province through its Education Office needs to conduct workshops on Bloom taxonomy-based questions, specifically about high cognitive levels (C4, C5, and C6) for all science teachers of State Junior High Schools. (2) To all natural science teachers in State Junior High Schools in Aceh Province must be pro-active in learning the correct techniques (how to develop high cognitive levels) based on Bloom's taxonomy, especially high-level questions (C4, C5, and C6), (3) And conduct further research on how to improve the ability to compile high-level questions for science teachers at State Junior High Schools by using training strategies that are able to improve these abilities.

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REFERENCES

- [1] L. Francisca, and C. R. P. Ajisuksmo. "Keterkaitan antara moral knowing, moral feeling, dan moral behavior pada empat kompetensi dasar guru". *Jurnal Kependidikan*, vol 45, pp. 211-221, 2015
- [2] Maimun. "Strategi Pengembangan Evaluasi Hasil Pembelajaran Bahasa Arab". *Jurnal OKARA*, vol. II, pp. 243-260, November 2011
- [3] Mariati. "Penerapan Alat Evaluasi Pembelajaran Bertingkat Berdasarkan Taksonomi Bloom Dalam Meningkatkan Kemampuan Berpikir Mahasiswa". *Liabilities Jurnal Pendidikan Akuntansi*, vol 1 , pp. 95-111, 2018
- [4] Camellia dan U. Chotimah. "Kemampuan Guru Falam Membuat Instrumen Penilaian Domain Afektif pada Mata Pelajaran PKn Di SMP Negeri Se-Kabupaten Ogan Ilir". *Jurnal Forum Sosial*, vol. V, pp. 114-122, 2012.
- [5] S. Heri. "Pelaksanaan Penilaian Pada Kurikulum 2013". *Jurnal Penelitian dan Evaluasi Pendidikan*, vol. 20, pp. 166-178, 2016
- [6] Hazraini. "Upaya Meningkatkan Kompetensi Guru Kelas Dalam Penyusunan Soal Pilihan Ganda Yang Baik dan Benar Melalui Pendampingan Berbasis KKG Semester Satu Tahun Pelajaran 2017/2018 di SD Negeri 40 Cakranegara". *Jurnal Pendidikan Mandala*, vol. 2, pp. 111-121, 2017.
- [7] H. Nurdinah. "Pengembangan instrumen penilaian *Higher Order Thinking Skill (HOTS)* di sekolah dasar". *Current Research in Education: Conference Series Journal*, vol.1, 2019.
- [8] R. Tabrani. "Pendekatan dalam Proses Belajar Mengajar". Bandung Remaja Rosdakarya, 2001.
- [9] Syahida, A., & Irwandi, D. Analisis Keterampilan Berpikir Tingkat Tinggi Pada Soal Ujian Nasional Kimia. *Edusains*, Vol. 7, No. 1, pp. 77-87, 2015.
- [10] Zulfadli. "Pengembangan Tes Berbasis Revisi Taksonomi Bloom Pada Materi Struktur dan Sel Untuk Siswa Kelas XI Di SMA Kota Tarakan". *Jurnal Pendidikan Biologi Indonesia*, vol. 3, pp. 174-182, 2017.
- [11] Sa'idadah, Nusrotus, H.D.Yulistianti , dan E. Megawati. "Analisis Instrumen Tes Higher Order Thnking Matematika SMP". *Jurnal Pendidikan Matematika*, vol. 13, pp. 41-54, 2019
- [12] K. Abdul. "Menyusun dan Menganalisis Tes Hasil Belajar". *Jurnal Al-Ta'dib*, vol. 8, pp. 70-81, Juli-Desember 2015.
- [13] A.N. Qurrota dan Sutrisno. "Kesesuaian Tngkat Berpikir Soal Ujian Dengan Tujuan Pembelajaran Pada Keahlian Teknik Gambar Bangunan Sekolah Menengah Kejuruan". *Jurnal Bangunan*, vol. 22, pp. 67-74, 2017
- [14] Subyantoro. "Pengembangan Evaluasi Pembelajaran Bahasa Indosesia Berbasis taksonomi Structure of Observed Learning Outcome". *LITERA*, vol. 13, pp. 67-77, 2014.
- [15] G. Imam dan P.A. Ret no. "Taksonomi Bloom – Revisi Ranah Kognitif: Kerangka Landasan Untuk Pembelajaran, Pengajaran, dan Penilaian". *Jurnal Ilmu Pendidikan* (On line), vol. 25, pp. 16-40, 2008
- [16] Pusperek. "Panduan Pemanfaatan HasilUjian Nasional Tahun Pelajaran 2017/2018". Jakarta: Balitbang Kemdiknas, 2018.
- [17] Azhary. "Analisis Assessment Soal Ujian Sekolah Mata Pelajaran Bahasa Indonesia Di SMP Negeri 17 Palu". *e-Jurnal Bahasantodea*, vol. 4, pp. 39-47, 2016.
- [18] A.D. May dan E. Supardi. "Kompetensi pedagogik guru terhadap efektivitas pembelajaran dengan variabel control latar belakang pendidikan guru". *Jurnal Pendidikan Manajemen Perkantoran*, vol. 3, pp. 149-155, 2018.
- [19] Djali dan M. Pudji. "Pengukuran Dalam Bidang Pendidikan". Jakarta: Grasindo, 2008.
- [20] G.Robert. "Instrumen Development in Affective Domain". Boston: Kluwer Nijhoff Publishing, 1993.
- [21] P. Isti. "Prinsip Penulisan Kuesioner Penelitian". *Jurnal Agribisnis dan Pengembangan Wilayah*, vol. 2, pp. 43-56, 2010.
- [22] Suparto. "Analisis Korelasi Variabel-Variabel yang Mempengaruhi Siswa Dalam Memilih PerguruanTinggi". *Jurnal IPTEK*, vol. 18, pp. 1-9, 2014.
- [23] A. Saifuddin. "Penyusunan Skala Psikologis". Yogyakarta: Pustaka Pelajar, 2012.
- [24] F.F. Diba. "Taksonomi Bloom-Revisi: Ranah Kognitif Serta Penerapannya Dalam Pembelajaran Bahasa Arab, Prosiding Konferensi Nasional Bahasa Arab II, Malang 15 Oktober 2016, pp 436-444.
- [25] D. R Krathwohl. "A revision of Bloom's taxonomy: An overview. Theory into practice", 2002.
- [26] N. Sudjana. "Penilaian Hasil Proses Belajar Mengajar". Bandung: PT Remaja Rosdakarya, 2010.
- [27] T.I. Prasetya. "Menigkatkan Keerampilan Menyusun Instrumen Hasil Belajar Berbasis Modul Interaktif Bagi Guru-Guru IPA SMP N Kota Magelang". *Journal of Educational Research and Evaluation*, vol. 1, pp. 106-112, 2012.
- [28] R.Y. Kurniawan. "Pemberian Pelatihan Analisis Butir Soal Bagi Guru di Kabupaten Jombang". *Jurnal Pemberdayaan Masyarakat*, vol. 1, pp. 179- 193, 2017.
- [29] Osnal, Suhartoni , I. Wahyudi . "Meningkatkan Kemampuan Guru Dalam Menyusun Tes Hasil Belajar Akhir Semester Melalui Workshop Di KKG Gugus 02 Kecamatan Sumber MalangTahun 2014/2015". *Jurnal Pancaran*, vol. 5, pp. 67-82, 2016.
- [30] S. Awaliyah. "Penyusunan Soal HOTS Bagi Guru PPKN dan IPS Sekolah Menengah Pertama". *Jurnal Praksis dan Dedikasi Sosial*, vol. 1, pp.46-53, 2018.
- [31] H. Mazlina, A. Halim, and Y. Yusrizal, "Self-Description and Observers' Perspective Toward Science Teachers' Ability in Using Questioning Technique in Middle School," *J. Penelit. Fis. dan Apl.*, vol. 8, no. 2, p. 106, 2018, doi: 10.26740/jpfa.v8n2.p106-114.
- [32] D. Salirawati. "Pelatihan Pengembangan Soal HOT (*Higher Order Thinking*) Sebagai Peningkatan Kompetensi Pedagogik Guru". *Jurnal Inoteks*, vol. 21, pp. 14 – 25, 2017.
- [33] A. Halim, Ngadimin, Soewarno, Sabaruddin, and A. Susanna, "Improvement of High Order Thinking Skill of Physics Student to Prepare Human Resources in Order to Face of Global Competition in ASEAN Economic Community," in *Journal of Physics: Conference Series*, 2018, vol. 1116, no. 3, doi: 10.1088/1742-6596/1116/3/032009.
- [34] Yusrizal, A. Halim, M. Daud, and Saminan, "Level of teachers' knowledge and understanding in developing test questions," *J. Phys. Conf. Ser.*, vol. 1460, no. 1, 2020, doi: 10.1088/1742-6596/1460/1/012112.
- [35] M. Fanani. "Stategi Pengembangan Soal Higher Order Thinking Skill (HOTS) Dalam Kurikulum 2013". *Jurnal Edudeena*, vol. II, Januari, pp. 57-76, 2018.
- [36] A. Halim, Yusrizal, Susanna, and Tarmizi, "An analysis of students' skill in applying the problem solving strategy to the physics problem settlement in facing AEC as global competition," *J. Pendidik. IPA Indones.*, vol. 5, no. 1, 2016, doi: 10.15294/jpii.v5i1.5782.
- [37] A. Halim, Yusrizal, H. Mazlina, Melvina, and Zainaton, "Questioning skill of science teacher from the students perspcetive in senior high school," *J. Phys. Conf. Ser.*, vol. 1088, 2018, doi: 10.1088/1742-6596/1088/1/012109.