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Analysis of final semester assessment questions (PAS) in grade XI chemistry online learning based on cognitive domain level of revised Bloom's taxonomy

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ABSTRACT

This study aims to determine the distribution of cognitive domain levels from Final Semester Assessment (PAS) questions in online learning chemistry grade XI based on the cognitive domain of Revised Bloom's Taxonomy. The method used is descriptive method with the instrument in the form of a check-list format. The object of this research is the question of PAS chemistry grade XI even semester in four schools in South Tangerang City. The data were obtained through analysis of the cognitive domain level of Revised Bloom's Taxonomy on each item and validated through triangulation techniques by two experts in the field of chemistry. The results showed each of the percentages for the C1 domain is 24.3%, the C2 domain is 32.9%, the C3 domain is 32.1%, the C4 domain is 10.7%, and the C5 and C6 domain are both 0%. This show that the distribution of cognitive domains on the chemistry PAS questions for grade XI was not evenly distributed, PAS questions were distributed in four domains out of a total of six cognitive domains, C1, C2, C3, and C4. There are no questions in the cognitive domains of C5 and C6.

1. Introduction

The community mentions education as the key to success, so they pay more attention to it (Kenni, 2020). The quality of education is influenced by the quality of learning and the quality of its assessment. To improve the quality of education, assessment and evaluation activities need to be carried out to measure the success of the learning (Mutmainah & Muchlis, 2022). Three important aspects of learning activities are learning objectives, learning process, and learning evaluation, all of which are interrelated with each other and cannot be separated (Hasanah et al., 2015). To determine the level of success of the learning process, an evaluation or assessment is carried out to measure the extent to which students understand the learning that has been carried out so that the objectives of the learning can be achieved (Putra & Ritonga, 2017).

Evaluation is an important part of curriculum learning. To make it easier for teachers in its implementation, Bloom makes taxonomy of students' thinking abilities and skills (Ulum, 2022). taxonomy is a classification from the lowest level to the highest level (Zorluoğlu & Kızılaslan, 2019; Zorluoglu et al. 2020). Bloom's taxonomy divides learning objectives into three domains, which we

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know as the cognitive domain, affective domain, and psychomotor domain (Effendi, 2015). The cognitive domain is grouped by Benjamin S. Bloom into six levels which are named Bloom's Taxonomy, which was later revised by Anderson and named Revised Bloom's Taxonomy. These six levels of cognitive domains include remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C6) (Wahyuni et al. 2017). Cognitive domain developed by Bloom can be used as a benchmark for achieving systematic educational goals, so that more efficient and effective learning designs can be made (Büken & Artvinli, 2021).

Remembering (C1) is the activity of retrieving memories from long-term memory as needed. Remembering is at the simplest level of thinking. Understanding (C2) is an activity to find out the meaning of new knowledge in various learning activities, relate it to the knowledge already possessed, then integrate the two knowledges. Applying (C3) involves the use of a certain method in completing something, such as a task or solving an unfamiliar problem. Analyzing (C4) is an activity to describe or divide something into smaller parts and then determine the relationship of each part. Evaluation (C5) is an activity to make an assessment of a statement and condition based on a certain criterion. Creating (C6) is a technique of combining components into a logical structure and having a function (Anderson & Krathwohl, 2010; Silaban, 2021).

Assessment is a systematic activity consisting of gathering information about the learning process and student learning outcomes with the aim of making decisions based on certain provisions (Sudarsana et al. 2020). The assessment process in learning is very important so that it cannot be separated from learning activities (Ramlawati et al. 2020). The main purpose of the assessment is to determine the extent to which the desired learning outcomes have been achieved. For students the assessment measures the success of students in understanding the subject matter, for teachers the assessment measures the success of their teaching (Upahi et al. 2015).

Most of the assessment activities measure the level of the cognitive domain or the thinking ability of students which cannot be separated from the six levels of the Revised Bloom's Taxonomy. The spread of the pandemic has caused learning to be carried out online, namely learning that uses information technology and is carried out separately between students and educators (Fitriyani et al. 2020). Assessment in learning must still be carried out in order to achieve educational goals and things can be decided next (Sandra-G et al. 2017).

The summative assessment is an overall assessment activity of student learning at the end of the learning activity (Upahi et al. 2015). Assessment activities carried out at the end of learning in one semester are called Final Semester Assessments (PAS). This assessment is carried out by giving a test containing questions to measure and find out the extent of students' understanding of the material that has been given (Purba et al. 2018). PAS questions must have good quality, including construction validity. Construction validity is met if the questions in the assessment can measure all levels of thinking (Maureen & Salirawati, 2016). PAS questions are generally made by the teacher who teaches, where the questions are made and compiled by the teacher to measure the level of knowledge and understanding of students after going through learning activities (Putra, 2013). According to Arikunto (2013) teacher-made tests rarely use items that have been analyzed, tested, and revised, so they have moderate or low reliability.

In line with teacher interviews at several public high schools (SMA) in the city of Waringin conducted by Gasela et al (2020), the results of the interview stated that the teacher made end-of-semester questions without doing the item analysis stage. The teacher is in a hurry to make questions so there is no time for analysis. Similarly, in an interview conducted by Prabayanti et al (2018) of teachers at the Undiksha Singaraja High School Laboratory that the final semester test prepared by the teacher has never been tried out.

The non-analysis of the PAS questions causes the distribution of the cognitive domain levels being tested to be unknown. This can lead to uneven levels of cognitive domains measured in each item. As in research Hasanah et al (2015) in the analysis of items in the Chemistry Odd Semester Exam

for grade XI where the percentage of cognitive domain levels of Revised Bloom's Taxonomy for each item is C1 15%, C2 45%, C3 40%, C4 0%, C5 0% and C6 0%. The test questions only measure thinking ability in the C1 to C3 domains, while there are no questions in the C4 to C6 domains. Cognitive domain analysis on PAS questions needs to be done so that the distribution of cognitive domain levels in each item is known, so PAS questions can test the thinking ability of students at various levels.

Relation to the quality of the PAS questions made by the teacher and so that the PAS questions can measure the cognitive domains of students at various levels, the researchers want to conduct research in the form of an analysis of the Final Semester Assessment (PAS) questions in online learning chemistry, so the researcher raised the title "Analysis of Final Semester Assessment Questions (PAS) in Grade XI Chemistry Online Learning Based on cognitive domain level of Revised Bloom's Taxonomy.

2. Methods

This research used a descriptive method and the research was conducted from January 2020 to April 2021 at four SMAN in South Tangerang. The subjects of the research were four high schools (SMA) in South Tangerang, namely SMAN A, SMAN B, SMAN C, and SMAN D. The research's object was Final Semester Assessment (PAS) chemistry grade XI texts. An instrument in the form of a check-list format was used for this research. The format contains question number, item questions, and choices of six cognitive domain level Revised Bloom's Taxonomy for each item. A tick is given for the appropriate cognitive domain in the item. The triangulation technique used to validated the results of the analysis by two experts in the field of chemistry education.

3. Results and Discussion

Data used in this study was PAS questions chemistry grade XI. Each item is analyzed and the level of cognitive domain is determined, then the proportion for each level is calculated on the entire PAS question. The results of the cognitive level distribution is shown in Figure 1.

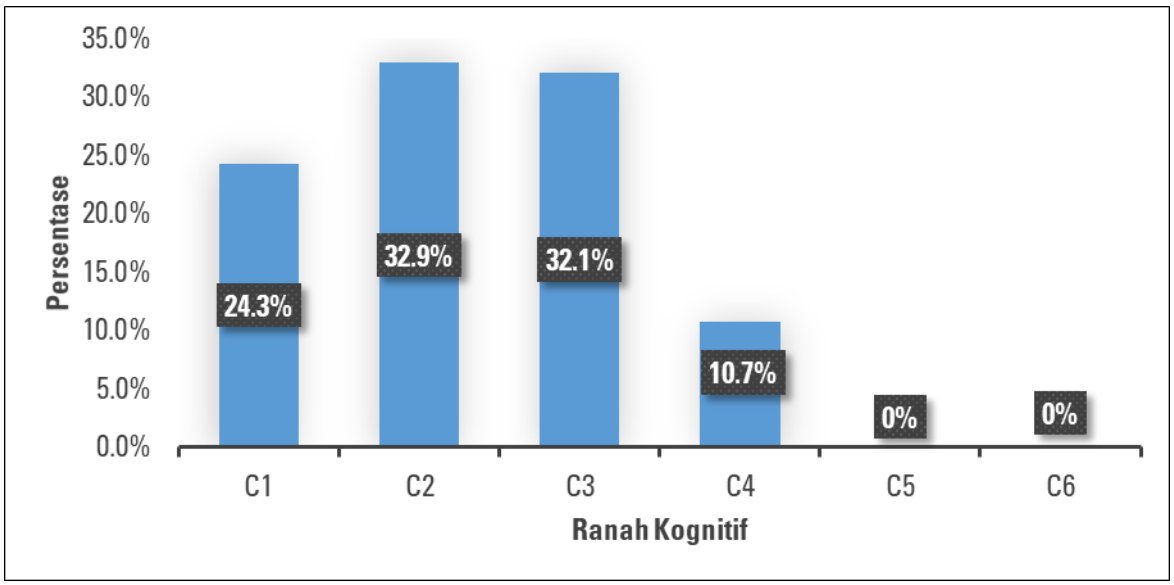

Figure 1. Cognitive Domain Revised Bloom's Taxonomy Distribution in Chemistry PAS Questions grade XI.

In Figure 1, we can see the data of distribution of cognitive levels that have been analyzed. The proportion of each level of cognitive domain is different. Based on the results of the analysis, there are only four levels of cognitive domain found in the PAS question text, namely remembering (C1), understanding (C2), applying (C3), and analyzing (C4). The level of understanding category domain

(C2) has the largest percentage, which is 32.9%. Meanwhile, the C5 (evaluating) and C6 (creating) domains were not found in the question text. It can be concluded that in PAS questions grade XI chemistry online learning based on cognitive domain level of revised Bloom's Taxonomy, not all cognitive domains appeared, only four out of six domains appeared. This proves that the cognitive domain isn't well distributed. The most dominant cognitive domains are the cognitive domains C1, C2, C3, which each percentages are 24.3%, 32.9%, and 32.1%. Cognitive domain C4 only appeared a little (10%), while questions in domains C5 and C6 did not exist.

This is in line with research conducted by Syani et al (2019) that end-of-semester assessment questions mostly contain domain C1, C2, C3 with the respective percentages of 24%, 60%, 60%. The percentage for the C4 cognitive domain is 4% and there are no questions with the C5 and C6 domains. Similar to the research conducted by Nurrada (2021) that the final assessment questions mostly have cognitive domains C1, C2 and C3 with percentages of 25%, 37.67% and 31.83%, the percentage of C4 domains is only 5% and there are no questions with C5 and C6 domains. According to Nurrada (2021), the distribution of the cognitive domain in the end-of-semester assessment questions that have been analyzed is not in accordance with the existing theory. According to Purba et al (2018) the best percentage comparison for each cognitive domain at the high school level is 30% for C1 and C2, 40% for C3 and C4, and 30% for C5 and C6.

The uneven cognitive domain can be caused by the achievement of the required competencies. The achievement of students' cognitive level competencies for grade XI Chemistry Final Semester Assessment (PAS) is mentioned in KD 3.10 to KD 3.14, where the ability to be measured is in the realm of C1 to C4 (Permendikbud, 2016). The uneven distribution of cognitive domains was also found in the 2013 National Examination questions analyzed by Syahida & Irwandi (2015) where the UN questions measured students' thinking abilities in the C1, C2, C3 and C4 domains only, there were no questions with the C5 and C6 domains. It can be seen that the assessment questions mostly measure the cognitive domains of C1, C2, C3, while only a few measure the high-level cognitive domains of C4, C5, and C6. As stated by Dempster (2012) in his research in four countries, the number of questions measuring higher order thinking skills on exams in some countries is small.

The proportion for the cognitive domain in the knowing category (C1) in this study has a percentage of 24.3%. This percentage has similarities with previous studies such as the research conducted by Maureen & Salirawati (2016) with a C1 percentage of 20.29%, Gasela et al (2020) with a percentage of 22.67%, Purba et al (2018) research with a percentage of 20 %, and research conducted by Syani et al (2019) with a percentage of 24%.

Maureen & Salirawati (2016) states that questions in the C1 domain still need to be included in the assessment as a basis for answering questions at a higher cognitive level. At this level, students are only asked to recall material that has been stored in memory (Anderson et al. 2010). Questions example:

32. Gerakan partikel koloid dalam medan listrik disebut...
    A. Dialisis
    B. Koagulasi
    C. Elektrolisis
    D. Peptisasi
    E. Elektroforesis

This question requires the ability to remember (recalling), which is to recall information that has been stored in memory for a long time which will reappear if there is related information (Mulatsih, 2021). Students are asked to recall the terms of the motion of colloidal particles in an electric field, then after finding the answer in memory, students can immediately answer the question where the movement of colloidal particles in an electric field is called electrophoresis.

The C1 cognitive domain is the initial thinking ability that students must have before being able to answer questions in a higher cognitive domain. Students will have no difficulty answering questions that require a higher level of thinking ability if they can answer questions in this domain (Maureen & Salirawati, 2016).

The cognitive domain of understanding category (C2) is the ability to associate or integrate knowledge that has been stored in memory with newly received knowledge, then can explain its meaning again by themself (Effendi, 2015). The ability to understand requires students to not only remember the knowledge they have, but also understand its meaning so that they can describe and provide examples related to the material (Kemendikbud, 2019). Questions example:

17. Perhatikan persamaan reaksi berikut!

(1) $CH_3COO^- + H_2O \leftrightarrow CH_3COOH + OH^-$

(2) $CN^- + H_2O \leftrightarrow HCN + OH^-$

(3) $Al^{3+} + 3H_2O \leftrightarrow Al(OH)_3 + 3H^+$

(4) $NH_4^+ + H_2O \leftrightarrow NH_4OH + H^+$

(5) $S^{2-} + 2H_2O \leftrightarrow H_2S + 2OH^-$

Pasangan persamaan reaksi hidrolisis untuk garam yang bersifat asam adalah ....

A.(1) dan (2) B. (1) dan (3) C. (2) dan (3) D. (3) dan (4) E. (4) dan (5)

This question requires the ability of students to give examples. The Operational Verb (KKO) used is to give an example. To be able to answer these questions, students are required to understand the concept of salt hydrolysis, such as what is the hydrolysis of acidic salts and how the equation for the hydrolysis reaction is. Students will collect related information, then provide examples of hydrolysis reaction equations for acidic salts.

The C2 domain in this study has the largest percentage, which is 32.9%. This means that most end-of-semester assessment questions require students to have the ability to think and understand. It is the same with research conducted by Yonelia et al (2014) where the percentage of the C2 domain on the exam questions he studied was the highest at 70%. Hasanah et al (2015), who also got the highest percentage of C2 domain at 45% in her research, said that this can be influenced by the depth of the material taught by educators, so that it becomes a benchmark in making assessment questions.

This is in accordance with the competency achievement where the C2 domain is the most widely measured, namely in KD 3.10 "Explaining the concept of acids and bases and their strengths and ionizing equilibrium in solution", KD 3.12 "Explaining working principles, calculating pH, and the role of buffer solutions in living organisms life", and KD 3.14 "Classify various types of colloids, and explain the use of colloids in life based on their properties" (Permendikbud, 2016).

The cognitive domain of applying (C3) is the ability to use a method in solving an existing problem (Anderson et al., 2010). The C3 domain (apply) is divided into two types of cognitive processes, the first is executing familiar tasks and the second is implementing new or unfamiliar tasks (Effendi, 2015). Questions example:

17. Sejumlah 50 mL $(NH_4)_2SO_4$ 0,1 M dicampurkan dengan 50 mL NH_3 0,1 M ($Kb=10^{-5}$). pH campuran sebesar…

A. 6
B. 6 – log 5
C. 9
D. 9 – log 5
E. 8 + log 5

To solve these questions, students need the ability to apply (C3), namely the ability to solve a problem using certain methods, formulas, theories (Gunawan & Palupi, 2012). The question asks students to determine the pH value of a solution with a certain treatment, namely a solution of

$(NH4)SO_4$ mixed with a solution of NH3. After knowing and understanding the condition of the solution they have, students can calculate the pH value by using a buffer solution formula that is added with base.

The percentage of the C3 domain in this study reached 32.1%, the second largest after the C2 domain. This percentage has similarities with previous research by Gasela et al (2020) where the percentage of questions in the C3 domain is 34%, the second largest after C2. This happens because educators are increasing the number of questions that require the application of formulas.

Questions with level C3 in the Final Semester Assessment (PAS) mostly asked students to calculate the value of pH and Ksp. It is compatible with Basic Competence (KD) number 3.12 which is mention the calculation of pH (Permendikbud, 2016). The cognitive domain of applying (C3) along with the domain of understanding (C2) according to Anderson & Krathwohl (2001) are categorized into MOTS (Middle Order Thinking Skill), the cognitive domain of remembering (C1) is categorized into Low Order Thinking Skill (LOTS), while the cognitive domain that categorized into High Order Thinking Skill (HOTS) are the top three domains in revised Bloom's taxonomy, namely the domains of analyzing (C4), evaluating (C5), and creating (C6) (Fanani, 2018).

The last level that appears on the PAS Chemistry grade XI questions is analyzing (C4). This level requires students to be able to describe the existing material into its parts and explain the relationship of each of these parts (Anderson et al. 2010). Questions example:

25. Garam-garam perak berikut yang memiliki kelarutan terbesar adalah …
    A. $AgCl$, $Ksp = 1 \times 10^{-10}$
    B. $AgBr$, $Ksp = 5 \times 10^{-13}$
    C. AgI, $Ksp = 1 \times 10^{-16}$
    D. Ag_2CrO_4, $Ksp = 3{,}2 \times 10^{-12}$
    E. Ag_2CrO_4, $Ksp = 1{,}1 \times 10^{-11}$

These questions require analytical skills (C4) in the process. To solve the problem, students first identify matters that are relevant to the problems that have been described, namely analyzing the concept of solubility in each compound, then proceed with determining the relationship between these elements, in this case the solubility order compounds from the largest of the five compounds. By knowing the order of the solubility of the five compounds, students can answer the question.

Based on the results of the analysis, the percentage of questions with the C4 domain is 10.7% both overall and in each question text in the four schools which also reaches 10% (PAS C is 12.5%). This is in line with Maureen & Salirawati research (2016) where the percentage of questions with high-order thinking skills in the final semester assessment questions is 15.96%, smaller than the percentage of cognitive domains C1, C2, C3 which is 84.04%. Questions with high-level cognitive domains such as C4 only appear a little at the end of the semester assessment.

The cognitive domains of evaluating (C5) and creating (C6) were not found in the PAS questions that had been analyzed. Syahida & Irwandi (2015) explains that the emergence of questions with a high level of thinking such as C5 and C6 is influenced by the type of assessment instrument used. The level of high thinking is difficult to measure by objective tests in the form of multiple choice, because in its implementation the realms of C5 and C6 tend to measure productive skills. In this case, it is measured more by skill competencies, namely Basic Competence (KD) 4. As in KD 4.14 "Making food or other products in the form of colloids or involving colloidal principles" (Permendikbud, 2016). The ability measured in these competencies is in the C6 domain because the verb used is to make.

Yonelia et al (2014) in her journal explains that there are various aspects that must be considered by an educator in making questions, such as the Final Semester Assessment (PAS). Not only in terms of material, construction, and language, other things that need to be considered include the proportion of cognitive levels in each item. This needs to be considered so that the assessment of

learning outcomes can work more optimally in determining the ability of students during learning in one semester.

The distribution of cognitive domain levels needs to be considered in making questions because the assessment that will be given to students must be able to measure the level of thinking of students from the lowest level of cognitive domain to the highest level (Prabayanti et al. 2018). In line with the purpose of the Revised Bloom's Taxonomy as a forum for students to develop thinking skills at every existing level (Kurniawan et al. 2021).

Judging from the results of the analysis obtained, the teacher did not make many questions in the high-level cognitive domain. This could make students less able to think at higher levels. This can be seen from the results of the scientific literacy of students in Indonesia according to PISA. PISA (Programming for International Student Assessment) is an assessment program carried out by the OECD (Economic Co-operation and Development) for randomly selected 15-year-old students in the fields of reading, mathematics, and science (Kemendikbud, 2019). The report of PISA held at the international level, is an effective result to determine students' literacy abilities and find out whether students' abilities have reached global standards (Tuna & Kapucu, 2022). The PISA results of Indonesian students for the first time taking the test from 2000 to 2018 are always in the bottom 10. The 2018 PISA results show Indonesia is ranked 70 out of 78 countries with a score of 396 (OECD, 2019). From these data it can be seen that the thinking ability of students is still at a low to medium level.

It is important for students to have higher order thinking skills. This ability makes a person able to think logically, critically, creatively and can think of solutions and solve existing problems (Kemendikbud, 2019). In accordance with the hierarchy in the Revised Bloom's Taxonomy, someone who has passed the low-level thinking stage will be able to continue to the next stage, namely higher-order thinking. In other words, higher-order thinking skills can be learned if you have been able to think low-level. Therefore, in the Final Semester Assessment (PAS), it is better to contain questions that contain all cognitive levels from the lowest to the highest (Adhani & Ilma, 2017).

HOTS (High Order Thinking Skill) questions are designed in such a way to familiarize students with thinking about solving complex problems so that when students have completed their education and are ready to enter society, students are able to face bigger challenges that require high level thinking skills (Siahaan et al. 2021). Thus, as with the LOTS questions, the HOTS questions are also important to be tested on students in order to produce a better generation (Pantiwati & Permana, 2017). To be successful in the 21st century era, the skills needed in the field of education, namely critical thinking skills or HOTS (Laila & Fitriyah, 2022). High order thinking skills are needed in solving problems in everyday life, such as in learning, performance at work, and so on (Permatasari et al. 2017).

The Final Semester Assessment (PAS) is as much as possible compiled based on the Revised Bloom's Taxonomy with the appropriate composition of each domain. This is intended to increase the quality of education in Indonesia. As stated by Sopiah (2019) that one of the efforts to improve the quality of education is in the assessment.

4. Conclusion

This study aims to determine the distribution of cognitive domain levels from the Final Semester Assessment (PAS) questions in online learning chemistry grade XI based on the cognitive domain of Revised Bloom's Taxonomy. Based on the existing data and the results of the discussion, it can be concluded that the distribution of cognitive domains on the chemistry PAS grade XI questions is uneven, the PAS questions are distributed in four out of six cognitive domains. Each of the percentages is for the C1 domain at 24.3%, the C2 domain at 32.9%, the C3 domain at 32.1% and the C4 domain at 10.7%. There are no questions in the cognitive domains of C5 and C6.

References

Adhani, A., & Ilma, S. (2017). Efektivitas strategi pembelajaran brain-based learning terhadap keterampilan metakognitif. *Jurnal Inovasi Pendidikan Sains*, 8(2), 1–6. http://dx.doi.org/10.20527/quantum.v8i2.4007

Anderson, L. W., & Krathwohl, D. R. 2010. Kerangka landasan untuk pembelajaran, pengajaran, dan asesmen. Yogyakarta: Pustaka Pelajar.

Arikunto, S. (2013). Dasar-dasar evaluasi pendidikan. Jakarta: Bumi Aksara.

Büken, R., & Artvinli, E. (2021). Analysis of geography attainments in the social sciences curriculum of turkey according to the revised Bloom's taxonomy. *Romanian Review of Geographical Education*, 10(2), 89–107. https://doi.org/10.23741/rge220215

Dempster, E. R. (2012). Comparison of exit-level examinations in four African countries. *Journal of Social Sciences*, 33(1), 55–70. https://doi.org/10.1080/09718923.2012.11893086

Effendi, R. (2015). Konsep revisi taksonomi bloom dan implementasinya pada pelajaran matematika SMP. *Jurnal Ilmiah Pendidikan Matematika*, 2(1), 72-78. https://doi.org/10.26877/jipmat.v2i1.1483

Fanani, M. Z. (2018). Strategi pengembangan soal HOTS pada kurikulum 2013. *Edudeena*, 2(1), 57–76. https://doi.org/10.30762/ed.v2i1.582

Fitriyani, Y., Fauzi, I., & Sari, M. Z. S. (2020). Motivasi belajar mahasiswa pada pembelajaran daring selama pandemik covid-19. *Jurnal Kependidikan*, 6(2), 165–175. https://doi.org/10.33394/jk.v6i2.2654

Gasela, Y., Sidauruk, S., & Fatah, A. H. (2020). Kualitas soal penilaian akhir semester (PAS) buatan guru mata pelajaran kimia kelas XI MIA SMA di kabupaten Kotawaringin barat pada semester ganjil tahun ajaran 2018/2019. *Jurnal Ilmiah Kanderang Tingang*, 11(1), 41–50. https://doi.org/10.37304/jikt.v11i1.72

Gunawan, I., & Palupi, A. R. (2012). Taksonomi Bloom - revisi ranah kognitif: Kerangka landasan untuk pembelajaran, pengajaran, dan asesmen. *Jurnal Pendidikan Dasar dan Pembelajaran*, 2(2), 98–117. http://doi.org/10.25273/pe.v2i02.50

Hasanah, I., Copriady, J., & Thaib, A. (2015). Analisis butir soal ujian semester ganjil pelajaran kimia kelas XI IPA SMA negeri 10 Pekanbaru tahun pelajaran 2013 / 2014. *Jurnal Online Mahasiswa Fakultas Keguruan dan Ilmu Pendidikan Universitas Riau*, 2(1), 1–10.

Kemendikbud. (2019). Buku penilaian berorientasi higher order thinking skill. Direktorat Jendral Guru dan Tenaga Kependidikan.

Kenni, A. M. (2020). Analysis of students' performance in chemistry in the west African senior school certificate examination (WASSCE) and national examination council (NECO) from 2015-2018. *International Journal of Research and Analytical Reviews*, 7(1), 35-49.

Kurniawan, Y. N., Zulfadli, & Adhani, A. (2021). Analisis penilaian akhir semester pada mata pelajaran biologi kelas X berdasarkan taksonomi Anderson di SMA Negeri 1 Tarakan. *Borneo Journal of Biology Education*, 3(1), 18–28. https://doi.org/10.35334/bjbe.v3i1.1887

Laila, I., & Fitriyah, I. (2022). An analysis of reading comprehension questions in english textbook based on revised Bloom's taxonomy. *Journal of English Teaching*, 8(1), 71–83. https://doi.org/10.33541/jet.v8i1.3394

Maureen, J., & Salirawati, D. (2016). Analyzing the quality of chemistry final odd semester examination of the XII grade senior high school in special region of Yogyakarta. *Jurnal Pembelajaran Kimia*, 5(6), 1–7.

Mulatsih, B. (2021). Penerapan taksonomi Bloom revisi pada pengembangan soal kimia ranah pengetahuan. *Jurnal Karya Ilmiah Guru*, 6(1), 1–10.

Mutmainah, S., & Muchlis, M. (2022). Implementation of assessment for learning to improve students' cognitive learning outcomes in the concept of chemical bonding. *Jurnal Pijar Mipa*, 17(2), 217–223. https://doi.org/10.29303/jpm.v17i2.3308

Nurrada, A. (2021). Kualitas soal penilaian akhir semester (PAS) buatan guru mata pelajaran kimia kelas X MIA SMA di Kabupaten Kotawaringin Barat pada semester ganjil tahun ajaran 2018/2019. *Jurnal Ilmiah Kanderang Tingang*, 12(1), 47–55. https://doi.org/10.37304/jikt.v12i1.121

OECD. (2019). PISA 2018 Assessment and analytical framework. in OECD Publishing.

Pantiwati, Y., & Permana, H. (2017). Analisis butir soal oleh mahasiswa s1 pendidikan biologi Universitas Muhammadiyah Malang (UMM) berdasarkan taksonomi Bloom revisi. *Prosiding Seminar Nasional Kedua Pendidikan Berkemajuan dan Menggembirakan*, p. 707–716.

Peraturan Kementrian Pendidikan dan Kebudayaan No. 24 Tahun 2016 Lampiran 9 Tentang Kompetensi Isi dan Kompetensi Dasar Kimia SMA/MA. (n.d.).

Permatasari, A., Wartono, & Kusairi, S. (2017). Analisis kemampuan berpikir tingkat tinggi siswa SMA. *Prosiding Seminar Pend. IPA Pascasarjana UM*, p. 2.

Prabayanti, N. M. D., Sudiana, I. K., & Wiratini, N. M. (2018). Analisis tes ulangan kenaikan kelas buatan guru mata pelajaran kimia. *Jurnal Pendidikan Kimia Indonesia*, 2(1), 25–31.

Purba, R. A. B., Susanti, N., & Rosna. (2018). Analisis butir soal ujian semester ganjil kimia kelas X SMA Negeri 1 Perbaungan. *Jurnal Inovasi Pendidikan Kimia*, 1(1), 38–43. https://doi.org/10.24114/jipk.v1i1.12536

Putra, I. B. T., & Ritonga, P. S. (2017). Analisis butir soal ujian semester ganjil pelajaran kimia kelas X di SMA / MA Sekecamatan Pekaitan. *Jurnal Pendidikan Kimia dan Terapan*, 1(1), 25–32. http://dx.doi.org/10.24014/konfigurasi.v1i1.4051

Putra, S. R. (2013). Desain evaluasi belajar berbasis kinerja. Yogyakarta: Diva Press.

Ramlawati, Anwar, M., Yunus, S. R., & Nuswowati, M. (2020). Analysis of students' competence in chemistry cognitive test construction based on revised Bloom's taxonomy. *Journal of Physics: Conference Series*, 1567(4), 042006. https://doi.org/10.1088/1742-6596/1567/4/042006

Sandra-G, C. E. S., Rery, R. U., & Herdini. (2017). Analysis of second semester exam questions in chemistry class XII MIA SMA Negeri 1 Tapung Academic Year 2016 / 2017. *Jurnal Online Mahasiswa Fakultas Keguruan dan Ilmu Pendidikan Universitas Riau*, 4(2), 1–13.

Silaban, S. (2021). Pengembangan program pengajaran. Medan: Yayasan Kita Menulis.

Siahaan, R., Sitorus, M., & Silaban, S. (2021). The development of teaching materials oriented to critical thinking skills for chemistry class XI high school. *Jurnal Pendidikan Kimia*, 13(1), 60-68. https://doi.org/10.24114/jpkim.v13i1.24145

Sudarsana, K. N. A., Antara, P. A., & Dibia, I. K. (2020). Kelayakan instrumen penilaian keaktifan belajar PPKn. *Jurnal Mimbar PGSD Undiksha*, 8(2), 150–158.

Syahida, A., & Irwandi, D. (2015). Analisis keterampilan berpikir tingkat tinggi pada soal ujian nasional kimia. *Edusains*, 7(1), 77–87. https://doi.org/10.15408/es.v7i1.1404

Syani, I., Sidauruk, S., & Meiliawati, R. (2019). Kualitas soal penilaian akhir semester (PAS) buatan guru mata pelajaran kimia kelas XI IPA SMA di Kabupaten Barito Timur pada semester ganjil tahun ajaran 2018/2019. *Jurnal Ilmiah Kanderang Tingang*, 10(2), 282–299. https://doi.org/10.37304/jikt.v10i2.38

Tuna, S., & Kapucu, M. S. (2022). Analysis of high school entrance exam (LGS) questions in terms of PISA scientific literacy. *Journal of STEAM Education*, 5(1), 31–54.

Ulum, Ö. G. (2022). Is the Revised Bloom's Taxonomy Revisited in the EFL/ESL Reading Textbooks?. *OPUS Journal of Society Research*, 19(45), 170-177. https://doi.org/10.26466/opusjsr.1062878

Upahi, J. E., Issa, G. B., & Oyelekan, O. S. (2015). Analysis of senior school certificate examination chemistry questions for higher-order cognitive skills. *Cypriot Journal of Educational Sciences*, 10(3), 218–227. https://doi.org/10.18844/cjes.v1i1.67

Wahyuni, E. S., Khaldun, I., & Sulastri. (2017). Analisis soal-soal ujian materi stoikiometri SMA negeri kota Banda Aceh. *Jurnal Pendidikan Sains Indonesia*, 5(2), 73–79. https://doi.org/10.24815/jpsi.v5i2.9820

Yonelia, V., Haryati, S., & Azmi, J. (2014). Analisis butir soal ujian semester genap mata pelajaran kimia kelas X IPA SMA PGRI Pekanbaru tahun ajaran 2013 / 2014. *Jurnal Online Mahasiswa Fakultas Keguruan dan Ilmu Pendidikan Universitas Riau*, 2(1), 1–25.

Zorluoglu, S. L., Kizilaslan, A., & Yapucuoglu, M. D. (2020). The Analysis of 9th Grade Chemistry Curriculum and Textbook According to Revised Bloom's Taxonomy. *Cypriot Journal of Educational Sciences*, 15(1), 9–20. https://doi.org/10.18844/cjes.v15i1.3516

Zorluoğlu, S. L., & Kızılaslan, A. (2019). Analysis of 10th chemistry curriculum according to revised Bloom taxonomy. *Journal of Education and E-Learning Research*, 6(2), 88–95. https://doi.org/10.20448/journal.509.2019.62.88.95