
Analysis High Order Level Thinking Skills of High School Students in Chemistry Learning

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Abstract

This study aims to describe the high-order thinking skills of high school students. The research method used is a descriptive method with a quantitative approach. The sampling technique used was the random sampling technique. The research subjects were 488 high school students. The data collection technique is a two-tier multiple choice test consisting of twenty questions covering analyzing, evaluating, and creating. Based on the research results and discussion, high-order thinking skills of high school students showed an average in the very high category with a percentage of 1.8% with a frequency of 9 students. The ability of students in the high category has a percentage of 19.9%, with a frequency of 97 students and the ability of students in the medium category is 49%, with a frequency of 239 students. Meanwhile, the average in the low category is 21.9%, with a frequency of 107 students and the ability of students in the very low category has a percentage of 7.4% with a frequency of 36 students. Overall, high-order thinking skills in high school in Tegal are in the medium category.

Keywords: higher order thinking skill; chemistry learning; two tier multiple choice

Abstrak

Penelitian ini bertujuan untuk mendeskripsikan kemampuan berpikir tingkat tinggi siswa SMA. Metode penelitian yang digunakan adalah metode deskriptif dengan pendekatan kuantitatif. Teknik pengambilan sampel yang digunakan adalah teknik random sampling. Subjek penelitian adalah siswa SMA sebanyak 488 orang. Teknik pengumpulan datanya adalah tes pilihan ganda dua tingkat yang terdiri dari dua puluh soal yang meliputi menganalisis, mengevaluasi, dan mencipta. Berdasarkan hasil penelitian dan pembahasan, kemampuan berpikir tingkat tinggi siswa SMA menunjukkan rata-rata berada pada kategori sangat tinggi dengan persentase sebesar 1,8% dengan frekuensi 9 siswa. Kemampuan siswa pada kategori tinggi mempunyai persentase sebesar 19,9% dengan frekuensi 97 siswa dan kemampuan siswa pada kategori sedang sebesar 49% dengan frekuensi 239 siswa. Sedangkan rata-rata pada kategori rendah sebesar 21,9% dengan frekuensi 107 siswa dan kemampuan siswa pada kategori sangat rendah mempunyai persentase sebesar 7,4% dengan frekuensi 36 siswa. Secara keseluruhan kemampuan berpikir tingkat tinggi di SMA Negeri Tegal berada pada kategori sedang.

Keywords: keterampilan berpikir tingkat tinggi; pembelajaran kimia; two tier multiple choice

Introduction

Basic chemistry serves as the foundational cornerstone for courses within the Chemistry Education study program. It covers a range of essential topics, including matter and its transformations, atomic structure, the periodic table of elements, fundamental chemical laws, chemical bonding, chemical compound nomenclature, various types of chemical reactions, oxidation numbers, chemical reaction equations, and stoichiometry (Asmaningrum & Kamariah, 2018; Emda, 2014; Haryono, 2019; Sulastri & Rahmayani, 2017). Each subject subsequently becomes an individual focus within the Chemistry Education study program's curriculum.

Educational progress has progressed towards curriculum changes in improving learning process results. Adjustment of the education curriculum in Indonesia by considering today's global challenges (Assa'idi, 2021; Hadi et al., 2018; Puad & Ashton, 2022) as a basis for stakeholder decision made that supports the birth of competitive graduates in the 4.0 Industrial Revolution era (Setiawan et al., 2014). The implementation of the 2013 curriculum in the Indonesian education system is now starting to improve the direction of learning, one of which is the focus on developing higher-order thinking skills (HOTs), which requires students to be able to learn metacognitive knowledge in learning (Kemendikbud, 2017).

Higher-order thinking skills are in line with competencies in the 4.0 era. Higher-order thinking skills have characteristics that are applied to learning, including: focusing on problem-solving skills, creative thinking skills, critical thinking, argumentation skills, and decision-making abilities (King et al., 2003; Kusuma et al., 2021) as higher-order thinking skills include critical, creative, problem solving, conclusion drawing, and metacognitive skills (Tan & Halili, 2015). HOTS learning will train students to become more independent, creative individuals, able to find problem-solving solutions, and use their critical thinking abilities to see various problems (Hugerat & Kortam, 2014).

Learning analysis higher-order thinking skills can be seen from the ability of students to solve problems according to the level of analyzing, evaluating, and creating.

The analysis in measuring students' abilities in Higher order thinking skills influences on the quality of the questions developed by the teacher. The ability of teachers to develop and measure students' HOTs is important for successful learning in this competitive century (Retnawati et al., 2018). Teachers' understanding of HOTs is still low, resulting in perfecting the space given to students to develop higher-order thinking skills (Heru & Suparno, 2019; Retnawati et al., 2018). The quality of instrument development affects students, especially for higher-order thinking skills, which are determined by the teacher's mastery in preparing questions. Higher-order thinking skills are very important for students in analyzing their problems (Ramadhan et al., 2018). This is in line with a research conducted by (Tajudin & Chinnappan, 2016) that the role of High Order Thinking Skills, often called HOTs, is better in improving students' cognitive from lower to higher levels in the context of problem-solving.

Instruments have a vital role in learning activities, especially for measuring certain variables (Syahfitri et al., 2019) in the form of learning outcomes have varying levels as students' thinking skills from LOTs to HOTs levels by paying attention to the proportion of each level of thinking skills in questions. Questions designed to measure low-order thinking skills can affect student learning patterns, which impact on mastery in memorizing techniques and practice questions compared to developing their way of thinking at a higher level when trying to solve a problem (Syahida & Irwandi, 2015). Given the importance of instruments in seeing learning outcomes, teachers are required to be able to develop assessment instruments that can measure students' abilities comprehensively, especially in the field of science, especially chemistry (Andrian et al., 2018; Saeed et al., 2019) as one of the more effective ways to measure the achievement of learning outcomes

(Bulunuz, 2019; Bulunuz et al., 2014). Chemistry is closely related to phenomena and human life, becoming the basis for understanding cognitive strengthening, especially in learning chemistry (Rusmansyah & Almubarak, 2020).

Research conducted by (Istiyono et al., 2014) developing an instrument to measure high-order physics thinking skills (PhysTHOTS) of high school students and the characteristics of PhysTHOTS that meet the requirements to be used to measure high-order physics thinking skills of high school students by developing higher order thinking skills physics questions. Research conducted by (Prasetyani et al., 2016) shows that students' ability to solve high-level thinking skills questions on trigonometry material after being taught using a problem-based learning model has the criteria of good analyzing and evaluating abilities and lacks the ability to create. Based on the description above, the aim of this research is to see a portrait of high-level thinking abilities in chemistry learning at State High Schools in Tegal City.

Tabel 1.

Data of Students' Higher-Order Thinking Ability

Component	Value
Maximum	95
Minimum	8
Mean	48
Standard Deviation	14

Table 1 shows the highest score obtained by students in solving HOTS questions from 488 students, namely the maximum and minimum scores of 95 and 8, with an average value of 48 and a standard deviation of 14. The levels of cognitive domains in HOTS include analyzing, evaluating, and creating. This shows that the average value of high-order thinking skills of high school students in Tegal City for chemistry subjects is classified as moderate. The classification of the medium category is based on the average score of students below the minimum completeness criteria set by

Method

This research uses quantitative descriptive, conducted in the Even Semester of the Academic Year 2020/2021. The population and sample are students of class XI MIPA, as many as 488 state high school students in Tegal City. The research method used in this research is descriptive quantitative. Collecting data by providing a test instrument in the form of higher-order thinking skills in the form of Two Tier as many as 20 questions for the material of ion balance in salt solution and acid-base titration. The data analysis technique used in this research is quantitative descriptive.

Result and Discussion

Based on the test scores obtained to measure the high-order level thinking skills of State Senior High School students in Tegal City on chemistry subjects, which are presented in Table 1 as follows.

the school of 76, which is presented in Table 2.

Table 2 shows that the highest frequency of higher-order thinking skills in the medium category is 49%, and the very high category has the smallest frequency of 1.8%. The following chart analyzes higher-order thinking skills. The percentage results show that most students are still in the realm of remembering. This higher-order thinking ability requires the ability to remember, and other higher abilities include analyzing, evaluating, and creating (Angraini & Sriyati, 2019).

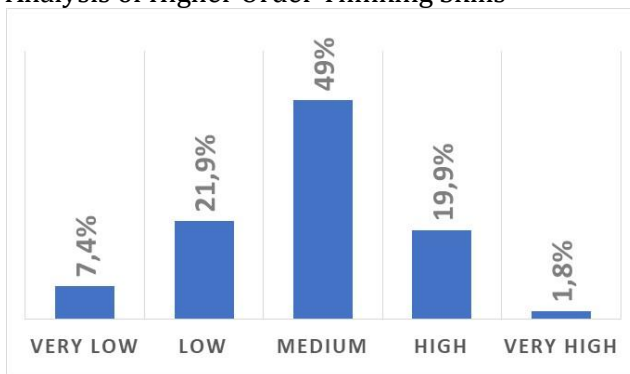
Tabel 2.
Persentase Students' Higher Order Thinking Ability

Score	Category	Frequency	Percentage (%)
80-100	Very high	9	1.8%
60-80	High	97	19.9%
40-60	Medium	239	49.0%
20-40	Low	107	21.9%
0-20	Very low	36	7.4%

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Figure 1.
Analysis of Higher Order Thinking Skills



Based on the results of the analysis of high-level thinking skills of State Senior High School students in Tegal City, the average is in the medium category with a percentage of 49% with a frequency of 239 students. This is due to the factors that cause the low level of students' higher order thinking skills, including learning models, the type of questions the teacher gives, and chemicals. According to (Novianti, 2014) suggests that some of the obstacles to solving high-level ability questions are the lack of persistence of students and students' inaccuracy in thinking. Higher-order thinking skills emphasize students' skills in applying questions by constructing knowledge of something based on facts.

order thinking skills of senior high school students in Tegal City show an average in the very high category with a percentage of 1.8% with a frequency of 9 students. The ability of students in the high category with a percentage of 19.9% with a frequency of 97 students. The ability of students in the medium category has a percentage of 49% with a frequency of 239 students. The average in the low category has a percentage of 21.9%, with a frequency of 107 students. Furthermore, the ability of students in the very low category has a percentage of 7.4%, with a frequency of 36 students. Overall, high order thinking skills in high school in Tegal are in the medium category.

Conclusion

Based on the research results and discussion, it can be concluded that the high-

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