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Research Article

Feasibility of an Instrument for Assessment of High Order Thinking Skills (HOTS) Material on Environmental Change for High School Students in Ambon City

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ABSTRACT

High Order Thinking Skills (HOTS) is interpreted as the ability to think in complex processes in decomposing material, criticizing and creating solutions to problems. The low percentage of Higher Order Thinking Skills questions in the pre-observation results is an indicator of low cognition of students in school. This study aims to determine the feasibility and effectiveness of the assessment instrument for high order thinking skills (HOTS) environmental change material in class X of high school in Ambon City. This type of research is development (R&D) with a quantitative approach designed to obtain products in the form of HOTS question measuring tools. The research population is State Senior High School 3 Ambon, State Senior High School 5 Ambon and State Senior High School 11 Ambon with a sample of 103 students. The research instruments used are HOTS test question instruments and test instrument validation sheets. The data analysis technique uses a feasibility analysis of test instruments based on HOTS questions. The results of the study show that :The HOTS question instrument for environmental change material is very feasible to be used as an assessment instrument in high schools in Ambon City. This means that the HOTS question instrument is very worthy of being given to students. HOTS-based assessment instruments on environmental change materials are effectively used as assessment instruments in high schools in Ambon City, this can be seen from the ability of students to work on question item instruments that are assessed individually. The students' scores obtained from the results of working on the test items were then averaged to obtain one score as the result of the students' HOTS thinking abilities, namely 1.27 for State Senior High School 3 Ambon, 1.71 for State Senior High School 5 Ambon, and 1.82 for State Senior High School 11 Ambon.

Keywords: Eligibility, HOTS, Test Instrument.

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INTRODUCTION

21st century biology learning is directed at student-centered learning. The orientation of student-centered learning emphasizes students to have the life skills needed in society (Rumahlatu & Sangur, 2019). Life skills or 21st century abilities include (1) critical thinking, (2) creativity, (3) research and discovery, (4) self-direction, initiative and persistence, (5) use of information, (6) systematic thinking, (7) communication, and (8) reflection (OECD, 2018). If observed, these abilities are aspects of high-level thinking skills (Higher Order Thinking Skill)/ (HOTS).

HOTS is part of the thinking skills that are important for someone, including students, to develop (Apino & Retnawati, 2017). HOTS is interpreted as the ability of complex thought processes in analyzing material, criticizing and creating solutions to problem solving (Budiarta et al. 2018). High-level thinking processes occur when students are able to change or create the knowledge they know and produce something new. Students are expected to have HOTS, characterized by being able to access, sort, analyze and manage information effectively to come to conclusions on the problems they face, not just knowing and memorizing a concept.

Students' HOTS can be developed through giving tests of higher level thinking abilities (Istiyono et al. 2014). HOTS questions require students to think about how to apply facts or concepts they have mastered. This means that HOTS questions present challenges that cannot be resolved with routine procedures that have been demonstrated to students. During the process of solving HOTS questions, students are required to use thinking and reasoning skills so that they learn more than just remembering or repeating. Students are expected to be able to solve problems that are new to them, in the form of non-routine and open ended questions or problems.

Indicators for measuring Higher Order Thinking Skills questions include analyzing (C4), evaluating (C5), and creating (C6) skills (Anderson & Krathwohl, 2001). HOTS questions are prepared using appropriate stimulants in a particular context according to the competency to be measured and the material that will be used as the basis for the questions. These stimulants can be raised from problems that exist in the environment around the educational unit which are contextual and interesting (Widana, 2017). This kind of stimulant can help trained students in solving contextual problems that require reasoning, argumentation and creativity in developing various problem-solving strategies.

In line with research by Budiman & Jailani (2014), it shows that HOTS assessment instruments in the form of valid and reliable test questions can be used to measure students' HOTS and can be used as a reference for developing HOTS assessment instruments for other Basic Competencies, and can be used by students as practice material for practicing HOTS. Apart from that Wardany, (2018), HOTS assessment instrument on ecosystem material was considered feasible and can be applied in schools.

The results of observations carried out at high schools in Ambon City, namely at State Senior High School 3 Ambon, State Senior High School 5 Ambon, and State Senior High School 11 Ambon through test questions, mid-semester exam questions, final semester exam questions, as well as from textbooks that teachers and students use on environmental change material show that the questions and questions are still in the low cognitive realm (Lower Order Thinking Skills). The average percentage of environmental change material in the three schools was 90.5% Lower Order Thinking Skills, in the cognitive domains C1 (knowing), C2 (understanding), C3 (applying) and in the dimensions of factual, conceptual and procedural knowledge, and only 8, 4% Higher Order Thinking Skills, in the realm of C4 (analyzing), C5 (evaluating) and in the dimensions of factual and conceptual knowledge.

The low percentage of HOTS questions in pre-observation results is an indicator of students' low cognitive abilities at school. The results of the needs analysis show that there are still weaknesses in fulfilling assessment standards in schools, this is proven by the assessment instruments used by teachers in schools based on Bloom's Taxonomy which are still categorized as low.

The results of the needs analysis show that teachers need assessments that are able to measure HOTS. Assessments that measure HOTS can use subjective tests and objective tests. Subjective tests are multiple choice tests. A good test tool must meet a number of criteria, including that the test must not be too easy and conversely not too difficult. A good test tool must be accountable in terms of appropriateness, validity, reliability, interpretability and usability (Suwandi, 2009).

METHODS

This type of research is development (R&D) with a quantitative approach designed to obtain a product in the form of a HOTS question measuring tool. The research population State Senior High School 3 Ambon, State Senior High School 5 Ambon, and State Senior High School 11 Ambon with a total sample of 103 students. The research instruments used were the HOTS test question instrument and the test instrument validation sheet. The data analysis techniques that will be used are scoring, determining grades, validity testing, reliability testing, question difficulty level, discrimination test and feasibility analysis. The student assessment criteria and suitability of the hots instrument are as follows:

Table 1. Test Result Value Interval

No	Value Range	Category
1.	67 – 100	Ability HOTS High
2.	34 – 66	Ability HOTS Medium
3.	<33	Ability HOTS Low

Reference: Yusuf, (2017)

Table 2. Criteria for Feasibility Assessment of HOTS Question Instruments

Eligibility Percentage (%)	Category
>75-100%	Very Worth It
>50-75%	Worth It
>25-50%	Not Worth It
0-25%	Totally Not Worth It

Reference: Surapranata, (2005)

RESULTS AND DISCUSSION

Results

Research data can be seen in the following Table below.

Table 3. Validity Test Results

Question Items	R Hitung	R Tabel	Category
Question PG 1	0.774	0.200	Valid
Question PG 2	0.818	0.200	Valid
Question PG 3	0.866	0.200	Valid
Question PG 4	0.761	0.200	Valid
Question PG 5	0.839	0.200	Valid
Question PG 6	0.834	0.200	Valid
Question PG 7	0.776	0.200	Valid
Question PG 8	0.798	0.200	Valid
Question PG 9	0.774	0.200	Valid
Question PG 10	0.724	0.200	Valid
Question PG 11	0.761	0.200	Valid
Question PG 12	0.839	0.200	Valid
Essay Questions 1	0.834	0.200	Valid
Essay Questions 2	0.776	0.200	Valid
Essay Questions 3	0.798	0.200	Valid
Essay Questions 4	0.780	0.200	Valid
Essay Questions 5	0.785	0.200	Valid
Essay Questions 6	0.780	0.200	Valid

The results of the construct validity test using the product moment coefficient can be seen that all the questions (items) are in the valid category, so the question items instrument can be used.

Table 4. Reliability Test Results

Cronbach Alfa	Criteria	Category
0.916	0.07	Reliabel

Based on the table, it can be seen that the question item instrument used in this research has very high reliability, namely 0.916 > 0.07, so it is very good to use for actual testing.

Table 5. Test Results of Difficulty Level of Question Items

Range of Difficulty Index Values (P)	Category	Question Number	Amount	Percentage (%)
0,71-1,0	Easy	7 and 8	2	11.11%
0,31-0,70	Currently	1,2,3,4,5,6,9,10, 11,12,13,14	50	66.67%
0,00-0,30	Difficult	15,16,17,18	30	22.22%

Based on the data in the table, it can be seen that 11.11% of the questions tested in learning environmental change material for X State Senior High School students in Ambon City were in the easy category, while 66.67% were in the medium category, and 22.22% were in the difficult category.

Table 6. Results of Differentiating Power of Question Items

Range of values Discriminatory power (D)	Category	Question Number	Amount	Percentage (%)
0,00 -0,19	Bad	-	-	-
0,20-0,29	Moderat	1, 8, 11, 14, 15, 17	6	33.33
0,30-0,39	Good	3, 4, 5, 6, 7, 10, 12, 13,	8	44.45
0,40 ≥	Very Good	2, 9, 16, 18	4	22.22

Based on the results in the table above, it can be seen that the HOTS questions created and tested on students have more discriminating power in the good category of 8 questions, the moderate category of 6 questions and the very good category of 4 questions. These results indicate that the HOTS questions compiled to assess students' cognitive learning outcomes can differentiate students' abilities.

The instrument feasibility test is carried out by giving the instrument to two experts (expert judgment). The aspects assessed in the content validity test include aspects of Content, Material Construction, Language, and Time. The assessor (validator/expert) will provide an assessment by providing relevant or irrelevant information on the statement items from the aspects being measured. The results of the validator assessment are as shown in the following table:

Table 7. Instrument Eligibility Results

Validator	Rated aspect	Percentage	Category
Validator I	Content	89.81%	Very Worth It
	Material Construction	87.96%	Very Worth It
	Language	84.26%	Very Worth It
	Time	83.33%	Very Worth It
Validator II	Content	90.74%	Very Worth It
	Material Construction	87.96%	Very Worth It
	Language	87.96%	Very Worth It
	Time	84.26%	Very Worth It

Based on the data in the table, it can be seen that all aspects measured by the HOTS-based test item instrument have a content validity level including the "very feasible" category, so it can be concluded that the HOTS question instrument on environmental change material is very feasible to be used as an assessment instrument in high schools in Ambon City.

The effectiveness test of the instrument in the form of HOTS-based questions on environmental change material can be seen in the results of students' cognitive learning in the following table:

Table 8. Student Test Results Recapitulation

No	School	Mark	Category	Frequency	Percentage (%)
1	State Senior	67 – 100	Ability HOTS High	3	9,09
	High School 3	34 – 66	Ability HOTS Medium	3	9,09
	Ambon	<33	Ability HOTS Low	27	81,82
		Total		**33**	**100%**
2	State Senior	67 – 100	Ability HOTS High	3	9,68
	High School 5	34 – 66	Ability HOTS Medium	16	51,61
	Ambon	<33	Ability HOTS Low	12	38,71
		Total		**31**	**100%**
3	State Senior	67 – 100	Ability HOTS High	3	7,69
	High School 11	34 – 66	Ability HOTS Medium	26	66,67
	Ambon	<33	Ability HOTS Low	10	25,64
		Total		**39**	**100%**

Based on the table above, it is known that at State Senior High School 3 Ambon, students with good HOTS thinking ability category are 3 (9.09%), students with sufficient HOTS thinking ability category are 3 (9.09%), and students with poor HOTS thinking ability category are 27 (81.82%). Then at State Senior High School 5 Ambon,

students with good HOTS thinking ability category are 3 (9.68%), students with sufficient HOTS thinking ability category are 16 (51.61%) and students with poor HOTS thinking ability category are 12 (38.71%). Furthermore, for State Senior High School 11 Ambon, students with good HOTS thinking ability category are 3 (7.69%), students with sufficient HOTS thinking ability category are 26 (66.67%) and students with poor HOTS thinking ability category are 10 (25.64%)

The comparison of student test results can be seen in the following graph:

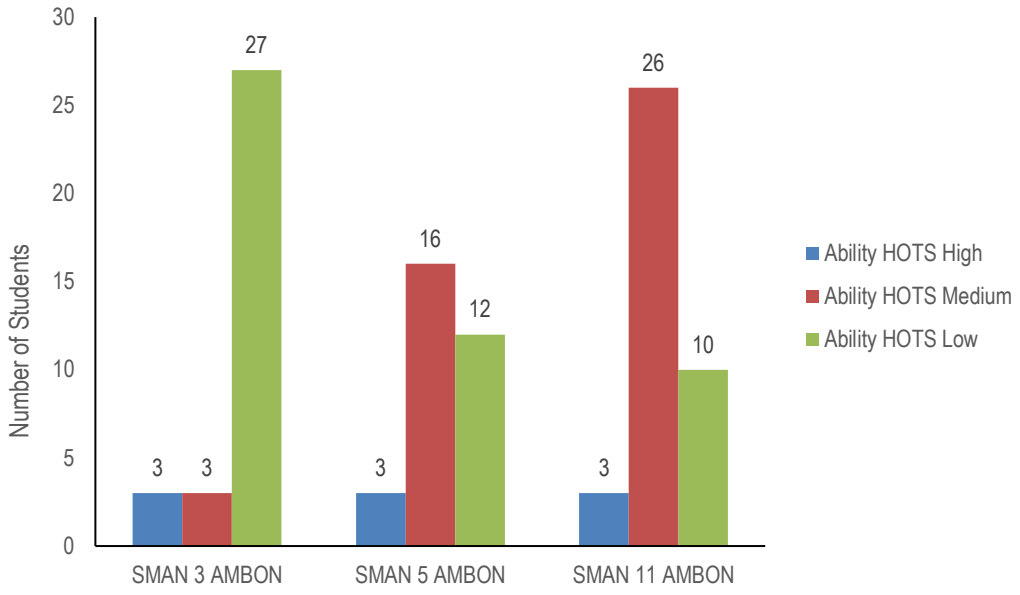

Figure 1. Student Test Results Graph

Based on the comparison graph of the results of the students' tests from the three schools, it can be seen that the HOTS thinking ability at State Senior High School 11 Ambon was 3 students in the good category, 26 students in the sufficient category and 10 students in the less category. From these results, it can be concluded that the HOTS-based assessment instrument on environmental change material is effectively used by students in the "medium" category at State Senior High School 3 Ambon.

Discussion

Feasibility of the HOTS question assessment instrument for environmental change material in class X high school in Ambon City

The feasibility test is carried out with the aim of finding out whether the measuring instrument is feasible, meaning that the measuring accuracy or measuring instrument is appropriate for measuring a variable to be measured. The HOTS-based assessment instrument on environmental change material has been designed to measure students' analytical, evaluative and creative abilities in dealing with environmental problems. The questions asked of students test their ability to analyze environmental change (for example, analysis of the impacts of deforestation or marine pollution), evaluate solutions, and design applicable new ideas (Mardapi, 2008).

The validity of the HOTS questions in the context of environmental change material in Ambon City can be said to be "sufficient". Based on the results of observations and interviews with teachers as well as analysis of questions, this instrument can measure students' ability to connect theory with real phenomena, such as forest destruction and marine pollution in Ambon. The validity of the instrument is also strengthened by involving validators in the question preparation process, as well as comparing it with academic references regarding environmental change material and measuring HOTS skills (Purbaningrum, 2017).

The HOTS-based assessment instrument has also proven to be quite reliable. Reliability testing is carried out by comparing the results of assessments given by several teachers on the same HOTS assignments. The results show that student assessment scores are relatively consistent despite variations in the assessment methods used by teachers. This shows that HOTS questions can be relied on to measure students' higher-order thinking abilities.

The HOTS instrument on environmental change material in class X State Senior High School Ambon City is designed to support curriculum objectives that emphasize the development of critical and creative thinking skills. In this case, HOTS questions not only ask students to remember facts or describe phenomena, but also to think analytically and formulate solutions based on their understanding. The HOTS instrument also supports improving students' critical and creative thinking skills (Suwartini et al. 2017). Questions that ask students to evaluate

solutions or design new ideas in the context of environmental change require them to think more openly and appliedly. This allows students to develop their abilities in dealing with complex problems in the real world.

According to research by Zubaidah (2017), applying HOTS-based instruments to students can improve their skills in constructing logical arguments, evaluating data, and formulating innovative solutions. This research is in line with the findings that students in Ambon City showed an increase in their analytical and creative abilities after applying the HOTS instrument to environmental change material.

Furthermore, research by Vina & Winarsih (2020) explains that the assessment instrument developed was declared valid in terms of material, construction and language aspects, getting a score of 4 in the very valid category, with a reliability value of 0.80 and categorized as very good, the question difficulty index with 25% easy, 50% medium and 25% difficult, and sensitivity indicating 100% sensitive questions. The instrument for assessing environmental pollution material is declared valid and reliable so that it can be used as an example of a HOTS question package.

Based on the research results, it shows that all aspects measured from the HOTS-based test item instrument have a level of content validity including the "very feasible" category, so it can be concluded that the HOTS question instrument on environmental change material is suitable for use as an assessment instrument in high schools in Ambon City.

Effectiveness of HOTS-based assessment instruments on environmental change material in class X high school in Ambon City

Student test results are measured based on the student's ability to complete the HOTS-based question instrument, totaling 18 questions consisting of 12 PG questions and 6 Essay questions which have been tested for the feasibility of the question instrument. Student HOTS thinking skills are taken from the student's ability to work on an instrument of individually assessed questions. The student scores obtained from the results of working on the questions are then averaged to obtain one score resulting from the student's HOTS thinking skills. This value is then converted categorically to obtain categorical data for each student.

From this data, it can be seen that the HOTS thinking categories include: good, sufficient, poor. Based on the results of field research, data was obtained on students' HOTS thinking skills, which is a measurement that refers to students' ability to perform, analyze, evaluate and create which is assessed through a question item instrument. Overall, the average of students' high-level thinking skills through the HOTS-based assessment instrument which is treated in class environmental changes in class X high school students in Ambon City.

The difference in student test results can be seen from the three schools at State Senior High School 11 Ambon, which is better than the other two schools, where there are 3 students in the good category, 26 students in the fair category and 10 students in the poor category. At State Senior High School 3 Ambon, 3 students got scores in the good category, 3 students in the fair category, and 27 students in the poor category. Meanwhile, at State Senior High School 5 Ambon there were 3 students in the good category, 16 students in the poor category and 12 students in the fair category.

Students' ability to work on HOTS questions is sufficient at State Senior High School 11 Ambon because the Biology Teacher has accustomed students to answering questions that are equivalent to HOTS questions, which are usually included in the mid-semester assessment (PTS) or final semester assessment (PAS). Apart from that, the curriculum implemented at State Senior High School 11 Ambon is more focused on developing good level thinking skills, such as analysis, synthesis, evaluation and creativity, so students will be more accustomed to dealing with HOTS questions. A curriculum that touches on these HOTS aspects will encourage students to think more critically, understand concepts in depth, and not just memorize.

Meanwhile, teachers from State Senior High School 3 Ambon and State Senior High School 5 Ambon stated that the PTS and PAS questions were still C2-C5 questions. Apart from that, from the test results obtained, students also answered the questions in minimal language and the answers given were quite short, thus not training students in high level thinking. Lack of student familiarization with HOTS questions. If in the learning process, students are not used to working on questions that require good level thinking skills, such as analysis, synthesis and evaluation. Learning that focuses more on memorization or understanding basic concepts without developing critical thinking skills could be one of the causes. In addition, some students do not fully understand the characteristics of HOTS questions, which require them to think more complexly and not just remember information (Kurniati, 2016).

Learning oriented towards developing HOTS aims to improve students' critical, creative and analytical thinking abilities. In the context of learning Environmental Change material in class Meanwhile, environmental pollution material can analyze the impact of environmental pollution on ecosystems, human health and the economy (Budiarta et al. 2018). HOTS-based assessments function to measure not only how well students remember information, but also how students can analyze, evaluate, and create solutions to complex environmental problems. HOTS-based assessment instruments have various advantages in improving the quality of learning, especially in

developing students' abilities in higher-level thinking. In its application to environmental change material in Ambon City, several aspects of effectiveness that need to be considered include students' ability to think critically, the ability to design innovative solutions, and a deep understanding of environmental issues (Arifin & Retnawari, 2017).

According to Budiman & Jailani (2014), the HOTS-based assessment instrument applied in learning environmental change material is designed to measure students' abilities in analyzing and evaluating environmental problems. For example, case study-based questions that ask students to analyze the causes and impacts of environmental change in Ambon, such as deforestation, marine pollution, or climate change, have proven effective in improving students' critical thinking skills. Meanwhile, according to Vina & Winarsih (2020), environmental pollution is often related to solutions involving various stakeholders, technology and public policy. HOTS questions can ask students to design or suggest solutions to pollution problems, such as the use of environmentally friendly technology, waste reduction, or effective government policies.

From the results of the research that has been carried out, it can be concluded that HOTS questions are effectively used as an assessment instrument in high schools in Ambon City because HOTS assessments are focused on developing student solutions and creativity. This is in line with research by Budiarta et al. (2018) which explains that HOTS-based instruments do not only focus on understanding the material, but also on developing creative solutions. In evaluation-based questions and creative projects, students are asked to design solutions to environmental change problems that are relevant to the local context in Ambon City. For example, they are asked to design an environmental awareness campaign that can be implemented in schools or local communities to overcome the problem of rubbish or marine pollution.

This is also in line with Hanifah (2019), which explains that the majority of students show sufficient ability in designing solutions, although there are still some who have difficulty implementing their ideas in a practical form. For example, in the task of designing a campaign about waste management, students propose various creative ideas, such as creating a waste bank or environmental awareness competitions at school. The HOTS instrument provides students with the opportunity to think more creatively in finding solutions that are not only theoretical, but also applicable, which can be applied in their daily lives. This is in line with the aim of the educational curriculum which aims to equip students with relevant skills to face world challenges (Kurniati, 2016).

Through HOTS questions that focus on impact analysis and solution evaluation, students can understand environmental change in more depth. These questions require students to not only memorize facts about climate change or ecosystem damage, but also to relate this understanding to environmental conditions in their area, such as damage to coral reefs or decreased air quality due to human activities (Anuru et al. 2017). HOTS-based assessment instruments also have a positive impact on student engagement in learning. More challenging and application-based questions encourage students to participate more actively in class discussions, both in small groups and in class forums. Students feel that their opinions and ideas are valued, which increases their motivation and self-confidence in learning (Abosalem, 2016).

CONCLUSION

Based on the research results that have been described, the following conclusions can be drawn: The HOTS question instrument on environmental change material is very suitable for use as an assessment instrument in high schools in Ambon City. This means that the HOTS question instrument is very suitable to be given to students. The HOTS-based assessment instrument on environmental change material is effectively used as an assessment instrument in high schools in Ambon City, this can be seen from the students' ability to work on the instrument's items which are assessed individually. The student scores obtained from the results of working on the questions are then averaged to obtain one score resulting from the student's HOTS thinking skills.

REFERENCES

Abosalem, Y. (2016). Assessment techniques and students' higher-order thinking skills. *International Journal of Secondary Education*, *4*(1), 1–11.https://doi.org/10.11648/j.ijsedu.20160401.11

Anderson, L.W., & Krathwohl, D.R (2001). *A Taxonomy for Learning, Teaching,and Asssing; Arevision of Bloom's Taxnonomy of Education Objectives*. Addison Wesley Lonman Inc: NewYork.

Anuru, T. A., Johan, R. C., & Ali, M. (2017). Peningkatan kemampuan berpikir tingkat tinggi dalam pelajaran Ilmu Pengetahuan Alam peserta didik Sekolah Dasar melalui model pembelajaran treffinger. *Eduthecnologica*, 3(2), 136–144.

Apino, E., & Retnawati, H. (2017). Developing instructional design to improve ma thematical higher order thinking skills of students. *Journal of Physics: Conference Series*, 812(1), 012-100.

Arifin, Z., & Retnawati, H. (2017). Pengembangan instrumen pengukur higher order thinking skills matematika siswa SMA kelas X. *PYTHAGORAS: Jurnal Pendidikan Matematika*. https://doi.org/10.21831/pg.v12i1.14058

Budiarta, K., Harahap, M. H., Faisal, & Mailani, E. (2018). Potret implementasi pembelajaran berbasis High Order Thinking Skills (HOTS) di Sekolah Dasar Kota Medan. *Jurnal Pembangunan Perkotaan*, 6(2), 102–111.

Budiman, A., & Jailani, J. (2014). Pengembangan instrumen asesmen Higher Order Thinking Skill (HOTS) pada mata pelajaran Matematika SMP Kelas VIII semester 1. *Jurnal Riset Pendidikan Matematika*, 1(2), 139.

Hanifah, N. (2019). Pengembangan instrumen penilaian Higher Order Thinking Skill (HOTS) di Sekolah Dasar. *Conference Series*, 1(1), 1–8. http://ejournal.upi.edu/index.php/crecs/article/view/14286.

Istiyono, E., Mardapi, D., & Suparno, S. (2014). Pengembangan tes kemampuan berpikir tingkat tinggi Fisika (pystHOTS) peserta didik SMA. *Jurnal Penelitian dan Evaluasi Pendidikan*, 18(1), 1-12.

Kurniati, D. (2016). Kemampuan berpikir tingkat tinggi siswa SMP di Kabupaten Jember dalam menyelesaikan soal berstandar PISA. *Penelitiandan Evaluasi Pendidikan*, 20(2), 142-155.

Mardapi, D. (2008). *Teknik Penyusunan Instrumen Tes dan Non Tes*. Mitra Cendikia Offset: Yogyakarta.

OECD. (2018). *PISA Mathematics Framework*. OECD Publishing

Purbaningrum, K. A. (2017). Kemampuan berpikir tingkat tinggi siswa smp dalampemecahan masalah matematika ditinjau dari gaya belajar. *JPPM*, *10*(2),40–49.

Rumahlatu, D., Sangur, K. (2019). The influence of Profect-Based Learning strategies ont the metacignitive skilla, concept understanding and retention of Senoir High School Students. *Journal of Education and Learing*, 13(1), 104-110.

Surapranata, S. (2005). *Analisis, Validitas, Reliabilitas, dan Interpretasi Hasil Tes Implementasi Kurikulum 2004*. Rosda.

Suwandi, S. (2009). Model Asesmen dalam Pembelajaran. Mata Padi Presindo: Surakarta

Suwartini, S. (2017). Pendidikan karakter dan pembangunan sumber daya manusia keberlanjutan. *Trihayu: Jurnal Pendidikan ke SD An*, 4(1), 220–234.

Wardany, K. (2018). Kelayakan instrumen pengembangan penilaian higher order thinking skills siswa SMA pada materi ekosistem. *Jurnal Pendidikan Sains*, 6(2), 21-31.

Widana, I. W. (2017). *Modul Penyusunan Higher Order Thinking Skill (HOTS)*. Jakarta: Direktorat Pembinaan SMA DEPDIKBUD.

Yusuf, A. M. (2017). *Asesmen dan Evaluasi Pendidikan*. Prenada Media.

Zubaidah, S. (2017). Pembelajaran Kontekstual Berbasis Pemecahan Masalah untuk Mengembangkan Kemampuan Berpikir Kritis. Seminar Nasional Universitas Muhammadiyah Makasar, Makasar, 6 Mei 2017.