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¹ Higher Order Thinking Skill (HOTS) and Bloom Taxonomy Revised

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Abstract

The advancement and sophistication of science and technology must be in line with the demands of the education world today which focuses on higher-order thinking skills. Thinking skills are an ability to carry out thought processes which are very important to be used and applied in life. HOTS is the highest stage in a cognitive process. In HOTS, students are expected to be able to apply higher order thinking patterns in carrying out the learning process. stated that higher order thinking skills (HOTS) form a new knowledge. This is obtained from creative thinking skills and strategies and the ability to create problem solutions. Students must have the ability to solve problems, think critically and think creatively

Keywords: Higher Order Thinking Skill, Bloom Taxonomy

1. Introduction

The quality of education in Indonesia continues to change and develop over time. Current developments include the advancement and sophistication of technology and information. Many educational platforms both government and private are provided for students to learn. And this educational platform has been integrated and takes advantage of the sophistication of science and technology.

The advancement and sophistication of science and technology must be in line with the demands of the education world today which focuses on higher-order thinking skills. Thinking skills are an ability to carry out thought processes which are very important to be used and applied in life (Sulaiman, Aziz & Mok: 2011). Thinking skills are a thought process which includes the formation of concepts, analysis, application, syntax and evaluation of existing information with observations, experiences and reflections (Ball & Garton: 2005). Thinking skills are also defined as an ability that combines cognitive processes and the ability to complete existing tasks (Milvain, 2008).

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HOTS is the highest stage in a cognitive process (Heong et.al: 2015). HOTS has been widely used and promoted with the main aim of obtaining improved learning outcomes (Tam & Lin: 2017). Higher Order Thinking Skill (HOTS) is the ability to think (C4-C6 cognitive domain: Bloom's taxonomy) in which it teaches analytical, evaluative and creative thinking skills (Setiawati: 2019).

This indicates that students are directed to be able to master several cognitive abilities in the C4-C6 domain (Ahmad & Sukiman: 2019). By doing higher order thinking skill process (HOTS), it will generate creative ideas that will be useful (Heong et.al: 2012).

In HOTS, students are expected to be able to apply higher order thinking patterns in carrying out the learning process (Giacumo, et.al 2012). According (Vidergor, 2017) stated that higher order thinking skills (HOTS) form a new knowledge. This is obtained from creative thinking skills and strategies and the ability to create problem solutions. Students must have the ability to solve problems, think critically and think creatively (Priyaadharshini & Sundaram: 2018). HOTS also includes critical thinking, reasoning and reflective thinking processes (Jarvis & Baloyi: 2020).

In the implementation of the 2013 curriculum with Permendikbud Number 22 of 2016 concerning Process Standards states that there are 3 (three) learning models that support the HOTS-based learning process. The three learning models include: (1) Discovery Learning; (2) Problem Based Learning; (3) Project Based Learning. The three models are very supportive of HOTS-based learning, a scientific approach and can stimulate student curiosity.

2. Higher Order Thinking Skill (HOTS)

2.1 Definition of HOTS

According Resnick (in Ariyana: 2018) explained that the definition of higher order thinking skills is a thinking activity that combines several behaviors of describing material, analyzing, representing, concluding and building relationships involving the most basic mental activities. From the above definition it is clear that the ability to think highly is very different from ordinary thinking activities. In the process of high-order thinking skills, it requires reasoning power, analytical skills and being able to make conclusions on the situation that is being faced. High-level thinking skills (HOTS) are always directed at the learning process (Lee: 2014).

The ability to think at a high level (Higher Order Thinking Skill) is described by Benjamin S. Bloom as a cognitive ability process which is divided into 6 (six) stages of the cognitive process. According to (Sukiman: 2017), it explains that the cognitive process is an activity that involves the mental / brain aspect. In thinking activities, we must use the ability and reasoning power which is directly processed by our brains. And higher order thinking skills can be trained (Murtonen & Balloo: 2019).

High-order thinking skills (HOTS), which includes Bloom's taxonomy which contains the ability to think critically, creatively, solve problems, make decisions and metacognition abilities (Roets & Maritz: 2017). Bloom's Taxonomy underwent an improvement from the old edition and this was done by Anderson and Krathwohl in 2001. This revised edition of Bloom's taxonomy can be found in the book "A Taxonomy for Learning, Teaching and Assessing: A Revision of Bloom Taxonomy of Educational Objectives". There are 6 (six) stages of the cognitive process which can be seen in this revised Bloom's Taxonomy as shown below:

Revisi Taksonomi Bloom

(Anderson, L.W. & Krathwohl, D.R.: 2001)

Taksonomi Bloom lama	C1 (Pengetahuan)	C2 (Pemahaman)	C3 (Aplikasi)	C4 (Analisis)	C5 (Sintesis)	C6 (Evaluasi)
Taksonomi revisi	C1 (Mengingat)	C2 (Memahami)	C3 (Mengaplikasikan)	C4 (Menganalisis)	C5 (Mengevaluasi)	C6 (Mencipta)

Figure 1. Bloom Taxonomy Revision

From Figure 1 above, it is clear that the ability to think highly is in the C4-C6 cognitive realm. Students will be accustomed to be able to analyze a problem, evaluate it and end with creating a finding or solution to the problem at hand. According to (Ariyana: 2019) states that high-level thinking skills are not only limited to the process of remembering, the process of restating and the process of doing citation without processing and this is called Lower Order Thinking Skill by Bloom. In this article we focus on the C4-C6 cognitive domain with the process of analysis, evaluation and creation.

In the cognitive domain (C4-C6) students are taught higher-order thinking processes. In this Higher Order Thinking Skill process students will learn to train their reasoning thinking to be able to process data and information received, analyze critically and be able to create solutions in solving problems. This kind of ability is expected to be embedded in students. This is important for students to prepare themselves for the times that require humans to continue to change and develop themselves in a more critical, innovative and solution direction.

TAKSONOMI BLOOM

C1- Pengetahuan	C2- Pemahaman	C3 - Aplikasi	C4 - Analisis	C5 - Evaluasi	C6 - Kreasi
Mengutip	Memperkirakan	memerlukan	menganalisis	mempertimbangkan	mengabstraksi
Menyebutkan	Menjelaskan	menyesuaikan	Mengaudit/ memeriksa	menilai	menganimasi
Menjelaskan	Mengategorikan	mengalokasikan	membuat blueprint	membandingkan	mengatur
Menggambar	Mencirikan	mengurutkan	membuat garis besar	menyimpulkan	mengumpulkan
Membilang	Merinci	menerapkan	memecahkan	mengkontraskan	mendana
Mengidentifikasi	Mengasosiasikan	menentukan	Mengkarakteristik- kan	mengarahkan	mengkategorikan
Mendaftar	Membandingkan	Menugaskan	membuat dasar pengelompokan	mengkritik	mengkode
Menunjukkan	Menghitung	Memperoleh	merasionalkan	menimbang	mengkombinasikan
Memberi label	Mengkontraskan	Mencegah	menegaskan	mempertahankan	menyusun
Memberi indeks	Mengubah	mencanangkan	membuat dasar pengkontras	memutuskan	mengarang
Memasangkan	Mempertahankan	mengkalkulasi	mengkorelasikan	memisahkan	membangun
Menamai	Menguraikan	menangkap	mendeteksi	memprediksi	menanggulangi
Menandai	Menjalin	memodifikasi	mendiagnosis	menilai	menghubungkan
Membedakan	Membedakan	mengklasifikasikan	mendiagramkan	memperjelas	menciptakan
Menyadari	Mendiskusikan	Melengkapi	mendiversifikasi	merangking	mengkreasikan
Menghafal	Menggali	Menghitung	menyeleksi	menugaskan	mengkoreksi
Meniru	Mencontohkan	Membangun	memerinci ke bagian-bagian	menafsirkan	memotret
Mencatat	Menerangkan	membiasakan	menominasikan	memberi pertimbangan	merancang
Mengulang	Mengemukakan	mendemonstrasikan	Mendokumentasi- kan	membenarkan	mengembangkan
Mereproduksi	Mempolakan	Menurunkan	menjamin	mengukur	merencanakan
Meninjau	Memperluas	Menentukan	menguji	memproyeksi	mendikte

Figure 2. Cognitive Bloom taxonomy

From Figure 2 above, it can be seen that you can see all indicators of operational verbs for the knowledge / cognitive domain. And we can see in table C4-C6 that the various activities that are part of the analysis, evaluation and creation process are explained. And these three cognitive domains are closely related to the ability of students to carry out higher-order thinking processes.

Higher Order Thinking Skill can also be applied to the assessment aspect. Higher Order Thinking Skill-based assessment instruments are made to train and improve higher-order thinking skills and abilities (Mustahdi: 2019)

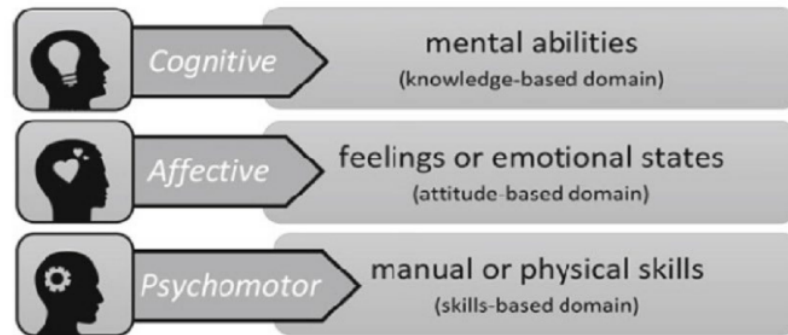
Bloom (1956) identified four main principles in developing his taxonomy as follows:

1. Must be in accordance with student behavior,
2. There must be a logical relationship between categories in the taxonomy,
3. It should describe the value judgments, and
4. It must reflect a psychological process.

2.2 Classification of HOTS

2.2.1 Bloom's Taxonomy

Bloom's original taxonomy consists of three domains of educational activity (Bloom, Engelhart, Furst, Hill, & amp; Krathwohl, 1956) as shown in Figure 3 and Figure 4 below:



1 **Figure 3.** Three domains of Bloom's taxonomy (Ghanizadeh et.al: 2020)

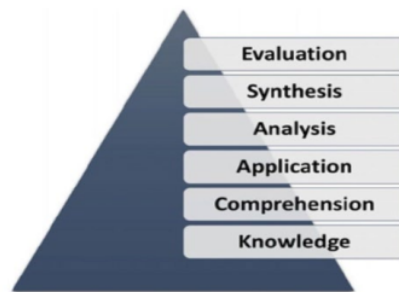


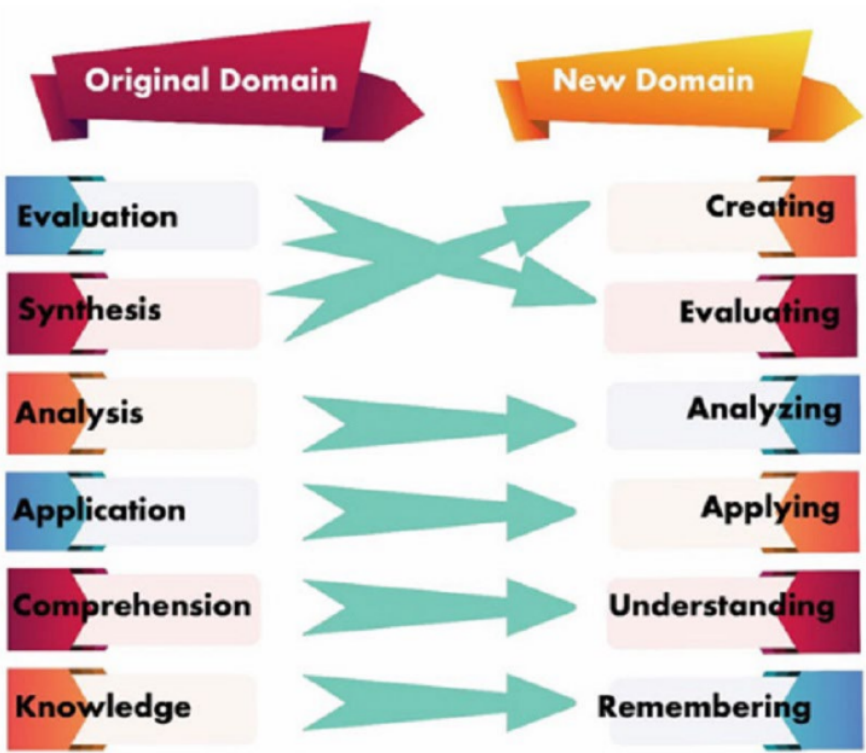
Figure 4. Graphic representation of Bloom's Taxonomy of Cognitive domain (Ghanizadeh et.al: 2020)

2.2.2 Bloom Revised Taxonomy

Lorin Anderson who is a former student of Bloom and David Krathwohl conducted an examination of the cognitive domain and made several changes, including (Anderson & Krathwohl: 2001):

- Modifying the names in the six categories from noun to verb forms
- Reordering creating and evaluation
- Creating a level of knowledge matrix

The original and revised Bloom Taxonomy can be seen in Figure 5 below:



1
 Figure 5. Bloom's revised taxonomy (Ghanizadeh et.al: 2020)

In Figure 5 above, it is clearly illustrated that there are some changes from the natural domain to the revised edition domain. What is easy to understand lies in the change in the noun to the verb. This begins with the activity of remembering, understanding, applying, analyzing, evaluating and creating.

1 In figure 6 below will explain in more detail the revised version of Bloom's taxonomy. The explanation is provided with examples of verbs that can be directly applied to the existing education system. More details can be seen in Figure 6 and Figure 7 below:

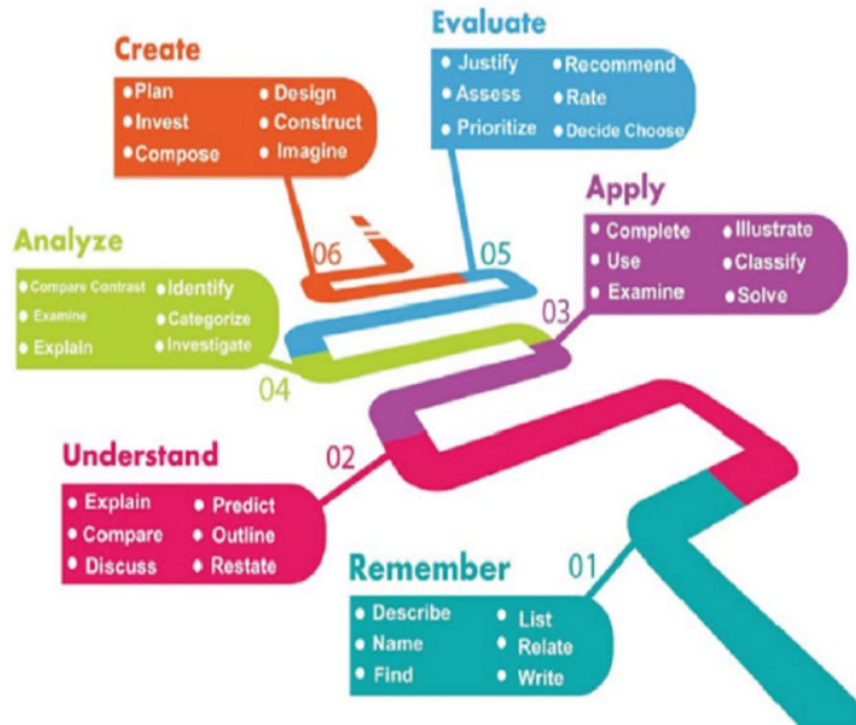


Figure 6. Bloom's revised taxonomy with examples (Ghanizadeh et.al: 2020)

The first domain of Bloom's taxonomy is memory which contains activities of describing, writing, obtaining, mentioning and others. The second domain is understanding which contains activities to discuss, compare, predict, explain and others. The third domain is the application that contains activities using, classifying, illustrating and so on. The fourth domain is analysis which contains activities categorizing, investigating, identifying and others. The fifth domain is evaluation, which contains activities to assess, prioritize, recommend and others. And the sixth domain is creation which includes planning, imagining, designing, constructing and other activities.

BLOOM'S TAXONOMY

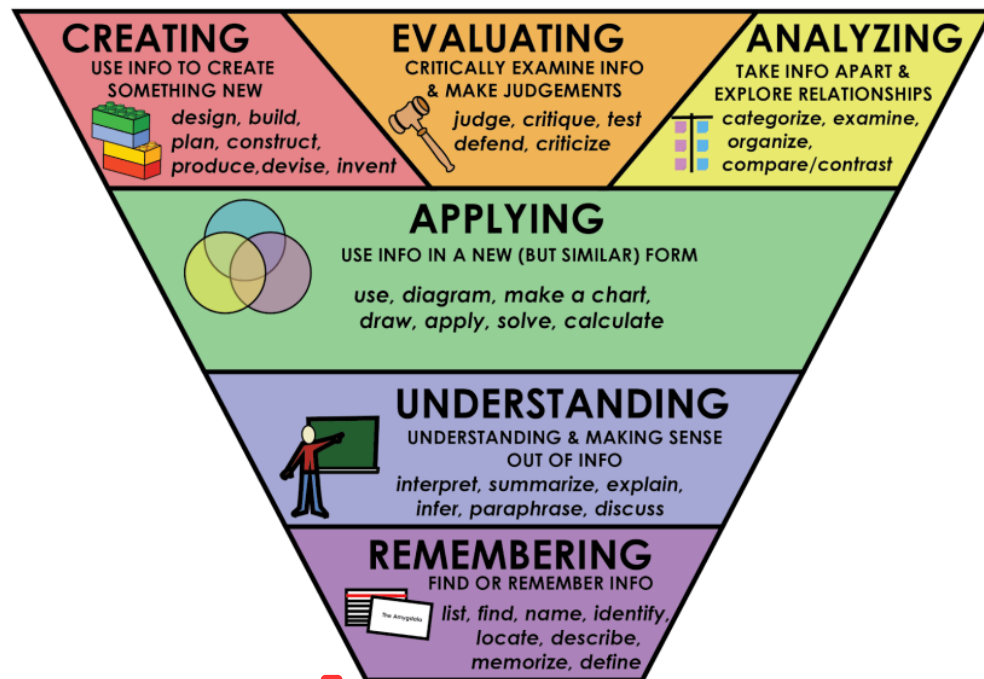


Figure 7. Bloom Taxonomy Diagram

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