

Organising The Distribution of Thinking Levels at Different Education Levels in Indonesia

Sutrisno¹

*Department of Civil Engineering,
Faculty of Engineering, Universitas
Negeri Malang, Indonesia
sutrisno.ft@um.ac.id*

Antelas Eka Winahyo²

*Department of Civil Engineering,
Faculty of Engineering, Universitas
Negeri Malang, Indonesia*

Ahmad Dardiri³

*Department of Civil Engineering,
Faculty of Engineering, Universitas
Negeri Malang, Indonesia*

Abstract: This paper discusses the distribution of thinking levels at different education levels in Indonesia. The research method involved discussion and formulation supported by literature review. The results showed the distribution of thinking levels at various educational levels. The distribution of thinking levels at the elementary school level is C1: 60%, C2: 38%, and C3: 2%. The distribution of thinking levels at the junior high school level is C1: 18%, C2: 60%, C3: 20%, and C4: 2%. The distribution of thinking levels at the high school level is C1: 2%, C2: 24%, C3: 52%, C4: 20%, and C5: 2%. The distribution of thinking levels at the bachelor's degree (S1) level is C2 : 4%, C3: 37%, C4 : 45%, C5: 12%, and C6: 2%. The distribution of thinking levels at the master's degree (S2) level is C3: 4%, C4: 40%, C5 : 46%, and C6 : 10%. The distribution of thinking levels at the doctoral degree (S3) level is C4 : 7%, C5 : 46%, and C6 : 47%.

Keywords: Thinking Level, Education Level

I. INTRODUCTION

One of the objectives of Indonesian national education is to enlighten the life of the nation. This educational aim is achieved in stages starting from primary to secondary and tertiary education [1]. Educating the nation means to create an enlightened and intellectual national life with an improved ability to solve problems. The higher the education level of the population, the closer the nation would be to achieving its goal to enhance the development of intellectual and thinking capacities. An attempt to achieve higher thinking skills should be preceded by efforts to develop lower order thinking—the foundation set of skills required for levelling up [2]. In other words, it is necessary to classify thinking abilities into levels of specificity and complexity, assign the appropriate thinking skills to each level of education, and determine the degree of success and development of the thinking process of students from primary, secondary and tertiary education. By doing so, potential failure can be properly and specifically identified.

There has not been established a standard for determining the level of thinking which should be achieved in each level of education. Researchers prefer to use the same standard set of thinking skills for all primary, secondary and higher education levels, i.e. higher order thinking. The research results, therefore, mostly do not reflect the actual standard level of thinking at the level of primary, secondary, or tertiary education. Most often than

not, many simply conclude that the output quality of education is poor if higher levels of thinking are not achieved—even though what is being assessed is the primary education level. In fact, not all levels of education must reach high-level thinking.

It is, therefore, necessary to formulate a standard framework for determining the proportion of thinking skills should be developed and practised in each level of education in Indonesia; it will serve as a basis for evaluation. This paper aims to shed light on the distribution of thinking levels at the elementary school, junior high school, senior high school, bachelor's, master's, and doctoral degree levels.

II. DISCUSSION

Thinking Levels

Bloom's Taxonomy breaks up thinking into six levels, namely knowledge, comprehension, application, analysis, synthesis, and evaluation. In the revised version, the process of thinking involves, from the simplest to the most complex, knowledge (C1), comprehension (C2), applying (C3), analysing (C4), evaluating (C5), and creating (C6) [3]. These six levels of thinking are categorised into lower- and higher-order thinking.

Experts hold differing opinions on categorising each thinking level as lower-order thinking or higher-order thinking. One stated that analysis, synthesis, and evaluation are higher-order thinking skills [4]. Another argued that higher-order thinking (HOT) includes application, analysis, synthesis, and evaluation [5]. Higher-order thinking is also considered as solving tasks in new contexts/situations [6]. The application level often falls into both categories, LOT and HOT. It belongs to HOT if it requires the application of knowledge in a new situation [6,7].

In sum, the levels of thinking based on Bloom's classification system include knowledge or memorisation (C1), comprehension (C2), application (C3), analysis (C4), evaluation (C5), and creation (C6); C1-C3 are the lower-order thinking, while C3-C6 belong to the higher-order thinking.

Education Levels

In Indonesia, the education levels consist of elementary school (Sekolah Dasar, or SD), junior high school (Sekolah

Menengah Pertama, or SMP), two kinds of upper secondary school (Sekolah Menengah Tingkat Atas, or SMTA), i.e. senior high school (Sekolah Menengah Atas, or SMA) and vocational high school (Sekolah Menengah Kejuruan, or SMK), associate's degree, bachelor's degree (S1), master's degree (S2), and doctoral degree (S3) [1].

The student recruitment process in Indonesia is generally done through a careful selection procedure, meaning that not all prospective students can be accepted to a particular educational institution. If candidates cannot fulfil the enrolment requirements for attendance at top-ranked institutions, they should choose lower-ranked institutions; they cannot continue their education if they keep failing the selection process. The success of education is reflected by the ease of continuing to a higher education level or seeking employment.

Through education, students are consistently trained to solve problems. They are confronted by problems with increasing levels of complexity over time. In fact, the higher the education level, the more complex the problems posed to students. In other words, the higher the level of education, the better the problem solving and critical thinking skills.

Different levels of education have different targeted thinking levels to reach. The higher the level of education, the higher the level of thinking that must be achieved. Higher-order thinking skills are required to attend higher education.

Thinking Levels and Education Levels

Several former studies on the relationship between the level of thinking and the level of education are as follows. There is a possibility of education causing differences in intelligence [8]. Investing more time at school can lead to an increase in intelligence. Intelligence and schooling have a two-way relationship, which influences one another. An increase in school attendance suggests a significant improvement in intelligence [9]. The effect of education on cognitive skills is approximately 1 to 5 points for each additional year [10]. The results of fourteen cross-sectional studies involving 800 students have shown increases in average cognitive development along with increases in education levels [11]. Particular schooling experiences can lead to increases in general cognitive abilities and specific abilities [12]. Age is negatively linked to cognitive development, while intelligence and education are positively related to cognitive development [11]. The results of a study on the effect of schooling on IQ using a longitudinal dataset of individuals aged 10 and 20 have indicated an increase in IQ by 2.9 - 3.5 points after 1 year of schooling [13]. Older adults are problem-focused more than young adults in their approach to solving problems. They are more selective in choosing strategies than young adults when dealing with interpersonal problems. In other words, older adults are more effective than young adults when overcoming everyday problems, especially for interpersonal problems [14]. Overall, it can be stated that the higher the level of education attained, the higher the level of thinking obtained. It is, thus, necessary to promote higher levels of thinking in higher levels of education.

The qualification standards set forth in the Indonesian Qualifications Framework (IQF) or Kerangka Kualifikasi Nasional Indonesia (KKNI) indicate that the higher the level of education, the higher the qualification requirements [15]. In early education, the qualification of the graduates is to be able to carry out simple tasks using tools and have factual knowledge. It means that elementary school graduates are expected to have thinking levels of around C1-C3. Since the early education consists of elementary and junior high school, the levels of thinking should be achieved by elementary school graduates are C1-C2, while junior high school graduates should develop C1-C3 thinking levels. It is, therefore, not wrong to say that the thinking skills should be developed in elementary schools are the levels of remembering (knowledge) and understanding (comprehension), while the students of junior high schools should move up to the application level, or even one level further [16].

Based on the IQF, high school graduates are required to be able to carry out a specific task, use tools and information, apply common procedures, have the operational and factual knowledge, select available solutions to problems. In other words, the thinking levels involved in the high school level are C1-C4. The thinking skills include critical thinking and problem solving [16].

Bachelor's degree (S1) graduates, according to the IQF, are expected to be able to apply science, technology, and art within their expertise, adapt to various situations faced, formulate procedural problem solving, take strategic decisions, and provide guidance. These thinking skills belong to the C3-C6 levels. The targets to be achieved by master's degree (S2) graduates based on the IQF include the abilities to develop, conduct research, produce innovative work, solve problems, and gain national and international recognition. In other words, the thinking levels involved in the high school level are C4-C6. Doctoral degree (S3) graduates are required to be able to develop knowledge, produce creative and original work, solve problems, and undertake research. These thinking skills belong to the C4-C6 levels.

Previous studies have suggested that the higher the level of education, the higher the level of thinking. Moreover, the requirements of IQF indicate that the higher the level of education attained, the higher the qualifications obtained. Thus, one should possess higher levels of thinking to attend higher levels of education.

Distribution of Thinking Levels at Different Education Levels

The primary education level involves memorisation the most, followed by comprehension and a little bit of application; the distribution curve of the thinking levels consists of C1-C3 with C1 as the peak. At the junior high school level, comprehension is the most addressed thinking level, followed by memorisation, application, and analysis; the distribution curve of the thinking levels consists of C1-C4 with C2 as the peak. The thinking skills developed in high schools include a big portion of application, a moderate amount of comprehension and analysis, and a little bit of memorisation and evaluation; the distribution curve of the thinking levels consists of C1-C5 with C3 as

the peak. The distribution curves of thinking levels at education levels are presented in Figure 1.

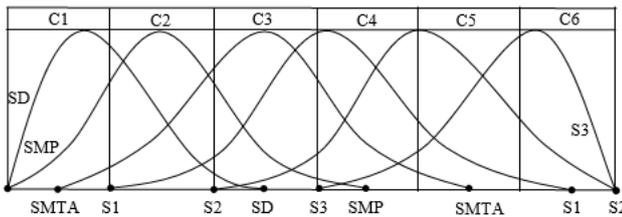


Figure 1. Distribution of Thinking Levels at Different Education Levels

The bachelor’s degree level involves application and analysis the most, followed by evaluation and a little bit of comprehension and creation; the distribution curve of the thinking levels consists of C2-C6 with a peak between C3-C4. At the master’s degree level, understanding and analysing are the most emphasised thinking levels, followed by creating and applying; the distribution curve of the thinking levels consists of C3-C6 with a peak between C4-C5. The thinking skills developed at the doctoral degree level include a big portion of evaluating and creating, a moderate amount of analysing; the distribution curve of the thinking levels consists of C4-C6 with a peak between C5-C6. The proportion of thinking level distribution at each education level is shown in Table 1.

III. CONCLUSION

The discussion has led to the following conclusions.

The distribution of thinking levels at the elementary school level is C1: 60%, C2 : 38%, and C3 : 2%. The distribution of thinking levels at the junior high school level is C1 : 18%, C2 : 60%, C3 : 20%, and C4 : 2%. The distribution of thinking levels at the high school level is C1: 2%, C2 : 24%, C3 : 52%, C4: 20%, and C5 : 2%. The distribution of thinking levels at the bachelor’s degree (S1) level is C2 : 4%, C3: 37%, C4: 45%, C5: 12%, and C6: 2%. The distribution of thinking levels at the master’s degree (S2) level is C3: 4%, C4: 40%, C5: 46%, and C6: 10%. The distribution of thinking levels at the doctoral degree (S3) level is C4 : 7%, C5 : 46%, and C6 : 47%.

Table 1 Distribution of Thinking Levels at Different Education Levels

Education Level	Thinking Level					
	C1	C2	C3	C4	C5	C6
SD	60%	38%	2%	-	-	-
SMP	18%	60%	20%	2%	-	-
SMTA	2%	24%	52%	20%	2%	-
S1	-	4%	37%	45%	12%	2%
S2	-	-	4%	40%	46%	10%
S3	-	-	-	7%	46%	47%

REFERENCES

[1] A. Hood & D. Deopere, The Relationship of Cognitive Development to Age, When Education and Intelligence Are Controlled For. *Journal of Adult Development*, Vol. 9, No. 3, p. 229-234, (2002).

[2] F. Blanchard-Fields, A. Mienaltowski, & R.B. Seay, Age Differences in Everyday Problem-Solving Effectiveness: Older Adults Select More Effective Strategies for Interpersonal Problems. *Journal of Gerontology*:

Psychological Sciences, Vol. 62B, No. 1, p. 61–64, (2007).

[3] I.J. Deary & W. Johnson, Intelligence and education: causal perceptions drive analytic processes and therefore conclusions. *International Journal of Epidemiology*, Volume 39, Issue 5, Pages 1362–1369, (2010), (online) (<https://doi.org/10.1093/ije/dyq072>).

[4] J.D. Ulmer & R.M. Torres, A Comparison Of The Cognitive Behaviors Exhibited by Secondary Agriculture and Science Teachers. *Journal of Agricultural Education*. Vol. 48, No. 4, p. 106–116, (2007). DOI: 10.5032/jae.2007.04106.

[5] J.E. Gustafsson, Schooling and intelligence: Effect of track of study on level and profile of cognitive abilities. *International Education Journal*, Vol. 2, No. 4, p. 166–186, (2001).

[6] J. Perez, Now Trending: Higher-Order Thinking Skills (2016). (online) (<http://www.hotchalkeducationnetwork.com/higher-order-thinking-skills/>).

[7] L.W. Anderson & D.R. Krathwohl, A Taxonomy for Learning, Teaching and Assessing: a Revision of Bloom’s Taxonomy, (2001) (Online) (<http://www.kurwongbss.qld.edu.au/thinking/Bloom/blooms.htm>).

[8] Perpres RI No. 8 tahun 2012. Deskripsi Jenjang Kualifikasi pada Kerangka Kualifikasi Nasional Indonesia. (Online) (http://kknikemenristekdikti.org/asset/pdf/perpres_No_8_tahun_2012_ttg_kkni.pdf).

[9] R. Bronk, Bloom’s Taxonomy, (2009). (Online) (http://etec.clt.ubc.ca/510wiki/index.php?title=Bloom%27s_Taxonomy&oldid=62298).

[10] S.J. Ceci, & W.M. Williams, Schooling, Intelligence, and Income. *The American Psychological Association*, Vol. 52 No. 10, 1051-1058, (1997).

[11] S.J. Ritchie & E.M. Tucker-Drob, How much does education improve intelligence? A meta-analysis. *Education-Intelligence Meta-Analysis*, 07 Nov. (2017).

[12] S. Mcleod, Do students need to learn lower-level factual and procedural knowledge before they can do higher-order thinking? February 18, (2012). (online) (<http://dangerouslyirrelevant.org/2012/02/do-students-need-to-learn-lower-level-factual-and-procedural-knowledge-before-they-can-do-higher-order-thinking.html>).

[13] T. Falch, & S. S. Massih, The Effect of Education on Cognitive Ability. *Economic Inquiry*, Vol. 49, No. 3, p. 838–856, (2011). doi: 10.1111/j.1465-7295.2010.00312.x.

[14] T. Thompson, Mathematics Teachers’ Interpretation Of Higher-Order Thinking In Bloom’s Taxonomy. *International Electronic Journal of Mathematics Education*, Vol. 3, No. 2, p. 96 –111, (2008).

[15] Undang-Undang Republik Indonesia No 20 Tahun 2003 tentang Sistem Pendidikan Nasional, (online) (<https://www.google.com/search?q=undang-undang+no+20+tahun+2003+tentang+sistem+pendidikan+nasional+sisdiknas&ie=utf-8&oe=utf-8&client=firefox-b>).

[16] Y. Abosalem, Assessment Techniques and Students’ Higher-Order Thinking Skills. *International Journal of Secondary Education*. Vol. 4, No. 1, pp. 1-11, (2016). doi: 10.11648/j.ijsedu.20160401.11.