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Critical Thinking Skills through Industrial Revolution 4.0 for Vocational Education

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ABSTRACT

Research is presented to map State Vocational High School (SMKN) in Boyolali based on Higher Order Thinking Skills (HOTS) owned by students. HOTS is indispensable in facing critical thinking skills in the 21st century. The research used uses a qualitative type of survey approach. Students in vocational schools are given cognitive questions oriented to HOTS which refers to Bloom's taxonomy, in the form of evaluating, analyzing, and creating. Questions are presented in multiple choice forms and have been validated with the questmaster program. The results showed that HOTS owned by students in Boyolali Vocational High School was still relatively low, ie 36% at SMKN 1 Klego, 37% in SMKN Nogosari, and 41% in students at SMKN 1 Klego.

Keywords: Critical thinking skills, Industrial Revolution 4.0, Higher Order Thinking Skills Vocational Education

INTRODUCTION

The history of the industrial revolution starts from industry 1.0, 2.0, 3.0, to industry 4.0. The industrial phase is real change from existing changes. Industry 1.0 is characterized by production mechanization to support the effectiveness and efficiency of human activities, industry 2.0 is characterized by mass production and quality standardization, industry 3.0 is characterized by mass adjustments and automation and robot based manufacturing flexibility. Industry 4.0 then comes to replace industry 3.0 which is characterized by physical cyber and manufacturing collaboration [1],[2],[3].

The number of unemployed people from Vocational High Schools (SMK) ranked the highest, namely 9.27%. Next are 7.03% High School (SMA) graduates, 6.35% Diploma III (D3), and 4.98% universities. Identification, the cause of the high contribution of vocational education to the number of unemployed in Indonesia, one of which is due to the low special skills and soft skills possessed. The Work Employment and Social Outlook Trend 2020 report that global unemployment rate stood at 5.4 per cent in 2019 and is projected to remain essentially the same over the next two years [4]. Unemployment in Indonesia is a challenge and even tends to be a threat. Indonesia's unemployment toll in 2019 7.014 million people out of a total of 131.560 million people in the workforce [5].

The job market requires graduates' multi-skills that are forged by education units and systems, both secondary and tertiary education. The contents of learning in the 21st century must always adjust to changes including in the industrial era 4.0. The content of learning is expected to be able to fulfill 21st century skills (21st century skills) in the form of; a) learning and innovation skills include mastering diverse knowledge and skills, learning and innovation, critical thinking and problem solving, communication and collaboration, and creativity and innovation; b) digital literacy skills include information literacy, media literacy, and ICT literacy; and c) careers and life skills include flexibility and adaptability, initiative, social and cultural interaction, productivity and accountability, and leadership and responsibility [6],[7].

Critical thinking is skill that must be achieved in the 21st century. Critical thinking is an inseparable part of education because it is a very important cognitive ability. Thus, educational institutions must continue to strive to improve it for their students [8]. Critical thinking's skill of each individual differs from one another depending on how far they have the ability. This is because students have different intelligences that affect their critical thinking skills [9].

An effort to improve critical thinking skills is through Higher Order Thinking Skills (HOTS). Bloom's Taxonomy states that educational goals include three domains:

cognitive domain, affective domain, psychomotor domain. The revised cognitive process of Bloom is divided into Lower Order Thinking and Higher Order Thinking Skill (LOTS). The capabilities that include LOTS are the ability to remember, understand, and apply, while HOTS includes the ability to analyze, analyze, evaluate, and create [10].

HOTS empowerment for students is an important aspect in improving life skills [11]. HOTS is a thought process that occupies a higher cognitive length, which is important to always be trained on students. HOTS aspects include problem solving, creative thinking skills, critical thinking, argumentative skills, and decision-making skills [12].

21st century learning is oriented towards digital lifestyles, tools of thinking, research learning and ways of working knowledge. Three of the four 21st century learning orientations are very close to vocational education, namely the way of working knowledge, strengthening thinking tools, and digital lifestyles. The way knowledge works is the ability to collaborate on teams with different locations and with different tools, strengthening thinking tools is the ability to use technology, digital tools, and services, and a digital lifestyle is the ability to use and adapt to the digital era [6].

Revitalization of the learning system includes, 1) curriculum and character education, 2) learning materials based on information and communication technology, 3) entrepreneurship, 4) alignment, and 5) evaluation. Education units include, 1) new school units and new classrooms, 2) other study rooms, 3) rehabilitation of classrooms, 4) student and teacher dormitories, 5) equipment, and 6) school management and culture. Elements of students include, 1) giving scholarships and 2) developing interest talents. Elements of educators and education personnel include, 1) provision, 2) distribution, 3) qualifications, 4) certification, 5) training, 6) career and welfare, and 7) awards and protection [3].

RESEARCH METHODS

The variable data used in this study is HOTS, then developed into a sub-variable that is evaluating, analyzing, and creating. Good data is measured by measuring instruments that have high validity. Instrument data that has been compiled is measured based on the level of validity and reliability. The instrument validity used in this study is construct validity and content validity.

The construct validity is stated to be good if the instrument is easily understood by its purpose and objectives, the respondent does not experience difficulties in answering or filling the instrument.

The validity of the items presented was tested with the Questmaster program with the INFIT MNSQ 0.77-1.30 range and Outfit t ≤ 2 for 20 valid multiple choice questions.

Test reliability is carried out to measure the degree of rigidity, consistency and stability of data in measuring what will

be measured. The multiple choice test reasoned reliability test was carried out with the help of the Questmaster program.

This study uses descriptive qualitative research with the type of survey. This study emphasizes more on tangible results in a condition, without giving treatment and changing variables. Test instruments are multiple choice questions related to Higher Order Thinking Skills (HOTS) which refer to revised taxonomic operational verbs to measure HOTS students in Boyolali Vocational High Schools.

The data analysis technique used is quantitative analysis by calculating the HOTS category based on the test results. This test scaling is made of four score categories with interpretations like the following.

Table 1. Scoring of reasonable multiple choice questions

No	Interpretation	Score
1	Answering wrong questions and wrong reasons	1
2	Answer the right questions and the wrong reasons	2
3	Answer wrong questions and correct reasons	3
4	Answer the right questions and the right reasons	4

Student scores are based on scoring, then divided into high to low categories by referring to the interval formula

$$X = \mu S/N$$

Information:

X = Total score of each respondent

μ = The theoretical mean on a scale price t at, degree of freedom n-1

S = standard deviation score

N = number of subjects [12]

Bloom's revised taxonomy, the cognitive process is divided into Lower Order Thinking and Higher Order Thinking [13].

Table 2. Bloom Revised Taxonomy

Knowledge Dimension	Explanation	Level of thinking
Remember	Remember facts and concepts	*Low Order Thinking Skills* (LOTS)
Understand	Basic understanding, which emphasizes students building their own meaning. The process in this category includes interpreting, exemplifying, classifying, summarizing, concluding, comparing, and explaining	
Apply	Implement procedures to solve a problem. Application level problems usually still have one best answer	
Analyze	Analyze information to its parts, determine the relevance of its parts. The process includes distinguishing, managing, and connecting	*Higher Order Thinking Skills* (HOTS)
Evaluate	Assess something to achieve goals, based on criteria.	

Knowledge Dimension	Explanation	Level of thinking
Create	The process includes checking and criticizing. Reorganization of existing elements to form new structures. The process includes producing, planning and producing	

Measurement of the results of the high-level thinking test (HOTS) on vocational students in machining engineering skills in Boyolali, shows that each school reaches different levels of HOTS.

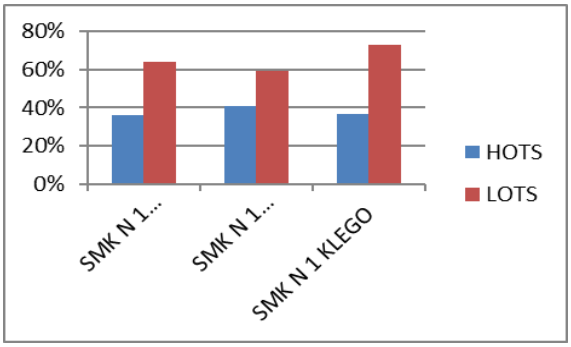

Figure 1. HOTS's Percentage of Mechanical Engineering Vocational Schools in Boyolali

RESULTS AND DISCUSSION

Table 3. Sequence of HOTS Levels in Mechanical Engineering Vocational Schools in Boyolali

No.	State Vocational High School (SMKN)	Thinking Skills (%)	
		HOTS	LOTS
1	SMKN 1 KLEGO	36%	64%
2	SMKN 1 MOJOSONGO	41%	59%
3	SMKN 1 NOGOSARI	37%	73%

Based on table 3, students of SMK Negeri 1 Mojosongo reach HOTS, the highest of the three SMK N in Surakarta, the second highest is SMK Negeri 1 Klego, and the third is SMK Negeri 1 Nogosari.

Competencies in the field of expertise in vocational schools are classified into three indicators, namely: (1) mastering the field of study in theory; (2) master the field of study in practice; and (3) linking material (theory and practice) taught with other related aspects.

Based on the surevy research conducted, obtained data that students in three Boyolali state schools have HOTS levels that are still relatively low. Competence both theoretically and practically, students have dominant LOTS levels, namely in limited dimensions: remembering, understanding, and applying.

Vocational education is inseparable from its attachment to the industrial world as a partner in learning vocational education, both of which cannot be separated or even stand alone. Ideally vocational education is built and developed based on the needs of the industrial world, so that the level of absorption of graduates in the industrial world can be maximized and does not produce significant unemployment.

The low level of HOTS students in these three vocational schools is caused by the lack of the role of teachers as facilitators of the development of students' cognitive processes that involve students plunging directly to

shape their experience in vocational practice [14]. Based on the opinion that a person's frame of mind can be processed and can be developed by means of increasing meaningful experiences. This experience is derived from the development of cognitive processes [15].

CONCLUSION

Based on research conducted in Boyolali State Vocational High School, it shows that high critical thinking skills (HOTS) can be said to be still low. The ability of students in the realm of analyzing, evaluating, and creating is still relatively low. This study presents the percentage of students' thinking skills, thus requiring further research to determine the factors causing low thinking skills in vocational schools in Boyolali.

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