

The Development of Higher Order Thinking Skill Test Instrument based Problem Based Learning to Improve Creative Thinking of the XIth Grade of SMK Negeri 1 Sosorgadong Tapanuli Tengah Academic Year 2022/2023

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Abstract. Through problem-based learning, this study aimed to improve the creative thinking of SMK pupils. By employing the Borg and Gall technique, this study is development research. The absence of creative thinking abilities among pupils in school and instructors' failure to create questions that call for Higher Order Thinking Skills are the issues that were found in this study. There were fifty students in the sample. An instrument for measuring higher order thinking skills was produced. Teachers of the relevant subjects, students, and two qualified validators verified this study result. The study found that the construction of the Higher Order Thinking Skills instrument based on Problem-Based Learning was viable based on the material's validation. The learning design expert got 94%, while the teacher response scored 81% with a description score of 81% and a multiple choice score of 81%. tests in the field at 87.5%. The creative thinking t-test is a Sig 2-tailed test. 0.000 0.05, and the t-test difference between the two averages of learning outcomes is obtained with t count 4,936 > t table 2,091. The experimental class scored higher on average for creative thinking 86.76 than for learning 85.50, which is the difference between the two groups' averages. With a learning result of 75.40, the control group's creative thinking test score was 50.20. Ho was therefore disqualified while Ha was approved, showing that class XI students at SMK Negeri 1 Sosorgadong Tapanuli Tengah TP. 2022/2023 had significantly higher levels of creative thinking when using the Higher Order Thinking Skills on Problem-Based Learning instrument than the Low Order Thinking Skills instrument.

Keywords: Creative Thinking, Higher Order Thinking Skills, Problem Based Learning Model

1 Introduction

One indication of a country's level of progress is its level of education. Quality human resources are necessary for the present development in order for the country to compete with other industrialized nations. In order to produce quality human resources, education is crucial. In order to advance science and technology (IPTEK), education can raise a person's level of

living. This can enhance education's effectiveness in producing qualified human resources. According to research [1], the advancement of science and technology is accelerating in the age of globalization, necessitating the need for competitive human resources who can keep up with the times.

In the era of industrial revolution 4.0, education focuses on building 21st-century competencies, which are comprised of four skills that students must possess and are referred to as the "4Cs": critical thinking, communication, cooperation, and creativity. (creativity). In the twenty-first century, pupils must possess higher-order cognitive abilities. Students must be able to arrange their problem-solving skills by evaluating, analyzing, and developing ideas, ideas, or concepts that can produce highly intelligent humans.

According to a research by [2], Indonesian students often have difficulty honing their capacity for creative thought. The results of the TIMSS and PISA surveys show that Indonesian pupils continue to score much worse than the world average in terms of their aptitude for learning mathematics. The accomplishment scores for students' learning outcomes in mathematics were 386 and 397, respectively, according to the TIMSS survey data from 2011 and 2015, with an average score of 500. The survey respondents' performance was divided into four groups according to the TIMSS criteria: low (low 400), moderate (middle 475), high (high 550), and advanced (advanced 625) The data show that Indonesia is in a poor condition (Novaliyosi and Hadi, 2019). A scientific journal called *Indriani* released in 2020.

Based on the researcher's observations of an entrepreneurship teacher at SMK Negeri 1 Sosorgadong, Kecamatan Sosorgadong, Kabupaten Tapanuli Tengah, Mrs. Agus Lidawati Simamarmata, S.Kom., the assessment tool provided is still in the form of one they created themselves without creating HOTS question criteria, and the teacher is still guided by the questions from a long time ago. The tendencies of students who tended to be passive in their answers to questions requiring problem-solving revealed that pupils' capacity for thought was still relatively low. the inquiries that solely ask about recollecting, for example the questions found are "Below are the entrepreneurial characters that need to be developed, namely?, The characters that must be avoided by an entrepreneur, they are?, What are the benefits of being an entrepreneur?" The questions that exist are questions that only test the memory aspect. In addition, the researcher also tried to test the level of up-to-date questions in the school based on the mid-semester test questions that had been done at school, which were processed with the ANATES software.

The assessment instrument made by the entrepreneurship teacher at SMK Negeri 1 Sosorgadong is still classified as not good, which can be seen from the results of the validity test which only has 3 valid questions and 19 invalid questions, and 3 questions that must be change, the discriminatory power of questions that are not too different from the power figures different from other questions, and the level of difficulty is still relatively weak, namely 3 very easy questions, 7 easy questions, and 15 moderate questions. So that the test instrument used is still not good and easy category so that it has not been able to trigger high-level thinking in the aspect of creative thinking. And on the other hand it is very convenient for students to work on these questions because they are easy and only contain elements of questions that remember the answers. In addition, the problem faced by teachers is that the ability of teachers to develop HOTS assessment instruments is still lacking, and there are no instruments designed to train HOTS or students' higher-order thinking skills.

In the era of the COVID-19 pandemic, there are problems that attract the attention of researcher, such as the problem of unemployment due to layoffs which are mostly carried out in various sectors, this is a new problem that will be faced by SMK graduates to get job, researcher are interested in providing breakthroughs in the form of product development of test

instruments which can trigger an increase in students' creative thinking, which will be useful as human resource capital to create their own jobs such as entrepreneurship and create creativity, creative thinking becomes a necessity to step up after graduating from vocational school. To advance and trigger the creative thinking of the vocational students, one way that can be used to improve students' creative thinking skills is to use the Problem Based Learning (PBL) learning model. The PBL model is a learning model that uses real-world problems as a context for students to learn about creative thinking and problem-solving skills, as well as to acquire knowledge that is essential to the subject (Komalasari, 2013). In this case, the researcher will develop a Higher Order Thinking Skill test instrument based on Problem Based Learning to improve the creative thinking of students at SMK Negeri 1 Sosorgadong Tapanuli Tengah.

Based on the background of the problem above, this research aims to produce Higher Order Thinking Skill-Based Problem Based Learning research instrument that is effective in increasing creative thinking for entrepreneurship subjects. Hopefully, the result product in this research create a valid instrument assessment, train and improve creative thinking skills in Class XI Vocational High School students at SMK Negeri 1 Sosorgadong Tapanuli Tengah.

2 Literatures Review

2.1 Assessment Instrument

The assessment tool is used to measure student learning achievement, factors deemed to be connected to or influencing learning outcomes, the growth of student learning outcomes, the success of the teacher's teaching and learning process, and the fulfillment of a particular program, according to [5]. The process of collecting and evaluating data to determine the accomplishment of student learning objectives is known as assessment, according to Permendikbud No. 23 of 2016. [6] asserts that assessment is a systematic, continuing process that collects information about the development of student learning and aids in raising learning efficacy. According to [7], evaluation is a necessary and inevitable part of the learning process. And evaluation is a duty that teachers and other professionals carry out, according to [7]. The evaluation's findings include. The student learning process entails collecting and analyzing information about the learning process and results that may be utilized to strengthen the student learning process and solve its flaws. The importance of assessment is increased in order to assess how well kids are learning. Assessments provide continuous feedback on pupils' development and performance. The evaluation is more in the interests of the students since they may use the results to reflect on their strengths and flaws and further enhance their learning.

2.2 Higher Order Thinking Skills

Higher Order Thinking Capabilities are in accordance with [8]. The ability to integrate, modify, and transform past knowledge and experiences in order to think critically and creatively in order to solve problems in fresh situations is known as higher order thinking skills (HOTS). The ability to think logically, reflectively, creatively, and metacognitively is referred to as a higher-order thinking talent, or HOTS. [9] discloses Thinking skills are cognitive processes that involve analysis, synthesis, and assessment (HOTS). Higher order thinking skills (HOTS) are broader thinking to identify new challenges, according to [10]. In order to think critically and

creatively about their alternatives, students must link, modify, and transform the information and experience they currently have in addition to just remembering and repeating stuff. Higher Order Thinking Skills (HOTS) are detailed in [11].

2.3 Problem Based Learning

According to [12], one of the most innovative teaching methods that may provide students with active learning chances in real-world situations where students are needed to learn via hands-on experience based on the problem of [13] is the problem-based learning (PBL) learning model. The problem-based learning model is a method of instruction that puts real-world issues front and center and challenges learners to apply critical thinking to find answers. Students gain essential skills and information in this manner.

2.4 Creative Thinking

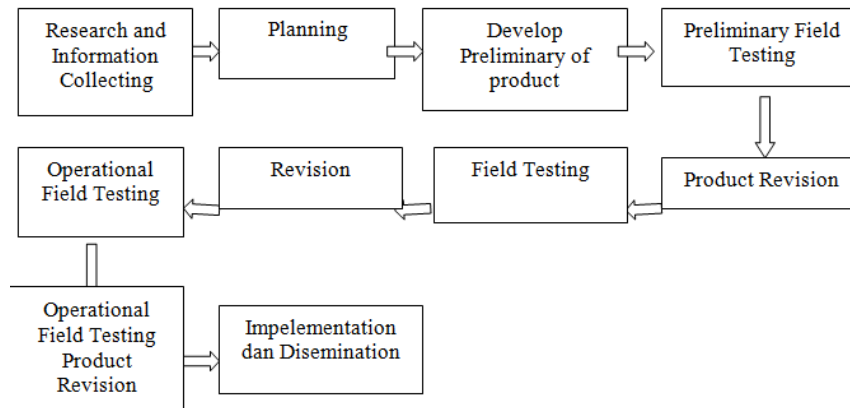
According to [14], creative thinking is a process of thought that can result in unique ideas or thoughts that may later result in the need for new information or the need for essential solutions. The goal of this HOTS instrument was to research creative thinking. Thinking creatively is fostered through problem-based learning, notably the Problem Based Learning Learning Model. It is believed that adopting this paradigm as a catalyst will help children think creatively. The learning paradigm that was thought to be most suitable to foster creative thinking, according to the study [15], was the problem-based learning (PBL) learning model. Because they are immediately presented with the difficulties, students will seek for existing knowledge or data to address them. Thus, students will make use of critical and originality to address contemporary issues. Research has shown [16] that creativity is the potential to think of something original. Students' creativity has to be nurtured daily in order to make innovations or breakthroughs for the area of education. A creative student has the resources and chances to fulfill all of his demands in life. According to [17], creative thinking involves four elements: fluency (fluency), flexibility (flexibility), originality (authenticity), and elaboration (originality) (details).

3. Research Method

The research and development (R&D) approach is used in this study. Research and development methods, according to [18], are research methods used to manufacture specific goods and evaluate the efficacy of certain products.

The development of a learning-related product is the ultimate aim of this research. The development of this assessment tool is anticipated to enhance students' critical-thinking abilities in entrepreneurship. The scope is the development of the HOTS assessment instrument based on Problem Based Learning, in the XI grade students' entrepreneurship material at SMK Negeri 1 Sosorgadong.

According to Borg & Gall (in Sukmadinata, 2013: 169–171), there are 10 processes for applying research and development techniques, including (1) information gathering and planning, (2) developing a preliminary product, (3) preliminary testing, and (4) preliminary testing., Product revision, field testing, revision, operational field testing, product revision for operational field testing, implementation, and dissemination are the next steps. The following sequence can be illustrated in Figure 1 below.



Source : (Barg and Gall, 1989)

Due to the simplification of product development steps due to time and cost limitations, so the adaptation of the ten stages above is carried out into three stages, namely: (1) preliminary study, (2) development, and (3) testing, which are generally depicted in figure 3.2 below.

4. Result And Discussion

4.1 Normality Test

The normality test was used to determine whether the data from the students' research was normally distributed. The Spss statistic19 app produced the following results for the normality test:

Table 1 Normality Test

Class	Data	α	Sig	Category
Eksperimen	Pretest	0,05	0,061	Normal
	Posttest	0,05	0,128	Normal
Control	Pretest	0,05	0,200	Normal
	Posttest	0,05	0,200	Normal

Based on the table above, the data obtained are normally distributed with the help of the SPSS statistic19 application and the attached data

4.2 Homogeneity Test

A homogeneity test was conducted to determine whether the sample was drawn from homogeneity or variance. Our Spss Statistic19 calculator yielded sig homogeneity results of $0.645 > 0.05$ (attached data), indicating that all groups both experimental and control groups are homogeneous samples or derived from the same variance.

Table 2 Homogeneity Test

Test of Homogeneity of Variance

		Levene Statistic	df1	df2	Sig.
Hasil Belajar Siswa	Based on Mean	.215	1	48	.645
	Based on Median	.228	1	48	.635
	Based on Median and with adjusted df	.228	1	46.761	.635
	Based on trimmed mean	.191	1	48	.664

Table 3 t - test for Creative Thinking

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Berpikir Kreatif	Equal variances assumed	.283	.597	24.441	48	.000	36.560	1.496	33.552	39.568
	Equal variances not assumed			24.441	47.994	.000	36.560	1.496	33.552	39.568

According to the results of the creative thinking t-test in the above table, $0.000 > 0.05$ there were two differences in the average group creative thinking between the experimental and control classes taught using the PBL model and given the HOTS assessment instrument.

Table 4 The difference between the two averages of Creative thinking

Kelas		N	Mean	Std. Deviation	Std. Error Mean
Hasil Berpikir Kreatif	Berpikir Kreatif Eksperimen-PBL	25	86.76	5.317	1.063
Hasil Berpikir Kreatif	Berpikir Kreatif-Kontrol (Konvensional)	25	50.20	5.260	1.052

has an average value of 86.76, while the control class taught with the conventional model by giving the LOTS instrument is 50.20.

Table 5 t - test – Learning outcomes

		Levene's Test for Equality of Variances		t-test for Equality of Means						
		F	Sig.	t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Confidence Interval of the Difference	
									Lower	Upper
Hasil Belajar Siswa	Equal variances assumed	.215	.645	4.936	48	.000	10.200	2.066	6.045	14.355
	Equal variances not assumed			4.936	47.217	.000	10.200	2.066	6.043	14.357

According to the learning outcomes t-test table above, the positive influence number and significance of 2 (tailed) is 0.000, which is less than 0.05 with t count $4.936 > t$ table 2.021. It caused the experimental group and control group's average student learning results to vary by two. A problem-based learning learning paradigm is used to educate the experimental class, which has an average grade of 85.60 as compared to the control group's average of 75.40. This suggests that the experimental class's use of the PBL learning paradigm led to a considerably higher average value of learning outcomes.

Table 6 The difference between the two averages of Learning Outcomes

Kelas		N	Mean	Std. Deviation	Std. Error Mean
Hasil	Post-Test-Eksperimen-PBL	25	85.60	6.819	1.364
	Post-Test-Kontrol (Konvensional)	25	75.40	7.762	1.552

5. Conclusion

Table 7 Result And Discussion

Data	Group	Treatment	Average Score	Information
Creative Thinking	Experiment	With PBL and HOTS Assessment Instrument	86,76	There is a significant difference between the two group means
	Control	With LOTS Assessment instrument	50,20	
Learning Outcomes	Experiment	With PBL and HOTS Assessment Instrument	85,60	There is a significant difference in the mean of the two groups
	Control	With Convensional and LOTS Assessment instrument	75,40	Increase No Significant Effect
The Effect of Learning Outcomes on Creative Thinking	Experiment	With PBL and HOTS Assessment Instrument	Sig 0,000 < 0,05 R Square 63.5%	Significant influence of R square 63.5%
	Control	With Convensional and LOTS Assessment instrument	Sig 0,069 > 0.05 Rsquare 11.7%	There is no significant effect, only 11.7%

Based on the results of the study shows that the development of the PBL-based HOTS assessment instrument was based PBL worthy was used on the results of the validation of material experts by 81% of descriptions and 82% of multiple choice, 94% of learning design experts, 87.5% of field trials. The t-test of creative thinking was obtained by Sig 2 tailed 0.000 < 0.05, the difference between the two group averages obtained the average value of the experimental class learning outcomes of 85.60 with creative thinking 86.76 in the control class learning outcomes of 75.40 with creative thinking of 50.20 The t-test of the difference between the two mean learning outcomes obtained sig 2 tailed 0.000 < 0.05 with t arithmetic 4.936 > t table 2.021,. It was concluded that Ho was rejected and Ha was accepted which stated that students' creative thinking using the Higher Order Thinking Skills assessment instrument based on Problem Based Learning was significantly higher than students using the Low Order Thinking skills assessment instrument in the XI grade students of SMK Negeri 1 Sosorgadong Tapanuli Tengah Academic Year 2022/2023.

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