

Developing Assessment Of Vocation-Based Hots On Mathematics Subject For X Class Of Vocational School

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Abstract: Assessment of Mathematic subject in Vocation school should be able to support skill and competency improvement for vocational school students based on their majored vocation. This study aimed at obtaining high quality of vocation-based HOTS assessment from validity, practicality and affectivity aspects. It used method of design research with development type which consist of three stages, i.e. preliminary, prototyping and assessment. In preliminary stage, it was collecting data about curriculum and students' condition, prototyping was process of product developing according to curriculum and students condition analysis, meanwhile assessment as product assessing through experts' validation, limited trial and field trial. The technique for collecting data was documentation, suggestion paper, interview, questionnaires and testing. The subject of this research was X class students of Wira Harapan Vocational School Badung. According to the result analysis, this research was successfully developing HOTS assessment for 10th class students of Vocational school.

Index Terms: Assessment, HOTS, Vocation, Mathematics Subject.

1. INTRODUCTION

Indonesia is expected for entering demographic dividend within 2020-2035, particularly in 2030. The group of productive or working age group (15-64 years old) is more than non-productive age group (adolescent below 14 years old and old generation upper 65 years old) [1]. This shows that dependency ratio of Indonesia in 2030 is expected will be less than 44%. In welcoming that demographic dividend, it needs to prepare the human resources in less than 10 years ahead to determine the success in utilizing its chance [2]. This phenomenon will be an opportunity for Indonesian to achieve high economy growth. The current adolescences in age of 18 years old should be well prepared so when the time is coming they are ready for actively participating and creating for country in 2020 until 2035. In 2030, there are several basic skills which very needed to settle in industry or competing in seeking for job. Those basic skills are (1) Hard and Soft skill regarding training technique and creative skill; (2) technique and business administration skill to build and settle their small business in local business; (3) competency and skill in manage human resource; (4) the high emotional control and well interpersonal skill under high pressure; (5) decertified qualification as competition insurance in fulfilling job requirement; and (6) increasing sustainable competency [3]. The quality of human resources can be improved through enhancement of education quality or formal training. SMK is one of vocational schools have strategic role in developing human resources. Since, this school has different characteristics than any formal education, even refers to the educational criteria, subject substances or graduates [2]. It is a middle formal education which specifically purvey their graduated students in becoming professionals, skillful and ready to contribute in society based on their majored vocation [3]. In order to overcome the free labor competition era, this vocational education is accused to improve the educational quality and develop learning concept and evaluation which can give significant result toward the skill or competency enhancement. The 2013 Curriculum is designed with many completions. First the substance standard, it is to reduce the irrelevant subject material and emphasize also widen relevant material for students, it also enriches the needs of students to think critically and analytically according to the international

standard [4] [10]. Second, the assessment standard, by gradually adapting the international standard of assessment models. Higher Order Thinking Skills (HOTS), since the skill of higher thinking can encourage students to think broadly and emphasize on related material. It is more directed to equip student various competencies needed for facing 21st century. Several important competencies were needed for this century is 4C, including; (1) critical thinking, its purpose is to enable students in resolving various contextual problems by using critical and rational logics; (2) creativity is to stimulate students to be more creative in finding various solutions, designing new strategy or finding prevalent ways that used in advance; (3) collaboration is to facilitate students for team-workable, tolerant, understand the diversity, able to live together to reach the goal; and (4) communication is to facilitate students to be able to communicate broadly, able to find the information/opinion, able to interpret the information and able to give argument in broad meaning [6] [8]. The analyzed result of mathematics subject in Wira Harapan Vocational School does not found any relevant assessment toward the demand of 2013 curriculum assessment which enhance the HOTS assessment models implementation and advance skills or competency based on their majored vocation. According to opinions of several teachers, there are many factors caused them, particularly mathematics teachers in Vocational School are unable to develop HOTS assessment based on vocation, i.e.: (1) there is less motivation from stakeholders; (2) less literatures that could help them to develop HOTS questions independently; (3) they never have any training or workshop about vocation-based HOTS question development; and (3) it is yet provided the example of vocation-based HOTS assessment. According to the facts above, it needs examples of HOTS assessment based on vocation. The developed examples from researchers are expected to be able to inspire vocational school teachers to implement the HOTS assessment models based on vocation. This is for actualize the studying and assessing of mathematics subject in vocational school could give significant result toward skill and competencies enhancement.

2 METHODOLOGY

The used method for this research is design research with

development type. This aimed at obtaining valid, practical and effective vocation-based HOTS assessment for improving mathematics learning results in vocational school. This research consisted of three stages, i.e.: Preliminary research, Prototyping and Assessment [7] [11]. It was conducted in 10th class of Wira Harapan Badung Vocational School. For the preliminary research stage is the first stage, researcher analyzed the students, curriculum, assessment and theory for supporting production of HOTS assessment based on vocation. Then, prototyping stage, researcher designed and developed vocation-based HOTS assessment namely draft 1. Assessment stage, this was begun with validations of expert researchers, the revision result from experts was named draft 2. Then draft 2 was tried on small sample to see the practicality, its result named draft 3. Next step was field trial by using draft 3, where for the step, researcher inspected the affectivity of used assessment for enhancing result of students' study. The revision result of this trials named final product. The techniques of collecting and analyzing data in this research included documentation, suggestion paper, questionnaires, observation paper, interview and testing. The suggestion paper was purposed to collect suggestion and comment from experts review to validate the prototype. Documentation was conducted to collect comments and suggestion result from validator and students, the results from students and photos of this research. Documentation was held in trial on small sample and field trial. Questionnaires was distributed to group while conducting small group trials and field trials. Observation paper and testing was delivered in small trials and field trial. The result of documentation, suggestion paper, observation paper and interview was analyzed qualitatively [12] [13]. Questionnaires and test was conducted to observe the potential effects of prototype produced through students' learning outcome. The potential impact from this research can be seen from questionnaires percentage and completion of outcome before and after applied vocation-based HOTS assessment [14].

3 RESULTS AND DISCUSSION

This research has obtained valid and practical vocation based HOTS assessment to evaluate student mathematics learning. Procedure used for this research are: Preliminary research, prototyping and assessment [7] [11]. On preliminary research stage was conducted in starting research about students' situation, curriculum and theory that support vocation-based HOTS assessment production. On students' analysis stage was found (1) students have less motivation in answering given questions from mathematics teachers; (2) students were excited in answering subject questions of their majored study program. The analysis of curriculum is in accordance with Education and Culture Minister No 34 in 2018 as one of Standard Competency of Vocational School (SMK) Graduates "Having Mathematics Comprehension in Conducting Duties Based on Their Skills". The sub-standard of graduated competency: (1) mathematical thinking related on the work field; (2) using factual knowledge, conceptual and mathematics procedural in resolving problem related on their major in logic, critical and creative way; (3) evaluating the accuracy and righteousness problem resolve related to their major by using basic mathematics; (4) communicating problem resolving that related to their major in systematically oral and written form [4]. The purpose of learning mathematics in vocational school should be integrated to the purpose of their

expertise program [3]. Basic principle of high order thinking: (1) presenting stimulus for students to think, usually in form of introduction text, visual, scenario, discourse or case study; (2) using new problem for students, yet discussed in class and not a questions only for memorizing process; and (3) differentiating between difficult questions (easy, medium or difficult) and cognitive level (low level thinking and high level thinking). Besides, the basic principle on theory analysis stage, it also discovers HOTS questions characteristics, i.e.: (1) measuring the skill of high order thinking; (2) based on interesting and contextual problems; and (3) it is not routine and upholding the regency. The role of HOTS questions, i.e.: (1) preparing students competency to welcome 21st century; (2) accumulate love and care (nationalism) for the regional progress; (3) giving more motivation for students to study; (4) increasing the quality and accountability on learning outcome assessment. Also, it was found several steps of assessing arrangement of HOTS, i.e.: (1) analyzing basic competency which can be transformed into HOTS assessment; (2) arranging problem grid; (3) formulating interesting and contextual stimulus; (4) writing questions according to the grid; and (5) making guidance for scoring and answer key [5]. In stage of prototyping is discovered vocation-based HOTS assessment, in accordance to study found in preliminary research stage. The example of vocation-based HOTS assessment which is produced in Prototyping stage can be seen in table 1.

Table 1 Draft of Vocation-Based HOTS Assessment Card

Basic Competency :	3.2 Explaining two variables linear program and its resolving method by using contextual problem. 4.2 Resolving contextual problem that related to two variable linear program.
Material :	Linear Program.
Question Indicator :	Students can solve vocational problems related to linear programs.
Study Program :	Gastronomy.
HOTS Assessment	Dewi will make two kinds of cake. The modal for first cake is Rp.20.000,00 by having profit about 40%. Modal for second cake is Rp.30.000,00 by having 20%. If the modal in every day is Rp.1.000.000,00 and can produce mostly 40 cake, the biggest profit can be reach by Dewi is...

Assessment above is for students of X class of vocational school who choose Gastronomy study program. That is HOTS assessment, since the developed one accuses students to: (1) analyzing the idea and information critically; (2) its thinking process are: (a) finding more way to arrange number by defined condition; (b) reasoning that there are several alternatives settlement of their problem; (c) concluding total of variation that they can do [8]. After assessment draft is done, next step is assessing. This stage is started with validating from experts, its result named draft 2. Both of expert researchers stated that the developed vocation-based HOTS assessment is valid qualified. The percentage calculation of material experts which was referred from its relevancy toward vocation-based mathematics subject material is obtained that the content appropriateness aspect is 85%, presentation 88%, language aspect 85% and contextual appropriateness 86%, so the total average is 86%. Several comments are given by expert researcher can be seen on this image.

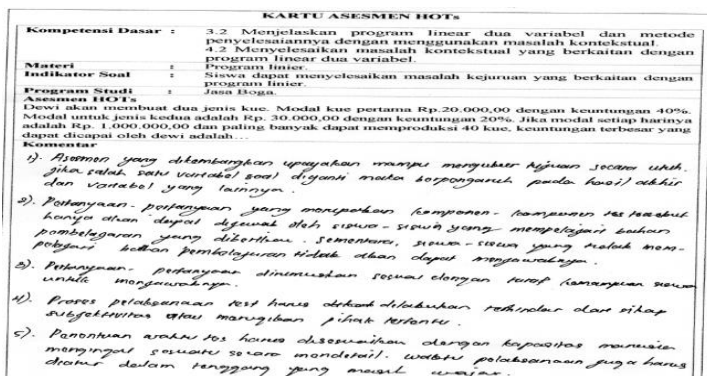


Figure 1 Expert Researcher Comment on Vocation-Based HOTS Assessment

The meaningful specificity questions which is that test components only can be answered by students who learning the given material. Meanwhile, students who not learning it will not be able to answer it. Assessment difficulty level where the formulated questions based on student's ability level to answer it. The assessment is designed in such way, so every student who do it has same chance to achieve good grade. Students need to have opportunity to show their knowledge, skill and any behavior that they mastered after their participation. While using an assessment (toolkit), the time allotment should be reasonable and adequate. Then, draft 2 is tried on small sample to see the practicality, its result named draft 3. The indicator of limited trial is: simplicity, explication, easiness, educative and fascination with 23 asked questions. The assessment result percentage are as follow: simplicity aspect is 85%, explication 78%, easiness aspect is 76%, educative aspect is 80% and fascination 90%. The limited trial on vocation-based HOTS assessment have total average 81.8%. this trial on small sample show that the developed assessment practically is used to measure the student ability and achievement on mathematics subject of vocational school. The next step is field trial by using draft 3, where the researcher observes the effectiveness of used assessment to enhance the student study result. The indicator of broad trial is: simplicity, clarity, easiness, educative and fascination on 23 asked questions. The result percentage is as follow: simplicity aspect is 82%, clarity 80%, easiness 85%, educative aspect 90% and fascination 85%. The total average of this trial is 84,4%. This following image is presented students' answer related on vocation-based HOTS assessment for gastronomy study program.

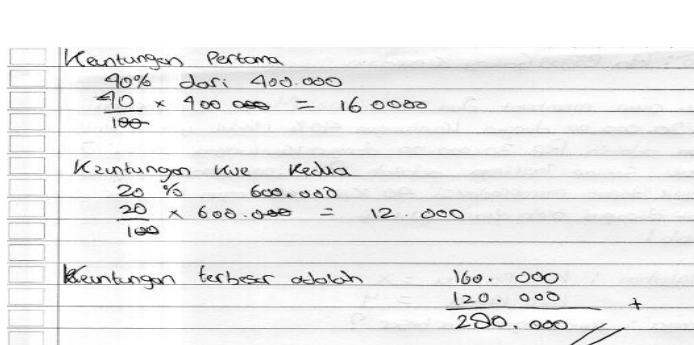


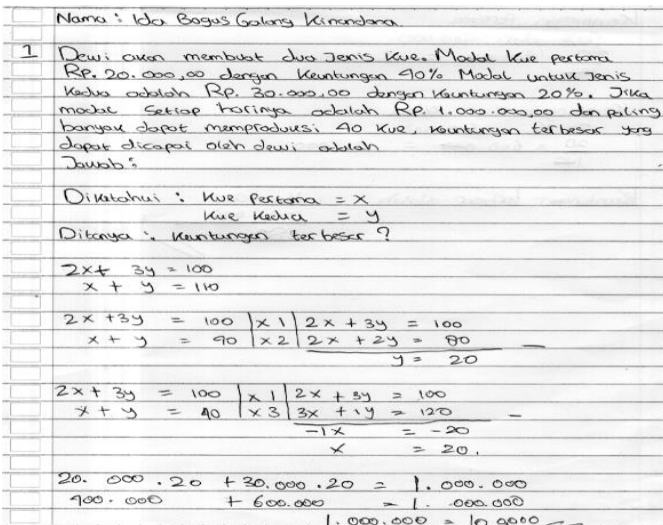
Figure 2 Image of Students' Answer on Vocation-Based HOTS Assessment

This image above shows that in answering vocation-based HOTS assessment, students are more enthusiastic and challenged. This is caused by math problems given are no longer memorized or memory, but it more emphasizes on the mathematic application in their majored vocation. From number of tried samples, it obtained that students give various resolving way, this is in accordance to the HOTS assessment characteristics. The learning achievement test scores used to measure learning outcomes are presented in the following table.

Table 2 Study Result Score

No	Interval Class	Median	Frequency	Percentage (%)
1	56 – 62	59	1	2,78
2	63 – 69	66	2	5,56
3	70 – 76	73	4	11,11
4	77 – 83	80	11	30,56
5	84 – 90	87	12	33,33
6	91 – 97	94	6	16,66
Total			36	100

Table 2 shows that 7 students get under average score, 11 students get around average and 18 students get above average. The HOTS assessment based on vocation is favored by the students, it is reflected from the result which is given that students with above average grade is more than students with under average grade [15]. Vocation-based HOTS assessment is an instrument which suitable for the real situation faced by vocational students, where they can apply the mathematic subject concepts to support them to resolve the problems that related to their majored vocation. The development of this assessment can enhance their creativity in resolving various contextual problems. The creative behavior is closely related to innovative concept which presenting the regency. If an item that was originally a HOTS problem is repeatedly tested on the same test taker, then the question is not a HOTS question because the student's thinking process becomes memorizing and remembering. Students only need to memorize the process that already did before. There is no more a high order thinking. Those questions are no longer motivating the test taker to creatively find new solution. Even, that item is unable to cultivate original idea from test taker to solve the problem. The subroutine questions can be developed from certain basic competency, by making various stimulus which sourced from many topics related to vocational students. The main question still refers to the must-have skill for students is in accordance to the requirement of basic competency. The form of questions can



be various regarding the test's purpose, as example to daily assessment is recommended to use question form description because the number of basic competencies tested is only 1 or 2 basic competencies. As for the final semester assessment questions or school exams, you can use the multiple choice questions (MC) form and description. To measure High Order Thinking (HOTs) will be better if using descriptive question. It is easier to see the thinking process from students, the skill of transferring concept into new situation, creativity in building an argument and logic, and also other things that related to measure the ability of high order thinking. Concerning one of purposes for arranging HOTs assessment is to develop students' creativity. Teachers should provide sufficient and various HOTs assessment of certain basic competency which can be transformed into HOTs questions for maintaining the characteristics of HOTs and its quality insurance [16]. The aim of developing vocation-based HOTs is to enhance the skill of high order thinking of vocational students in more effective way and able to be used in solving things that related to their vocational major program. It is also found in this research that the assessment principle of HOTs including, i.e. 1) Presenting stimulus for student to think, usually in form of introductory text, visual, scenario, discourse or case study; 2) using new problem for student, yet discussed in class and not a question for memorizing process; 3) differentiating between question difficulties (easy, medium or difficult) and cognitive level (low level thinking and high level thinking). The developed vocation-based HOTs assessment in this research is successfully enhancing students learning outcome.

4 CONCLUSION

The product which produced in this research is vocation-based HOTs assessment in valid, practical and effective quality. The validation test average is 86%. The limited trial to assess the practicality is in average 81,8%. The field trial for assessing the effectiveness obtained from 18 person get above average and 11 people get average score. The developed vocation-based HOTs assessment is able to train students in applying the mathematics concept into their majored vocational program. There is integration between mathematics assessment with their vocational major, it fascinates them to do the mathematics exam or questions. This research does not stop here; the researchers are advised to develop vocational-based mathematics learning for vocational students.

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