American Journal of Engineering Research (AJER)
e-ISSN: 2320-0847 p-ISSN : 2320-0936
Volume-7, Issue-8, pp-84-87
www.ajer.org
Research Paper Open Access

# Higher Order Thinking Skill Instrument Design Of Student Based On Bloom's Taxonomy

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***ABSTRACT:*** *This study aimed to design test results based on HOTS criteria. This research was a development research. The development method used by Borg and Gall steps, consisting of 10 steps: The step of viewing potential problem, data collection, product design, design validation, design revision, product testing, product revision, trial usage, revision products, and mass production. In this study focused on product design and design validation. Subjects in this study were students of grade XI IPA SMA Pertiwi 1 Padang, as many as 30 students. The results obtained from the research on the product design stage and validation of this had been generated draft instrument Higher Order Thinking Skill (HOTS) Based on Bloom Taxonomy on poluynomial materials.*
***KEYWORD :*** *Instrument, Higher Order Thinking Skill, Bloom's Taxonomy*

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Date of Submission: 27-07-2018 Date of acceptance: 11-08-2018

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## I. INTRODUCTION

Mathematics is one of the means to form high order thinking (analyze, evaluate, and create) or called as Higher Order Thinking. In learning mathematics students are expected by themselves will be careful in work, critical in thinking, consistent in attitude, and honest in various situations [9]. According to Permendiknas No 22 of 2006, subject of mathematics need to be given to all students from elementary school to equip learners with logical, analytical, systematic, critical, creative, and cooperative ability. In relation to the purpose of mathematics learning it turns out that it has not been fully obtained by students. Illustrated in the process of learning mathematics so far is giving the problems to students with low thinking ability level (remembering, understandig, applying) or often called Low Order Thinking [10].

While in the curriculum of 2013 the assessment models adapt international standard assessment models that are expected to help students improve high-order thinking (High Order Thinking). But in reality it has not been done well. In monitoring supervision and Development of High School Learning Outcomes (EHB) that has been implemented by the Directorate of High School Development, most high school teachers in composing items tend to only measure low-level thinking skills [3]. This is one of the factors that cause the students' thinking ability is still low, because the lack of achievement of Indonesian children in completing the test / questions of the nature of analysis, evaluation, and creativity is high. Problems that have these characteristics are questions to measure HOTS [2]. Teachers also still think that only students who have high ability can be given high-level thinking problems. This is not in line with the demands of the implementation of the 2013 curriculum.

Bloom's taxonomy is considered the basis for higher-order thinking. This thinking is based that some types of learning require more cognition processes than others, but have more general benefits. According to Bloom, Kratwhwol, & Anderson [10], that the thinking level of students in thinking there are six levels of remembering (C1), understanding (C2), applying (C3), analyzing (C4), evaluating (C5), and creating (C6). This level of thinking can occur in the dimensions of factual knowledge, conceptual knowledge, procedural knowledge, and metacognition knowledge. Levels of thinking on C1, C2, and C3 are low-order thinking, and thinking levels in C4, C5 and C6 are high-order thinking levels (Higher Order Thinking).

Related to Bloom's taxonomy that has been revised, according to [4] higher order thinking is a high-level thinking ability from aspects of analyzing to create. According to the NC DPI mathematician in Thompson, the ability to think are as follows: The thinking skill of knowledge, generating, integrating, and evaluating are considered HOT [10].

Thus, high-level thinking is the ability to use the mind in manipulating the information obtained as self-understood and real.

This high-level thinking requires one to apply new information or prior knowledge and to manipulate information to reach possible answers in new situations [5].

HOTS is a student's thinking activity involving high-level cognitive levels of Bloom's thinking taxonomy including analyzing, evaluating and creating [1]. HOTS activities enable skilled students to seek knowledge in inductive and deductive reasoning to think of answering or identifiying and exploring scientific examinations of existing facts [8]. The following table describes the HOTS in the learning to be achieved and the operational verbs used in the lesson.

**Table 1. HOTS Level and Operational Verb**

| HOTS Activity Level | Operational Verb |
|---|---|
| Analyzing: can student distinguish different concepts? | Assessing, comparing, criticizing, sorting, differentiating, defining |
| Evaluating: can the learner justify a particular statement or choice by reasoning? | Evaluating, assessing, criticizing, selecting, connecting, giving opinion |
| Creating: can learners create or develop new products, theories or perspectives based on learning? | Merakit, mendesain, merancang, membuat, menformulasikan |

Source : Anderson & Krathwohl,2015 ; Narayanan, et al., 2015

Based on these description, the design of Higher Order Thinking Skill (HOTS) assessment instruments based on Bloom taxonomy wis very important to improve students' critical thinking skills, which are in line with the objectives of the lesson using the 2013 curriculum.

## II. RESEARCH METHOD

This research was the type of R & D (research and development) or type of research development. The development of the research was the product of HOTS instrument assessment to measure students' high thinking skill.

In the instrument of development procedure used the steps according to Borg and Gall [7]. There were 10 research development steps covering: step of viewing potential problem, data collection, product design, design validation, design revision, product trial, product revision, trial usage, product revision, and mass production. In this study focused on product design and design validation. Samples taken in this study were students of grade XI IPA SMA Pertiwi 1 Padang as many as 30 people taken randomly from 5 classes, then from each class taken each of 6 people.

## III. RESULTS AND DISCUSSION

### RESULTS

Researcher designed the product in accordance with the research objectives of developing an instrument assessment based on Bloom's Taxonomy, on the subject of Polynomial.

Beginning of design development, researcher had made some indicators of Basic Competence (KD) namely : 3.1 Describing the concept and analyzing the charactheristic of algebraic operations on the polynomial and applying it in solving math problems. 3.2 Describing the rules of multiplication and polynomial division and applying residual theorem and polynomial processing in solving mathematical problems. 4.1 Solving real problems using the concept of remaining theorem and factorization in polynomials. 4.2 Solving real problems with cubic equation models and applying rules and properties to polynomials.

Researcher created indicators based on the taxonomic level of the bloom starting from the stage of remembering to create.

## IV. DISCUSSION

Preparation of product design began with determining the class that is class XI IPA SMA used as sample research, then researchers determine the Core Competence, Basic Competence and indicators developed.

The activities done were : :

a. Determinig Test Purpose

The purpose of instrument development is to measure high-order thinking ability (HOTS) of high school student of class XI IPA.

b. Determining Basic Competencies (KD) that match with the characteristics of HOTS questions.

- CORE COMPETENCIES

3. Understanding and applying factual, conceptual, procedural knowledge in science, technology, arts, culture, and humanities with the insights of humanity, nationality, state and civilization on phenomena and events, and applying procedural knowledge to specific areas of study in accordance with their talents and interests to solve the problem.

4. Processing, reasoning, and presenting in the concrete and abstract domains related to the development of the self-study in the school independently, and able to use the methods according to scientific rules.

- Basic competencies and indicator

Basic competencies

3.1 Describing the concept and analyzing the nature of algebraic operations on polynomials and applying them in solving mathematical problems.

3.2 Describing the rules of multiplication and polynomial division and applying residual theorems and polynomial factoring in solving mathematical problems.

Indicator

The students were expected to :

1. Understanding the charateritic of algebraic operation on polynomials in solving math problems,
2. Applying the properties of algebraic operations on polynomials in solving mathematical problems,
3. Understanding the rules of multiplication and division of polynomials
4. Applying residual theorem and polynomial factoring in solving mathematical problems.

Basic competence

4.1 Solving real problems using the concept of remaining theorem and factorization in polynomials.

4.2 Solving real problems with cubic equation models and applying rules and properties to polynomials.

Indicator

The students were expected to :

1. Presenting the cubic equation model and applying the rules and properties to the polynomial, trying to solve the cubic equation model using the concept of the remaining theorem and factorization in the polynomial.

c. Making the Question Form

The test questions were developed based on KD and HOTS indicators. The KD indicators of test were developed in accordance with Core Competencies and Basic Competencies (KD) for high school mathematics class XI IPA. Then based on KI, KD, and indicator were described for mathematics material of SMA XI IPA appropriate class. In order to make a good item was needed grid matter. The grid was needed to pay attention to KI, KD, materials, stimulus and HOTS capabilities (analyze, evaluate, and create). From the result of mathematics material description based on KI, KD and indicator then in HOTS instrument designed in the form of description which consist of 7 questions.

## V. CONCLUSION

Based on the results and discussion, it can be concluded that in this study, it had been produced a HOTS instrument based on Bloom Taxonomy for high school mathematics subjects XI IPA. The instrument was developed in accordance with Core Competencies (KI), Basic Competence (KD), and indicators.

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Yusri Wahyuni"Higher Order Thinking Skill Instrument Design Of Student Based On Bloom's Taxonomy." American Journal of Engineering Research (AJER), vol. 7, no. 08, 2018, pp. 84-87