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Validity and Practicality of Guided Inquiry Based Modules to Increase Students' Higher Order Thinking Skills (HOTS) on Colloid Material

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Abstract:-The scientific learning that was launched in the 2013 curriculum is a form of the effort of Indonesian government to improve the quality of human resources. Scientific learning process is not only just transferring knowledge and skills but also buildingHigher Order Thinking Skills (HOTS). Study is aimed to develop a guided inquiry based module and to see the validity and practicality. The kind of research study conducted is Research and Development (R & D) by using the model of Plomp Development which consist 3 phases, they are (1) Preliminary research, (2) Prototyping stage, and (3) Assessment phase. The validity test was carried out by 4 chemistry lecturers of State University of Padang, 1 chemistry teacher at SMAN 1 Painan and 1 chemistry teacher at SMAN 3 Painan. The practicality test was carried out by 2 teachers of chemistry at SMAN 1 Painan and 2 teachers of chemistryat SMAN 3 Painan and 36 students from SMAN 1 Painan and 24 students from SMAN 3 Painan. The results of the research analyzed by the Cohen Kappa formula show that the Guided Inquiry Based Module is valid for use as a learning medium, as evidenced by the validation result data limitations of content aspects, constructions, language and graphic component, respectively 0.90, 0.90, 0.88 and 0.87 including in the very high category. The practical aspects of the Small Group are reviewed based on the criteria of convenience, time efficiency, and benefits respectively getting 0.86, 0.77, 0.82 and the practicality of the Field Test respectively 0.83, 0.83, 0.86 in the very high category. While the results of the practicality of the teachers were respectively 0.89, 0.86, 0.98 in the very high category.

Keywords:-*Validity, Practicality, Module, Guided Inquiry, HOTS.*

I. INTRODUCTION

The 21st century is the era when tech,and scientific advances become the foundation. Human resources capability to prosses kinds of needed skills to overcome the global challenges [1]. The scientific learning that was launched in the 2013 curriculum is the effort of Indonesian government to improve the human resources quality. Scientific learning emphasizes active and critical thinking in building and understanding material through scientific stages [2]. Learning is seen as not just a transferring knowledge and skills but to developHOTS[1]. HOTS is the ability to change the knowledge and experience that is already owned in solving problems creatively and critically [3].

A Revised Bloom taxonomy, states that indicators to measure HOTS include analyzing (C4), namely the ability to describe problems or objects into their elements and determine how the relationship between these elements is evaluated (C5), namely making a judgment based on criteria and standards exist, and create (C6), namely the ability to combine elements into a form of unity [4].

HOTS cannot be applied instantly and suddenly to students [5]. Getting used to HOTS requires strategies from teachers. Teachers cannot charge students with HOTS-type measurements and assessments at the end of the lesson without doing HOTS learning first. One of the strategies of learning which can be applied to train HOTS is inquiry based learning [5]. HOTS is an important component of inquiry [6]. HOTS of students can be improved through inquiry learning model [7].

Inquiry learning is more than just a hand activity, "inquiry is more than hands on" [8]. Inquiry is an activity of thinking. The process carried out in inquiry is used to explore questions, ideas, and phenomena in finding and finding answers to the problems being asked. The problem solving process carried out by students will involve various levels of cognition. Where learners start by identifying and understanding a problem. The process is continued by formulating problems, making plans or methodologies to solve problems, making decisions and drawing conclusions. These processes are what train HOTS students.

Inquiry learning is closely related to chemistry. Chemistry is classified as a difficult and abstract subject so many students are afraid to learn it [9]. One of the materials in the second semester of SMA class XI chemistry subject is colloid. Based on interviews that have been conducted with several teachers and students at SMAN 1 Painan, SMAN 2 Painan, and SMAN 3 Painan regarding chemistry learning, especially on colloid material, it is stated that basically students consider chemistry to be a pure calculating subject, so when given the material which is memorizing they have difficulty memorizing and understanding it. This is due to the lack of interest of students in finding relevant information about the material, and the material that is read does not last long because students only memorize and remember without inherent understanding of the concepts of the material. Likewise with group discussions which are only dominated by clever and diligent students while other students still seem difficult to convey ideas due to a lack of understanding of the material [10].

Another problem that was found was that the teaching materials used had not included phases which guided students to discover the maximum concept required in revision of 2013 curriculum, but still emphasized the content of the material that presented learning material from beginning to end. This causes students not to be directly involved in building their own concepts or knowledge. In addition, the comprehension test questions that were given to students were still in the C1-C3 cognitive domain. This means that the students' thinking level is still at the Lower Order Thinking Skills (LOTS) level, which is a level often used in class to check, understand, and remember information.

One of the most effective inquiry learning models is guided inquiry [11]. This is in accordance with the statement that guided inquiry examination which is related the psychology of student at elementary and middle school, because the student still receive guidance in a certain process. [12]. From the data above can appropriate inquiry level in learning process for the student in high school in guided inquiry.

The inquiry model of learning must be supported by the existence of appropriate learning tools so that the teaching and learning process runs smoothly and optimally, including the use of modules. Inquiry-based modules are modules that involve inquiry steps in carrying out the learning process. A model of learning which teaches student to learn to discover, infer, arrange, solve the problems in which the process help the student to practice their HOTS[13].

II. RESEARCH METHOD

This research uses research and development [14]. The development model applied is the Plom model advanced by TjeordPlom. This model consists of 3 main phases, they are (1) Preliminary research, (2) Prototyping stage, and (3) Assessment phase. [15].

The validator's assessment was resolved with applying Kappa moment.

moment kappa (k) = (P-Pe) / (1-Pe)

Information:

K : Kappa moment to indicates the product validity.

P : Realized proportion is computed from dividing the number given by validator by the number of the highest score

Pe : Unrealized proportion, computed mean of the maximum value minus the total score given by the validator divided by the maximum value

The level of validity of this module will be seen after the results of the kappa moment calculation are converted to the categories in the table below [16].

Intervals	Category
0.81-1.00	Outstanding
0.61-0.80	Excellent
0.41-0.60	Acceptable
0.21-0.40	Marginal
0.01-0.20	Deficient
<0.00	Invalid

Table 1:- DecisionsCategories Moment of *Kappa*

III. RESULTS AND DISCUSSION

The find of the development of a guided inquiry-based colloid module are portrayed as follows:

1. Preliminary Research

At this phase, preliminary research is fulfilled to develop guided inquiry-based modules. Preliminary research begins with needs analysis, curriculum analysis, and concept of analysis. The findings in this stage are applied as the basis for the initial design of the module. The results of the analysis are described as follows:

1) Colloid is material which is hard for students due to memorization involvement.
2) Teaching materials used by teachers such as the internet, worksheets / modules and textbooks have not been able to optimize the HOTS of students.
3) Teachers and students expect teaching materials that are equipped with innovative and attractive according to the learning objectives and can optimize the HOTS of students.

2. Prototyping Phase

Based on the findings of the preliminary research, a module is planned according to these results. The first design of this module is named Prototype I. The design of this module consists of a cover, a foreword, a table of contents, a list of pictures, the characteristics of the module, terms in laboratory activities, laboratory rules, chemical substances in the laboratory, introduction to laboratory equipment, dimensions of knowledge , instructions for using modules, competencies (KI, KD, indicator and objectives of learning), learning materials, student's activity sheet, student'sworksheets, key answer, and bibliography. Prototype I was carried out by self-evaluation with the aim of reviewing the completeness of the components that must

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be included in the guided inquiry module. Following are some views of the module components, see figures 1 and 2.

Picture 1. Cover ofModule

Picture 2. Contentsof Module

Based on the self evaluation results obtained Prototype II. Prototype was verified by skilful persons (lecturers and chemistry teachers) and individual assesment (one-to-one evaluation) was carried out with three students. After the revision was made, a prototype III was produced. Then the validator provides an assessment of the module on the validation sheet. The validation value given by the validator is then resolved using the moment of kappa. The results of the module validity resolved are summarized in Table 2.

Aspects assessed	K	Category
Componentof content	0.90	Excellent
Componentof construct	0.90	Outstanding
Componentof language	0.88	Outstanding
Componentof graphic	0.87	Outstanding
Average	0.88	Outstanding

Table 2. Module Validation Result

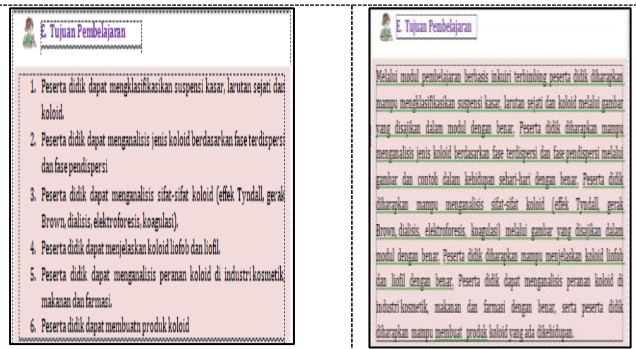
Based on components of the feasibility of the module content have an average0.90 of kappa moment of with a very highly verified category. The categoryof kappa moment is very high indicating that inquiry basedguided colloid module to increase the HOTS of students developed in agreement with the core of competence, basic competence, indicators and competency achievement must be achieve indicator. The content of the module which contains material of learningin the form of facts, concepts, principles and procedures is scientifically correct in accordance with the 2013 curriculum guidance. In conclusion, the problems provided are to be investigated by students to lead other students to figure the concept is in agreement with the subject material taught. It is in accordance with the theory that its content of validity indicates the product developed in accordance with curriculum and based on ardent theoretical [17]. Validity of product in terms of content if they are appropriate with the need and component based on the latest scientific knowledge [15].

Based on the assessment of the construct components, the module an average 0.90 of kappa moment with highlyverified category. The assessment shows there is a systematic fit between the module preparation and guided inquiry model steps.Futhermore, the material is delivered sequentially based on the formulated indicators of achievement competency in order to make interrelationships between the consepts studied. This is appropriate with the opinion that constructthe validity of a product shows that the various element of the product are connected one and another in consistent relationship [17]. The product is said to be valid in terms of the construct if all components are consistently interrelated [15].

The validity of the module from the linguistic are an average 0.88 of kappa moment with a highly verified category. It indicates that the language used in the module is in accordance with good and correct Indonesian rules and could be understood confortability. In addition, text and pictures can be read clearly. This is consistent with the statement that the indicator valued by language including legibility,information clarity, suitability of writing Indonesian correctly rules and use of effective and efficient language [18].

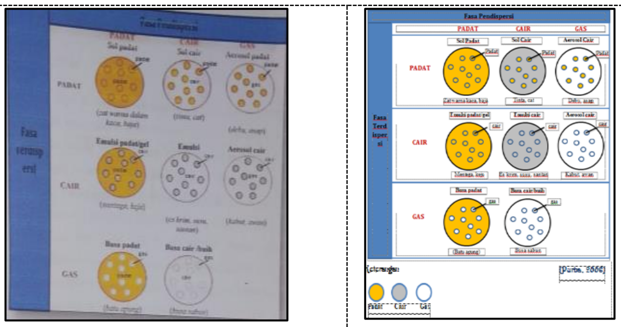
In the graphic component, the module validity has a kappa moment value of 0.88 with a very high validity category. The graphic component shows the aspects of using type and font size, module layout, illustrations, images, designs and product colors that are developed so that the module is attractive as a whole [18]. The existence of visual images and symbols in the module can help students understand the concepts being learned [19].

Although the validity of the guided inquiry-based colloid module to increase the HOTS of the students produced was high, there were still several components that had to be fixed according to the suggestions given by the validator. One of the improvements suggested by the validator can be seen in Figures 3 and 4. From Figure 3 the validator suggests changing the appearance of learning objectives and in Figure 4 the validator corrects the image to make it clearer.



(a) Before revision (b) After revision

Figure 3. Display Competency Achievement Indicators (a) Before and (b) After Revision



(a) Before revision (b) After revision

Figure 4. Display of data collection and organization stages (a) Before and (b) After Revision

Furthermore, a small group evaluation was conducted on prototype III. Small group evaluations are carried out to see the practice of the modules developed before they are tried out in field tests. In this evaluation there were 9 students with low, medium, and high abilities. The practical results are listed in Table 3.

Aspects assessed	K	Category
Ease of use	0.86	Excellent
Efficiency of time	0.77	Excellent
Benefits	0.82	Excellent
Average	0.82	Excellent

Table 3. Small Group Practices

The result of small group practicality analyzed with the kappa moment were 0.82 with aexcellentcategory.

3. Assessment Phase

An evaluation of small group a Prototype IV is obtained and will be used for the Field Test. The trials of large group at 2 Painan State Senior High Schools, namely Painan 1 Public High School (low criteria) and Painan 3 High Schools (high criteria). The results of the Field Test are summarized in Table 4.

Aspects assessed	K	Category
Ease of use	0.83	Excellent
Efficiency of time	0.83	Excellent
Benefits	0.86	Excellent
Average	0,82	Excellent

Table 4. Practicality of Field Test

The student response questionnaire was filled in by 60 people. The acquisition of an average of kappa moment for practicality from the response of student questionnaire was 0.82 with anaxcellent category. Then the practicality by the teacher is summarized in table 5.

Aspects assessed	K	Category
Ease of use	0,89	Very High
Time efficiency	0,86	Very High
Benefits	0,98	Very High
Average	0,91	Very High

Table 5. Results of Teacher Practicality

The questionnaireof the teacher response conducted by 4 teachers of chemistry. The average kappa moment for practicality from the teacher'squestionnaire response is 0.91 with an axcellent category practicality, meaning that the guided inquiry-based colloid module developed is used by teacher practically and learning process.

IV. CONCLUSION

Guided inquiry-based modules on colloid material developed are valid and practical for use in learning.

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