DESIGN OF MATHEMATIC LEARNING MODULE BASED ON ETHNOMATHEMATICSUSING INQUIRY METHOD TO IMPROVE MATHEMATICAL CONNECTION ABILITY STUDENTS OF CLASS VII

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Abstract

Mathematical connections are the ability to link between topics in mathematics, associate mathematics with other sciences, and with daily life. Mathematical connection day is one of the abilities that are the goal of learning mathematics. Teaching materials or modules that are not compatible with mathematical connection capabilities can support learning objectives. Ethnomathematics is one that used in learning mathematics through cultural media that is around students. The inquiry is a way of learning to find solutions in a critical, analytical, and scientific method by using steps to conclusions because facts support them. So, getting ethnomathematics and inquiry combined can improve students' mathematical connection abilities. This study aims to design teaching materials consisting of ethnomathematics-based mathematical modules using inquiry methods to improve mathematical connections. This research is a type of ADDIE development research. The procedure of this research includes analysis, design, development, implementation, and evaluation. This research is limited to the design stage. The subjects of this study consisted of teachers and students from MTs Al Muhsin II Kasihan in Indonesia. Data collection instruments include observation guidelines, interview guidelines, and documentation sheets. Observation guidelines are used to see the characteristics of students' mathematical connections. Interview guides are used to determine the teaching material needs of teachers. A documentation sheet is used to obtain data on curriculum implementation in schools. Qualitative-quantitative techniques analyzed data. This research resulted in ethnomathematics are based on module design according to student's needs. This module is designed to improve students' mathematical connection skills. The results of expert validation on the design of modules get an average value of 4 and are declared valid and can proceed to the next stage.

Keywords: Modules, Ethnomathematics, Inquiry, Mathematical Connection

INTRODUCTION

21st-century education aims to provide provision to students so they can achieve success in the fields of education, career, and life (Trilling & Fadel, 2009). The provision of students to be able to achieve success is one of them through the mastery of various 21st-century life skills. The mathematical connection is one of the skills that is the goal of learning mathematics. Mathematical connection ability is one of the abilities students must have. Thus, students need to practice their mathematical connection skills so that students can know the usefulness of mathematics (NCTM, 2000).

The mathematical connection is an essential ability in students' perceptions about seeing mathematics as a whole, and training students with problem-solving can improve their mathematical connection abilities (Maisyarah, 2017). The knowledge of mathematical connections is the ability to understand, use, and make connections between mathematical ideas in context or outside the context of mathematics to build an understanding of mathematics (NCTM, 2003). The mathematical connection is

the ability to understand students in connecting mathematical ideas that can facilitate students' ability to formulate and prove deductive conjectures among topics. Mathematical concepts and procedures developed advanced can be applied to solve problems in mathematics and other scientific disciplines. (Rohendi, 2012).

The results of the Program for International Students Assessment (PISA) in 2015 stated that Indonesia's mathematics score was 386 below the average of an average score of 490. Then the percentage of math skills at level 5 or 6 (the ability to link information or mathematical topics and apply insight and mathematical relationships) reached 0.8% of an average achievement of 15.3% (PISA, 2016). Based on the data above, it shows that mathematics learning outcomes in the aspect of mathematical connection ability are still relatively low. Results of the research(Rusmini & Edy Sury, 2017)showed that students still see mathematical concepts as fragmentary. Students have difficulty connecting mathematical concepts, mathematical concepts with other disciplines, and mathematical concepts in everyday life. Therefore, we need a media that can complete learning activities to help students relate it to problems in life (Kubieck, 2005). Learning media are various tools and materials used to facilitate learning activities so that learning objectives can achieve (Holden & Westfall, 2010). One of the learning media used in the learning process is the module

The modules are an essential part of the learning process because of the problems that often occur in the learning process that occurs because of teaching materials (learning materials) and learning resources. Modules are printed teaching materials in independent learning with integrated topics (Dick & Carey, 2001). Thus, the module needs to be an essential part of good learning outcomes. The learning activities in the module begin with a presentation of learning objectives by the basic competencies expected by students regarding the direction of learning and targets to achieve. Study the material in the module which presented, discussing the pictures depicted and examples that are close to the student environment. The methods that can improve clarity in learning are through the delivery of the material as simple as possible according to the level of student development and linking it to the knowledge developed by students (Bulger, Mohr, & Walls, 2002).

However, based on observations made by researchers at MTs Al Muhsin II shows that teaching materials available in schools are only available modules from publishers with the discussion of material that is less able to help students understand the concept of lessons and variations of practice questions that can’t train students' mathematical connection skills. Therefore, the module that is supposed to facilitate students to hone students' mathematical connections in mathematics learning is ethnomathematics based learning module, because with ethnomathematics students learn mathematics through culture so that students are expected to understand concepts by linking topics in mathematics, linking mathematics with scientific disciplines others, and are able to relate mathematics to everyday life.

Ethnomathematics includes mathematical ideas, thoughts, and practices developed by all cultures (Astri, Aji, Tias, & Budiman, 2013). Mathematics is a form of culture (Bishop, 1994). Mathematics, as a form of culture, actually has been integrated into all aspects of people's lives wherever they are. Culture influences individual behavior and has a significant role in the development of personal understanding, including mathematics teaching (Bishop, 1991). Ethnomathematics first introduce by educators and mathematicians from Brazil, D'Ambrosio in 1997, in a presentation for the American Association for the Advancement of Science. Ethnomathematics is a defined science of mathematics carried out by members of different cultural groups, which considered as indigenous peoples, workers' groups, professional classes, and groups of children from certain groups, etc. (D'Ambrosio, 2006). Ethnomathematics means cultural mathematics, not only referring to ethnic culture, but also general experiences such as language, beliefs, customs, or history (Begg & Hamilton, 2001). Ethnomathematics is a field of study that examines how people from other cultures understand, articulate, and use concepts and practices that originate from their culture and which researchers describe as mathematics (Barton, 1994). Ethnomathematics study is a very broad science so that ethnomathematics is considered as one of the two centers of thought to understand mathematics (Wedege, 2010). Thus, ethnomathematics can be defined as specific methods used by certain cultural groups or communities in mathematical activities such as real experiences in daily life into mathematics or vice versa, including grouping, counting, measuring, designing buildings or tools, making patterns, spelling, determine location, play, explain, etc.

The learning process through culture can be optimized if, through the learning method, by that reason in this study the inquiry learning method will be used. Inquiry learning is part of the realm of the inductive learning approach that starts from the learning process of a particular object or problem, in inductive learning students understand an object or question to get the facts, procedures, or concepts

needed in learning (Sproken-Smith, 2007). Typically Inquiry learning puts questions, ideas, and the results of students' investigations about problems as the main learning experience (central to learning experiences). The teacher plays an active role in the process of getting students used to expressing their ideas, testing these ideas, and then communicating the results of their investigations (Scardamalia, 2000). So it can be concluded that inquiry learning is one of the ways of learning that looks for solutions to problems critically, analytically, and scientifically by using certain steps towards conclusive conclusions because they are supported by the facts.

From the description above, the researcher will create a design of Mathematics learning modules based on Ethnomathematics using an inquiry method containing sample questions, questions, and experimental activities that students must do with the opportunity to formulate problems, conduct experiments, collect data, and analyze data, and draw conclusions based on culture in the community. The purpose of developing this module design is to create a module design that is able to make students interested in mathematics by using learning through the culture of Yogyakarta so as to develop a module that is expected to help students discover mathematical concepts and be able to improve the mathematical connection abilities of students of MTs Al Muhsin II.

METHODOLOGY

The module is designs using ADDIE development model, which includes five activities, Analysis, Design, Development, Implementation, and Evaluation (Branch, 2014). This research is limited to design. The researcher applies the ADDIE model to ensure students can use modules and follow effective learning so that learning objectives can achieve. The stages of module development activities are presented in figure 1.

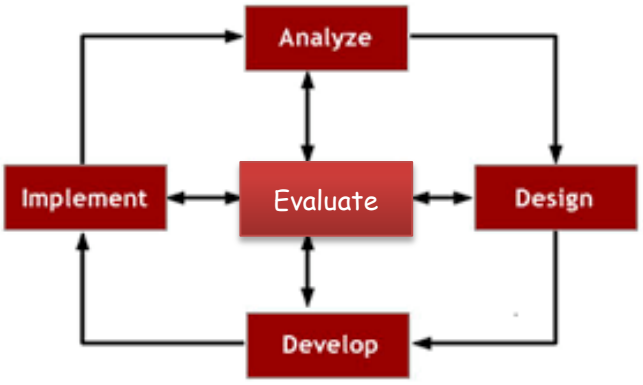

Figure 1 ADDIE model inside

The module material that will be designed is about the flat build. Researchers conduct curriculum studies to see existing modules, observe students' mathematical connection skills in learning, and build flat instructional materials. Interview teachers and students about what is need to support students' mathematical connections. The subjects in this study were students of class VII and mathematics teachers at MTs Al Muhsin II Kasihan. Research objects include curriculum, student characteristics, and evaluation of teaching materials. Data collection instruments include interview sheets, document sheets, and question sheets. Interview sheets to take data on student characteristics and curriculum, document sheets to evaluate teaching materials, description sheets to find out students' mathematical connection abilities. Data obtained from the results of observations and interviews conducted at school are then summarized and concluded. The results of the analysis obtained things needed in the development of the module. Therefore, the researcher designed the module, which was then validated by a team of experts.In this study, validity data obtained from the results of the validation's assessment. The explanation of data analysis techniques from the validity of this design module is turning qualitative data into quantitative data with the provisions of the Likert scale, calculate the average score, andconverttheaveragescoretoaqualitative value accordingtotheassessmentaspect.The followingis a conversion score for the assessment aspect in table 1.

Table 1 Conversion Score Range

Score Range	Classification
$\bar{X} > 4{,}2$	Very Good
$3{,}4 < \bar{X} \leq 4{,}2$	Good
$2{,}6 < \bar{X} \leq 3{,}4$	Enough
$1{,}8 < \bar{X} \leq 2{,}6$	Less
$\bar{X} \leq 1{,}8$	Very Less

In this assessment, the learning device is said to be valid if it meets the classification of the minimum learning device assessment either.

RESULTS

Analysis

In the data analysis stage, theoretically and empirically determine the characteristics of students, curriculum, and teaching materials: data obtained through interviews with teachers and students, learning observations, and ongoing curriculum observations. Based on the analysis of the characteristics of students in the learning process, it was found that most students still had difficulty in associating mathematical concepts that had been learned to solve mathematical problems. Students tend to be passive in learning mathematics, so the ability of students' mathematical connections, which is one of the skills that are the goals of mathematics learning have not been utilized optimally. The results of the analysis of some of the responses of teachers and students to teaching materials found that mathematics textbooks provide in accordance with the curriculum that is being used in Indonesia. The 2013 curriculum is seen in terms of the curriculum of textbooks used in the teaching and learning process that is in accordance with KI and KD along with indicators achievement, as well as every material in the textbook has been displayed KI and KD along with indicators. However, the textbooks used by students during learning do not yet support students' mathematical connection abilities. Teachers and students also agree that textbooks in the form of ethnomathematics based modules are developed with the inquiry method because they will be able to facilitate students in improving students' mathematical connection abilities so that mathematical problems can be solved properly, as well as being able to make students more prepared in accepting subject matter, and can instill values culture in students.

Design

At the design stage, an ethnomathematics-based learning module design will be developed. This stage is done by designing module products in accordance with the results of the analysis data. The steps taken are the preparation of KI (Core Competencies), KD (Basic Competence), SKL (Graduates Competency Standards), student material, test standards, media selection in accordance with the characteristics, and the choice of teaching material formats in the form of ethnomathematics-based modules with oriented inquiry methods on students' mathematical connection skills. Ethnomathematics-based mathematics modules using inquiry methods are created to help students more easily understand the material presented by the teacher.Ethnomathematics based module design uses the inquiry method in the form of an initial draft, which is then validated by an expert. Expert validation is carried out by media experts and material experts whose purpose is to obtain data on module validity. The initial draft was made is a cover module, identity module identity, preface, table of contents, KI & KD, material module, and exercises.

Cover Module

The cover of the mathematics module entitled "Let's Learn to Build Flat." In order to make this module easily recognizable, then the cover is written on an identity such as "Mathematics Junior High School / MTs Class VII Curriculum 2013 by Syah Fathi Azzatia". Refer Figure 2. The conclusion part of this module is in Figure 3.

Identity Module

The module identity page consists of the module title, author, supervisor, and validator. The identity module in this module agrees in Figure 3.

Preface

A preface ofthe module was created to thank this module. The introductory part of this module is in Figure 4.

Table of contents

The Table of Contents in this module is used to provide search material in the module. The contents section in this module is in Figure 5.

Core Competencies (KI) & Basic Competencies (KD)

KI and KD are written in Core Competencies and Basic of class VII / MTs Basic Competency material. KI and KD sections in this module are in Figure 6.

Module Concept Map

The Concept Map consists of a chart containing the material flow compiled in this module. The concept of material will be created to improve students' mathematical connections. The concept map section in this module is in Figure 7.

Material Module

The subject matter in this module is flat build material. In the section, the material will be presented using culture in Yogyakarta, and the material presented will help students improve their mathematical connection skills. The material section of this module is in Figure 8.

Exercises

The Question Exercise is structured to study the students' level of understanding about the material in flat shapes. The practice questions given to students are designed using a cultural basis (ethnomathematics) so that the questions given are able to foster students' mathematical connections. The practice questions section in this module discusses in Picture 9.

Figure 2

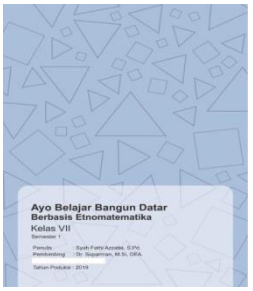

Figure 3

Figure 4

Figure 5

Figure 6

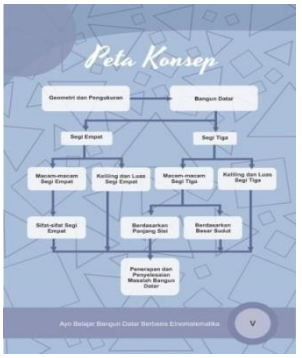

Figure 7

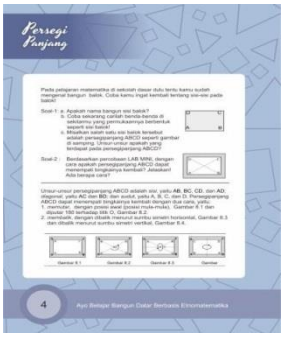

Figure 8

Figure 9

Next is the expert validation stage, an assessment is carried out to determine the validity of the draft module to be developed. The module design that has been changed by the supervisor is then validated by a validator, material expert lecturer, expert media lecturer, and teacher. The module design validation uses instruments that have been reviewed by lecturer Dr. Suparman, M.Sc, DEA., Two validators validate module design. The first validator was Bustanika Lutfi Harisna, S.Pd. as a Mathematics teacher at MTs Taruna Al Qur'an. The second validator is Balu Hidayati, S.Pd. as a Mathematics teacher at Muhammadiyah 9 Middle School in Yogyakarta. The following are some comments and suggestions from experts which are summarized in Table 2.

Table 2. Inputs and suggestions from expert validators

Inputs and suggestions	Follow up
• If doing a module, it is better to take one material. Suppose the material is triangles and rectangles then KI KD is taken should be triangles and rectangles as well.	• Change some material modules.
• In KI and KD, please include indicators of achievement of competence.	• Complete indicators in KI and KD
• The cover and appearance of the module are less attractive, and it should be made more attractive in terms of color and images so that students are interested in learning.	• Repair cover and appearance of the module.

Furthermore, the results of the validation of the Module design by the validator are shown in Table 3.

Table3 Results of Expert Validation on Module Draft

Assessment Aspect	Average Score	Criteria
1.Technical aspect	4.3	Very Good
2. Language	3.9	Good
3.Content of module	3.8	Good
Average	4	Good

Based on Table 3, it can be seen that the average score of material expert judgment is 4. These results indicate that the module design is in a good category.

DISCUSSION

The results of the analysis, in the module, covers KD, KI, and SKL so that to overcome the passive characteristics of students needed modules that can make students active in the learning process. The material chosen is flat because many students only memorize the formula without understanding the formula in the flat material. So we need the right learning model to overcome student problems is to use the inquiry method.The results of the design obtained by ethnomathematics-based module characteristics with the inquiry method are; cover module, module identity, preface, table of contents, KI & KD, material module, and practice exercises. Then, the test results of module design validation show that the module design is in the good category with an average score of 4. The results show that the module design can develop into an ethnomathematics module that can improve students' mathematical connections.From the results of the study, it was concluded that the development of ethnomathematics-based modules with the inquiry method arrived at the design stage. For the next stage, the researcher will proceed to the development stage.

CONCLUSION

The results of the discussion from analysis,design,and validation of expert on the design of ethnomathematics-based modules with the inquiry are declared valid and can be continued later on. With the Ethnomathematics and inquiry method, it is expected to be able to improve students' connection mathematics skills.

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