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Validity of The Abstract Algebra Teaching Book

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ABSTRACT

The Abstract Algebra is one of the most difficult subjects for students. In this course, students are required to have several textbooks as their reading source. However, the existing textbooks do not guide students in carrying out the process of preparing evidence and tend to speak non-Indonesian languages. The purpose of this research is to design and develop textbooks on abstract algebra courses which contain proofs in full step by step that can improve the ability to organize evidence. This type of research is development research with formative evaluation design consisting of self-evaluation, prototyping (expert reviews, one-to-one, and small groups), and field tests. The validity of the development of abstract algebra textbook is passed through the stages of self-evaluation and expert reviews. The results showed that the prototype of abstract algebra teaching books had a very high level of validity (89.29%).

Keywords : Abstract Algebra, Teaching Book, Validity

INTRODUCTION

The Abstract Algebra is one of the subjects in the curriculum of mathematics study programs and mathematics education at universities in Indonesia [1]. The Abstract Algebra can be defined as a non-empty set with one or more binary operations and satisfies certain axioms (properties). Through this course students can better understand mathematical systems that are already known before. For example, the algebraic properties 0 and 1 are respectively in addition and multiplication known as identity in the abstract algebra.

The Abstract Algebra is one of the most difficult subjects for students. This is reinforced by [2], which states that this course discusses abstract concepts, so students often have difficulty in learning them. The abstract algebra is loaded with definitions, entries, and theorems. For this reason, lecturers must find solutions to help students understand the subject matter more easily.

In the absract algebra course, students are required to have several textbooks as their reading source. The character of college textbooks,

especially Abstract Algebra textbook, namely some proof steps are often omitted as material for the reader. The omitted part must be found in order to obtain a complete understanding of the proof of a entry or theorem.

This is an obstacle for students, they are difficult to find the evidentiary part that was omitted. The effort made by the lecturer to overcome it is by giving lead questions. However, these efforts are often unsuccessful, even if they succeed in spending a long time. So, in this way in lectures are seen as ineffective.

For this reason, it is necessary to develop a textbook for students. The textbook referred to contains complete proof step by step. That way, students will get used to understanding the basics of proof of entry or theorem. The question is which part of the textbook can force students to think about proof? For this reason, some textbooks or theorems and practice questions are not proven, but complete evidence is presented separately from the textbook.

Proof in the structure of algebra is very thick will be the understanding of students in the science of logic. The schematics or theorems presented in algebraic structure are dominated by the premises that form an implication. The mistake that often happens is that students are often wrong in choosing the right assumptions in a statement of the entry or theorem. Therefore, researchers assume that bringing back supporting concepts in an algebra book is important. Concepts are not expected to be presented in the same form as textbooks, however, they will be presented separately in a reminder box. This is done so that the resulting textbooks are not monotonous.

The specific purpose of this research is to develop textbooks on algebraic structure that can improve the ability to compile evidence of students who have proven their worthiness. Research is considered important to do, because the procurement of textbooks on algebraic structure is one way out for students in proving an abstract algebra problem.

Textbooks are intended as completeness of the learning process, where textbooks follow curriculum and syllabus rules. The curriculum in question is the curriculum that will follow the curriculum and profile of the graduates of the Mathematics Education Study Program FKIP UIR. While the syllabus at tertiary institutions is RPKPS (Program Planning and Semester Learning Activities).

Algebra is a branch of mathematics. In the ninth century on the quadratic equation, Al-Jabr Wal Muqabala was written by Persian mathematician Al-Khowarizmi. Algebra maintained its emphasis on polynomial equations until the nineteenth century. Around 1900, algebra headed for a revolution that made mathematics abstract and axiomatic. The next generation, which is about twenty years later various algebraic figures use the clarity and generality of mathematics called modern algebra [7].

One of the subjects included in the algebra group is the structure of algebra. The algebraic structure course is one of the subjects in the curriculum of the Mathematics Education Study Program Faculty of Teacher Training and Education (FKIP), Riau Islamic University. This course is presented in semester 5. This course is charged with 3 (three) credits, with the content or contents of this course, including groups and their nature, group orders, subgroups and their characteristics, normal subgroups, and ismorphic groups.

METHOD

This study develops textbooks on algebraic structure courses, which are carried out using the formative evaluation stage of Martin Tessmer. Here is the formative evaluation design flow:
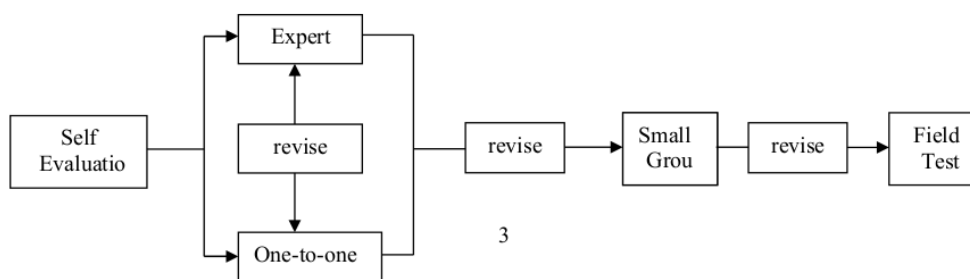

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Fig 1. Flowchart of *Formative Evaluation* [8]

The prototype (textbook of algebraic structure) is declared to have valid content and construct after an improvement is made based on expert review recommendations [9]. This research will be carried out in the Mathematics Education Study Program FKIP Riau Islamic University in the academic year 2019/2020. The research time will be planned starting in the middle of the even semester of the 2018/2019 school year until the mid-semester of the 2019/2020 odd school year.

The validation sheet is used for the fill-in control sheet to be given to experts in order to assess the first prototype of the textbook in the algebraic structure course. The validation sheet will follow the characteristics of the content, construct, and language. Based on the formative evaluation design, the data collection techniques at each stage are:

1. *Self Evaluation*

The prototype design is an algebra structure textbook that will be guided by the characteristics of content, construct, and language. So, the first prototype was obtained in the form of a draft textbook for algebraic structure courses.

2. *Prototyping*

a. *Expert Review*

Data collection techniques at this stage are carried out by way of walkthrough to experts in this case called a validator. This stage procedure is:

- The first prototype is given to the validator
- The validator evaluates the first prototype file (draft textbook structure of algebra), then provides advice with the help of the validation sheet instrument.
- Researchers will revise the first prototype textbook by considering all comments and suggestions from the validator.

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All analyzes of this stage will be carried out in a descriptive analysis. Instruments from the self evaluation, prototyping, small group, and field test stages will be analyzed by descriptive analysis.

RESULT AND DISCUSS

The research began with the preparation of prototype 1 textbooks on algebraic structure. The preparation of prototype 1 is based on several textbooks related to algebraic structure courses. The development process is guided through the formative evaluation stages.

Self-Evaluation Stage

The researcher conducts a self-evaluation with the team to see the extent to which the algebraic structure material will be studied using prototype 1. In addition, technical errors such as typing symbols and Justified Spelling are also the focus of researchers at this stage of self-evaluation.

Based on these weaknesses, researchers revised prototype 1 to prototype 2 before entering into the expert and one-to-one stages. Protoype 2 has been prepared in accordance with the Semester Learning Design (RPS) of algebraic structure courses and several references have been added to support the varied examples of questions. Prototype 2 produces a draft algebra structure textbook that is better than prototype 1, where in this prototype 2, researchers have compiled textbooks in accordance with the RPS of algebraic structure courses, contains varied examples, and has designed the cover of textbooks.

Some discussion about prototype 2 also conducted by researchers, so it can be said that this stage is a stage of self-evaluation 2. This stage of self-evaluation 2 includes the activity of re-checking the typing of mathematical symbols, as well as the selection of the appropriate cover. The researcher also prepared an instrument about the ability to compile valid evidence as an instrument at the last stage of this study, namely the field test. Because one of the subjects of this research is the

5th semester algebra structure student of the 2019/2020 school year, so the pretest was held before the lecture began, namely on July 31, 2019.

Prototyping Stage
Expert Review

Prototype that has been prepared, then validated by experts with the help of validation sheets. The validator in this study is Agus Dahlia, S.Sc., M.Sc., who is one of the lecturers in the field of analytical science. Suggestion from the validator for the development of this textbook is to add some exercises so that students are trained to prepare a proof.

Interpretation of validity refers to the following criteria: 1) very high (80% - 100%); 2) high (60% - 79%); 3) Sufficient (40% - 59%); 4) Low (20% - 39%); 5) Less (0% - 19%) (modified from [1]). Therefore, the interpretation of the test results of the validity of the textbook draft algebraic structure by experts is at a very high level (89.29%). Two aspects that support the data, namely aspects of constructworthiness (87.5%) and aspects of language eligibility (91.67%) also obtain very high validity interpretations.

The suggestions for building from experts include: 1) adding examples of questions and exercises in algebra structure textbooks; 2) pay close attention to typing in particular mathematical symbols that are still wrong.

CONCLUTION

The results showed that the prototype of algebra structure teaching textbooks had a very high level of validity (89.29%).

ACKNOWLEDGEMENT

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