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Practicality of (Big Scale) Complex Analysis Module Based on Guided Research

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ABSTRACT

The purpose of this research was to find out the practicality of complex analysis module which was based on guided research on a big scale. This research was the continuation research of the previous research which has found out module practicality on a small scale. On a small scale research, the module has already been practical on the ease of use, time, interpretation, and equivalence with other teaching materials. This research was developmental research which used 4D module. This research was the series of previous research on developing stage. The instruments used in this research were questionnaire and interview guidance. The questionnaire which had 11 questions were distributed to 25 students. From the real try-out's result, it was found that the average score of the ease of use of the module was 3,73, which belonged to very practical category. For the time aspect, it was 3,52 which belonged to very practical. For the ease of interpretation aspect, it was 3,74 which belonged to very practical. For the equivalence with other teaching materials aspect, it was 4,14, which also belonged to very practical. Thus, overall, it was found that the average score was 3,79. This indicated that complex analysis module based on guided research was very practical. Furthermore, interview was being given to three students with three different competences, high competence, average competence, and low competence. The result of the overall interview showed that the students found ease in using the module, the time needed to use the module was relatively short, and the module can be used as the teaching materials.

Keywords: Practicality, big scale, module, guided research

Introduction

Teaching materials are learning resources that until these recent times have an important role to support the learning process (Lester, 2013 in Rosidah, 2013). Teaching materials have to be adjusted to the students' characteristics. One of the suitable teaching materials for students is modules. According to Amalia (2), module is one alternative teaching material that can be used by the students according to their characteristics. Module is one of the teaching materials in printed form which can be used independently by the students (Amalia, 2013). Lecturers/teachers have to make the modules as interesting as possible so that the modules can be more easily understood by the students and they are also challenged to understand it. The results of the observations showed that the students tend to memorize formulas in complex analysis materials without knowing from which the formula was derived. This is in accordance with Amalia (2013). One of the learning to make the students not memorizing formulas are guided research learning. According to Yusnawan (2013) guided research was one of the learning which can be implemented to encourage

students to construct new knowledges indepently so that the learning becomes more memorable and meaningful. Therefore, this learning is suitable to be adopted as instructional materials in the form of modules. According to Amelia (2013) the good points of guided research based modules were the students can learn independently and were equipped with attractive teaching materials and can express ways that correspond to their abilities and interests. Amelia (2013) has developed a guided research based module which was effective in the rank and root materials.

Furthermore Melisa (2015) has developed a valid guided research based module on Lots 1 Variable Calculus lectures. This article discusses the practicality of guided research based modules in the complex analysis subject. According to Rogier (2014) practicality was associated with the cost of development, maintenance, time, ease of use, and availability. In this article practicality aspects which were discussed were the ease of use, time, interpretation, and equivalence with other teaching materials. The previous research has investigated the practicality of the module in a small scale number of students (six students). According to the results finding, the modules have been practical in every aspect. Practicality in a small scale researches have also been conducted by several reserachers such as: Handunah (2015) analyzed the module practically in a small scale number of students (ten students). Furthermore, Mardayani research (2013) has conducted a limited trial to see physics teaching materials which were integrated to Al-Qur'an verses values on the motion. This article will try to see the practicality on big scale number of students (25 students) which was the number of one class students. The study described in this article was conducted to answer the following research questions: How was the practicality of guided research based modules? With the aim to find out the practicality of complex analysis guided research based modules in a big scale.

Analysis Complex Subject

The Subject matter of Complex Analysis subject was form and operation of complex numbers; function, limit, continuity,; complex differentiation; and complex integration. After studying this course students are expected to meet the standards of the following competences.

- a) Students understand the real number system, presents a graph of the real numbers, complex numbers system form, and the basic operations in complex numbers.
- b) Students can operate an absolute value, proving the axiom and using charts and polar form.
- c) Students are able to prove the De'Moivre theorem and resolve problems associated with the roots of complex numbers, Euler formula, equations and polynomials.
- d) Students can use the function form and analyze single and plural valued function problems as well as inverse function form.
- e) Students can use the elementary functions and limit to solve the continuity problems.
- f) Students can use derivatives to analyze the analytic functions, Cauchy Riemann equations and harmonic functions.
- g) Students are able to operate the rules of differentiation to prove elementary functions derivatives and analyze high-level derivatives problems and the L' Hospital rule.
- h) Students are able to analyze complex line integral and rill line integral problems and use the properties of integral.

Module

Module is a lecture material consisting of a series of lectures and compiled specifically, clearly, and interestingly that includes content, sample questions, and

exercises. Nasution (2008: 205) argues, "Module is a complete unit that stands alone and consists of a series of learning activities which are arranged to help students achieve a number of objectives that are formulated specifically and clearly". Module provides opportunity for students to learn independently, because each student will use different techniques to solve a problem.

Rosyid (2010: 1) describes five characteristics of a module, they are self-instruction, self-contained, stand-alone, user friendly, and adaptive.

a. *Self Instruction*

Self Instruction is an important characteristic of a module, this characteristic allows a student to learn independently and not rely on others.

b. *Self Contained*

The module is said to be self contained if all the required course materials contained in the module.

c. *Stand Alone*

Stand Alone is a characteristic of a module that does not depend on teaching materials/other media, or should not be used with teaching materials/other media.

d. *Adaptif*

A module is said to be adaptive if the module is able to adjust the development of science and technology.

e. *User Friendly*

The use of language module that are simple, easy to understand and use the commonly used term, is one form of user friendly.

Module structure should be simple and in accordance with needs. Muljono (2001: 5) states the structure of the module has the following components.

a. Introduction

Introductory section consists of a brief description, the relevance and instructional goals.

- i. Brief description contains statements about the contents of the module. Students get a general overview of the contents of the module by reading the description.
- ii. Relevance contain student usefulness in studying the module if the module is linked to other modules.
- iii. Instructional objectives in the form of basic competencies and indicators are taken from the syllabus.

b. Presentation Section

Presentation section is the module content comprising several sub sections called Learning Activities. Each Learning Activity is composed of a title of the learning activity , followed by a description of the material sample, summary or a summary of the material studied in the Learning Activity and exercises.

c. Closing Section

The closing section includes feedbacks, follow ups, answer keys, and references.

- i. The feedbacks provide guidance for students to match the answers of the exercises with the answer keys located at the end of the module.
- ii. Follow up section provides instructions to do follow-up activities whether to re-learn the learning activities, or continue to the next learning activities.
- iii. Answer keys of exercises are at the end of each module.
- iv. References at the end of each module contain references that are used at the time of writing the modules.

Guided Research

One method that can make students active in learning is guided research method. Suherman (2003 : 212) explains that teaching with a research method hopes that students can actually learn actively to find the learning materials by themselves. Moreover, Suherman (2003: 213) also added that the research method can be done under guidance. Guided research method according to Sabri (2005: 12) is a way of delivering a mathematical topic so that the learning process allows students to find their own pattern or mathematical structures through a series of past experiences that are within the guidance of the pertinent teacher. In guided research learning the lecturers task is as facilitators.

According to Widdiharto (2004: 5) the steps of guided research learning are as follows.

- a. Formulate the problems that will be given to students with the sufficient data.
- b. From the data provided by the teacher, students compile, process, organize, and analyze the data.
- c. Students compile a conjecture (forecasts) on the results of the analysis.
- d. If it is necessary, a conjecture that was created by students is checked by the teacher.
- e. If it has been ascertained about the truth of the conjecture, the conjecture verbalization should also be directed to the students to compile it.
- f. After the students find what they seek, teacher should provide exercises or additional practices to examine whether the findings are true or not.

Practicality

Practicalities can be seen in the following aspects.

- 1) Ease of use, include: easily organized, stored, and can be used at any time.
- 2) The time required in the implementation should be short, quick, and precise.
- 3) The attractiveness of the course material to the students interests.
- 4) Easily interpreted by expert lecturers and other lecturers.
- 5) Having the same equivalence, so that it can be used as a substitute or variation.

According to Rogier (2014) practicality associated with the cost of development, maintenance, time, ease, and availability.

Methodology

Participant

Subjects in this study were students of mathematics education study program year 2013/2014 STKIP PGRI West Sumatera consist of 25 participants. One local number of students chosen is C session of the three existing sessions. This is because the researchers

teaching at this session, so that researchers know the characteristics of the students. The practicality questionnaires were filled by the whole students. Furthermore, for interviews there were three students chosen with three different abilities: high, medium, and low.

How the research being carried out

Instruments used in this study were a questionnaire and interview guidance. Technique of data analysis of practicality questionnaire results of the students were analyzed by finding the average score of the questionnaire by using the formula

$$R = \frac{\sum_{i=1}^n V_i}{n} \quad (\text{Mulyardi, 2006:82})$$

Then the average obtained was confirmed with the specified criteria. The criteria are as follows:

- a. Range of scores was from 1 to 5
- b. The criteria were divided into five levels. The terms used were adjusted to the relevant aspects.

The average range was divided into five interval classes. Then the average of all aspects of the modules was calculated. To determine the validity level of the modules used the following criteria.

- a. If $R > 3,20$, the module was categorized as very valid.
- b. If $2,40 < R \leq 3,20$ the module was categorized as valid
- c. If $1,60 < R \leq 2,40$ the module was categorized as valid enough.
- d. If $0,80 < R \leq 1,60$ the module was categorized as less valid.
- e. If $R \leq 0,80$ the module was categorized as not valid.

Descriptive technique was used to describe data from interviews with students about the practicality of the module. Miles and Huberman in Nyimas (2007: 62) state that "the interviews of the experts produce qualitative data based on the written transcript and notes made during the interview". Miles states procedures to analyze qualitative data that are consist of three stages, which are data reduction, data presentation, and conclusion.

Results and Discussion

After the result of limited trial obtained, the research continued to an actual trial (big group). The module was given to the students for a semester of study. All the materials were tested to the students. After the module was tested to students, the students who followed the lecturer were given a questionnaire and the results were as followed.

Table 1. The Actual Trial Questionnaire Results (Big Group)

NO	NAME	ASPECT											Average per std
		EASE				TIME	INTERPRETATION				EQUIVALENCE		
		1	2	3	4	1	1	2	3	4	1	2	
1	STD 1	4	4	4	5	4	4	4	4	5	4	5	4,27
2	STD 2	4	4	3	3	4	3	3	4	4	4	4	3,64
3	STD 3	5	5	5	4	3	5	5	4	3	5	4	4,36
4	STD 4	4	4	4	3	3	4	3	4	4	4	5	3,82
5	STD 5	5	4	4	4	3	5	4	4	4	4	4	4,09
6	STD 6	4	4	4	4	4	4	4	4	4	4	4	4,00
7	STD 7	5	4	4	3	4	5	5	4	5	5	4	4,36
8	STD 8	5	4	5	5	4	4	3	4	4	5	5	4,36
9	STD 9	4	4	4	4	4	4	4	4	4	4	5	4,09
10	STD 10	4	3	3	4	4	4	5	3	5	4	5	4,00
11	STD 11	3	4	2	3	3	2	2	4	2	3	3	2,82
12	STD 12	5	4	3	3	4	4	4	5	4	4	5	4,09
13	STD 13	4	4	5	3	4	4	4	4	5	4	3	4,00
14	STD 14	3	3	3	3	3	2	2	3	4	3	4	3,00
15	STD 15	3	3	3	3	4	4	4	3	3	4	4	3,45
16	STD 16	4	4	4	3	4	3	3	4	4	4	4	3,73
17	STD 17	3	3	4	4	4	4	4	4	4	4	4	3,82
18	STD 18	5	4	4	5	4	3	4	4	5	5	5	4,36
19	STD 19	4	4	3	4	4	4	4	4	4	5	5	4,09
20	STD 20	4	3	4	4	3	3	3	3	4	4	4	3,55
21	STD 21	4	4	3	3	3	4	4	3	4	4	5	3,73
22	STD 22	4	3	3	2	2	2	3	2	3	3	4	2,82
23	STD 23	2	3	4	4	3	3	3	3	4	3	3	3,18
24	STD 24	3	3	4	4	3	3	4	4	4	4	4	3,64
25	STD 25	3	3	4	3	3	3	3	4	4	4	4	3,45
Average per item		3,92	3,68	3,72	3,6	3,52	3,6	3,64	3,72	4	4,04	4,24	3,79
Average per aspect		3,73				3,52	3,74				4,14		

From the actual trial results, it was obtained that the average in the aspect of ease of use of modules was 3.73, categorized to very practical. Aspect of time was 3.52 categorized as very practical. Aspect ease of interpretation was 3.74, categorized as very practical. Aspect of equivalence with other teaching materials was 4.14, categorized as very practical. The overall average was 3.79, complex analysis module based on guided research was very practical.

Further interviews to three students with three different ability: high, medium, and low can be seen in the following table.

Tabel 2. Actual Trial Interview Results (Big Group)

NO	Questions	Students		
		Anggi(high)	Cris (medium)	Azis (low)
1	How were the learning instructions in guided research based module in Complex Analysis course?	Clear Enough	Clear Enough	Clear Enough
2	Was the language used in this module easy for you to understand? Explain!	Easy to Understand	Easy to Understand	Easy to Understand
3	Can you use the guided research based module corresponding with your own ability, for parts of the guided research based module were compiled systematically, Explain!	Corresponding	Corresponding , Sistematis	Corresponding , Sistematis
4	Can you use this guided research based module for studying individually and in group?	Yes, I can	Yes, I can	Yes, I can
5	Did you need a relatively short time in understanding the complex analysis course in guided research based module?	Short time	Short time	Short time
6	Did the module			

NO	Questions	Students		
		Anggi(high)	Cris (medium)	Azis (low)
	contain of clear words so that it was easy for you to understand? Explain	Clear	Clear	Clear
7	How were the sentences used in the module? Were they easy to understand?	Clear	Clear	Clear
8	Were the instructions in the module easy to understand?	Easy	Easy	Easy
9	Were the questions in the exercises can be used as measurements to see your comprehension level? Explain!	Yes, they can	Yes, they can	Yes, they can
10	Can you use the guided research based module as the main teaching material in Complex Analysis course? Explain!	Still need	Need	Still need
11	Can the module be used as the learning resource in the courses in class?	Yes, it can	Yes, it can	Yes, it can

Results of overall interviews showed that it was easy for the students to use modules, the time needed in using the module was relatively short, and the module can be used for learning resources.

Recommendation and Conclusion

In the next study it is recommended to increase the subject of the practicality trial in a bigger scale. The conclusion in this research was that guided research based module has been practical on a big scale trial.

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