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Local Wisdom-Oriented Learning Module to Improve Mathematical Creative Thinking Ability of Dyscalculia Students

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***Abstract*---**This study aims to examine the effectiveness and the positive responses given by dyscalculia students and teachers toward a module oriented to Kudus' local wisdom to improve the mathematical creative thinking ability of dyscalculia students. This research was conducted in Kudus Regency, Central Java, Indonesia with 75 fourth graders from eight different elementary schools as the subject of the study. The model used in the teaching materials development is the Dick & Carey model. The results showed that the local wisdom-oriented module which was developed according to the experts is excellent. In addition, the results of the Pre-test and Post-test showed that there is an increase in the mathematical creative thinking ability of dyscalculia students. Meanwhile, the results of interviews and questionnaires showed that teachers and dyscalculia students give positive responses to the use of modules oriented to Kudus' local wisdom.

***Keywords*---**dyscalculia students, local wisdom, mathematical, module, oriented learning.

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Introduction

The development of science and technology is the result of human creative thinking ability (Syamsuddin et al., 2020). With this ability, humans create changes and implement them to solve problems. The rapid development of science and technology requires education -not to mention mathematics- to be more responsive in carrying out the assimilation and accommodation processes so that they can mix educational grand designs to be able to balance the progress of other components of life that are more advanced and visionary (Lukman et al., 2016; Widana et al., 2020). The ability to think creatively is one of the important skills developed in mathematics. But in fact, the current development of these capabilities has not been optimal. Students have difficulty in solving math problems that require creative thinking skills. Many students complain and they are not eager whenever they are asked to give various answers. Students are used to getting routine questions, but they are not accustomed to finding the solutions to problems in different ways (Utomo et al., 2017). They are only able to find an idea/way of solving the problem and use the usual method. They are not yet able to explain the answer in detail. Creativity in learning mathematics cannot develop if someone is accustomed to thinking procedurally. Mathematical concepts are arranged hierarchically, students must master the previous concepts (prerequisites) to understand the next concept. Thus, the teacher must understand that every student has different abilities (Gillum, 2012; Butterworth, 2011; Essa & El-Zeftwy, 2015). Some students learn mathematics very easily without obstacles while others may have learning difficulties (Widodo, 2012; Pornpimon et al., 2014).

Learning difficulty in mathematics is known as dyscalculia (Azhari et al., 2020). Students with dyscalculia need repeatedly longer time to complete academic/non-academic tasks. They often do not follow Piaget's pattern of cognitive development (Maf'ulah et al., 2016). Whereas the curriculum at schools is usually based on that pattern. As a result, they are unable to complete the cognitive tasks demanded by school. Based on the observation from twelve elementary schools in Kudus Regency, the availability of teaching materials which were used based on the characteristics of students with dyscalculia is only 5.71%. Usually, teachers use the same teaching materials for all students (Ding et al., 2015; Ni et al., 2018; Zualkernan, 2016). Moreover, the learning process is teacher-centred so that students' participation/activity is low (Siswono et al., 2018). Whereas dyscalculia students need special education services compared to other students (Azhari, 2017).

The results of the questionnaire on 50 teachers also showed that the overall teaching materials used are in printed form and do not display the local culture character (Tanwete & Kombinda, 2020; Hoach, 2021). Teaching materials are more theoretical Desiana (2008), and are lacking activities that engage students to recognize the local culture. These could cause boredom among students, so it is necessary to innovate the teaching materials that are interesting, fun, innovative, and easy to use. One of them is by developing a module that is oriented to Kudus' local wisdom. The existence of this module is expected to facilitate students in learning. The urgency of the research is the need for product innovation in the form of modules oriented to Kudus' local wisdom. The purpose

of this study is to examine the effectiveness and the positive responses given by dyscalculia students and teachers toward a module oriented to Kudus' local wisdom to improve the mathematical creative thinking ability of dyscalculia students (Kazmerski, 1997; Szentagothai, 1975).

Research Method

The research model developed in this study is the Dick Carey & Carey (2001), model. This model consists of ten steps, but in this study only nine steps were carried out, because the development did not reach the final step, namely conducting a summative evaluation. Those steps are:

- Identifying the need to determine general learning objectives.
- Conducting learning analysis.
- Identifying input behaviour and learning characteristics.
- Formulating specific learning objectives.
- Developing reference test items.
- Develop learning strategies.
- Develop and select learning materials.
- Design and conduct formative assessments.
- Revise the learning materials.

The subjects of this study were 75 fourth-grade students spread over eight elementary schools in Kudus Regency, Central Java, Indonesia. The data collection techniques were in the form of test techniques (to obtain data on the mathematical creative thinking ability of dyscalculia students) and non-tests (to collect qualitative data). Non-test instruments are:

- Expert validation sheet (measures the level of validation of the developed module).
- Questionnaire responses of dyscalculia students and teachers in using the developed module.
- Structured interview sheets (teachers and students with dyscalculia).
- Observation sheet.

Results and Discussions

The results of the study based on the steps of Dick Carey & Carey (2001), model are as follows:

- Identify the need to define general learning objectives
  At this stage, the researcher identified the general objectives of learning mathematics, which was to determine what students had after they finished learning mathematics. Identifying the general objectives of this learning is done to get a description of expected ability qualifications that can be possessed by students after participating in the lesson.
- Doing Learning Analysis
  Learning analysis is carried out to determine the required skills that the students should master by classifying the learning objectives. It aims to

classify the general-purpose statements according to the type of learning capability, namely psychomotor skills, intellectual skills, verbal information, and attitudes.

- Identifying input behaviour and student characteristics
  This module was developed for fourth-grade dyscalculia students at elementary school in Kudus Regency, Central Java, Indonesia. The topic was about area and perimeter of squares, rectangles, and triangles. Elementary school students have different characteristics in learning this topic. Some students experience problems or difficulties during the learning process while others do not experience any problems.
- Formulate specific learning objectives
  After identifying the characteristics of students, the learning objectives are formulated. The formulation of learning objectives is limited to the formulation of specific learning objectives. Specific learning objectives contain statements about what dyscalculia students must master at the end of the learning process. Specific learning objectives are made based on the following criteria: (1) refers to the general objectives of learning, (2) is clear and based on observable behaviour, (3) can be measured, (4) is formulated specifically, (5) describes the existence of four components, they are: A (Audience), B (Behaviour), C (Condition), and D (Degree).
- Developing questions' item
  From the formulation of specific learning objectives, further test items or questions are developed to measure the level of student progress and the level of achievement of the formulated goals. The product result of this step is a set of practice questions related to the topic of area and perimeter of squares, rectangles, and triangles.
- Developing learning strategies
  Based on the identification of learning objectives and student characteristics, the learning strategy used in mathematics is individual teaching. The teaching is carried out by the teacher with a group of students presented individually through the teaching modules. In this learning, the role of the teacher remains as a motivator, mentor, examiner, and decision-maker.
- Develop and select learning materials
  The developed learning strategies, the practice questions and tests items that have been prepared are the reference in developing the learning materials. The development of teaching materials is referred to the form of learning where teacher presents the selected and developed materials and students learn the presented materials
- Design and carry out a formative evaluation
  Formative evaluation is used to improve the product development. The results obtained will be used as a consideration in revising the learning package.
- Revise the learning products
  This is the last step (and the first step in the iterative cycle). Data from formative evaluations are summarized and interpreted to identify difficulties experienced by students in achieving goals and to relate these difficulties to specific deficiencies in learning.

The results of the expert assessment of the Kudus local wisdom-oriented module for dyscalculia students are as follows. The recapitulation of the validation results by experts is as follows:

Table 1
Recapitulation of validation results by experts

No	Aspect	Average Percentage	Criteria
1	Math Material	89,11%	Very Good
2	Language Content	85,86%	Very Good
3	Mathematics Learning Media	87,25%	Very Good
	Average	87,41%	Very Good

Based on the data above, the results of the assessment from the validator indicate that the average aspects of mathematics, linguistic aspects, and aspects of learning media are very good. In research activities, researchers conducted pre-test and post-test to determine the increase in the mathematical creative thinking ability of dyscalculia students (Kazemi et al., 2014; Maryam et al., 2011). The form of learning carried out in the field test is based on a module that is oriented to Kudus' local wisdom. At the end of the lesson, dyscalculia students were asked to do a post-test to measure the increase in their mathematical creative thinking skills. The results of the recapitulation of the pre-test and post-test scores of students' mathematical creative thinking skills with dyscalculia are as follows.

Table 2
Results of analysis on the pre-test and post-test of students' mathematical creative thinking skills in field trial activities

No	School Name	Test Result	Analysis Result			
			Average	Median	Variant	Standard Deviation
1	SD 1 Samirejo	Pre-test	5,5	5,5	11,17	3,17
		Post-test	81,8	82	7,29	2,56
		N-gain	0,81	0,81	0,00	0,02
2	SD 2 Samirejo	Pre-test	5,4	4	8,04	2,69
		Post-test	80,2	80,5	44,40	6,32
		N-gain	0,79	0,8	0,00	0,006
3	SD 3 Samirejo	Pre-test	4,5	5	7,17	2,54
		Post-test	79,2	79,5	9,07	2,86
		N-gain	0,78	0,78	0,00	0,02
4	SD 3 Puyoh	Pre-test	5,7	5	18,86	3,93
		Post-test	80,8	81	22,36	4,24
		N-gain	0,8	0,8	0,00	0,04
5	SD 5 Puyoh	Pre-test	4	4,5	9,11	2,86
		Post-test	80,4	80	6,93	2,5
		N-gain	0,8	0,8	0,00	0,02
6	SD 2 Ternadi	Pre-test	4,2	4	5,73	2,27
		Post-test	79,8	80	17,51	3,97
		N-gain	0,79	0,79	0,00	0,004
7	SD 6 Cendono	Pre-test	6,9	6,5	20,54	4,3
		Post-test	82,6	82	24,93	4,74

		N-gain	0,81	0,81	0,00	0,04
		Pre-test	7,7	8	6,68	2,45
8	SD 3 Karangmalang	Post-test	83,4	83	24,93	4,74
		N-gain	0,82	0,82	0,00	0,05

Based on the table above, it is known that the module oriented to Kudus' local wisdom can improve the mathematical creative thinking ability of dyscalculia students. This can be seen from the n-gain scores in eight elementary schools which are considered high. The module was not only tested for its effectiveness, but also tested for its practicality (Cachay et al., 2012; Bronkhorst et al., 2011). The practicality test was carried out using a student response questionnaire and interviews with teachers. In general, students gave positive responses to the use of the product. The results of the recapitulation of student responses are presented in Table 3 below.

Table 3
Recapitulation of the questionnaire responses of dyscalculia students toward the draft of interactive digital module in the form of printed textbook

No	Statement	Answer (%)	
		Yes	No
1	The module is interesting to be applied in learning mathematics.	93	7
2	The module has understandable and communicative language.	92	8
3	The module has interesting design with clear illustration.	100	0
4	The module is presented coherently and clearly.	94	6
5	The module can improve the mathematical creative thinking ability of dyscalculia students.	90	10
6	The module makes it easier for students to understand math material.	91	9
7	The module makes accepted math material useful in real life.	94	6
8	Culture-based mathematics learning using module makes students more active in learning.	91	9
9	Learning math after using the module become more interesting.	93	7
10	The module helps me to discover new concepts.	92	8
	Average	93	7

The table above shows that the dyscalculia students gave positive responses to the use of the Kudus' local wisdom-oriented module. Most of the dyscalculia students agree that the module is interesting to use in learning mathematics (Bulusan, 2019). Most of the dyscalculia students also agreed that through the module they could improve their mathematical creative thinking skills. In addition, the module can also make them interested and be more active in every math learning activity (Kember & Kwan, 2000). There are series of tasks that must be done by dyscalculia students in the module. They can be used to improve students' mathematical creative thinking skills. This is in accordance with the

results of other studies which show that the mathematics learning process using the drill method of practice questions can train the ability of dyscalculia students in understanding the material about the area of squares and rectangles (Harland, 2011; Wu et al., 2021). The main point is students with dyscalculia will have better cognitive level if they are guided by the teacher in their learning process (Reed et al., 1972; Jackson & Byrne, 2000). In addition, the teacher also gave their responses to the use of Kudus' local wisdom-oriented module the teacher's responses to the draft module were obtained through structured interviews. The recap of the interview results is as follows.

Table 4
Recap of interview results with teachers on the draft of interactive digital module in the form of printed textbook

No	Question	Teacher Answer
1	Is the material in the textbook in accordance with the Core Competency and Basic Competency?	Yes, it is appropriate.
2	Is the content of the textbook in accordance with the characteristics of dyscalculia students?	Yes, it is in accordance with the development of dyscalculia students both in its language content and its pictures.
3	Do you think that textbooks can improve dyscalculia students' mathematical creative thinking skills?	Yes, these textbooks can improve the mathematical creative thinking skills of dyscalculia students.
4	How are pictures and letters presented in textbooks?	The pictures and letters are clearly presented.
5	Do you think that the use of textbooks helps dyscalculia students to understand the material better and make the learning feel more real?	Yes, abstract mathematics learning becomes more meaningful. In addition, mathematical material becomes easier to understand because it is associated with everyday situation
6	Does learning using textbooks make students more active?	Students are actively involved in every learning activity.
7	In your opinion, are there any obstacles in using textbooks for dyscalculia students?	The obstacle that arises in learning is about timing.
8	In your opinion, what are the advantages of using textbooks in learning mathematics?	Students become active, not feeling bored and the creative thinking abilities of dyscalculia students can be develop.
9	In your opinion, are textbooks suitable to be used in learning mathematics for dyscalculia students?	Yes, the module is feasible to use, and I am interested in using it regularly, especially for dyscalculia students.

It can be seen from Table 4 above, that the teacher gave positive responses to the use of Kudus' local wisdom-oriented module as teaching materials. They were interested in using the module in the next lesson, especially for dyscalculia students (Diachenko et al., 2021; Stanichenko et al., 2021).

Conclusion

The preliminary studies revealed that the teaching materials used by elementary school students from the government are general and apply equally to all students. The available teaching materials only emphasize on the concepts so that they cannot connect the local culture to the subject matter. Teachers have difficulty in improving the mathematical creative thinking skills of dyscalculia students. The students and teachers expect the availability of teaching materials that are suit to the characteristics of dyscalculia students and display interesting and fun activities. Modules oriented to Kudus' local wisdom can be a reference that can be used in learning process at elementary schools to improve the mathematical creative thinking skills of dyscalculia students.

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