

THE NEED FOR A DIGITAL MODULE TO IMPROVE THE NUMERICAL LITERACY OF DYSCALCULIA STUDENTS

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ABSTRACT

Numerical literacy is the ability to collaborate understanding and knowledge of mathematics effectively in facing life's challenges. This ability is very important for every student to solve everyday problems, including dyscalculia students (having difficulty learning mathematics). This research is a qualitative descriptive describing the need for a digital-based module to improve the numerical literacy of dyscalculia students. The digital-based module is an application to be used anytime and anywhere. The subjects of this study were six teachers and 18 students with dyscalculia, a combination of six primary schools in Kudus Regency, Central Java, Indonesia. The instruments used in this study were interview sheets, observation sheets, and questionnaires for a digital module need. Students were classified as dyscalculia based the dyscalculia screening test and the WISC (Wechsler Intelligence Scale for Children) test. The data analysis involved data reduction, data presentation, and concluding. This study indicates that a digital module is needed by teachers to improve the numerical literacy of elementary school students, especially students with dyscalculia. The development of a digital module can increase students' motivation and interest in studying abstract mathematical concepts.

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INTRODUCTION

Mathematical concepts are abstract and hierarchical in which students must master the previous concepts (prerequisites) to understand the next concept. This makes students face obstacles in learning (Baharuddin & Jumarniati, 2018). Each student has different abilities; some students easily learn mathematics, while others find it difficult.

In education, student learning difficulties are known as educationally handicapped (children's difficulties in following the educational process). Children with special learning disabilities cannot follow lessons at school even though their intelligence levels are average, slightly above average, or slightly below average. Difficulty learning mathematics is called dyscalculia. Dyscalculia students have problems understanding basic mathematical terms, learning number operations, and mathematical symbols (Hernawati & Somad, 2013). They take longer and repeatedly to complete academic and non-academic tasks. They often do not follow Piaget's pattern of cognitive development. On the other hand, the curriculum in schools is usually based on the pattern of cognitive development. As a result, they cannot complete the cognitive tasks demanded by the school (Abdurrahman, 2010).

Dyscalculia students usually have the following characteristics: (1) having difficulty in recognizing number operation symbols; (2) having difficulty in operating counting/numbers; (3) Often misspelling; (4) Being inconsistent in counting objects sequentially while mentioning the numbers; (5) Often misinterpreting numbers; and (6) having difficulty in distinguishing geometric shapes. Several other characteristics of students with learning difficulties are: (1) disturbance in spatial relations; (2) difficulty in recognizing and understanding of symbols; (3) disturbance of body appreciation; and (4) performance IQ being lower than verbal IQ score (Lerner, 1989). The mistakes that students generally make with learning difficulties in mathematics are (1) lack of understanding of symbols; (2) place value; (3) using of the wrong process; (4) wrong algorithm and not paying attention to place value; (5) miscalculation; and (6) unreadable writing (6).

Numerical literacy is the ability to acquire, interpret, use, and communicate aspects of mathematics, both in the form of numbers and symbols, to solve practical problems in everyday life (Winarni, 2021). Numerical literacy is important to develop because the core of learning mathematics is to find solutions to everyday contextual problems (Tyas & Pangesti, 2018). The development of numerical literacy will be difficult to achieve if the learning of

mathematics is still done conventionally where students are encouraged to think at a low level (Tatang, 2007) and are more directed to the memorization process. Whereas indicators of achievement of numerical literacy can be achieved when students can formulate, apply, and interpret various mathematical contexts, perform mathematical reasoning, use concepts, procedures, and facts to describe, explain or predict phenomena/events (Ekowati et al., 2019)

Modules are a package of teaching materials that is systematically, planned, and designed to help students learn (Daryanto, 2013). Module development is used as a solution to prevent student boredom (Rosyidah et al., 2013). Because the purpose of the module is to make it easier for students to learn, all elements of the subjects given by the teacher must be formed into a set of printed, audiovisual/computer-based materials or a combination of all of them (Smaldino et al., 2012). The results of the observations of the 12 elementary schools regarding the availability of teaching materials showed that only 5.71% used are based on the characteristics of dyscalculia students. Usually, teachers use the same teaching materials for all students, even though dyscalculia students require special education services. In terms of appearance, the existing teaching materials are not attractive because they do not use color ink, only black and white. There are pictures but not clear and more writing with a boring layout.

Digital-based modules are modules developed from software programs to become interactive (AD & Wahidin, 2021). The module was developed using multimedia technology that allows one to insert text, graphics, images, videos, and animations to provide interactive conditions. Display images and animations help visualize the teaching material delivered so that students are helped to understand the content of the module. Interactive conditions will increase communication, meaning that information can be seen as a printed version and heard. The existence of an animation presentation that has a high graphic value can excite users (Safrina, 2014).

Based on a survey by the Association of Indonesian Internet Service Providers in 2017, the internet use in education is 55.3% for reading articles, 49.67% for viewing tutorial videos, 21.73% for sharing educational articles/videos, 17.85% for online courses and 14.63% for enrolling schools. It shows that digital technology is very influential in education due to a significant increase in internet use. Thus, with a digital module, it is hoped that dyscalculia students will experience interaction and be active in learning mathematics to develop their literacy and numeracy skills. The application of technology in the learning process allows

changes in learning to be more modern and effective.

This study aims to describe the need for a digital module to improve the numerical literacy of dyscalculia students. The benefit of this research is that there is information on the need for learning media in the form of digital-based modules that can be developed to increase the numerical literacy of students with learning disabilities.

METHOD

This research is a qualitative descriptive study to describe the need for a digital module to improve the numerical literacy of dyscalculia students. Research subjects were selected using the dyscalculia screening test and the WISC (Wechsler Intelligence Scale for Children) test.

The dyscalculia screening test is an instrument used to identify the risk of dyscalculia and the first step in establishing a diagnosis in elementary school students. This screening uses a development that relies on the concept of number sense by (Bariroh, 2021). This test consists of three parts: the numeracy test, number knowledge test, and basic arithmetic test. WISC (Wechsler Intelligence Scale for Children) is one type of intelligence test commonly used by psychologists to measure intellectual function in children aged 8-15 years. This test consists of verbal and performance tests, in which there are different aspects of measurement. The measurement of these aspects can provide an overview of the child's abilities and can also be used in detecting disorders in children (Nanik, 2007). Analysis of test results is carried out using scoring based on guidelines and guidance from psychologists, which consists of several stages, including (1) calculating raw scores or rough numbers on the arithmetic subtest; (2) Determining the chronological age of the child; (3) Adjusting the rough numbers that have been obtained in the numeracy subtest with the scale score seen from the chronological age in the WISC norm book; and (4) Categorizing based on the number of scales on each subject. After all the stages were done, a profile of the students' mathematical ability was made, supported by the observation results. The category of mathematical difficulty is described as starting from the "somewhat low" category, where this has been adjusted for low-high levels based on the IQ classification.

The subjects of this study were six teachers in six schools in Kudus Regency, Indonesia. In addition, 18 students from the six elementary schools were classified as dyscalculia students. The instruments used in this study were face-to-face interview sheets,

observation sheets, and questionnaires for learning media needs which had previously been checked by the validator and declared valid. The data analysis techniques used are data reduction, data presentation, and concluding. Table 1 displays the teacher interview instrument sheet.

Table 1. Teacher Interview Sheet Instruments

No	Interview Questions
1	Do you always prepare a Lesson Plan before teaching?
2	What methods/models do you provide in delivering learning materials so that all students can understand/follow the learning process well?
3	Is the method/model of learning that you provide effective? How much impact does it make to help students learn well?
4	How was the atmosphere/condition of the class when you taught?
5	How do you condition the class during the learning process?
6	What is the average ability of students in receiving mathematics learning?
7	How are student learning outcomes in Mathematics?
8	According to you, what materials make it difficult for students to learn mathematics?
9	In your opinion, what causes students to have difficulty in learning mathematics?
10	What are the difficulties that you face as a math teacher?
11	How do you deal with students who have difficulty learning mathematics?
12	What learning resources do you use in learning mathematics? And what do you think of the contents?
13	Are students actively involved in learning in class and enjoy having discussions?
14	What form of evaluation do you give after completing a material?
15	Do you use media in learning mathematics?
16	What alternative media, according to you, can make it easier for learning resources to support the learning process activities?
17	Do you do math learning by linking everyday life?
18	In your opinion, what kind of media is needed to be developed as an independent learning resource for students?
19	Have you ever used an e-module that you made yourself during the COVID-19 pandemic?
20	Do you need an e-module in teaching mathematics?
21	In your opinion, do students have difficulty expressing again the concepts that have been explained?
22	According to you, can students classify objects according to their type and based on the properties of the material?
23	In your opinion, can students apply and choose the correct concept in solving or solving a problem with the right steps?
24	Do students have difficulty distinguishing which are examples and which are not examples in a material?
25	Do students have difficulty explaining or presenting a material, concept, and solution that is completed sequentially? Provide your reasons!
26	Can students relate mathematical concepts mathematically or in real life?

Table 1 shows the teacher interview questions about the need to develop a digital module to improve numerical literacy of dyscalculia students. Meanwhile, the interview instrument sheet for dyscalculia students can be seen in Table 2.

Table 2. Student Interview Sheet Instrument

No	Interview Question
1.	What is your opinion about the mathematics learning carried out by the teacher?
2.	Have you ever given a question with a level of difficulty?
3.	In your opinion, is math the most difficult subject?
4.	What methods/models do teachers use in learning mathematics?
5.	What kind of problems/difficulties have you experienced in learning mathematics?
6.	What do you think is the most difficult Year 5 material? Explain some of the material for Year 5 that you find difficult? What is the reason?
7.	In your opinion, what should be done to overcome these problems/difficulties? What should be improved on the learning method/model? Explain why!
8.	Has the teacher ever held a group discussion in learning mathematics?
9.	Does the teacher always invite students to be active in learning in class?
10.	Are you actively involved in exchanging ideas in discussions and solving problems?
11.	Do you often use Android smartphones?

No	Interview Question
12.	Have you ever used an electronic module/e-module/android-based learning application in learning mathematics?
13.	Do you need interactive media in learning mathematics? Explain why!
14.	Would you be more passionate about using an Android based module than a print module?
15.	In your opinion, do you like it or not if the learning media contains a lot of writing? Give the reason!
16.	Do you like android-based learning media in the learning process (by loading audio/sound, visual/image, text, and animation)? Give the reason!
17.	Do you like learning applications related to everyday life?
18.	Do you have difficulty expressing what concepts have been explained by the teacher?
19.	Can you classify objects according to their type and by the properties of matter?
20.	Can you apply and choose the right concept in solving or solving a problem with the right steps?
21.	Do you have difficulty distinguishing which is an example and which is not an example in a material?
22.	In your opinion, is it difficult or not in explaining or presenting or explaining a material, concept, and solution that is completed sequentially? Give your reasons!
23.	Are you able to relate mathematical concepts mathematically or in real life?

Table 2 shows the student interview questions for dyscalculia students in the studied schools related to the need for developing a digital module. Table 3 present the observation sheet used by researchers to observe learning activities in research schools.

Table 3. Observation Sheet Instrument

No.	Observation Aspect
1	The teacher starts learning by giving problems of daily life related to the material
2	The teacher directs the learning given to the learning to be achieved
3	Students work on questions related to everyday life
4	Students use objects to solve problems
5	Students can create or develop mathematical models
6	Students can make conclusions from the activities that have been carried out
7	Students find a variety of ways and different answers
8	Students find problem-solving independently with the help or guidance of the teacher
9	Students can arrange steps to solve problems
10	Students give and respond to opinions from other students
11	Students ask their friends in group discussions
12	Students ask the teacher if they have difficulty
13	Teachers provide opportunities for students to be active in the learning process
14	The teacher guides students to solve problems
15	Teachers and students together discuss the results of group discussions
16	Students take advantage of the linkage of the material studied with other mathematical material or other subject matter in problem-solving
17	The teacher directs the linkage of the material studied with other mathematics material or other lessons in problem-solving

RESULT AND DISCUSSION

The results of the dyscalculia and WISC screening tests are as follows. Table 4 shows that of the 64 total students in six elementary schools, 38 students were diagnosed with dyscalculia. of the 38 students, three students from each elementary school were taken to be the subjects of the interview. So, the total number of students used as subjects was 18 students. The selection of students who were used as research subjects was based on discussions between the research team and class teachers at each research school.

Table 4. Results of Dyscalculia and WISC Screening Tests

No	School ID	Total Students	Total Students Diagnosed with Dyscalculia
1	SD 1	19	8
2	SD 2	8	4

No	School ID	Total Students	Total Students Diagnosed with Dyscalculia
3	SD 3	8	5
4	SD 2	10	10
5	SD 3	10	6
6	SD 5	9	5
	Total	64	38

The interviews with teachers conducted face-to-face show that teachers have prepared lesson plans before teaching. Usually, they use various learning methods or models, such as discussion and question and answer. Although sometimes, using the chosen method or model is not effective in learning because not all students are active and enthusiastic about participating in mathematics learning. This is because not all teachers use mathematics learning media when carrying out learning activities. The results of interviews with teachers related to dyscalculia students' ability to grasp mathematics learning showed that on average, students' mathematical performance was lacking. This indicates that their numerical literacy is below average. Student learning outcomes with dyscalculia in mathematics did not reach 75% of the minimum criteria of mastery learning.

The math material that is considered difficult to learn by students with dyscalculia includes fractions, both simple fractional operations, decimals, and others. Fractions material is often used by students in everyday life. However, if it is applied to mathematical material, students still do not understand it (Baharruddin & Sukmawati, 2021). Difficulties in learning mathematics are also caused by a lack of understanding of basic mathematics. Many of them have difficulty solving mathematical problems, such as applicative word problem suitable for everyday life. In addition, dyscalculia students also have difficulty rewriting mathematical concepts.

The other difficulties experienced by dyscalculia students are (1) students have not been able to apply and choose the correct concept in solving or solving a problem with the correct steps; (2) students have difficulty in distinguishing which are examples and which are not examples in a material; (3) students have difficulty in explaining or presenting or explaining a material, concept, and completion that is completed sequentially; and (4) students have not been able to relate mathematical concepts mathematically or in real life. Thus, students' literacy is not optimally developed. It is hoped that the development of a digital module can overcome learning difficulties in learning mathematics. One of the learning media that can be used by teachers in improving numerical literacy is an interactive digital module.

This module is in the form of an application to be used anytime and anywhere. It is said to be interactive because users will experience interaction and be active, for example, actively paying attention to images, writing that varies in color/moving, sounds, animations, and even videos/films.

The interviews with dyscalculia students showed that almost all students stated that mathematics was a difficult subject. The difficulties experienced by them include having difficulty solving math problems that contain lots of numbers and word problems. They are also not used to being active in discussions and solving math problems.

Table 5 presents the results of observations of mathematics learning in Year 5 in six elementary schools.

Table. 5 Results of Observation of Mathematics Learning

No.	Observation Aspect	Percentage of Answer	
		Yes	Not
1	The teacher starts learning by giving problems of daily life related to the material	83%	17%
2	The teacher directs the learning given to the learning to be achieved	83%	17%
3	Students with dyscalculia work on problems related to everyday life	83%	17%
4	Dyscalculia students use objects to solve problems	17%	83%
5	Dyscalculia students can create or develop mathematical models	17%	83%
6	Students with dyscalculia can make conclusions from the activities that have been carried out	17%	83%
7	Dyscalculia students find a variety of ways and different answers	0%	100%
8	Dyscalculia students find problem-solving independently with the help or guidance of the teacher	50%	50%
9	Students can arrange steps to solve problems	17%	83%
10	Students give and respond to opinions from other students	17%	83%
11	Students ask their friends in group discussions	33%	67%
12	Students ask the teacher if they have difficulty	17%	83%
13	Teachers provide opportunities for students to be active in the learning process	83%	17%
14	The teacher guides students to solve problems	100%	0%
15	Teachers and students together discuss the results of group discussions	100%	0%
16	Students take advantage of the linkage of the material studied with other mathematical material or other subject matter in problem-solving	17%	83%
17	The teacher directs the linkage of the material studied with other mathematics material or other lessons in problem-solving	83%	17%

Table 5 shows that more than 75% of teachers have started learning mathematics by providing daily life problems related to the material, conveying learning objectives, and connecting the material studied to other mathematics materials or other subjects in problem-solving. They also have provided opportunities for students to engaged in the learning process, and guided and discussed with students about problem-solving.

However, not all students can (1) work on problems related to everyday life, using objects to solve problems; (2) conclude the activities that have been carried out; (3) find a variety of ways and different answers; (4) arrange steps to solve problems; (5) give and respond to opinions from other students; and (6) take advantage of the linkage of the material studied with other mathematics or other subject-matters in problem-solving.

The questionnaire results on the needs of a digital modules distributed to teachers are as follows.

Table 6. Results of the Learning Resource Needs Questionnaire

No	Item Question	Percentage Answer	
		Yes	Not
1	Do you know the characteristics of dyscalculia students?	17%	83%
2	Do you know that there are students with dyscalculia in your class?	17%	83%
3	Do you only use learning resources in the form of books published by the Ministry of Education and Culture?	100%	0%
4	Are the books published by the Ministry of Education and Culture that you use enough to teach mathematics?	0%	100%
5	Have you ever used the module as a source/material in learning?	17%	83%
6	Are the mathematics learning resources used by students with normal dyscalculia the same?	100%	0%
7	Do dyscalculia students have special textbooks/modules/handbooks for learning mathematics?	0%	100%
8	Do math learning resource books used by dyscalculia students help them understand math material?	0%	100%
9	Do dyscalculia students have mathematics learning resources other than books to improve their mathematical abilities?	17%	83%
10	Do you use special textbooks/modules/handbooks in learning mathematics for dyscalculia students?	0%	100%
11	Do you use math learning resources to improve your dyscalculia students' mathematical abilities?	0%	100%
12	Independently, have you developed a special textbook/module/handbook for dyscalculia students?	0%	100%
13	Is the material in the textbooks/modules/handbooks in mathematics learning easy to understand and understand by dyscalculia students?	33%	67%
14	Is the material in the textbooks/modules/handbooks in mathematics learning equipped with practical activities that can help dyscalculia students understand math material?	83%	17%
15	Is the language used in textbooks/modules/handbooks in mathematics learning easy to understand and understand by dyscalculia students?	33%	67%
16	Is the material in the textbooks/modules/handbooks used by dyscalculia students equipped with pictures that interest them in reading?	83%	17%
17	Can the math practice questions you ask your dyscalculia students improve their mathematical thinking skills?	33%	67%
18	Do the textbooks/modules/handbooks used by dyscalculia students currently ask students to be active in learning mathematics?	83%	17%
19	Should math modules for dyscalculia students be interesting?	100%	0%
20	Should the math module for dyscalculia students contain illustrations for each studied material?	100%	0%
21	Do students with dyscalculia enjoy learning mathematics using interactive learning media?	100%	0%
22	Do students with dyscalculia enjoy learning mathematics by using interesting and colourful learning media?	100%	0%
23	Are dyscalculia students always enthusiastic about learning mathematics in class?	100%	0%
24	Can dyscalculia students use textbooks/modules/books independently?	0%	100%
25	Do you need alternative teaching materials specifically for dyscalculia students in mathematics?	100%	0%

The results of the questionnaire analysis of the needs of a digital module in Table 6 show that dyscalculia students need special interesting, and colorful teaching materials that make it easier to learn mathematics. The teachers also agree that the existence of learning media specifically used by dyscalculia students can develop their mathematical abilities, one of which is students' numerical literacy. This opinion is in line with a study by (Purwaningrum et al., 2021) reporting that digital-based mathematics modules for dyscalculia students are needed by teachers. It is a complementary learning resource to complement books published by the government.

From the study results, further research is needed to develop an interactive digital module to improve students' numerical literacy. It is hoped that the application of an

interactive digital module in the mathematics learning process can increase dyscalculia students' learning enthusiasm to learn mathematics. This is also in accordance with a study conducted by Kharizmi (2015) stating that the use of learning resources in the school environment is critical in learning mathematics. These learning resources stimulate students to be more daring to try new things or complicated things. The use of appropriate learning media will also encourage teachers in delivering learning to be more effective and fun so that students are more motivated to participate in learning activities (Baharruddin & Sukmawati, 2021)

CONCLUSION

This study concluded that digital-based modules were needed by dyscalculia students, especially in mathematics. Students can use the module to improve their numerical literacy. The modules can be designed for statistics, geometry, algebra, and arithmetic. To ensure the quality of the module is guaranteed, it is recommended for further researchers to prepare theory for the development of digital modules and the development of numerical literacy for dyscalculia students. In addition, validation was also carried out by experts, namely mathematics learning experts, language experts, educational psychologists, and mathematics learning media experts.

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