Multiplication E-Module Media to Improve Cognitive Ability of First Grade Elementary School Students

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ABSTRAK

Di era digital ini masih banyak sekolah yang belum menggunakan media pembelajaran berbasis IT khususnya pada muatan pelajaran matematika pada materi perkalian. Padahal matematika merupakan salah satu mata pelajaran yang wajib dicapai dalam pendidikan sekolah dasar. Banyak siswa yang menganggap matematika itu sangat sulit dan rumit. Hal ini dikarenakan banyak cara menyelesaikan permasalahan dalam kehidupan sehari-hari yang menggunakan perhitungan. Penelitian ini bertujuan untuk menganalisis kebutuhan pengembangan media yang valid dan praktis serta menganalisis efektivitas hasil media untuk meningkatkan kemampuan kognitif siswa. Jenis penelitian yang digunakan dalam penelitian ini adalah Research and Development. Pengembangan e-modul perkalian menggunakan desain model pengembangan Borg and Gall. Data diperoleh dari angket kebutuhan pengembangan media. Analisis data menggunakan skala Guttman. Hasil penelitian menunjukkan bahwa media e-modul perkalian diperlukan untuk meningkatkan kemampuan kognitif siswa kelas II sekolah dasar. Hasil uji validitas media memperoleh hasil yang sangat layak untuk digunakan. Sedangkan hasil uji praktikalitas guru dan siswa memperoleh hasil sangat praktis. Sedangkan hasil uji efektivitas menunjukkan peningkatan kemampuan kognitif pada kelas eksperimen lebih tinggi dibandingkan kelas kontrol.

ABSTRACT

In this digital era there are still many schools that have not used IT-based learning media, especially in the content of mathematics lessons on multiplication material. Even though mathematics is one of the subjects that must be achieved in elementary school education. Many students think mathematics is very difficult and complicated. This is because there are many ways to solve problems in everyday life that use calculations. This study aims to analyze the need for valid and practical media development and to analyze the effectiveness of media results for improving students' cognitive abilities. The type of research used in this research is Research and Development. The development of the multiplication e-module uses the Borg and Gall development model design. The data obtained from the media development needs questionnaire. Data analysis uses the Guttman scale. The results of the study showed that the multiplication e-module media is needed to improve the cognitive abilities of second grade elementary school students. The results of the media validity test obtained results that were very feasible to use. While the results of the practicality test of teachers and students obtained very practical results. While the results of the effectiveness test showed that the increase in cognitive abilities in the experimental class was higher than the control class.

1. INTRODUCTION

In this digital era there are still many schools that have not used IT-based learning media, especially in the content of mathematics lessons on multiplication material. Even though mathematics is one of the subjects that must be achieved in elementary school education. Many students think mathematics is very difficult and complicated. This is because there are many ways to solve problems in everyday life that use calculations (Sucahyo et al., 2021; Utami & Wutsqa, 2017). Perceptions of students can be caused by the use of learning strategies and media that do not match the interests and mindset of students. So that causes children to become bored and lazy to learn mathematics (Bosica et al., 2021; Fauzi et al., 2023). This is in accordance with the results of observations and interviews with teachers at SDN 4 Bategede, teachers rarely use learning media and have not been able to make IT-based learning media and only use objects around

them to calculate multiplication operations. Students consider mathematics as a subject that is difficult to understand. Moreover, the lack of inadequate learning media causes students to become bored, less attractive and less directly involved in learning. Cognitive abilities of students regarding multiplication material are also still low. This is because students do not understand the concept of multiplication and word problems regarding multiplication problems. Meanwhile, SDN 2 Bendanpete also does not have math learning media specifically for multiplication material, only using worksheets. Teachers lack mastery of making IT-based learning media. Even though schools already have facilities such as tablets, laptops, notebooks and projectors for the use of IT-based learning media. However, teachers do not make the most of it. In addition, mathematics subjects are often considered difficult by students. Especially on multiplication material. Students are still confused about how to complete multiplication arithmetic operations with repeated addition. In addition, when there are story questions and students are asked to solve existing problems, students work by subtracting and adding randomly using the numbers in the story questions. This is what makes students cognitive abilities still quite low.

This research is a research with module development. Modules are usually printed in book form containing subject matter which aims to allow students to study independently without being accompanied by a teacher or parents (Fitriani et al., 2022; Patel et al., 2018; M. R. Wulandari & Iriani, 2018). However, as the development of science and technology allows for changes in the packaging of teaching materials. There are printed modules packed into digital formats that are presented electronically, commonly known as electronic modules or e-modules (Sulistiani, S., Kartimi, K., & Sahrir, 2022; F. Wulandari et al., 2021). In the development of science and technology, it encourages teachers to produce technology-based learning media to improve the quality of education better. One of the teaching materials that can be used is the E-module. Modules are usually printed in the form of books containing learning materials with the aim that students are able to study independently without having to be accompanied by a teacher. The characteristics of the E-module are the same as the characteristics of the module, namely self-instruction (clear instructions), self-contained (learning material that can be studied alone), stand alone (not dependent on other teaching materials), adaptive and user friendly (easy to use) (Pallant, 2016; Tytler & Prain, 2022; Winarno et al., 2022).

Based on research conducted by several previous researchers, E-Modules are proven to be used as effective learning media. According to previous research on Electronic Module Design and Development: An Interactive Learning states that electronic modules provide many features and uses, and can be used anytime and anywhere (Yulando et al., 2019). Other study states that IT-based learning media that supports the use of gadgets provides greater opportunities for enthusiasm for learning (Jafar, A.F. et al., 2020). The development of e-modules can be developed with a wide variety of applications. The use of e-modules using the Kvisoft application developed by other study can be used to assist teachers and students in thematic learning of theme 4 sub-theme 3 in elementary schools. E-modules made with the Flipbook Maker application to help the needs of teachers and students in increasing students' creativity in learning in elementary schools. Other study uses e-modules created using Sigil Software to improve student learning outcomes in learning physics (Perdana et al., 2017). Supported by study that uses the Ethno Digital Module to improve the speaking skills of class IV elementary school with the result that the language is spoken politely (Spante et al., 2018).

Researchers chose e-modules as research material because e-modules adapt to the characteristics of students who really like the use of gadgets in learning. In addition, an educator must also help his students to have skills in using IT-based media so that students are not bored in learning and it is easier to understand multiplication material (Aufa et al., 2021; Sriyanti et al., 2021). Based on the description above, the researcher is interested in conducting research on the development of multiplication e-modules in class II students to improve the cognitive abilities of elementary school students. While the purpose of this study was to analyze the need for developing multiplication e-module media to improve the cognitive abilities of second grade elementary school students at Nalumsari Jepara, develop multiplication e-module media to improve the cognitive abilities of second grade elementary school students at Nalumsari Jepara multiplication which is valid and practical. As well as analyzing the effectiveness of the results of the multiplication e-module to improve the cognitive abilities of grade II elementary school students at Nalumsari Jepara.

2. METHOD

The type of research used in this research is Research and Development. The development of the multiplication e-module uses the Borg and Gall development model design. The data obtained from the media development needs questionnaire which was distributed to grade II students at SDN 4 Bategede and

SDN 2 Bendanpete Nalumsari Jepara will then be analyzed. Data analysis uses the Guttman scale which is still in the form of letters namely "yes" and "no" then converted into numbers which can be seen in Table 1.

Table 1. Guidelines for Scoring the Media Development Needs Questionnaire

Score	Description
Yes	1
No	0

After the data is collected, then the data is analyzed using the percentage formula as follows formula for percentage of media development needs questionnaire. To determine the criteria for the percentage of media development needs, it is carried out in the manner proposed regarding the percentage score criteria as described in Table 2.

Table 2. Criteria for Score Percentage of Media Development Needs Questionnaire

No.	Presentase	Criteria
1.	81-100	Very good
2.	61-80	Good
3.	41-60	Enough
4.	21-40	Not good
5.	0-20	Not good

The development of multiplication e-module media for improving the cognitive abilities of grade II elementary school students in Nalumsari Jepara is said to be needed if the percentage results are obtained in the range of 81-100% with the criteria "very good" which means it is very much needed and the range 61-80% with the criteria " good" which means needed. The data that has been obtained from the validation results of experts is analyzed to determine the validity of the product. The product developed is said to be valid if it meets valid and very valid criteria. The following are product validity criteria is show in Table 3.

Table 3. Product Validity Criteria

Validity (x)	Validity Classification
1.00 <X≤1.75	Invalid
1.75<X≤2.50	Invalid
2.50<X≤3.25	Valid
3.25<X≤4.00	Very Valid

Base on Table 3, product quality is said to be good if the amount of data results from the validator lies in valid or very valid category intervals. The practicality of learning media can be seen from the responses of teachers and students. Research products are said to be practical if they meet practical criteria and are very practical. The following are product practicality criteria which can be seen in Table 4.

Table 4. Product Practicality Criteria

Practicality (y)	Practicality Classification
1.00 <X≤1.75	Impractical
1.75<X≤2.50	Less practical
2.50<X≤3.25	Practical
3.25<X≤4.00	Very practical

3. RESULT AND DISCUSSION

Result

Multiplication E-Module Development Process to Improve Students' Cognitive Ability

Analysis of Student Needs for the multiplication e-module to improve the cognitive abilities of class II elementary school students in Nalumsari Jepara. A multiplication e-module media needs questionnaire to improve the cognitive abilities of grade II students at SDN 2 Bendanpete and SDN 4 Bategede which was distributed by researchers to 40 grade II students at SDN 2 Bendanpete obtained an average percentage of 79% for yes answers at fifteen questions that the researcher has attached to the needs questionnaire. Meanwhile, the answer did not get a percentage of 21%. This shows that the multiplication e-module is in

the range of 61-80% with good criteria, which means that e-module media is needed to improve the cognitive abilities of grade II elementary school students in Nalumsari Jepara.

This step includes: 1) conducting an initial field test of the multiplication e-module media design; 2) is limited, both in terms of the substance of the design and the parties involved; 3) initial field tests are carried out repeatedly to obtain a feasible design. Based on the results of teacher and student interviews in the limited trial, it can be concluded that the multiplication e-module media received positive responses from teachers and students both in terms of graphics, content, and presentation. After conducting initial field tests/limited trials on the multiplication e-module, the next step is to revise the initial product based on suggestions from teachers and students. Students did not give any suggestions, only responded positively regarding the multiplication e-module media. Meanwhile, the teacher's suggestion is to add questions to the assessment or practice of student questions on the multiplication e-module media. Researchers have made revisions according to the teacher's suggestions.

Validity and Practicality of Multiplication E-Module Media

Validation test to determine the quality of multiplication e-module media. The validators in this study consisted of 3 validators, namely material experts, language experts, and learning media experts. Test the validation of multiplication e-module media using a questionnaire instrument made using a Likert scale. The research results were obtained by dividing the scores obtained by the number of questions, then interpreted on the product validity criteria. The result is show in Table 5.

Table 5. Recapitulation of Multiplication E-Module Media Validation Results

No.	Expert	Score Average	Category
1.	Material	3.59	Very Valid
2.	Learning Media	3.61	Very Valid
3.	Language	3.89	Very Valid
	Average	3.70	Very Valid

The practicality of the Multiplication E-Module Media was tested using a Likert scale questionnaire which was distributed to grade II teachers and grade II students at SDN 2 Bendanpete and SDN 4 Bategede. The questionnaire was given to the teacher after showing the multiplication e-module media which was compiled using presentation technique aspects, language suitability aspects, material suitability aspects, material accuracy aspects, convenience aspects, and cognitive ability aspects. While the questionnaire was distributed to students after students used multiplication e-module media which was compiled using aspects of language suitability, aspects of presentation appearance, aspects of conditions, and aspects of cognitive ability. The results of the practicality test by the teacher can be seen in Table 6.

Table 6. Practical Test Results by Teachers

Assessment Aspects	Rating Score
Presentation	3.80
Language	3.60
Material Suitability	3.75
Material Accuracy	3.75
Cognitive Ability	3.75
Convenience	3.63
Average	3.71
Category	Very Practical

Next, the questionnaire was distributed to 40 students from 20 grade II students at SDN 2 Bendanpete and 20 grade II students at SDN 4 Bategede. The questionnaire was used to test the practicality of the multiplication e-module media for improving the cognitive abilities of grade II elementary school students in Nalumsari Jepara. Table 7 show practicality test results by students.

Table 7. Practicality Test Results by Students

Assessment Aspects	Score
Language Suitability	3.85
Presentation View	3.78
Convenience	3.65

Assessment Aspects	Score
Cognitive Ability	3.67
Average	3.73
Category	Very Practical

Base on Table 7 all aspects of the assessment have a supportive response from both teachers and students. The results of the practicality test of the media by the teacher and students showed that the multiplication e-module media could help students and teachers in improving the multiplication e-module media. The multiplication e-module media is accompanied by instructions for use in communicative language so that it can be used independently by students. Multiplication e-module media can be used to hone and improve cognitive abilities. The existence of this multiplication e-module media can also help students make learning activities interesting and efficient.

Testing the Effectiveness of the Multiplication E-Module Media for Improving the Cognitive Ability of Class II Elementary School Students in Nalumsari Jepara

The effectiveness test was used to determine the cognitive abilities of the multiplication e-module media in improving the cognitive abilities of grade II elementary school students in Nalumsari Jepara. Students' cognitive abilities were measured twice, using the pretest and posttest. SD Negeri 4 Bategede is the control class in this study. Following are the results of calculations for increasing cognitive abilities in the control class using normalized gain which can be seen in Table 8.

Table 8. Results of Improved Cognitive Ability in the Control Class

Criteria	Number of Students	Percentage
Low	1	5%
Currently	18	90%
Tall	1	5%

Base on Table 8 the results of an increase in the control class on the low criterion of 5%, medium 90%, and high 5%. The average value of students' cognitive abilities as measured based on the results of the pretest is 58. While the average value of students' cognitive abilities as measured based on the results of the posttest is 80, so that the classical average value of normalized gain g is So that the classical average is obtained by a normalized value gain g of 0.5 which means the interpretation of the increase in cognitive abilities of students in the control class is in the moderate category. SD Negeri 2 Bendanpete is an experimental class in this study. Following are the results of calculations for improving the cognitive abilities of students in the experimental class using normalized gain, which can be seen in Table 9.

Table 9. Results of Experimental Class Cognitive Improvement

Criteria	Number of Students	Percentage
Low	0	0%
Currently	11	55%
Tall	9	45%

Base on Table 9 the experimental class on the low criterion were 0%, medium 55%, and high 45%. The average value of students' cognitive abilities as measured based on the results of the pretest is 54. While the average value of students' cognitive abilities as measured based on the results of the posttest is 86, so that the classical average value of normalized gain g is So that the classical average is obtained by a normalized value gain g of 0.7 which means the interpretation of the increase in cognitive abilities of students in the control class is in the moderate category.

Discussion

This e-module can make it easier for students to solve problems in multiplication material. The characteristics of the development of this module are found in the use of pictures, choice of words, and suitability of subject matter, especially multiplication which will directly increase enthusiasm for learning and influence students in improving their cognitive abilities. Making e-modules using the Canva application which will later be converted into PDF format. So that students can study anywhere and anytime, and of course can improve students' cognitive abilities in understanding multiplication material.

The form of the Multiplication E-Module developed by the researcher is in PDF form and has a total of 33 pages, consisting of the front page, about the module builder, preface, table of contents, mapping (core

competencies, basic competencies and indicators), concept maps, materials with four chapters, summary, assessment and bibliography. The material in the Multiplication E-Module contains repeated addition, multiplication of two one-digit numbers, the properties of multiplication, and stories of solving problems with multiplication. Each chapter in the material contains let's observe and let's practice. Students can understand the material in Sub-chapter A. Let's observe and then test the abilities of each chapter by working on the questions in Sub-chapter B. Let's practice. In the summary, students can read a summary of the material from the four chapters. Then students can continue by working on the post-assessment questions to find out cognitive abilities in the multiplication material that has been learned from the multiplication e-module.

Multiplication E-Module Media Development Process

The results of the analysis of the needs for multiplication e-module media show that the multiplication e-module media needs questionnaire for improving the cognitive abilities of second grade students at SDN 2 Bendanpete and SDN 4 Bategede which was distributed by researchers to 40 class II students at SDN 2 Bendanpete obtained average results. the average percentage is 79% for yes answers to the fifteen questions that the researcher has attached to the needs questionnaire. Meanwhile, the answer did not get a percentage of 21%. This shows that the multiplication e-module is in the range of 61-80% with good criteria, which means that e-module media is needed to increase the cognitive abilities of grade II elementary school students in Nalumsari Jepara.

The researcher conducted interviews with second grade teachers at SDN 2 Bendanpete and obtained the result that the school did not yet have mathematics learning media specifically for multiplication material, only using worksheets. Teachers lack mastery of making IT-based learning media. Even though schools already have facilities such as tablets, laptops, notebooks and projectors for the use of IT-based learning media. However, teachers do not make the most of it. In addition, mathematics subjects are often considered difficult by students (Dennis et al., 2016; Djamdjuri et al., 2014). Especially on multiplication material. Students are still confused about how to complete multiplication arithmetic operations with repeated addition. In addition, when there are story questions and students are asked to solve existing problems, students work by subtracting and adding randomly using the numbers in the story questions.

Meanwhile, in interviews with second grade teachers at SDN 4 Bategede, the results showed that teachers rarely used instructional media and had not been able to make IT-based learning media and only used objects around them to calculate multiplication operations. Students consider mathematics as a subject that is difficult to understand. Moreover, the lack of inadequate learning media causes students to become bored, less attractive and less directly involved in learning. Cognitive abilities of students regarding multiplication material are also still low (Khaitova, 2021; Sugiyarto et al., 2018). This is because students do not understand the concept of multiplication and word problems regarding multiplication problems. Based on these interviews, it can be concluded that the multiplication e-module media is needed by teachers and second grade elementary school students.

Validity and Practicality of Multiplication E-Module Media

The results of the expert validation obtained a score of 3.59 in the material expert research with very valid categories. While the results of linguists obtained a score of 3.89 and a score of 3.61 in the study of learning media experts. Both are included in the very valid category. In line with research with a validity score of 3 which indicates that the research product from media assessment is valid even though there are revisions (Sugiharni et al., 2018). Media validation is very important for researchers in developing teaching materials. In addition, validation assessments are very beneficial for researchers in developing and formulating media. Validation assessment is also important for users of teaching materials in avoiding conceptual errors and the suitability of the material contained in teaching materials. Based on this assessment, it can be stated that the multiplication e-module media for improving the cognitive abilities of second grade elementary school students in Nalumsari Jepara is stated to be very valid both in terms of material, language and learning media (Cahyono et al., 2016; Yu, J., Kreijkes & Salmela-Aro, 2022).

The total average obtained is 3.70, which means it is included in the very valid category. The assessment category explains that the multiplication e-module media that has been made is running well and there are no errors when the multiplication e-module media is used. Based on this assessment, it can be stated that the multiplication e-module media for improving the cognitive abilities of second grade elementary school students in Nalumsari Jepara is stated to be very valid both in terms of material, language and learning media. According to previous study the validation results with a score of 3.49 are included in the valid criteria so that the product is suitable for use even with improvements from validator experts (Zahra & Saleem, 2021). According to other study revealed that the results of expert validation developed

by researchers will be used as a basis for improving the product before it is tried out (Putri & Irwan, 2019; Samerkhanova & Imzharova, 2018). The existence of an explanation according to experts confirms that the multiplication e-module media with an average validity level of 3.70 with a very valid category can already be used to improve the cognitive abilities of grade II elementary school students in Nalumsari Jepara.

In addition to testing the validity of the media, the multiplication e-module media also goes through a practicality test stage. The results of the practicality test were obtained through a practicality questionnaire for the multiplication e-module media which was distributed by researchers to be filled out by teachers and grade II students at SDN 2 Bendanpete and SDN 4 Bategede. The results of the practicality test of the multiplication e-module media by the teacher obtained an average result of 3.71 in the very practical category. In the presentation indicator, a score of 3.80 is obtained. The language indicator gets 3.60. Material suitability indicators get a score of 3.75, material accuracy indicators get a score of 3.75, cognitive ability indicators get a score of 3.75, and ease of use indicators get a score of 3.63. So the results of the practicality of the teacher obtained an average score of 3.71 in the very practical category. Similarly, the opinion that states that the average score above 2.99 for the practicality criterion value of a media is included in the practical classification/category (Abdullah et al., 2016; Yasin & Ong, 2020).

All aspects of the assessment have a supportive response from both teachers and students. The results of the practicality test of the media by the teacher and students showed that the multiplication e-module media could help students and teachers in improving the multiplication e-module media. The multiplication e-module media is accompanied by instructions for use in communicative language so that it can be used independently by students. Multiplication e-module media can be used to hone and improve cognitive abilities. The existence of this multiplication e-module media can also help students make learning activities interesting and efficient.

Test the Effectiveness of Multiplication E-Module Media

In testing the effectiveness of the multiplication e-module media for improving students' cognitive abilities it was measured twice. Filling out the first questionnaire was carried out after carrying out the pretest, while the second was carried out after the learning was completed (posttest). To test the increase in students' cognitive abilities, the normalized gain test was used. The usefulness of the normalized gain test is to determine the extent to which students' cognitive abilities increase before and after learning.

Based on the results of an increase in the control class on the low criterion of 5%, medium 90%, and high 5%. The average value of students' cognitive abilities as measured based on the results of the pretest is 58. While the average value of students' cognitive abilities as measured based on the results of the posttest is 80, so that the classical average value of normalized gain g is So that the classical average is obtained by a normalized value gain g of 0.5 which means the interpretation of the increase in cognitive abilities of students in the control class is in the moderate category.

While the results of the increase in the experimental class on low criteria were 0%, medium 55%, and high 45%. The average value of students' cognitive abilities as measured based on the results of the pretest is 54. The average value of students' cognitive abilities as measured based on the results of the posttest is 86, so that the classical average value of normalized gain g is So that the classical average value is obtained normalized gain g of 0.7 which means the interpretation of the increase in cognitive abilities of students in the control class is in the moderate category. The increase in students' cognitive abilities in the control class and the experimental class showed that the increase in the experimental class was higher than the control class. Students are said to have completed their studies if they have achieved the Minimum Completeness Criteria (KKM) that has been set, namely 70. It is said to be effective if the average value of all students in the experimental class is more than 70 and the test results show that there is a significant influence significantly between the control and experimental classes.

The suggestions for this research the multiplication e-module media can be used for learning media for mathematics subject matter, especially multiplication material so that it will make it easier for grade II students in elementary schools to improve cognitive abilities. In addition, the hope is that it can help the teacher's role in learning and can be applied to all levels of education which can later be developed better, creatively and innovatively. Beside that is necessary to further develop the multiplication e-module media to improve the learning quality of students at Nalumsari Jepara Elementary School. So that this learning e-module media can be used as a reference or reference in developing a more interesting learning media. Moreover the use of multiplication e-module media requires supporting facilities, namely Android mobile phones, tablets, computers, laptops, or chromebooks where this multiplication e-module media can make it easier for students to study anywhere and anytime.

4. CONCLUSION

Students and teachers need multiplication e-module media to improve the cognitive abilities of second grade elementary school students in Nalumsari Jepara. Thus it can be concluded that the multiplication e-module media is very appropriate to be used as a medium for improving the cognitive abilities of grade II students in elementary schools in Nalumsari Jepara. Thus the multiplication e-module media for improving practical cognitive abilities is used because it gets positive responses from teachers and second grade students of elementary schools in Nalumsari Jepara. The results of the effectiveness test showed that the increase in cognitive abilities in the experimental class was higher than the control class.

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