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Developing a Think-Pair-Share Cooperative Learning-Based E-book Module in Improving Students' Mathematical Communication Skills in Elementary School

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ABSTRACT

Based on the pre-research activities covering interviews, observation and data documentation which were conducted in the fifth-grade of State Elementary School Pandeanlamper 05 Semarang (SD Negeri Pandeanlamper 05 Semarang), it was found that students encountered difficulty in comprehending and communicating mathematics questions, particularly with the measurement material. The underlying cause of this problem is the transition from online to offline learning. During the process of online learning, students tend to use gadgets, while during face-to-face learning, they do not. Moreover, students' interest towards learning tends to decrease, because the modules used by the teachers are still limited and not various. Teachers have not integrated technology into learning activities optimally, which is supposed to be implemented to succeed in the improvement of students' mathematical communication skills in elementary school. Therefore, this research aims to develop and examine the effectiveness of developing a think-pair-share cooperative learning-based e-book module for mathematics subject in improving students' mathematical communication for the fifth-grade students of SDN Pandeanlamper 05 Semarang. This research used the research and development (R&D) method and adapted the ADDIE model postulated by Branch. The instrument of data collection of this research was validation sheet questionnaires that were given to several expert validators, and the effectiveness tests were conducted in the control class and experimental class. The results of analysis from the media expert, material expert, and learning expert were obtained through the analysis of the quantitative data by using criteria guidelines with the assessment categories to determine the quality of the product that was being developed and to examine its effectiveness by using the independent sample t-test. The validation result taken from the media expert obtained a percentage score of 92% which can be categorized as "very feasible", the result taken from the material expert obtained a percentage score of 94,3% which can be categorized as "very feasible", and the result taken from learning expert obtained a percentage score of 95% which can be categorized as "very feasible", and also the result of t-test showed that the significance value of two-tailed test with $t < 0,05$ has a meaning that H_0 is rejected and H_a is accepted. Based on the collected data, it can be concluded that a think-pair-share cooperative learning-based e-book module in improving the students' mathematical communication skills of the fifth-grade students of SDN Pandeanlamper 05 Semarang is feasible to be used.

Keywords: E-book Module, Think Pair Share, Mathematical Communication, Elementary School

INTRODUCTION

Mathematics is an excellent subject for nurturing and developing children's

thinking and communication skills throughout their educational journey, from primary school to higher education. Thinking and communication abilities are the main factors that underly their mathematical skills (Nasution dan Ahmad, 2018).

According to El Seikh and Najdi, as cited by Suyani & Wulandari (2020), communication plays a crucial role in the process of learning mathematics, this kind of communication is often defined as mathematical communication. According to the National Council of Teachers of Mathematics (NCTM), as cited in Adiansha et al. (2018), mentions that mathematical communication skill serves as a means for students to articulate, explain, consolidate, and embrace their positive mathematical thinking. To Siregar in Nahdi et al. (2019), mathematical communication encompasses the students' ability to express their mathematical ideas or notions through pictures or graphics, tables, mathematical equations, mathematical notation, or their own language. Mathematical communication covers two kinds, those kinds are oral and written. Oral communication is demonstrated by students' communication skills through the act of explaining their knowledge to their peers. Meanwhile, written communication is exhibited through picture or graphic, table, mathematical equation, mathematical notation, and other objects.

Permendekbudristek No. 7 Year 2022 (The policy of the Minister of Education, Culture, Research and Technology) states that the mathematics learning process in a school is expected to be able to implement the mathematics learning objectives, which are (1) comprehending mathematics that includes its facts, concepts, principles, operation and relation and applying them flexibly, accurately, efficiently and precisely when addressing mathematical challenges (mathematical comprehension and procedural skill), (2) employing reasoning on patterns and attributes, performing mathematical manipulations for the generalization, compiling evidence, or explaining mathematical ideas and statements (mathematical reasoning and proof), (3) solving problems that covers the skills of understanding the problem, designing the mathematical model, finishing the model or interpreting the solution (mathematical problem solving), (4) communicating the ideas by using symbols, tables, charts, or other medias that aims to clarify the situation or problem, also presenting a situation into symbols or other mathematical models (mathematical communication and representation), (5) connecting mathematics materials such as facts, concepts, principles, mathematical operations and relation towards a field of study, across fields, and life (mathematical connections), and (6) having an attitude that values the use of mathematic in real-life which includes fostering curiosity, attention and enthusiasm toward the process of learning mathematics, as well as an attitude of being creative, patient, independent, diligent, open-minded, resilient, determined, and confident in solving problems (mathematical disposition).

Royani's research (2020: 94) mentions that the National Council of Teacher of Mathematics has established learning objectives in mathematics subjects including problem solving, communication, connection, reasoning, and representation. These objectives can help students to have the capability of: (1) creating and using representation to organize, take notes, and communicate ideas. (2) developing a form of mathematical representation which can be used for a specific purpose, in a flexible and precise way, and (3) communicating the representation as a means to model and interpret physical, social, and mathematical phenomena (Nahdi et al., 2019).

In fact, students' mathematical communication skills in Indonesia are still low. Several researches on mathematical communication have been conducted. Rohman (2017) stated that students still exhibit a deficiency in their mathematical communication skills. This kind of

deficiency is evidenced by the manifestation of three of four indicators. The three indicators are explaining ideas, situations, and the concept of relation by using a real object, picture, and other things. On the contrary, the absent indicator was revealing concepts by using their own language. Sari et al., (2019) mentioned that conventional learning (teacher-centered learning) is one of the factors why students' mathematical communication skills are still low. Ariawan (2017) revealed that a significant correlation exists between students' problem-solving skills and their overall mathematical communication skills. The higher students' problem-solving skills, and their mathematical communication skills also follow. Astuti (2018:109) also mentioned that there is a significant influence on students' mathematical communication skills toward their learning achievements. The higher the students' mathematical communication skills, their achievement in mathematical learning also increases.

Following the results of interview and observation conducted by both the class teacher and fifth-grade students of SDN Pandeanlamper 05 Semarang and SDN Sambirejo 01 Semarang, the results showed that students encountered challenges in comprehending and communicating mathematics questions, particularly within the measurement topic.

The reason that underlies the problem is the transition from online to offline learning. During the process of online learning, students tend to use gadgets, while during face-to-face learning, they do not, so their learning interest decreases. Furthermore, according to the interview results with teachers, students tend to encounter challenges in comprehending and communicating mathematical sentences in the measurement topic. This is caused by the non-optimal use of learning media by teachers and the improper learning model in the classroom. Consequently, students tend to be passive and less interested in participating in the process of learning.

Arnidha's research findings (2016) showed that the implementation of think-pair-share cooperative learning during mathematics lessons encourages students to be more active by interacting and collaborating with peers in comprehending the mathematics topic being taught. This group interaction enhances students' communication skills. The significant aspect of mathematical communication is the ability to represent ideas in pictures, symbols, numbers, etc. which has a means to elucidate the mathematical problem scenarios.

As a response to the deficiency of students' mathematical communication skills in Indonesia, innovative learning that can be accepted by students is needed. One of which is to combine the e-book module development and the application of the cooperative learning model in the classroom. E-books will help students study anywhere and anytime. Besides, the think-pair-share learning model can also support students' enthusiasm and promote their active involvement during the process of learning in the classroom. Think-pair-share is a small-group learning model, typically consisting of two persons in pairs, which optimizes the active participation of the students in the group and eases the exchange of mathematical ideas and thoughts, either verbally or in writing. The development of an e-book module is a perfect pair for the think-pair-share model which can optimize the students' participation.

The output of this research is an e-book containing texts, pictures, and materials about distance, speed, and time. This book e-book is expected to be beneficial for the learning process and be able to improve students' communication skills. If the content of this e-book can be delivered to students proficiently, effectively, and efficiently, it will ease them to comprehend the material, so that it can impact positively towards the continuity of education in Indonesia.

RESEARCH METHOD

This research used research and development (R&D) method. This kind of research produces a product as a result. According to Sugiyono (2022), research and development is defined as a scientific way to research, design, produce and assess the validity of the resulting product. Based on that definition, the activities of research and development can be formulated into research, design, production, and testing.

The development model used in this research was ADDIE approach by Robert Maribe Branch (2009). According to Sugiyono (2022:38), Branch model includes analysis, design, development, implementation, and evaluation. The instrument of data collection of this R&D research was validation sheet questionnaires that were given to several expert validators. The validators consist of three persons, they are a media expert, a material expert, and a learning expert. The research instruments used were media validation sheet questionnaire for the media expert, material validation sheet questionnaire for the material expert, and learning validation sheet questionnaire for the learning expert. Additionally, the effectiveness assessment was also conducted in the control class and the experimental class. The validation data analysis obtained from the media expert, the material expert, and the learning expert were then analyzed using assessment criteria in order to determine the product quality that was being developed. While to test its effectiveness, this research used the independent sample t-test.

This research applied Likert scale by using quantitative data and qualitative data. The quantitative data can be seen from the assessment of the think-pair-share cooperative learning-based e-book module provided by expert validators. Meanwhile, the qualitative data can be seen through criticism, suggestions and recommendations provided by the expert validators (Khairunnisa et al., 2019).

The feasibility of the think-pair-share cooperative learning-based e-book module in improving the students' mathematical communication skills towards the material of distance, speed, and time was examined by several expert validators based on the feasibility questionnaire. The equation used is as follows:

$$P = \frac{x}{xi} \times 100\%$$

(Purwanto, 2017)

Description:

P = The Expected Percentage Value

x = Obtained Raw Score

xi = Maximum Ideal Score from the Related Assessment

The classification for the percentage result of the module can be converted based on the table below:

Table 1. The feasibility criteria of the module

Percentage	Criteria
76%-100%	Very Feasible
51%-75%	Feasible
26%-50%	Feasible Enough
0%-25%	Not Feasible

RESULTS AND DISCUSSION

The outcome product of this research is an e-book containing contextual material and mathematics formulas. The main topic contained within this book focuses on distance, speed, and time, intended for elementary students in grade 5. This research adopts ADDIE (Analyze, Design, Development, Implementation, Evaluation) model formulated by Robert Maribe Branch in 1975 as the framework to develop the learning media.

1. Analysis Stage

This research began with the analysis of the occurring problems in the field. The first step was conducted in SDN Pandeanlamper 05 Semarang by interviewing the teachers about students' problems, learning models, learning methods, and teaching modules to understand the real problems encountered by students during mathematics class. The last step was observing the process of learning in order to obtain insights from the learning process, and the utilization of teaching modules and learning resources.

This module was created by using heyzine.com website because of its accessibility across a range of devices such as computers, laptops, tablets, handphones, and more without the need for app installation. Besides, another benefit of this module is the application of the cooperative learning model. Specifically, the learning model used in this module is think-pair-share cooperative learning. In this kind of learning model, students are organized into pairs and then the teacher provides problems to both students in these pairs. The students discuss the problems through the brainstorming session. Finally, the students present the results of their discussion to their peers in the class.

2. Design Stage

At this design stage, the problems that have been identified from the analysis stage were used to develop the teaching module. This stage commences with designing the structural framework for the e-book. The process includes creating the storyboard, determining the background for the cover and the content, the content materials, design of animations for each sub-topic, the instructions to use the think-pair-share-based e-book, a table of contents, and questions related to the concept of distance, speed, and time. The determination of the e-book design must be aligned with the purpose and the content of the module. Below is the design of the think-pair-share cooperative learning-based e-book module to improve the students' mathematical communication skills.

Figure 4.1 Front cover design

The cover design contains three components. First, the concept of distance is represented by the road. Second, the speed is represented by a biker who cycles his bike. Lastly, time is represented by a huge clock. Those three components combined into one illustration of a professional biker who cycles his bike on a mountain road.

Figure 4.2 Content design

The content design provides the formula of DST (Distance, Speed, and Time). The picture above shows an illustration of how to use the DST triangle formula. Each page provides each formula one by one in the DST triangle formula.

Figure 4.3 Practice questions design

This part provides three practice questions. Each question has an illustration in it. This part also provides both the answer and the solution method.

3. Development Stage

This development stage discusses the development of a think-pair-share cooperative learning-based e-book. The final product design established during the design stage continues to be developed in this stage. The purpose of this is to generate the final product that has been enhanced based on the feedback from experts and the trial data, which will be implemented for students afterwards.

This stage is started by validating the e-book conducted by the related experts such as media expert, material expert, and learning expert to find out the feasibility of thee-book.

Media Expert Validation

The calculation of data validation by media expert can be seen in the following table:

Table 2. Data validation result calculation by the media expert

No	Aspects	Percentage	Category
1.	Cover	93%	Very Feasible
2.	Relevance	100%	Very Feasible
3.	Quality	80%	Feasible
4.	Efficiency	95%	Very Feasible

Based on the calculation results from the media expert regarding the design of the e-book, it can be seen that the e-book achieved an average feasibility score of 92%. Therefore, this e-book can be considered as feasible. An example of revision suggested by the media expert can be seen in Figure 4.4:

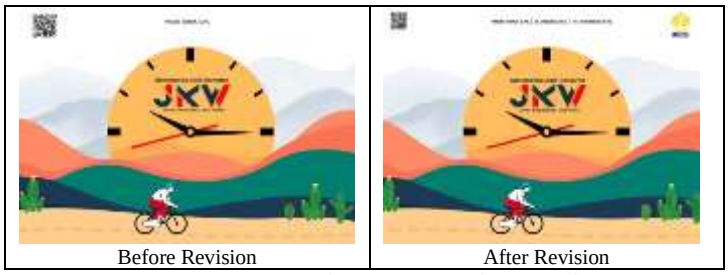

Figure 4.4 The improvement of cover design before and after revision

a. The cover page needs to include academic identity, the name of the e-book author, and the name of the supervisor.

The cover provides the author's identity and the title of the e-book, but the media expert considered it incomplete. Therefore, the identity part needs to include the academic identity, the name of the e-book author, and the name of the supervisor.

Material Expert Validation

Aspects assessed by material expert encompasses content relevance, learning material, and think-pair-share approach. The results of e-book validation, along with the explanation from material expert can be seen below.

The calculation of data validation by media expert can be seen in the following table:

No	Aspects	Percentage	Category
1.	Content Relevance	93%	Very Feasible
2.	Learning Material	90%	Very Feasible
3.	Think-pair-share Approach	100%	Very Feasible

Based on the calculation by the material expert regarding the e-book design, it shows that the e-book has achieved an average feasibility score of 94%. Therefore, this e-book module can be categorized as very feasible. An example of feedback suggested by the material expert is depicted in Figure 4.5 below:

Figure 4.5 Result of the material integration

Before the revision, the story in the description and example for each sub-definition of distance, speed, and time was presented separately. Each of these sub-concepts stands alone and has no contextual correlation. However, after the revision, the story in the description is well-integrated which makes the storyline of this e-book more engaging.

Learning Expert Validation

Aspects assessed by the learning expert encompasses the learning process, learning method, learning model, module, and students' response. The results of e-book validation, along with the explanation from the learning expert can be seen below.

The calculation of data validation by media expert can be seen in the following table:

No	Aspects	Percentage	Category
1.	Learning process	93%	Very Good
2.	Learning method	90%	Very Good
3.	Learning model	100%	Very Good
4.	Module	95%	Very Good
5.	Students' responses	97%	Very Good

Based on the learning expert calculation, the learning process that used the think-pair-share cooperative learning-based e-book has achieved a score of 95%, meaning that the process can be categorized as very good. An example of feedback suggested by the learning expert is depicted in Figure 4.6 below:

Figure 4.6 Revision of font size in the module

The guidelines for using the e-book are well-crafted and appropriate to the chosen learning model. The learning expert validator suggested adjusting the font to a bigger size to enhance the readability for students.

4. Implementation Stage

The implementation stage discusses the utilization and the effectiveness of the think-pair-share cooperative learning-based e-book toward students after being revised in accordance with the suggestions by the validator experts. In the prior stage, the suggestions and feedback provided by the experts resulted in the updated version of the module that is ready to be tested on students. The purpose of this stage is to find out the feasibility of the e-book by looking at the students' responses from the given questionnaires and to test the effectiveness of the module that has been developed and applied to students.

This research applied one pre-test, four treatments, and one post-test. The development of the think-pair-share cooperative learning-based e-book was applied to the experimental class in SDN Pandeanlamper 05 Semarang, while the conventional method and think-pair-share learning model were applied to the control class from SD Islam Bilingual Annisa Semarang. This particular sample was selected because the scores of both schools demonstrated a normal distribution and homogeneity based on the normality and homogeneity tests. Furthermore, those two schools almost have similar conditions and facilities, justifying the choice of this sample and allowing for the assumption that both schools had students with relatively similar abilities.

5. Evaluation Stage

This research applied formative and summative evaluation as it aligns with the objectives of the research, which are to assess the feasibility of the e-book and to find out its effectiveness based on the assessment from the media expert, the material expert, and the learning expert. These experts acknowledged that the e-book was feasible and suitable for the innovative and interesting learning purpose, though some feedback for the improvement was noted. Furthermore, after assessing the effectiveness of this think-pair-share cooperative learning-based e-book, it was found that this e-book effectively enhanced the mathematical communication of fifth-grade elementary students.

CONCLUSION

Think-pair-share cooperative learning-based e-book module was developed by using the five stages of Branch's theory, including (1) analysis; (2) design; (3) development; (4) implementation; and (5) evaluation. The assessment result of the feasibility components of the think-pair-share cooperative learning-based e-book module obtained from a media expert toward the presentation component was 92%, the material expert provided an assessment score for the content feasibility component of 94.3%, and the learning expert provided an assessment score for the learning process component of using the think-pair-share cooperative learning-based e-book module of 95%. The effectiveness result in developing the think-pair-share cooperative learning-based e-book module showed that the significance value of the two-tailed test with $t < 0,05$ means that H_0 is rejected and H_a is accepted. Based on those data, it can be concluded that the think-pair-share cooperative learning-based module in an e-book version is more effective than the printed one in improving the mathematical communication skills of fifth-grade students of SDN Pandeanlamper 05 Semarang.

Declaration by Authors

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REFERENCES

1. Adiansha, A. A., Sumantri, M. S., & Makmuri, M. (2018). Pengaruh model brain based learning terhadap kemampuan komunikasi matematis siswa ditinjau dari kreativitas. *Premiere Educandum : Jurnal Pendidikan Dasar Dan Pembelajaran*, *8*(2), 127. https://doi.org/10.25273/pe.v8i2.2905
2. Nahdi, D. S., Kunci, K., & Brainstorming, P. (2019). Muallimuna : Jurnal Madrasah Ibtidaiyah Efektivitas Pendekatan Brainstorming Teknik Round-Robin Dalam Meningkatkan Kemampuan Komunikasi Matematis Siswa Sekolah Dasar. *Terbit Sejak*, *5*(1), 11–22. http://ojs.uniska-bjm.ac.id/index.php/jurnalmuallimuna
3. Nasution, P. D. (2018). *Penerapan Pembelajaran Matematika Realistik untuk Meningkatkan Kemampuan Komunikasi Matematis Siswa Mosharafa : Jurnal Pendidikan Matematika Mosharafa : Jurnal Pendidikan Matematika*. *7*(September), 467–476. https://journal.institutpendidikan.ac.id/index.php/mosharafa/article/view/mv7n3_8
4. Permendikbudristek Nomor 7 Tahun 2022 tentang Standar Isi pada Anak Usia Dini, jenjang Pendidikan Dasar, dan jenjang Pendidikan Menengah.
5. Rohani. (2019). Diktat Media Pembelajaran. *Fakultas Ilmu Tarbiyah Dan Keguruan Universitas Islam Negeri Sumatera Utara*, 1–95.
6. Purwanto, N. (2017). *Prinsip-Prinsip dan Teknik Evaluasi Pengajaran*. PT Remaja Rosda Karya.
7. Sari, N. H., Sesunan, F., & Nyeneng, I. D. P. (2019). Pengaruh Model Pembelajaran Think Pair Share Terhadap Hasil Belajar Fisika Siswa Ditinjau Dari Keterampilan Berkomunikasi. *Jurnal Pendidikan Fisika*, *7*(1), 68. https://doi.org/10.24127/jpf.v7i1.1396
8. Sugiyono. (2022a). *Metode Penelitian dan Pengembangan (Research and Development/R&D)* (Sofia Yustiyani Suryandari (Ed.); 5th ed.). Alfabeta.

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