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"Transformasi Matematika dan Teknologi Menuju Generasi Matematika Unggul untuk Pendidikan Indonesia Maju"

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"Transformasi Matematika dan Teknologi Menuju Generasi Matematika Unggul untuk Pendidikan Indonesia Maju"

Universitas Negeri Medan, 09 November 2023

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KATA PENGANTAR
KETUA PANITIA

Segala puji dan syukur kepada Allah SWT atas terbitnya Prosiding Seminar Nasional Jurusan Matematika (SEMNASTIKA) FMIPA Universitas Negeri Medan. Prosiding ini merupakan kumpulan artikel ilmiah yang telah dipresentasikan pada kegiatan SEMNASTIKA 09 November 2023 di Aula Gedung Prof. Syawal Gultom, Universitas Negeri Medan. Adapun cakupan bidang kajian yang disajikan dalam prosiding ini meliputi Matematika, Statistika, Ilmu Komputer, dan Pendidikan Matematika.

Dengan mengangkat tema seminar, "Transformasi Matematika dan Teknologi Menuju Generasi Matematika Unggul untuk Pendidikan Indonesia Maju", kami mengharapkan SEMNASTIKA dapat turut serta berkontribusi bagi perkembangan ilmu pengetahuan jurusan matematika sebagai wadah bagi para peneliti, praktisi, penggiat pendidikan matematika dan pengguna untuk terjalinnya komunikasi dan diseminasi hasil-hasil penelitian.

Kegiatan SEMNASTIKA dan prosiding ini dapat diselesaikan dengan baik tidak terlepas dari bantuan berbagai pihak, oleh sebab itu kami mengucapkan banyak terimakasih kepada:

1. Pimpinan Universitas Negeri Medan
2. Dekan FMIPA dan para Wakil Dekan FMIPA Universitas Negeri Medan
3. Para Narasumber yaitu Bapak Prof. Dr. Janson Naiborhu, M.Si., Bapak Mangara Marianus Simanjorang, M.Pd., Ph.D dan Bapak Ahmad Isnaini, M.Pd.
4. Ketua Jurusan Matematika FMIPA Universitas Negeri Medan
5. Para Ketua Program Studi di Jurusan Matematika Universitas Negeri Medan
6. Panitia SEMNASTIKA
7. Pemakalah dan Peserta SEMNASTIKA
8. Semua pihak yang terlibat dalam pelaksanaan SEMNASTIKA

Kami menyadari bahwa buku prosiding ini masih jauh dari kata sempurna, karena itu kami mengharapkan kritik dan saran yang membangun dari para pembaca untuk perbaikan selanjutnya. Akhirnya, kami menghaturkan maaf jikalau ada hal-hal yang kurang berkenan bagi para pembaca serta ucapan terimakasih kepada semua pihak yang telah berkontribusi bagi terbitnya buku prosiding ini. Semoga buku prosiding ini dapat memberikan manfaat sesuai dengan yang diharapkan.

Medan, November 2023
Ketua Panitia,

Susiana, S.Si., M.Si.
NIP.197905192005012004

KATA PENGANTAR
DEKAN FAKULTAS MATEMATIKA DAN ILMU PENGETAHUAN ALAM
UNIVERSITAS NEGERI MEDAN

Puji dan Syukur kepada Allah SWT atas segala rahmat dan anugerah-Nya sehingga Prosiding Seminar Nasional Jurusan Matematika dengan tema "Transformasi Matematika dan Teknologi Menuju Generasi Matematika Unggul untuk Pendidikan Indonesia Maju" yang diselenggarakan oleh Jurusan Matematika FMIPA Universitas Negeri Medan pada hari Kamis, 09 November 2023 di Medan dapat diselesaikan.

Publikasi prosiding ini bertujuan untuk memperluas wawasan pengetahuan yang berasal dari para akademisi baik dari Universitas Negeri Medan maupun yang berasal dari luar Universitas Negeri Medan. Selain itu, prosiding ini juga sebagai sarana untuk mengkomunikasikan hasil penelitian dengan menyajikan topik-topik terbaru yang meliputi bidang Pendidikan Matematika, Statistika, Ilmu Komputer dan Matematika.

Kami mengucapkan terimakasih dan apresiasi yang setinggi-tingginya kepada semua pihak yang telah berkontribusi dalam Seminar Nasional Jurusan Matematika, baik sebagai keynote speakers yaitu Prof. Dr. Janson Naiborhu, M.Si., Mangara Marianus Simanjorang, M.Pd., Ph.D dan Ahmad Isnaini, M.Pd., reviewer makalah, peserta dam panitia yang terlibat. Akhir kata, semoga Prosiding Seminar Nasional Jurusan Matematika ini bermanfaat bagi kita semua sehingga dapat memberikan kontribusi maksimal bagi negara dan bangsa.

Medan, November 2023
Dekan

Prof. Dr. Fauziyah Harahap, M.Si
NIP. 196607281991032002

KATA PENGANTAR
KETUA JURUSAN MATEMATIKA
FMIPA UNIVERSITAS NEGERI MEDAN

Dengan penuh rasa syukur kepada Allah SWT, prosiding Seminar Nasional Jurusan Matematika FMIPA Universitas Negeri Medan ini dapat diselesaikan. Kemajuan ilmu pengetahuan dan teknologi di era ini sangat berdampak bagi kehidupan manusia. Kajian penelitian terkait perkembangan ilmu pengetahuan dan teknologi serta terapannya perlu disosialisasikan kepada khalayak. Seminar Nasional Jurusan Matematika merupakan forum diskusi ilmiah yang sangat penting dalam pengembangan dan penyebaran pengetahuan di bidang matematika yang meliputi pendidikan matematika, statistika, ilmu komputer dan matematika (non pendidikan). Melalui buku prosiding ini, kami berupaya untuk menyajikan rangkuman makalah-makalah yang telah dipresentasikan, serta memberikan wadah bagi pembaca untuk menjelajahi gagasan-gagasan cemerlang yang ditawarkan dan penelitian-penelitian terkini yang dihasilkan oleh para akademisi, peneliti, dan praktisi matematika.

Tema seminar kali ini, "Transformasi Matematika dan Teknologi Menuju Generasi Matematika Unggul untuk Pendidikan Indonesia Maju", mencerminkan komitmen kami untuk terus menghadirkan diskusi yang relevan dan mendalam mengenai isu-isu terkini dalam dunia matematika. Melalui buku ini, kami berharap pembaca dapat m engeksplorasi berbagai sudut pandang, temuan, dan pemikiran-pemikiran baru yang dapat memperkaya wawasan serta menginspirasi penelitian dan pengembangan dan ilmu matematika.

Secara khusus, kami mengucapkan terimakasih kepada para narasumber, yaitu : Prof. Dr. Janson Naiborhu, M.Si., Mangara Marianus Simanjorang, M.Pd., Ph.D dan Ahmad Isnaini, M.Pd., yang telah membagikan ilmunya dalam kegiatan seminar. Terimakasih yang tulus juga kami sampaikan kepada semua pihak yang telah mendukung kegiatan ini, para pimpinan Universitas Negeri Medan dan para pimpinan FMIPA Universitas Negeri Medan. Apresiasi yang tinggi juga saya ucapkan teruntuk para penulis, reviewer, dan panitia yang telah berperan aktif dalam pembuatan buku prosiding ini. Kontribusi dari setiap individu adalah pondasi kesuksesan acara ini, dan semangat kolaboratif ini sangat berharga bagi perkembangan ilmu matematika.

Akhirnya, kami berharap buku prosiding ini dapat menjadi sumber pengetahuan yang bermanfaat dan memotivasi pembaca untuk terus menggali potensi dalam bidang matematika. Mari kita bersama-sama memperkuat dan memajukan ilmu matematika demi keberlanjutan pembaruan pengetahuan.

Medan, November 2023

Ketua Jurusan Matematika

Dr. Pardomuan Sitompul, M.Si
NIP.196911261997021001

SUSUNAN ACARA

Waktu	Kegiatan	**PIC**
08.00 - 08.30	Pendaftaran Ulang	Panitia
08.30 - 09.00	Acara Pembukaan 1. Salam Pembuka 2. Menyanyikan Lagu Indonesia Raya 3. Doa 4. Laporan Ketua Pelaksana 5. Sambutan dan Pembukaan acara seminar oleh Dekan Fakultas Matematika dan Ilmu Pengetahuan Alam 6. Foto Bersama	MC: Putri Maulidina Fadilah, S.Si., M.Si Nurul Ain Farhana, M.Si Khairuddin, M.Pd. Susiana, S,Si., M.Si. Prof. Dr. Fauziyah Harahap,M.Si
09.00 - 10.00	Pembicara I Prof. Dr. Janson Naiborhu, M.Si (Guru Besar Matematika ITB)	Moderator: Yulita Molliq Rangkuti, M.Sc., Ph.D
10.00 - 11.00	Pembicara II Mangaratua Marianus Simanjorang, M.Pd. Ph.D (Dosen Jurusan Matematika UNIMED)	Moderator: Andrea Arifsyah Nasution, S.Pd., M.Sc.
11.00 - 11.45	Pembicara III Ahmad Isnaini, M.Pd (Guru berprestasi Nasional)	Moderator: Dinda Kartika, S.Pd., M.Si.
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16.00	Penutupan acara oleh Dekan FMIPA	MC

KEYNOTE SPEAKER

KEYNOTE SPEAKER 1

Prof. Dr. Janson Naiborhu, S.Si., M.Si.

Prof. Janson Naiborhu memiliki dua gelar doktor yang ia peroleh dari Keio University (Jepang) dan Institut Teknologi Bandung. Kariernya sebagai dosen dimulai sejak tahun 1991, sejak ia bergabung sebagai Dosen FMIPA ITB, dengan Kelompok Keahlian Matematika Industri dan Keuangan. Ia menjadi Guru Besar sejak 1 Desember 2014 dan Pembina Utama Muda/Gol IV C sejak 1 April 2011.

Prof. Janson aktif dalam melakukan riset dan telah banyak menghasilkan jurnal ilmiah baik nasional maupun internasional. Namanyapun telah dikenal luas di dunia pendidikan dan industri, khususnya dalam bidang Matematika.

KEYNOTE SPEAKER 2

Mangaratua M Simanjorang, M.Pd., Ph.D

Mangaratua M Simanjorang, M.Pd., Ph.D adalah dosen Pendidikan Matematika di Universitas Negeri Medan. Beliau meraih gelar sarjana di Universitas HKBP Nomensen tahun 2003, dan di tahun 2007 beliau mendapat gelar magister dari Universitas Negeri Surabaya. Beliau melanjutkan program doktor di Murdoch University, Australia dan memperoleh gelar Ph.D tahun 2016. Fokus pada pendidikan matematika, beliau melaksanakan tridarma universitas, beliau mendapatkan penghargaan sebagai dosen muda terbaik tahun 2009.

Dengan menjadi reviewer dan narasumber dibanyak kegiatan seminar, beliau berbagi ilmu dalam bidang pendidikan matematika, pendidikan karakter dan media pembelajaran seperti *augmented reality*.

KEYNOTE SPEAKER 3

Ahmad Isnaini M.Pd.

Ahmad Isnaini, M.Pd adalah seorang pendidik yang memiliki dedikasi tinggi terhadap dunia pendidikan. Ia meraih gelar Sarjana Pendidikan Matematika dari Universitas Negeri Medan pada tahun 2010, kemudian melanjutkan studi pascasarjana dan meraih gelar Magister Pendidikan Matematika pada tahun 2019 dari universitas yang sama. Saat ini, Ahmad sedang mengejar gelar Doktor dalam bidang yang sama di Universitas Negeri Medan.

Ahmad Isnaini juga telah mengukir prestasi gemilang dalam berbagai kompetisi dan olimpiade. Sebagai Finalis Apresiasi GTK 2023 BBGP Sumatera Utara Tingkat Provinsi dan penerima berbagai medali emas, perak, dan perunggu dalam Olimpiade Guru tingkat Nasional dan Provinsi, Ahmad Isnaini memperlihatkan dedikasinya dalam pengembangan kemampuan diri dan juga siswanya.

Tidak hanya aktif di dunia akademis, Ahmad Isnaini juga telah berkontribusi dalam literatur pendidikan. Karya-karyanya yang terpublikasi dalam jurnal nasional dan internasional, serta buku-buku seperti "Guru Merdeka" (2020) dan "Inovasi Pembelajaran" (2018), mencerminkan pemikiran dan wawasan yang mendalam dalam bidang Pendidikan.

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DEVELOPMENT OF INTERACTIVE COMICS BASED ON REALISTIC MATHEMATICS APPROACH TO IMPROVE MATHEMATICAL COMMUNICATION ABILITIES OF STUDENTS OF SMPS MUSDA PERBAUNGAN

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Abstract

This research aims to knowing the validity, practicality, effectivity of the interactive comics based on realistic mathematics approach to improve mathematical communication abilities of students of SMPS Musda Perbaungan; and also to finding out the improvement of students' mathematical communication by using interactive comics based on realistic mathematics approach students of SMPS Musda Perbaungan. This research is development research that refers to the 4-D development model (define, design, develop, disseminate) which has been modified to 3-D. The research sample was the seventh grade students of SMPS Musda Perbaungan, Serdang Bedagai. The results showed that: (1) Interactive Comics that have been developed meet the validity with an average of 3.615 and obtain a valid category, (2) In terms of practicality, the percentage of student response questionnaires to interactive comics developed with the Realistic Mathematics Approach is 94.5% with a practical (positive) category and the percentage of teacher response questionnaires is 88.125% with a practical (positive) category (4) Interactive comics developed have also met the effectiveness criteria with individual completeness of 88.58 and classical completeness of student learning of 86.79% with average of gain result is 0.726940 with high category. Overall, the result of the research was found to be an effective interactive comic in teaching and learning activities to improve students' mathematical communication ability.

Keywords: *Interactive Comic, Realistic Mathematics Approach, Mathematical Communication Ability.*

1. INTRODUCTION

Education is a fundamental need for human survival. One of the efforts to improve the quality of education is to make innovations or new breakthroughs in the field of education, especially in learning activities so that students can achieve their potential as well as possible. These capabilities can be developed through the process. This process can be pursued through formal education, namely school (Ilahiyah, 2019). A good learning process will certainly have a positive impact on student learning outcomes (Mbagho, 2021). Learning at school includes various sciences that are communicated through subjects, one of which is mathematics.

According to Rahmata, (2020) mathematics is an important subject because it is very useful in the fields of science and technology as well as is very much needed in its application in everyday life which should be equipped as early as possible. Mathematics has a role as the mother of science, due to the many applications of mathematics in other fields of science, either as a tool or development tool. This is in line with the opinion of Arrafi (2020).

In the initial observation, the researcher gave a diagnostic test with set material to measure the mathematical communicaton ability of students of SMP Swasta Musda Perbaungan. The test contains description questions that are adjusted to the indicators of mathematical communicaton ability. The low communicaton ability is thought to have an impact on their low learning outcomes. From the results of document searches, it was found that over the past year, the number of students whose math was above 65 on average was only 30%. This result is clearly far below the target of successful teaching at VII SMP Swasta Musda Perbaungan, which requires at least 30% of students to be able to do math. This result is clearly far below the target of teaching success at VII SMP Swasta Musda Perbaungan which requires at least 75% of students to get a score above 65.

Based on observations with the mathematics teacher at SMP Swasta Musda Perbaungan, many students still have not achieved the basic abilities that have been determined during the learning process. This is evidenced by the low mathematics learning achievement of students who have not reached the minimum completion standard. This fact shows that the teaching and learning process is not going well. In learning students will not only interact with the teacher as a learning resource used to achieve learning objectives so the quality of education must be improved, especially in mathematics as a basic science.

In the learning process, the learning tools developed here are learning media. In this paper, researchers limit the learning tools developed only to learning media due to several reasons obtained from observations that have been made. As an interesting learning media to use, it should be used in making learning media that is combined with a learning approach that suits the needs of students so that learning is more meaningful.

In connection with the problems that have been described, a mathematics learning approach is needed to treat mathematical communicaton problems, that is a realistic mathematics approach. The realistic mathematics approach was chosen because this approach has proven successful in various countries, especially in the Netherlands, even Erman Suherman (2001) in his book entitled "Contemporary Mathematics Learning Strategies" wrote: A study conducted in a school in Puerto Rico, with 570 students. This school was used as a test site for realistic research. This place was chosen as a research sample based on the consideration that although by American standards this area is poor, the teachers, school personnel and parents of the system pay serious attention to the school. Dramatically and amazingly students who learned using the realistic approach were recorded by the Department of Education as having sharply improved scores.

The realistic mathematics approach is an approach that uses problems raised from daily life that are close to students so that it is in accordance with the 2013 curriculum.

Mathematics learning with a realistic mathematics approach that links real-world problems or problems that students can imagine with learning materials so that learning becomes meaningful to students. This can be used as a consideration for using a realistic mathematics approach as an alternative to many forms of student-oriented / student-centered learning approaches in improving students' mathematical abilities, especially can improve mathematical communicaton abilitys.

Thus, the realistic mathematics approach is the right method to improve the quality of the learning process. This can be used as a consideration to use the realistic mathematics approach as an alternative to many forms of student-oriented / student-centered learning approaches in improving mathematical abilities which in turn are expected to improve student learning outcomes.

Based on observations with teachers and some students at SMP Swasta Musda Perbaungan that they have never used learning media in the form of comics developed by their own teachers. For this reason, the author is interested in developing a learning media in the form of digital comics through a realistic mathematics approach at SMP Swasta Musda Perbaungan with the title “Development of Interactive Comics Based on Realistic Mathematics Approach to Improve Mathematical Communication Abilities of Students of SMPS Musda Perbaungan”.

2. METHOD RESEARCH

This research had been held in SMP Swasta Musda Perbaungan located in Jl. Serdang Bedagai – T. Tinggi KM 40. The subjects of this research are students at SMP Swasta Musda Perbaungan consisting

of 30 students grade VII. The object of this research is an increase in student's mathematical communication. The type of research used is research and development. The development model used in this study refers to the modification of the 4-D development model proposed by Thiagarajan and Semmel consisting of four stages, namely the defining stage, design stage, development stage and dissemination stage. But from Thiagarajan and Semmel's development model in this study, which was taken or used up to the development stage (develop), namely the type of trial activity as a complement learning tools based on the applicable curriculum. To obtain data with high credibility, proper and correct data collection techniques are needed. In this study, data collection was carried out using interviews, questionnaires, and tests.

Development research procedures that must produce mathematics learning media consist of:

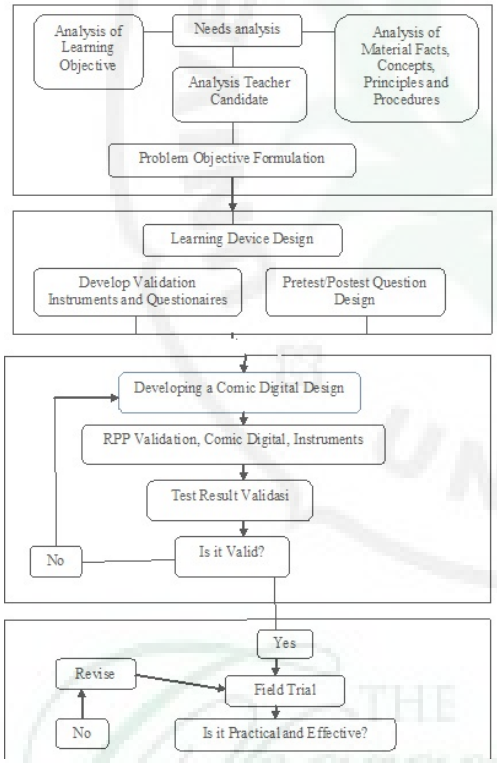

Figure 1. Research Procedure

3. RESULT AND DISCUSSION

This research is development research. The product of this research is an interactive comic whose application uses the RME (Realistic Mathematics Education) approach to Set material for grade VII students. The development of this interactive comic refers to the 4-D development model (define, design, develop, disseminate) which has been modified to 3-D. The procedures carried out in this study are limited only to the define, design, and development stages.

The product development stage is carried out by designing the developed, namely interactive learning comics based on realistic mathematics education. The programs used to design this product are ibis paint x, canva, and Microsoft Word. In outline, the development stage of the learning module based on realistic mathematics education-based learning module as follows.

1. Determine the reference material developed in the learning module. The learning module refers to the Volume of Spatial Buildings material. After that, formulate Basic Competencies, Indicators, and Objectives to be achieved in the module.
2. Collecting learning materials related to the Basic Competencies and Indicators on the Volume of Spaces. After that, design learning activities and student activities that are divided into sub-materials.
3. Designing the cover and cover page of the learning module. The cover and cover page of the module are dominated by blue color. The fonts used in the cover are Comic Sans MS and Times New Roman.
4. Designing the layout of the learning module. The module layout consists of header, content, and footer.
5. Designing dividers between sub-materials and layouts in each sub-material. The divider between sub-materials is differentiated based on the dominant color (red, orange, yellow, green, blue, and magenta).
6. Creating evaluation questions, answer keys, and assessment guidelines. Answer keys and assessment guidelines are made simply.
7. The draft learning module is printed using 80 gram HVS paper of A4 size, for the cover using 230 gram ivory paper, and printed in full color.
8. In general, the realistic mathematic education-based learning module consists of 136 pages.

The results of the define and design stages resulted in an initial design called draft 1. After the learning device was designed with a realistic mathematics approach in the form of draft 1, comic products based on realistic mathematics education were developed through revisions based on input and suggestions from experts.through validity test was carried out by experts in the field of mathematics.

Before After

Figure 2. Comic Before and After Revisi

The validity test was used to determine the shortcomings and improve the draft 1 learning device. This validity test was carried out by lecturer, head master, and teachers in the field of mathematics. The validators' biodata are as follows:

Table 1. Validator Biodata

Validator's Name	Status	Code
Muhammad Badzlan Darari, S.Pd., M.Pd	Mathematics Lecturer of Universitas Negeri Medan	V1
Didi Febrian, S.Si., M.Sc.	Mathematics Lecturer of Universitas Negeri Medan	V2
Novija Julinar, M.Pd	Head of SMPS Musda Perbaungan	V3
R. Rizky Hayatun Anisa, S.Pd	Mathematics Teacher of SMPS Musda Perbaungan	V4

Learning devices that have been declared valid are called draft 2.

a. Comic Validation Results

The validator's assessment of the comics can be seen in the appendix. At this stage aims to obtain input, suggestions, and evaluation of the comics developed. Furthermore, revisions were made to the input to review the initial product so that valid comics were obtained and could be applied in research.

Table 2. Comic Validation Results

Validator	Status	Score	Decision
V1	Material Validation	3.84	Can be used without revision
V2	Media Validation	3.39	Can be used without revision
Average Score		**3.615**	
Category		**Very Valid**	

Validation of comics was carried out by 2 Medan State University mathematics lecturers by dividing the assessment aspects into 2, namely material validation and media validation. Based on the table above, the material validation score is 3.84 that means the comic material is declared very valid. While the comic media received a score of 3.39 which is declared very valid. Based on the value of the two validators, the average validation value is 3.615 with a very valid category, so the comic is declared valid.

b. Results of Lesson Plan Validation

Table 3. Lesson Plan Validation Results

Validator	Score
V1	3.59
V3	3.86
V4	3.82
Average Score	**3.76**
Category	**Very valid**

Based on Table 3, the lesson plan is said to be valid.

c. Problem Validation Results

The validation results of the three validators regarding the questions are as follows:

1. Initial Ability Test

Table 4. Initial Ability Test Validation Results

Validator	Score
V1	3.63
V3	3.54
V4	3.66
Average Score	**3.61**
Category	**Very Valid**

Based on Table 4, the initial ability test question is said to be valid.

2. Final Ability Test

Table 5. Final Ability Test Validation Results

Validator	Score
V1	3.66
V3	3.67
V4	3.66
Average Score	**3.66**
Category	**Very Valid**

Based on table 5, the final ability test question is said to be valid.

d. Results of Validation of Learner Response Questionnaire

Table 6. The Results Of Expert Validation Of The Learner Response Questionnaire

Validator	Assessment Aspects	Average Score
V1	Comic Presentation Aspect	3.65
V3	Benefit Aspect	3.67
V4	Language Aspect	3.80
Average		**3.71**
Category		**Very valid**

Based on Table 6, the student response questionnaire is said to be valid.

Field Trial

Field trials are activities to test product designs on real subjects. After the comics were declared valid by the experts, the comics were tested on students. This trial was conducted on seventh grade students with a subject of 53 students. In this trial, comics were tested with a realistic mathematics approach, so that the data from the trial were analyzed to determine the effectiveness and student responses to the comics developed.

Learning activities were carried out for 6 meetings, 1 meeting for giving pree-test and 1 meeting for giving post-test after using interactive comics with realistic mathematics approach. In 1 week there are 2

meetings, namely on Monday 2 lessons or 90 minutes and Tuesday 2 lessons or 90 minutes.

Analysis of Improvement of Students' Mathematical Communication Ability

The test of students' mathematical communication ability was carried out by giving a pre test and post test in the experimental class and control class. The pre test was conducted to determine the initial mathematical communication abilities of students. While the post test was conducted to determine the mathematical communication abilities of students after taking part in learning both using modules based on realistic mathematics education and those that did not use the module.

Furthermore, to determine the effectiveness of the comic based on relaistic mathematics education-based module in improving students' communication ability can be seen through the gain score obtained from the pre and post test data of each class.The improvement of students' mathematical communication ability will be seen through N-Gain score.

Table 7. Summary of N-Gain Results of Students' Mathematical Communication Ability

Amount of gain (g)	Classification	Amount of Student
$g \geq 0,70$	High	32
$0,3 \leq g \leq 0,7$	Currently	16
$G \leq 0,3$	Low	5

Based on Table 7, the mathematical communication ability was in the "Low" category.

Table 8. Achievement of Posttest Learning Objectives of Students' Mathematical Communication Ability

Information	Pretest	Posttest
Maximum Score	100	100
Minimum Score	35	41
Average	67.40	88.58

From Table 8, the average pretest result is 67.40 and the average posttest result is 88.58. From the average ability of the student learning outcomes test there was an increase of 21.18.

Results of Analysis of the Practicality of Interactive Comics

Analysis of the Practicality of Interactive Comics obtained from student response questionnaire data and teacher responses to Comics. Teacher response questionnaire data on learning by using comics developed are as follows:

Table 9. Result of Analysis Practicallity

Aspect	Average Score	Percentage
Content Component	3.55	88.75%
Language Component	3.76	94%
Presentation Component	3.40	85%
Graphics Component	3.47	86.75%
Learning Time Efficiency	3.30	82.5%
Benefits	3.67	91.75%
Average	**21.15**	**88.125%**

From the table above, it can be seen that the teacher's response to all aspects of the comic is 88.25%, which means that all aspects are responded well by the teacher so that the interactive comic does not undergo revision based on the teacher's response. It can be concluded that the teacher's response to the components and learning activities using interactive comics based on realistic mathematics approach is positive.

Table 10. Data of Students' Response Quesionaire

Aspect	Question No-	Average score	Average aspect	%
Interest in comics	1	3.89	3.77	94.25%
	2	3.68		
	3	3.87		
	4	3.66		
	5	3.74		
	6	3.77		
Understanding of Material	7	3.81	3.80	95%
	8	3.85		
	9	3.72		
	10	3.81		
Layout	11	3.70	3.74	93.5%
	12	3.79		
	13	3.72		
Average			3.78	94.5%

From Table 10, the students' responses to all aspects, namely aspects of interest in comics, aspects of understanding the material and aspects of the appearance of comics are 94.5%, which means that all aspects are responded well by students so that interactive comics do not undergo revision based on student responses. It can also be concluded that student responses to learning components and activities using interactive comics based on realistic mathematics approaches are positive.

Results of Analysis of the Effectiveness of Interactive Comics

a. Achievement of Learning Objectives of Students' Mathematical Communication Ability

Table 11. Achievement of Posttest Learning Objectives of Students' Mathematical Communication Ability

Information	Pretest	Posttest

Maximum Score	100	100
Minimum Score	35	41
Average	67.40	88.58

From Table 11, the student learning outcomes test there was an increase of 21.18.

b. Classical Student Learning Completeness of Mathematical Communication Ability of Students

Table 12. Level of Completion of Pre-Test and Post-Test Mathematical Communication Ability of Students

Category	Pre-test	Percentage of Classical Completion	Post-test	Percentage of Classical Completion
	Number of Students		Number of Students	
Completed	20	37.74%	46	86.79%
Not Completed	33	62.26%	7	13.21%
Total	53	100%	53	100%
Average Class' Score	67.40		88.59	

c. Learning Time

The learning time in this study was in accordance with the time criteria carried out at the research site or did not exceed the usual learning time. From the research, it can be seen that the students during the learning process have been able to do the things that have been determined so that they are included in the time tolerance category that has been determined.

d. Student Response Results

Based on the recapitulation of the results of the student response questionnaire, it was concluded that the overall results of the student response questionnaire to the comics developed were 94.5% of students responded positively. The conclusion from these results is that the interactive Comic based on the realistic approach developed is effectively applied to learning activities.

4. CONCLUTION

1. The validity of interactive comics is seen from the components of format, illustration, language, content. The results of the validation of interactive comics in the form of expert statements that this interactive comic is suitable for testing with some revisions or suggestions for improvement. In addition, from the results of the validation of interactive comics, quantitative data were obtained which showed that the interactive comics developed received a material validation score of 3.84 and media validation of 3.39 with an average of 3.615 with a very good category. The input provided by the expert team (validators) is very useful for this research, because the suggestions and input provided by the expert team make it easy to read the contents of interactive comics, besides that in accordance with the indicators to be achieved, namely regarding mathematical communication ability, there are many input questions and contexts that really help students develop students' mathematical communication ablities.
2. Improvement of students' mathematical communication ability through interactive comics based on the developed realistic mathematics approach. A total of 46 students were complete and 7 students were not complete. Then a class is said to have completed learning if in the class there are 85% who have reached a minimum learning completeness of 75%. Based on the percentage of classical completeness of 86.79%. Thus classically meeting the criteria for completeness. It can also be seen that the average gain is 0.726940 in the High category. Based on the gain value of students who are in the high category, there are 32 people or 60.4% and the medium category is 16 people or 30.2% and the low category is 5 people or 9.4% This shows that students' mathematical communication abilities through learning with comics developed have increased.
3. The teacher's response to all aspects of the comic is 88.25% and students' responses to all aspects, namely aspects of interest in comics, aspects of understanding the material and aspects of the appearance of comics are 94.5%, which means that all aspects are responded well by the teacher and students so that the interactive comic does not undergo revision based on the teacher's response. It can be concluded that student responses to learning components and activities using interactive comics based on realistic mathematics approaches are positive.
4. Based on learning completeness, 46 students were complete and 7 students were not complete. Then a class is said to have completed learning if in the class there are 85% who have reached a minimum learning completeness of 75%. Based on the percentage of classical completeness of 86.79%. Thus classically meeting the criteria of completeness. The learning time in this study was in accordance with the time criteria carried out at the research site or did not exceed the usual learning time with online assisted learning. The learning time is within the effective limit that has been set according to the indicators. From the research, it can be seen that students during the learning process have been able to do the things that have been determined so that they fall within the time tolerance category that has been determined. The results of student responses to comics based on a realistic approach, the results showed that 94.5% of students responded in the appropriate category. The conclusion from these results is that the developed

realistic approach-based comics are effectively applied to learning activities.

EPIGRAPH AND DEDICATION

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