

Lapentor Application in Utilizing Virtual Reality Technology in Mathematics Learning Media

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ABSTRACT

This research is motivated by the implementation of the Merdeka curriculum which is expected to improve the learning crisis in Indonesia. Facing this challenge, the implementation of the Merdeka curriculum is an indicator of learning innovation in the current era of technological development through the use of technology in the learning process. Technology utilization can increase the attractiveness of material presentation, so that it can motivate students and teachers to innovate more often with the help of technology. One technology that is currently developing is Virtual Reality (VR) where VR users will be presented with a virtual world like the original. The benefits of VR for learning include increasing curiosity and enthusiasm for learning, encouraging students to think creatively and critically, and making it easier for teachers to deliver VR material is expected to be an innovation as well as a solution to the problem of learning Mathematics in Indonesia. So it is considered necessary to develop mathematics learning media assisted by the Lapentor application in the use of VR Technology. This study aims to see the feasibility of developing mathematics learning media based on the assessment of media validators, material validators, and based on student responses in the initial field trial. The results of this study indicate validation in the aspect of material expert assessment is 88.25% with a very valid category or can be used without revision with a reliability value of 85.71% with a very good category. Validation in the aspect of media expert assessment is worth 87.50% with a very valid category, or can be used without revision with a reliability value of 88.89% with a very good category and the results of the student response questionnaire in the initial field trial were 86.08%, with very practical criteria. So it can be concluded that the mathematics learning media assisted by the Lapentor application can be used for further testing to the main product field trial stage.

Keywords: Math Learning Media, Lapentor Application, and Virtual Reality

1. INTRODUCTION

The learning crisis in Indonesia has been going on for a long time and has not improved over the years. The learning crisis has increased after the Covid-19 pandemic which has caused learning loss and increased learning gaps. The implementation of the Merdeka Curriculum is expected to be able to improve the learning crisis in Indonesia. The Merdeka Curriculum gives educators the freedom to create quality learning that suits the needs and environment of students, (Ibda, 2020).

Facing this challenge, the Merdeka curriculum can also be an indicator of learning innovation in the current era of technological development through the use of technology in the learning process. Utilization of technology can engage students with various types of activity-based learning stimuli. Technology utilization can increase the attractiveness of material presentation, so that it can motivate students and teachers to innovate more often with the help of technology. The importance of technology in learning is a need that must be met by educational units to advance and develop the cognitive and psychomotor abilities

One technology that is currently developing is Virtual Reality (VR) technology where with VR users will be presented with a virtual world like the original. Currently in Indonesia the development of virtual reality is not so rapid, whereas in developed countries the development of VR is very promising. In Indonesia, the development of school materials with VR is almost non-existent. VR in Indonesia is still dominated by smartphone users with the game application (Sulistyowati & Rachman, 2017).

VR is a technology that aims to mimic the real world with its environment generated by computers and involves the five human senses. (Ariatama et al., 2021), wrote that VR technology is a way of displaying a learning image in the form of three-dimensional media or what is usually better known as 3D, where this process is made through the help of computer components so that the results will look more real and of course with the support of a number of other important tools. This will make the users (students) feel as if they are seeing directly and physically in a predetermined environment.

The benefits of VR for learning include increasing curiosity and enthusiasm for learning, encouraging students to think creatively and critically, and making it easier for teachers to deliver material. With the various advantages provided by VR, in learning mathematics VR can also be a medium to achieve the goals of learning mathematics. VR is expected to be an innovation as well as a solution to the problem of learning Mathematics in Indonesia. (Setyawan et al., 2023). Given the low ability of students in the field of mathematics as reflected in the results of the PISA (Program for International Student Assessment) survey in 2018, placing Indonesia in 74th place, aka the sixth rank from the bottom, Mathematics skills get a score of 379 in position 73. Indonesia's low ranking in mathematics in PISA 2018, so it is necessary to develop mathematics learning to improve students' Mathematics skills.

(Ernawati, 2021) revealed that the development of mathematics learning is needed because it is related to the cultivation of concepts in students, which later the students will also take part in the further development of mathematics or in the application of mathematics in everyday life.

This research tries to build a VR-based mathematics learning environment which in its development uses the help of the Lapentor virtual application as one of the devices in the utilization of VR. Lapentor Virtual Application is a program that combines information technology with photography which has the aim of providing information about space in a three-dimensional and interesting way. The space or object processed into the application comes from images taken with the help of a 360° camera. (Ibrahim & Raharjo, 2022). This research focuses on the development of mathematics learning media at the junior high school level with the help of Lapentor in the use of VR. The media developed later is the material of building space, where in the Lapentor application is designed with teaching materials, learning videos and practice questions are also contained in this application.

2. LITERATURE REVIEW AND HYPOTHESIS

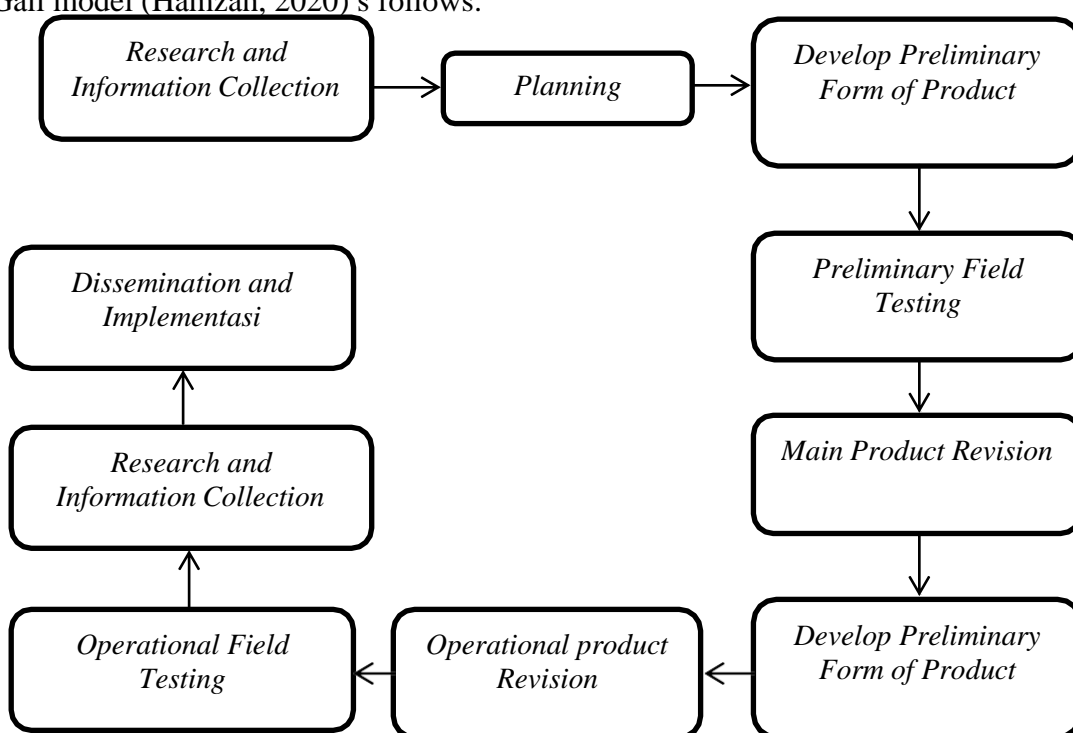
Learning Media is anything that can be used to convey messages or information in the teaching and learning process so that it can stimulate students' attention and interest in learning. According to (Nurrita, 2018) Learning media is a tool that can help the teaching and learning process so that the meaning of the message conveyed becomes clearer and educational or learning objectives can be achieved effectively and efficiently. The learning media used in this research is learning media in the form of the results of designing geometry

material on the sub-chapter of building space in the lapentor application as a utilization of VR

The development of virtual reality (VR) system is the latest development of multimedia. According to ALA (The Center for the Future of Libraries American Libraries Association), virtual reality is an image simulation of the entire computer-generated environment that can be perceived by users using special electronic equipment, which allows users to "be present" in an alternative environment like in the real world to three-dimensional (3D) virtual objects and information with additional data such as graphics or sound. It takes the form of a 360° video that captures the entire scene where the user can look up, down, and around and allows the user to interact with physical and virtual objects. (Marom, 2023).

3. RESEARCH AND METHOD

This type of research is applied research with a research and development (R&D) method. According to (Sugiyono, 2017) stated that Research and Development (R&D) is a research method used to produce certain products, and their effectiveness can be tested. The model used in this research is the Borg and Gall model until the seventh stage. Steps of the Borg and Gall model (Hamzah, 2020) s follows:



Gambar 1. Langkah-langkah R&D model *Borg and Gall*

Data

The data collection technique used was a validation questionnaire which was tested on 4 validators, namely 2 material expert validators and 2 media expert validators. After the Learning Media is validated, it is then tested on students to find out the response to the Learning Media. The number of responses in this study were 30 students from SMPN 1 Dewantara class VII.

Data analysis method

In analyzing the feasibility of learning media using the feasibility validation formula calculated by formula 1 analyzing the feasibility of learning media using the feasibility validation formula.

(1)

Ket. : Va : expert validation
TSh : total maximum expected score
TSe : total empirical score (validation results from validators)

The results of expert validation are then percented according to the criteria in table 1.

Table 1. Validation Criteria

No	Validation Criteria	Validation Level
1	75,01 % - 100,00%	Very valid, or can be used without revision
2	50,01 % - 75,00 %	Moderately valid, or can be used with
3	25, 01 % - 50,00%	some minor revisions
4	01,00 % - 25,00%	Less valid, so it should not be used

Furthermore, to determine the stability and consistency of the learning media using the reliability formula in formula 2.

$$R = \left(1 - \frac{A-B}{A+B}\right) \times 100\% \quad (2)$$

Ket : R = Percent agreement
A = he highest score given by the validator
B = The lowest score given by the validator

To determine the reliability criteria of learning media, the guidelines in table 2 are used.

Table 2. reliability percentage criteria

No	Persentase	Criteria
1	75,01% ≤ R ≤ 100 %	Very good
2	50,01% ≤ R ≤ 75%	Good
3	25,01% ≤ R ≤ 50%	Fairly Good
4	0% ≤ R ≤ 25%	Not Good

Analysis of the practicality of learning media seen from students' responses to learning media is calculated based on formula 3.

$$p = \frac{X}{Y} \times 100\% \quad (3)$$

Keterangan p : Practicality score

X : Score

obtained Y :

Maximum score

The results of the response questionnaire were analyzed using the assessment criteria in Table 3.

Table 3. Criteria for Practicality of Teaching Materials

Interval	Categories
0 – 20	Not practical
21 – 40	Less practical
41 – 60	Practical enough
61 – 80	Practical
81 – 100	Very practical

Sumber: (Rismaini, Debby, & Syelfia, 2019)

4. RESULT AND DISCUSSION

This research was conducted at SMPN 1 Dewantara, involving material expert

lecturers from Sebelas Maret University and FKIP UISU Medan media expert lecturers, in addition to lecturers, mathematics subject teachers from SMPN 1 Dewantara also became media experts and mathematics subject teachers from SMPN 6 Lhokseumawe became material expert validators. Response from 30 students of class VII at SMPN 1 Dewantara in the initial field trial process. The implementation of the research was carried out in the odd semester of the 2023/2024 school year.

The research and development procedure using the Borg and Gall model used in this study has only reached four stages, namely Research and Information Collection, Planning, Develop preliminary form of product and Preliminary Field Testing. The following is a description of the findings of this research:

1. Research and Information Collection

The analysis step consists of 2 stages, namely problem analysis and needs analysis. These stages are explained in detail, namely:

a. Problem Analysis

Problem analysis is carried out to find out and clarify the problems of student problems in the learning process. The absence of mathematics learning media with the help of lapentordi application at SMPN 1 Dewantara is one of the objectives of researchers to develop learning media. Then problems in learning such as low student understanding, especially those related to flat-sided space building material can be helped by presenting media as an intermediary. The complexity of the material can be simplified with the help of media.

b. Needs analysis

Needs analysis aims to conduct a learning program as a solution to the learning problems being faced. Based on the problem analysis, a math learning media is needed with the help of the lapentor application. Because the lapentor application is an application that makes it easy for teachers to upload teaching materials and fun for students to study the teaching materials available on the lapentor application.

2. Planning

It is a stage carried out to determine the achievement of basic competencies and core learning competencies that will be the purpose of learning, the scope of the material and the learning situation that takes place during the learning process.

Furthermore, material analysis is carried out on flat-sided space building material. At this stage also planned the instrument to be used, namely the expert validation sheet, student response questionnaire sheet. Research instruments are used to measure the feasibility level of learning media based on expert validation scores and the practicality of learning media. This planning stage is then evaluated together with peers who are fellow lecturers and mathematics teachers to improve the results of the analysis at this stage. The results of the discussion and evaluation of this stage are used as a consideration in the next stage, namely the develop preliminary form of product stage.

3. Develop Preliminary form of Product

At this stage, the development of learning media is carried out as an initial product. The learning media developed consists of two main parts, namely the initial part, containing the

homepage of the beginning of the classroom while the second part contains, the classroom with a photo background of the library, in which several points have been added containing classroom rules, learning videos, teaching modules, student worksheets, and additional materials.

At this stage, the validation sheet and response questionnaire were also prepared. The initial product developed was then validated by media and material experts. This stage is followed by revision based on the assessment and input in the form of suggestions from experts to improve the learning media developed. The validation of this learning media development product was tested by 4 experts, consisting of 2 lecturers of material experts and 2 lecturers of media experts. Material expert validation aims to find out the opinion of the validator regarding the feasibility of the product as a learning media and as a basis for improving and improving the quality of the material on the learning media. Validation is done by showing the material on the learning media that has been developed to be seen and submitting a validation sheet to the validator. The material expert validator sheet consists of 30 assessment items which are divided into 3 aspects, namely aspects of content feasibility, aspects of presentation feasibility and aspects of linguistic feasibility. The results of validation and reliability based on aspects of material expert assessment are as follows:

Table 4. Results of Validation and Reliability Based on Aspects

No	Assessment Aspect	Average	Validity Score (%)	Criteria	Reliability Criteria (%)	Criteria
1	Content Appropriateness Aspect	3,6	89,5	Very valid, or can be used without revision	85,71	Very good
2	Presentation Appropriateness	3,74	88	Very valid, or can be used without revision	85,71	Very good
3	Language Appropriateness	3,33	87,25	Very valid, or can be used without revision	85,71	Very good
Average		3,55	88,75	Very valid, or can be used without revision	85,71	Very good

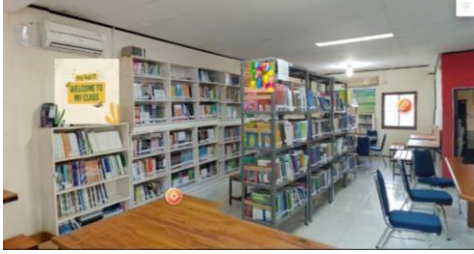



Based on the analysis of the results of the material expert assessment, it can be seen that the validity value has an average of 3.55. Furthermore, this average value is converted into a validation percentage with a value of 88.75% so that it can be concluded that the material contained in the learning media is in a very valid category, or can be used without revision. The overall reliability value is 85.71% with a very good category. Furthermore, the results of validation and reliability based on the aspects of the media expert assessor are as follows:

Table 5. Validation and Reliability Values based on Media Expert Assessment Aspects

No	Assessment Aspect	Average	Validity Score (%)	Criteria	Reliability Criteria (%)	Criteria
1	Lapentor Application Learning Media Display	3,89	88,45	Very valid, or can be used without revision	93,9	Very good
2	Lapentor Application Learning Media Design	3,71	82,58	Very valid, or can be used without revision	86,34	Very good
3	Benefits	3,83	91,47	Very valid, or can be used without revision	86,45	Very good
Average		3,81	87,5	Very valid, or can be used without revision	88,89	Very good

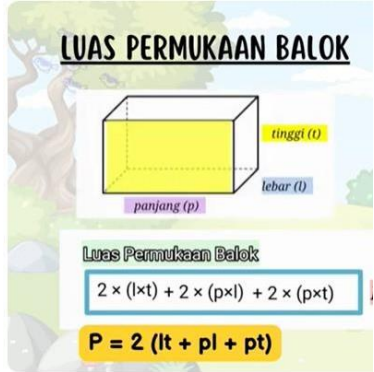
Based on the results of the media expert assessment, it can be seen that the average validity value is 3.81. Furthermore, this average value is converted into a validation percentage with a value of 87.5% so that it can be concluded that the lapentor-assisted learning media is in the Very valid category, or can be used without revision. The overall reliability value is 88.89% with a very good category. After validation, the next process is revision according to suggestions or input from material and media experts. The following are revisions based on suggestions from material experts and media experts.

Table 6. Revision of Material Expert and Media Expert Validation Results

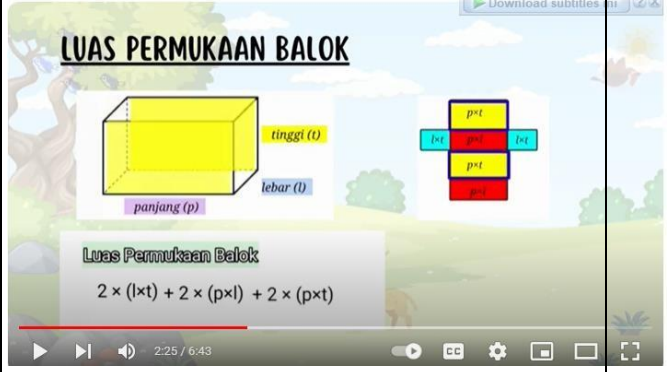
Revision of Lapentor application-assisted math learning media		
No	Before	After
1.	<p>Saran: Improve the initial display so that the library photo does not appear immediately. Before:</p> 	<p>Researchers improved the initial appearance of the application After:</p> 
2.	<p>Improve some icons with attractive images. Before:</p> 	<p>Researchers created an attractive image on the icon and provided a numbering sequence to make it easier for users After:</p> 

3. Add more interesting material to the learning video when finding the surface area of a block.

Before:



After:



Revised learning media assisted by lapentor application that has been evaluated is then used in the Preliminary Field stage.

4. Preliminary Field Testing



This Preliminary Field stage was carried out by testing the learning media assisted by the lapentor application to students. The initial field test was conducted involving 30 students of grade 7 of SMPN 1 Dewantara. The initial field test was intended to test the readability and practicality of the product. The trial was carried out by using learning media assisted by the lapentor application during the learning process to determine the readability of the media. Meanwhile, to find out the practicality of learning media, a response questionnaire was distributed to students after the learning process was completed. The results of the students' response questionnaire to the learning media being developed can be seen in the following table.

Table 7. Criteria for Evaluating the Initial Field Trial Response Questionnaire

No.	Assessment Indicator	Average Value	Persentase	Criteria
1.	Response to media	3,65	85,99	
2.	Response to learning activities using media	3,9	86,18	
	Average	3,77	86,08	Very Practical

Based on table 7 above, it can be seen that the response of students is 86.08%, with very practical criteria. This means that the mathematics learning media developed is very practical for students in its use. Furthermore, the learning media based on the results of the initial field trial are as follows:

Table 8. Learning Media Revision of Trial Results

Revision of Lapentor application-assisted math learning media		
No	Before	After
1	<p>Suggestion: Add learning videos and other teaching materials.</p> <p>Before</p> 	<p>Researchers add learning videos and other teaching materials to make it varied</p> <p>After :</p> 

The development of lapentor-assisted learning media to facilitate students in learning mathematics, was carried out using the Borg and Gall model until the fourth stage, namely Research and Information Collection, Planning, Develop preliminary form of product, and Preliminary Field Testing. The Research and Information Collection stage starts from analyzing problems and then analyzing needs. then analyzing needs. The analysis stage resulted in the conclusion that lapentor applications were needed to facilitate the delivery of material. So the lapentor application-assisted math learning media was designed and developed. Planning Stage, at this stage focused on activities: 1) Determining learning outcomes, 2) The Develop preliminary form of product stage is focused on activities 1) Designing learning media, 2) Developing validation sheets and response questionnaire sheets, 4) Validation of material experts and media experts (measuring media feasibility), 5) Revision based on expert input/suggestions. The activity begins with making learning media as an initial product. Then validated to material experts and media experts. Material validation resulted in a validity value of 88.25% which means it is very valid or can be used without revision, a reliability value of 85.71% with a very good category. While validation from media experts produces a validity value of 87.71%, meaning that the media is in a very valid category or can be used without revision, the reliability value of the book is 87.50% with a very good category. The results of the response questionnaire analysis amounted to 86.08%, with very practical criteria.

This research is in line with the research on Interactive Media Design for Virtual Tour of Catur Insan Cendikia University. (Vicko Fadho Sabilillah, A Sobi Muthohari, 2023), The difference between this research and previous research is that this research is the development of learning media assisted by the Lapentor application in the utilization of VR technology.

5. CONCLUSION

Based on the results of the research and discussion, it can be concluded that:

- 1) Based on the material expert assessment, it is declared very valid or can be used without revision (88.25%) and the reliability category is very good (85.71%).
- 2) Based on the assessment of book media experts, it is declared very valid or can be used without revision (87.50%) and the reliability category is very good (88.89%).
- 3) Based on student responses in the initial field trial, 86.08% with a very practical category, meaning that the learning media can be tested on a wider scale.

6. ACKNOWLEDGEMENT

This research is financed by non-tax state revenue (pnbp) funds in the malikussaleh university budget implementation list (dipa) fiscal year 2023. Thank you to malikussaleh university and the institute for research and community service (lppm) malikussaleh university.

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