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Development of Digital Module of Virtual Reality-Based Measurement Materials Assisted by MOOCs Platform for Class X High School Students

Veni Fahrenda[1,2], **Eko Risdianto**[1], **dan Dedy Hamdani**[1]
[1]Program Studi Pendidikan Fisika, Fakultas Keguruan dan Ilmu Pendidikan, Universitas Bengkulu

[2]E-mail: venifahrenda19@gmail.com

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Abstract. The problems that are often experienced in physics learning in the classroom lie in the limited use of learning media so that students' interest and motivation in learning decrease. Therefore, the purpose of this study is to describe the feasibility of the digital module of Virtual Reality-based measurement materials assisted by the MOOCs platform and describe the students' response to the digital module of Virtual Reality-based measurement materials assisted by the MOOCs platform. The research method is (Research and Development) which uses the ADDIE (Analysis, Design, Development, Implementation, Evaluation) model. To determine the feasibility of learning media and student responses to the media that has been designed so that research instruments are used in the form of expert validation questionnaires and student response questionnaires. The results of the study show that the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform is very feasible to be used in the physics learning process in schools, with an average feasibility percentage score of 89.94%. In addition, this study was able to increase students' understanding of concepts with an average percentage score of 85.04%. Based on the results of the field test on the response of students, the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform is categorized as very good with an average percentage score of 85.81%. Based on the results of the study, it can be concluded that the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform is very feasible to use for physics learning and can increase students' understanding of concepts and get a positive response to students.

Keywords: digital module, MOOCs platform, virtual reality.

1. Introduction

The rapid development of technology requires that we be able to adapt to these developments so as not to be left behind by the times. In daily life, it is undeniable that technology has been widely used by people in various fields, one of which is the field of education. The use of technology in the field of education is very necessary to improve the quality of education, especially in the process of learning and teaching [1]. The process of learning and teaching activities is one of the important things in the world of education. Education is a process that can be used to develop the potential that everyone has because it is done to face future challenges [2].

The teaching process is not only limited to conveying knowledge or knowledge, but also involves deep and strategic efforts to create positive changes in all aspects of students. To achieve the desired learning goals, educators must choose the right media and methods. Educators must be able to create a conducive learning environment, be engaging, and encourage students to be actively involved in the learning process [3] as in the current learning curriculum, namely in the independent curriculum. Where the independent curriculum focuses on the character of students, the formation of character is important because it is the goal and demand of producing intelligent students [4]. The implementation of the independent curriculum is very much needed as a character-based and technology-based (digital)

learning media with the hope that learning will be more meaningful and can meet the learning needs of students and innovations in learning [5].

There are several forms of innovation that are carried out in order to adjust the education system with current technological advances. One of them is the use of technology in the manufacture of teaching materials such as videos. Video learning is one of the multimedia-based learning media that can be used for distributing content that is included in the category of audio-visual teaching materials. Audio visual media is media that has sound elements and visual elements. This type of media has better capabilities because it contains sound and images [6].

Based on the results of interviews conducted with 5 high school (SMA) students and 2 students of Madrasah Aliyah School (MA) in Bengkulu Province, it is known that teachers still do not use interactive learning media, most teachers only focus on providing learning materials to students using print media and using learning media in the form of Power Points. Meanwhile, the lack of use of interactive learning media makes students less interested and easily bored and less understanding of the learning taught by the teacher to the lesson. Therefore, technology-based interactive learning is needed to improve students' understanding of concepts.

One of the learning media that can make students interested and interact is by using Virtual Reality-based learning media. Virtual reality (VR) is a technological advancement that provides learners with an immersive and interactive experience that is very similar to reality [7]. This Virtual Reality-based learning media can be used in learning media in the current era of globalization [8]. Technically, Virtual Reality is used to describe a three-dimensional environment generated by a computer and interacting with a person [9]. Virtual Reality (VR) is broadly defined by Macpherson and Keppell as "a technology that produces a digital environment that resembles the real world and allows users to interact with that environment" [10]. This technology was introduced as an innovative device for solving complex problems, resulting in unique, realistic, and practical solutions for students [11]. The use of Virtual Reality-based learning media makes students more involved in the learning process, therefore using it is a good way to make students more enthusiastic in learning, especially in physics learning [12].

Based on the results of the research using bibliometric analysis, it can be seen that by conducting this analysis, Virtual Reality is needed for learning media, in addition to learning media, Virtual Reality is also widely developed in other fields other than education such as in the field of technology, health, media, entertainment, and others. In addition, the use of technology such as MOOCs platforms to develop Virtual Reality-based learning applications also emerged as an interesting theme in the study.

Massive Open Online Courses (MOOCs) platforms are online interactive learning environments and record an extensive digital footprint of learners [13]. MOOCs are online courses designed for broad interactive participation and open access through websites [14]. MOOCs exist as a new model of education and learning, which uses the internet to deliver lecture materials in the world's prestigious universities and educational institutions, creating a kind of revolution and people joining forces to conduct sustainable classes [15]. MOOCs allow students to have enough storage capacity to store their materials. MOOCs platforms also allow students to share learning materials with their peers. Given the features of these MOOCs, students can apply the knowledge gained in decision-making and problem-solving activities [16]. The MOOCs platform used in this study is a MOOCs platform managed by the University of Bengkulu, https://moocs.unib.ac.id.

Learning with Massive Open Online Courses (MOOCs) can be an effective way to learn physics, especially for those who want to study independently or as an addition to their formal education [17]. An accessible MOOCS platform that is open to anyone around the world. These courses are usually free or low-cost, and offer a variety of learning materials, such as video tutorials, assignments, discussions, and exams [18]. MOOCs platforms are designed in such a way that they can achieve predetermined learning objectives [19]. Then, the design of this MOOCs Platform aims to allow users to access it online anywhere and anytime, where students can choose the material they are interested [20]. The use of technology such as Massive Open Online Courses (MOOCs) platforms to develop Virtual Reality (VR)-based learning applications is one of the innovative ways to increase interaction and effectiveness

in the learning process. In addition, the use of MOOCs especially among academics helps to increase motivation and interest among students who are still fading in physics learning [21].

The purpose of this study is to describe the feasibility of the digital module of Virtual Reality-based measurement materials assisted by the MOOCs platform and describe the students' response to the digital module of Virtual Reality-based measurement materials assisted by the MOOCs platform. Therefore, a study entitled "Development of Digital Modules for Virtual Reality-Based Measurement Materials Assisted by MOOCs Platform for High School Students in Class X" will be conducted."

2. Method

The method used in this study is Research & Development (RND) research, which is development research that focuses on producing new products or developing existing products [22]. The research model used is the ADDIE development model. This model can be used for various forms of product development such as models, learning strategies, learning methods, media and teaching materials [23]. The ADDIE model is organized into five stages, namely Analysis, Design, Development, Implementation and Evaluation. The five stages in the ADDIE model are a guide for researchers to create effective learning and obtain maximum results. For the stages of the RnD research method on the ADDIE model, it can be seen in Figure 1.

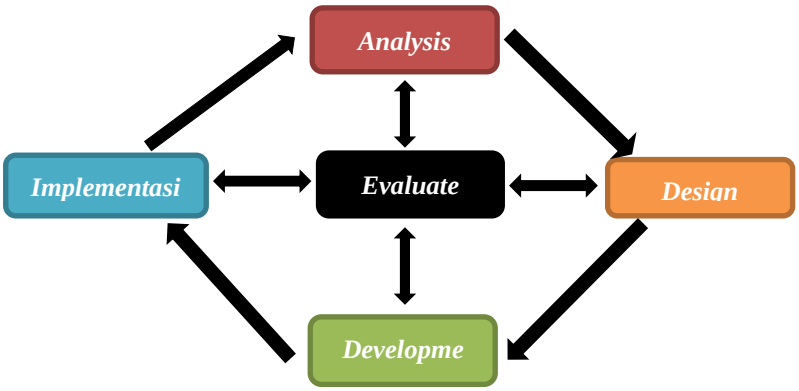

Figure 1. ADDIE development research stages [24].

Participants in this study consisted of 2 physics education lecturers from the University of Bengkulu, 1 physics teacher from MAN 2 Bengkulu city and students from MAN 2 Bengkulu City. A lecturer in physics education at the University of Bengkulu and a teacher of physics subject at MAN 2 Bengkulu City became a team of experts or validators on Virtual Reality-based digital modules assisted by the MOOCs Platform to provide assessments based on components of the feasibility assessment aspect. The subject of this product trial was carried out to 34 students of MAN 2 Bengkulu City. This research was conducted during the odd semester of the 2024/2025 school year.

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$$\text{Validation (S)} = \frac{\text{total score}}{\text{maximum score}} \times 100\% \quad (1)$$

From the results of the validity that the percentage has been known, it can be matched with the criteria in Table 1.

Table 1. Learning media eligibility category [25].

Percentage	Interpretation
0% - 25 %	Very Unfeasible
26 % - 50 %	Not Eligible
51% - 75 %	Eligible
76% - 100 %	Very Viable

The results of the analysis of response questionnaire data can be processed by presenting percentages using the likert 4 scale as a measurement scale. The data was analyzed by calculating the percentage of answers based on the score obtained using the formula:

$$\text{Percentage} = \frac{\text{total score obtained}}{\text{mazimum score}} \times 100\% \quad (2)$$

To find out the students' response to the product developed, the researcher uses a percentage value as a reference for data research. The value of the percentage can be seen in Table 2.

Table 2. Student response questionnaire category [26].

Percentage	Interpretation
0%-25%	Very Bad (STB)
26%-50%	Bad (TB)
51%-75%	Good (B)
76%-100%	Excellent (SB)

This analysis uses a cognitive aspect test, with pretest and posttest as an instrument to measure the results of students' understanding of concepts in the measurement material. The pretest and posttest values were analyzed using the Normalized average gain or N-gain. N-gain criteria can be seen in Table 3.

Table 3. Categories of improving students' cognitive understanding [27].

Average	**Criterion**
$g > 0.7$	Tall
$0.3 \leq g \leq 0.7$	Keep
$0 < g < 0.3$	Low
$g \leq 0$	Fail

Data analysis of students' concept understanding using [28] Normalized average gain or N-gain in the following equation:

$$\text{N} - \text{Gain} = \frac{\text{Posttes score} - \text{Pretest score}}{\text{maximum score} - \text{Pretest score}} \quad (3)$$

3. Results and Discussion

3.1. *Result*

This study aims to describe the feasibility of the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform for high school students in class X and describe the students' response to the digital module of virtual reality-based measurement materials assisted by the MOOCs Platform for high school students in class X. Results of the research on the development of digital modules of virtual reality-based measurement materials With the help of the MOOCs Platform for high school students in class X, it includes the stages of analysis, design, develop, implement, and evaluation.

3.1.1. Analysis Stage

The first stage is the analysis stage. The research analyzed the data by conducting interviews with students and literature studies. Interviews are used to identify existing needs and problems. Interviews were conducted with students to find out the difficulties faced in the learning process, facilities and

infrastructure in schools, learning media that are often used in the learning process, and students' interest in digital modules of Virtual Reality-based measurement materials assisted by the MOOCs Platform.

Based on the results of interviews conducted with 5 Senior High School (SMA) students, namely SMA Negeri 1 Bengkulu Utara, SMA Negeri 2 Bengkulu Utara, SMA Negeri 3 Bengkulu Tengah, SMA Negeri 5 Bengkulu Tengah, SMA Negeri 11 Bengkulu City and 2 students of Madrasah Aliyah School (MA), namely MA Negeri 1 Bengkulu City, and MA Negeri 2 Bengkulu City in Bengkulu Province, It is known that teachers still do not use interactive learning media, most teachers only focus on providing learning materials to students by using print media and using learning media in the form of power points. Meanwhile, the lack of use of interactive learning media makes students less interested and easily bored and less understanding of the learning taught by the teacher to the lesson. Therefore, there is a need for interactive learning media that makes students interested and not bored when carrying out learning in the classroom.

In addition, a literature study was also carried out with bibliometric analysis of the use of Virtual Reality learning media in physics learning. Based on the bibliometric analysis of the research trends of Virtual Reality learning media using the VosViewer application, it can be seen that by conducting this analysis, Virtual Reality is much needed as a learning medium, in addition to in the world of education Virtual Reality-based learning mediaIt is also widely developed in other fields such as in the field of technology, the health sector, the media sector, the entertainment sector, and others.

The results of the analysis of interviews with students and the results of the bibliometric analysis obtained were then evaluated on the results obtained. The evaluation was carried out to explore and identify the problems obtained based on the results of interviews and bibliometric analysis in order to design the right solution, as well as minimize errors that may occur in the next stage. After an evaluation at this stage of analysis, the results obtained will be used as the basis for the development of a digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform.

3.1.2. Design Stage (Planning)

At this stage, all information is obtained from the analysis stage and begins the creative process of designing teaching materials based on information technology to achieve learning goals. The product designed on this media is the development of a digital module of Virtual Reality-based learning materials assisted by the MOOCs Platform for high school students in class X. At this design stage, an evaluation is also carried out. Evaluation at the design stage is carried out to ensure that the design is in accordance with the purpose of the product to be developed, identify and correct the shortcomings of the design made before entering the development stage and then disseminate.

3.1.3. Development Stage

This stage aims to modify the final learning media after undergoing revisions based on comments, suggestions, expert assessments and data from the test results:

1. Initial Products

The initial product is made based on the design that has been done at the design stage, at this stage it usually refers to the prototype stage or the initial model making in the product development process. Below are the parts of the initial products that have been produced

1. Main Page

   The main page of MOOCs (Massive Open Online Courses) platforms usually contains a variety of important information and navigation for users. Elements that can be found on the main page of the MOOCs Platform are the title of the module, then there is a description of the subjects taught, requirements for attending classes, target students, and author profiles that can be accessed by students. In addition, menus such as Overview which contains a preface, Curriculum which contains learning materials, sample questions, and quizzes, and there is a materials menu that contains a link to the Virtual Tour of the Laboratory. View of the main page of the MOOCs Platform in Figure 2.

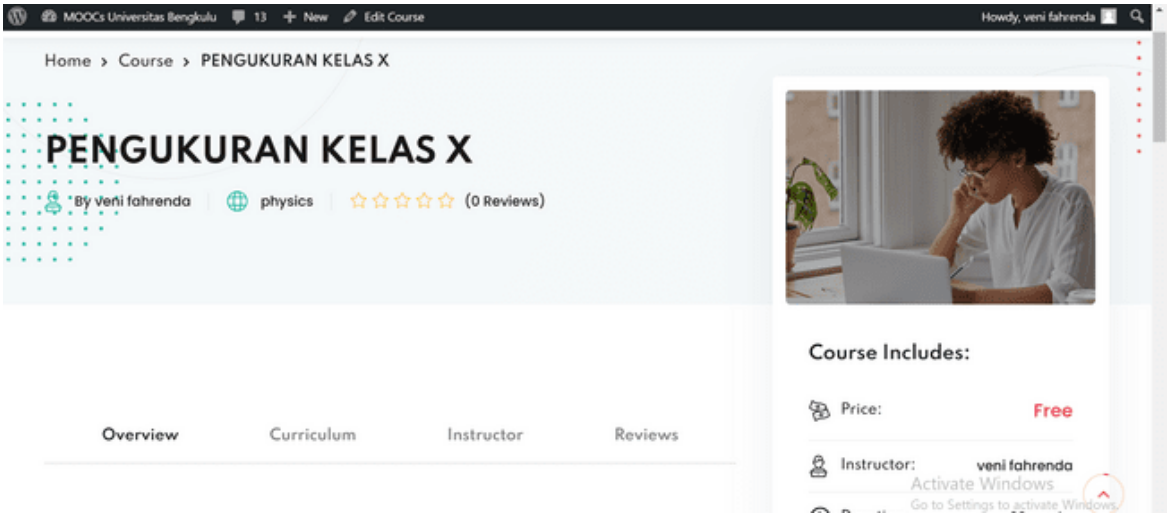

Figure 2. Main page view of MOOCs platforms.

2. Foreword

The preface in the MOOCs (Massive Open Online Courses) Platform usually contains a brief introduction that explains to the user an initial overview of the purpose, benefits, and how the Virtual Reality-based digital modules assisted by the MOOCs Platform work. The display of the preface is seen in Figure 3.

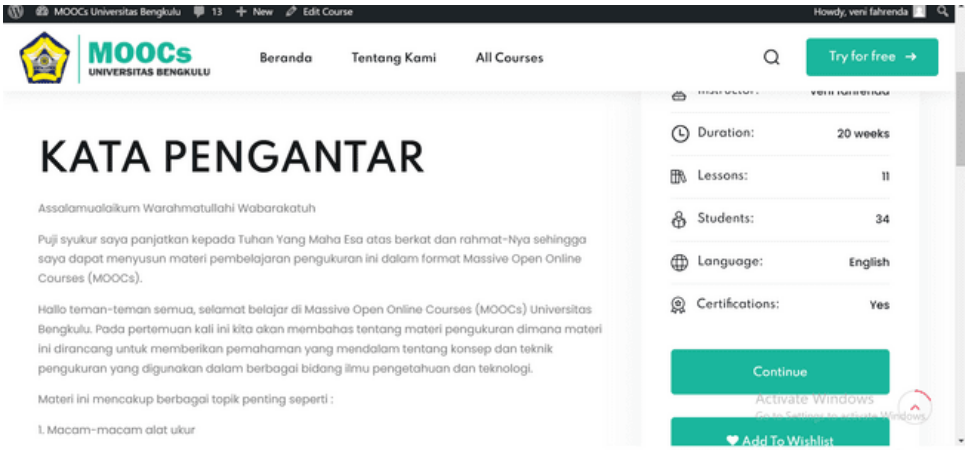

Figure 3. Foreword on MOOCs Platforms.

3. Material

The material section on the MOOCs Platform refers to all the learning content provided in an online course. The material on the MOOCs Platform is the most important part of the learning process of the Digital Module of Virtual Reality-based measurement materials assisted by the MOOCs Platform to convey knowledge, test understanding, interaction and discussion. There are four topics of discussion in the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform, namely the first material on various measuring instruments, the second material on quantities, units, and dimensions, the third material on the rules of important numbers and the fourth material on scientific notation. The display of the material page on the MOOCs Platform is seen in Figure 4.

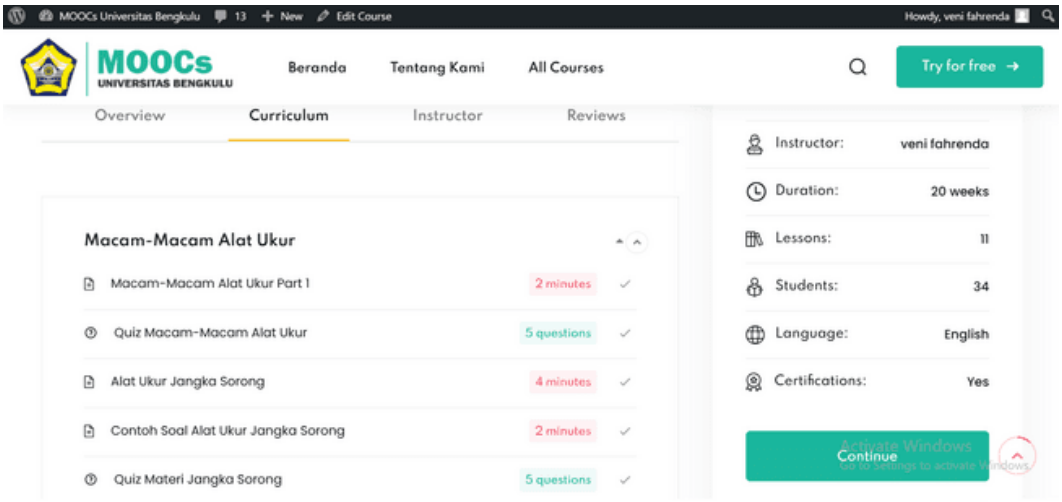

Figure 4. The display of the material page on the MOOCS platform.

The material on the Virtual Reality-based digital module assisted by the MOOCs Platform is explained in the form of a video. Where this learning video is taken using the insta 360 X3 camera, then exported through the Insta360 studio application which aims to edit 360 degree videos thoroughly. Then, the 360 video is uploaded via YouTube. After that, the youtube link is linked to the MOOCs Platform. The video display of learning materials on the MOOCs Platform is seen in Figure 5.

Figure 5. Video display of learning materials on MOOCs platform.

4. Quiz

Quizzes on the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform are very important in online learning. Quizzes on these MOOCs platforms can help participants achieve their learning goals effectively. In addition, quizzes can measure students' understanding of the material that has been delivered, and can increase students' understanding of concepts. The quiz in the digital module of Virtual Reality-based measurement materials assisted by

the MOOCs Platform is presented in the form of multiple choices, where students choose one correct answer from several choices. The view of the quiz page on the MOOCs Platform is seen in Figure 6.

Figure 6. View of the Quis page on the MOOCs platform.

5. Virtual Tour Laboratorium

In addition to using digital modules, Virtual Reality-based measurement materials are assisted by the MOOCs Platform. Virtual Reality-based learning media is also presented in the form of a Virtual Laboratory Tour. This Virtual Laboratory Tour is a digital simulation that allows users to explore and interact with a laboratory virtually. The application or AI used in creating this laboratory Virtual Tour uses https://kuula.co/. This virtual tour of the laboratory can be on the materials section on the MOOCs platform. The main view of the Virtual Tour of the Laboratory is seen in Figure 7.

Figure 7. Virtual view of laboratory tour.

In this Virtual Tour of the Laboratory, learning meters were also presented. Where students in addition to exploring the Virtual Tour of the Laboratory they can also access learning materials. This learning material is presented in the form of a video. The display of learning materials on the Virtual Laboratory Tour is seen in Figure 8.

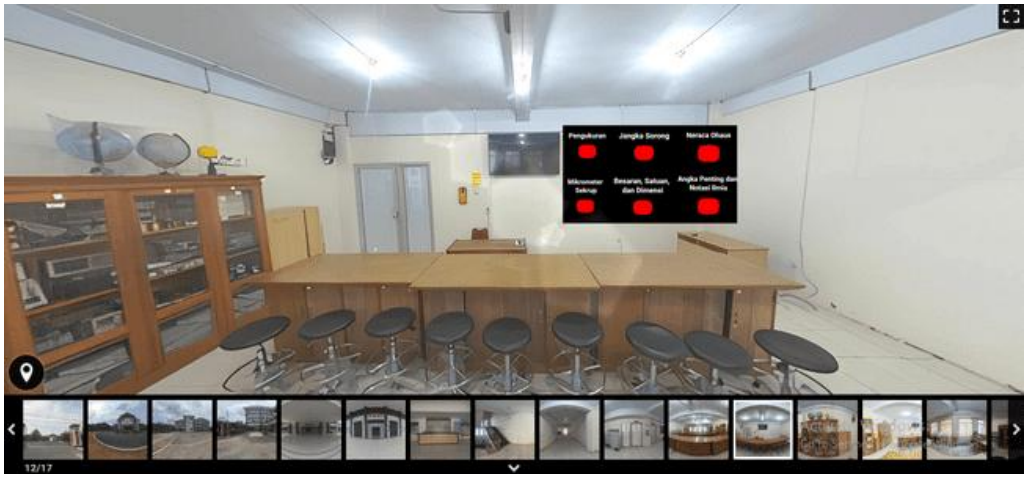

Figure 8. Virtual learning materials for laboratory tour.

2. Expert Validation

At the development stage, the researcher conducts a media feasibility test by way of product validation. Product validation is done after the initial product manufacturing. The validation was carried out by 3 experts, consisting of 2 experts from Physics Education Lecturers at the University of Bengkulu and 1 expert from physics teachers of MA Negeri 2 Bengkulu City. The results of the product validation of the development of digital modules of Virtual Reality-based measurement materials assisted by the MOOCs Platform for high school students in class X showed a percentage of 89.94% with very feasible criteria in all aspects measured, namely content feasibility, presentation feasibility, language feasibility, media feasibility, and concept comprehension. The following are the results of product validation in Table 4.

Table 4. Feasibility results of the digital module of virtual reality-based measurement materials assisted by MOOCs platform.

Assessment Aspects	Response	
	Score	Qualitative Category
Content Eligibility	86,1%	Highly Worthy
Eligibility of Serving	100%	Highly Worthy
Language Eligibility	95%	Highly Worthy
Media Eligibility	87,96%	Highly Worthy
Understanding Concepts	85%	Highly Worthy

3. Revision

At this revision stage, the results of validation from the validator will then the data will be analyzed and improvements will be made to the digital module product. Revision or improvement activities on Virtual Reality-based digital modules assisted by MOOCs platforms that refer to the results of expert validation questionnaires to analyze shortcomings and make improvements to digital modules. The following are suggestions by validators for the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform, namely

1. Correction of writing errors in material titles

Figure 9. The display before the title writing is corrected.

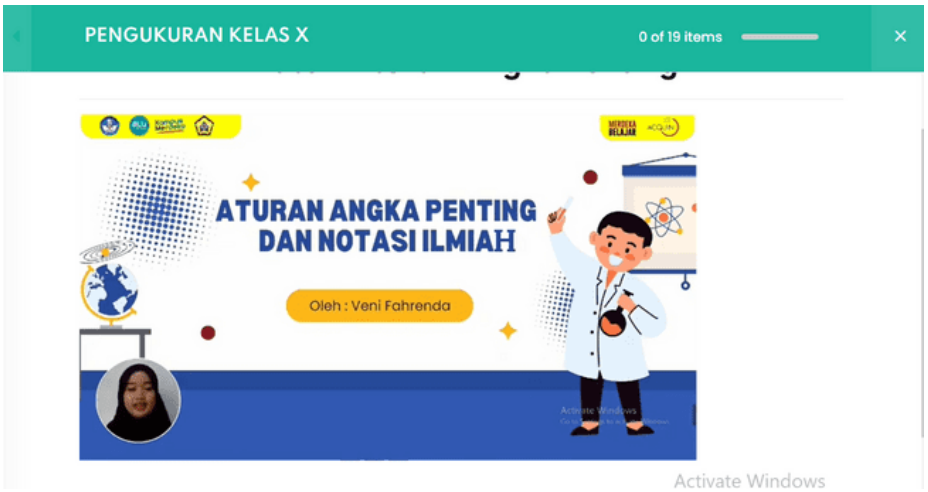

Figure 10. The display after the title writing is corrected.

3.1.4. Implement Stage

After the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform has been declared very feasible by experts, the next step is to use the media in learning as well as a form of field trial. The product trial was applied to class X students totaling 34 students at MA Negeri 2 Bengkulu City. In this implementation activity, there will also be a measurement of students' understanding of concepts and student responses. The measurement of students' concept understanding will be measured by conducting Pretest and Posttest. Where this Pretest is carried out before using the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform, while the Posttest is carried out after the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform. The learning outcomes of students before and after using the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform where effectiveness data of 0.85 and N-Gain percentage level of 85.04% were obtained. So, based on the category, the effectiveness of increasing students' understanding of concepts is high. This shows that the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform can improve students' understanding of concepts.

Then, this study also uses a student response questionnaire to see students' responses to Virtual Reality-based digital modules used during the learning process. The results of students' responses to learning media can be seen in Table 5.

Table 5. Results of student response to the digital module of comics-based static electricity materials assisted by the MOOCs platform.

Assessment Aspects	Response	
	Score	Qualitative Category
Effectiveness of Digital Modules	87,74%	Excellent
Learning Motivation	85,47%	Excellent
Student Learning Activities	84,31%	Excellent

Based on the results of student responses to the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform in Table 7, it shows that the overall average score of the percentage of student responses is 85.81% with very good criteria in all aspects measured. This stated that most students liked and were interested in the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform in the learning process.

3.1.5. Evaluation Stage

At this stage, an assessment of the product developed is carried out. The evaluation stage is carried out to evaluate the developed product based on the input obtained from expert validation and implementation of product tests. The results of these assessments and suggestions are used as a basis for making improvements and adjustments so that the developed learning media can reach the desired standards. The product developed is a digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform for high school students in class X. This is shown by a high N-Gain score of 0.85 and a student response of 85.81%. Therefore, the product developed, namely the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform for high school students in class X, is very feasible and good to be developed after obtaining very feasible validation results from all validators and getting a very good response from students to the media.

3.2. *Discussion*

3.2.1. Feasibility of Virtual Reality-Based Digital Modules Assisted by MOOCs Platform

Based on the results of the feasibility test shown in table 6, the average percentage of the feasibility of the Digital Module product of Virtual Reality-based measurement materials assisted by the MOOCs Platform is 89.94% with the criteria of "Very Feasible" in all aspects measured, namely the feasibility of content of 86.1%, the feasibility of presentation of 100%, the feasibility of language 95%, the feasibility of media 87.96%, and increasing the understanding of student learning concepts by 85%. These results state that the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform is very feasible to be developed and used for the learning process. This is supported by Octifa [29] research with the results showing that the Virtual Lab application based on Surface Tension Virtual Reality developed is classified as "feasible and without the need for revision" criteria with an overall average score of 89% so that this learning media meets the validity aspect. This statement is in line with the findings by Sigit's [30] which states that the use of Virtual Reality media has a positive impact on student understanding. This causes the experience of using the media to make learning meaningful and very feasible in the learning process.

3.2.2. The effectiveness of virtual reality-based digital modules assisted by MOOCs platforms to improve students' understanding of concepts

The effectiveness of learning media is seen from the learning outcome test given to students. The results of the analysis showed that the N-Gain percentage value obtained was 85.04% with the effective category. This states that the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform significantly improves student learning outcomes, especially in measurement

materials. Packaging learning materials in the form of videos makes students more interested in learning them, in addition to that the quizzes contained in the MOOCs Platform help students to hone their understanding of concepts about measurement materials. Thus, the Virtual Reality-based digital modules assisted by the MOOCs Platform developed are very effective in improving students' understanding of concepts in the learning process. This study is related to research conducted by Sehli [31] where in this study based on the analysis carried out that the use of interactive learning media based on Virtual Reality (VR) assisted by millealab can improve student learning outcomes in business and energy materials because an N-gain value of 0.73 was obtained in the high category. Furthermore, in line with this, according to Kartikasari [32] that using Virtual Reality media can motivate and increase their understanding of concepts to learn physics.

3.2.3. Student response to virtual reality-based digital modules assisted by MOOCs platform

This study found that the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform was very well received by students, with a high percentage of positive responses. The average percentage score of student responses was 85.81% with the criterion of "Very Good" which showed that the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform met the learning needs of students in the measurement material. This is because Virtual Reality creates an interactive and immersive learning environment, which allows students to feel as if they are in the learning and makes physics learning more interesting and fun. The use of digital modules of Virtual Reality-based measurement materials assisted by the MOOCs Platform in physics learning can increase students' curiosity and enthusiasm for learning. This research is related to research conducted by Yeni [33] that this application can support learning activities of Natural Science content on the integration of solar system materials and through the trial use of Virtual Reality-based solar system learning media to students, stating that 96.89% of students feel happy learning by giving positive responses. This statement is in line with the findings by Iqbal [34] where students responded to the use of Virtual Reality media in disaster mitigation learning very positively. Students acknowledged that Virtual Reality is effective in making it easier to understand disaster mitigation material by presenting disaster introductions and mitigation steps directly, thus helping them understand the material better. This is also supported by research conducted by Ulfa [35] concluding that this Virtual Reality-based media provides convenience to students in analyzing and providing attraction for students so that there is an increased desire to learn. The different and interactive learning experiences offered by the digital modules of Virtual Reality-based measurement materials assisted by the MOOCs Platform have also managed to attract students' interest, making them more engaged and motivated in learning. So, the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform received a good and positive response.

4. Conclusion

This study can be concluded that the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform which has been validated by expert states that the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform is very feasible to use. Based on the results of the Pretest and Posttest, the Virtual Reality-based digital module assisted by the MOOCs Platform that has been developed can improve students' understanding of concepts in measurement materials. Meanwhile, after using this digital module, there was a good and positive response from students as users of the digital module of Virtual Reality-based measurement materials assisted by the MOOCs Platform. Therefore, the use of digital modules of Virtual Reality-based measurement materials assisted by the MOOCs Platform can be used by students as an independent learning resource that can be accessed anywhere and anytime. In addition, digital modules are a solution to be able to improve students' understanding of concepts, especially in measurement materials. The next suggestion for researchers is to be able to explore the development of Virtual Reality content for more complex physics subjects or other themes that have not been widely studied.

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