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Development Of Teaching Modules For Merdeka Curriculum Based On The *Realistic Mathematics Education* (Rme) Approach Integrated With Geogebra *Software* At Sman 1 Muara Batu

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ABSTRACT

The independent curriculum teaching module is a learning tool for the independent curriculum, previously known as lesson plans in the 2013 curriculum. Unlike the lesson plan, the teaching module has 3 main components: identity, core activities, and attachments. Teaching modules can be combined with interesting learning approaches and media. The purpose of this research is to develop an independent curriculum teaching module using the GeoGebra integrated RME approach that is valid, practical, and also effective. This type of research is *Research and Development* (R&D) with the ADDIE development model. The stages in this study begin with analyzing the curriculum, learning device needs, and the situation of students. Then proceed with design, development, validation, revision, and small and large group trials to get the final product. Validation was carried out by 4 expert validators, 2 material validators, and 2 mediavalidators. While the product trial was conducted in class X IPAS 4 SMAN 1 Muara Batu. The results of validation by validators obtained an average percentage of 90.87% (very valid) on materialvalidators and 84.79% (valid) on media validators so the product was "valid" to use. The results of students' responses obtained an average percentage of 81.94% (very positive) and an average percentage of observer responses of 91.26% (very good) so that the product is "practical" to use. The results of classical learning completeness of students obtained an average percentage of 100% (complete) so that the product was "effective" to be used in the learning process. It can be concludedthat the independent curriculum teaching module based on the GeoGebra integrated RME approach on vector material developed is valid, practical, and effective for use as a learning tool in schools.

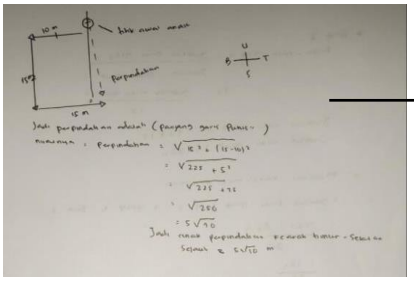
Keywords: ***GeoGebra, Independent Curriculum Teaching Module, RME, Vectors*.**

1. INTRODUCTION

Several efforts have been made by the government to produce quality human resources through improving the quality of education in Indonesia, including by completing facilities and infrastructure in schools, improving the quality of teaching staff, and also by improving the curriculum that emphasizes the development of *life skills* to be able to adapt and succeed in the future through the achievement of learner competencies. The curriculum is one of the most important components in education so the government is very concerned about improving the education curriculum in Indonesia. Sitepu et al., (2020: 97).

Several significant differences can be seen in the development of an independent curriculum such as the application of learning hours per year, Learning Outcomes (CP) previously known as KMM, replacing the syllabus with the Flow of Learning Objectives (ATP),the application of Teaching Modules (MA) as a substitute for lesson plans and others. (Angga et al.,2022: 5886). The Ministry of Education and Culture developed an independent curriculum as an important part of the effort to recover learning from the crisis that we have experienced for a long time. (Maulinda, 2022:130). This is because many national and international studies have stated thatIndonesia has also long experienced a *learning crisis*.

The following is an example of one of the answers of students who are given vector test questions.



Students have not been able to identify and formulate problems correctly. and students are still wrong in determining the direction of displacement of the vector. Learners also do not recheck the results of their answers.

Figure 1. 1 Example of a Learner's Answer

So learning in the classroom is considered interesting by students and also fosters a senseof interest in students to become more developed than before. Laurens et al, (2018: 576) *"The teachers must develop more appropriate learning media, strategies, or models whichare more suitable with learning materials or with the contexts that their students are dealing with"*.

One of the efforts that can be made to overcome this problem is to develop teaching modulesthat can support teachers to be more creative in the teaching and learning process. Maulinda (2022: 130) Maulinda (2022: 130) states that the independent curriculum teaching module is a learning tool that replaces the lesson plan which has a varied format and nature that contains learning material/content, learning methods, interpretation, and also evaluation techniques which are arranged systematically and directed to achieve the expected achievement indicator goals.

Realistic Mathematic Education (RME) is one of the approaches to learning mathematics that is oriented towards mathematizing everyday experiences and applying them in everyday life. (Sinaga, 2018:27). The *Realistic Mathematics Education* (RME) approach is known to help improve students' problem-solving skills and learn independence such as the results of research by Hasibuan et al. Hasibuan et al., (2020: 95) show the results of students' mathematical problem-solving ability and learning independence have increased after using learningtools with the RME approach.

GeoGebra is a math *software* developed by Markus Hohenwarter. GeoGebra software is deemed appropriate to be developed in the form of teaching materials so that it can help teachers during the learning process to present abstract concepts in mathematics into something more concrete and easy to understand (Lestari et all., 2021: 13). Based on the results of research conducted by Andyny & Panggabean (2021: 80) the development of interactive ICT-based math LKPDs assisted by Geogebra that he did was very feasible and practical to use. So that GeoGebra *software* is deemed appropriate to be developed in the form of teaching materials that can help students change the abstract form of mathematics into a form that is more concrete and easy to understand. So researchers hope that the use of teaching modules with the RME approach and GeoGebra *software* assistance in mathematics can help students to make it easier to learn vector material.

2. LITERATURE REVIEW AND HYPOTHESIS

The independent learning curriculum means that the government provides broad opportunities for learners and teachers to be able to think broadly. (Wijayanti et al., 2022: 783).. The independent curriculum plays a role in helping to reorganize the national education system in Indonesia to support the change and progress of the nation so that it can immediatelyadapt to the changing times and technological developments that exist. (Yamin & Syahrir, 2020: 127).

According to Rahimah (2022: 96) teaching module is several learning tools that contain directions and references that are systematically and interestingly assembled. The

independent curriculum teaching module refers to tools or media, methods, instructions, and guidelines that are arranged systematically (directed), interesting, and of course by what is needed by students. What is said with the teaching module is the application of the Flow of Learning Objectives (ATP) which is elaborated from the Learning Outcomes (CP) with the aim of the Pancasila learner profile. (Setiawan et al., 2022: 50).

Teaching modules are structured according to the phase or stage of learner development, considering what will be learned with learning objectives, and based on long-term development. Teachers need to understand the concept of teaching modules to make the learning process more interesting and meaningful. This is in line with the opinion of Maulinda (2022: 132) who said that the teaching module is a very important component for teachers and students because teachers will find it difficult to increase effectiveness in learning if they do not use a complete teaching module.

Realistic Mathematics Education abbreviated as RME is a domain-specific theory of instruction for mathematics, which has been developed in the Netherlands. (Heuvel-Panhuizen et al., 2014:1).. Where is an institution that always tries to find updates in mathematics learning, the institution is Freudenthal Institute pioneered by Hans Freudenthal who is a German / Dutch. Freudenthal has the belief that students not only passively accept the learning provided by the teacher, but students must be allowed to rediscover the mathematical concepts learned through activities they experience in their lives. (Listiana et al., 2022). RME became known in Indonesia when RK Sembiring and Pontas Hutagalung brought the idea back from the ICMI (*International Conference on Mathematical Instruction*) conference in Shanghai, China in 1994 (Hadi, 2017:9).

A learning approach that involves the environment, experience, and daily life of students is the definition of the *Realistic Mathematics Education* (RME) approach. (Febriana 2021:120). In line with Febriana, the RME approach is an approach to learning mathematics that considers mathematics as a human activity and emphasizes contextual meaning in mathematics learning, then in this RME approach, students are expected to be able to think of a problem that is by the environment and everyday life and find a way to solve the problem with help from the teacher through the scaffolding process. (Ahmad & Asmaidah, 2018: 375).

According to Laurens et al, (2018:) *Realistic Mathematics Education* (RME) aims to make learning mathematics at school more interesting, fun, and meaningful for students by introducing the context of mathematics to students. Learning with the RME approach begins by presenting problems that are by the experience and knowledge possessed by students, then the teacher becomes a facilitator to help students solve these contextual problems.

In line with Laurens, Ulandari, et al, (2019: 376) stated "*The Realistic Mathematics Education approach provides an opportunity for students to rediscover mathematical ideas and concepts with adult guidance through exploring various situations and real-world problems*". Principles and Characteristics of *Realistic Mathematics Education* Approach

There are several principles and characteristics in learning mathematics with the RME approach that can distinguish the RME approach from other approaches. Sohilait (2021:9) mentions three main principles in RME: The first principle is called guided *reinvention* and progressive mathematizing, according to this principle learners should be allowed to experience a process similar to the process of mathematical discovery. The second principle relates to the idea of *didactical phenomen*ology, according to didactical phenomenology the situation in which a particular mathematical topic is applied should be investigated for two reasons: to uncover the type of application that should be anticipated in learning and to consider its suitability as an impact point for the progressive mathematization process. The third principle is found in the role of *self-developed models* in bridging the gap between

knowledge, information, and formal mathematics.

According to Wahyudi (2016:51) mathematics learning with the *Realistic Mathematics Education* (RME) approach uses steps: the initial stage is to guide students to be able to understand the problem/context that has been presented by the teacher, the second stage is to explain the contextual problem, this is done by the teacher when students cannot understand the problem properly, then the teacher is expected to explain/understanding to students regarding related problems, the third stage, Learners are guided to be able to solve contextual problems, both individually and in groups, the fourth stage, learners are guided back to compare and discuss the answers that have been completed by students with other students, and the fifth stage, it is hoped that students can conclude problem-solving, concepts, procedures and principles that have been built together.

GeoGebra *software* is a computer program that can be used to combine geometry, calculus, and algebra in one dynamic environment. (Listiana et al., 2022: 41). In line with Listiana, Fitriyana et al., (2020: 3) stated that GeoGebra can help students make it easier to draw a geographic shape in more detail and with a variety of appearances and can also build the creativity of students. Compared to other software, such as *Algebrator, Matlab, Maple, autograph,* and others, GeoGebra has several advantages that make it superior. There are several advantages of GeoGebra *software* (Hidayat & Tamimuddin, 2015: 17-18)namely: it provides worksheet facilities and can be used in analyzing data, because GeoGebra is included in the dynamic geometry software (DGS) and *Computer Algebra System* (CAS) categories, easy to use, free applications for continuous use and the program code is also available so that many people are involved in developing, can be used in various types of computers (*multi-platform*) such as PCs, tablets, smartphones and various computer systems such as Windows, Linux, Unix, Mac OS X and various other *platforms* that can run Java programs, have been translated into more than 35 languages, there are forums on the internet for GeoGebra software development and provide solutions to problems.

3. RESEARCH AND METHOD

The type of research used is Research and Development Research and Development (R&D). Research methods (R&D) are research methods used to produce certain products, and test their feasibility and effectiveness so that they become products that can be utilized Sugiyono (2018:407). Research and Development Model The Research and Development (R&D) used is the ADDIE (Analysis, Design, Development, Implementation and Evaluation) development model. The ADDIE development model was developed by Reiser and Mollenda in the 1990s (Supardi, 2020:43). This research aims to produce an independent curriculum teaching module product based on a realistic mathematics education (RME) approach integrated with GeoGebra software that is valid on vector material. This research was carried out at SMAN 1 Muara Batu. The reason the researcher chose to conduct research was because there were no independent curriculum teaching modules that were used using the RME approach and they had never used the GeoGebra software learning media in mathematics learning activities at the school. Small group trials were carried out by testing the product on 9 students of class with a large group (class) of 33 students from class X Science and Technology 4 at SMAN 1 Muara Batu

Data analysis method

The reason the researchers chose to conduct research at SMAN 1 Muara Batu is because there is no independent curriculum teaching module used using the RME approach and never used GeoGebra *software* learning media in mathematics learning activities at the school, and the location of the school is close to the researcher's residence. The development

of an independent curriculum teaching module based on the *Realistic Mathematics Education* (RME) approach assisted by GeoGebra *software* on vector material uses the ADDIE development model (*Analysis, Design Development, Implementation,* and *Evaluation*).

To determine the validity (feasibility) of the teaching module developed. The formula used to calculate the expected percentage value of the Likert scale results of the teaching module validity assessment is:

$$Percentage = \frac{score\ obtained}{highest\ score}\ x\ 100\%$$

The interval for determining the criteria for the validity of the teaching module based on the percentage obtained from the assessment of the validity of the teaching module developed is asfollows:

Table 1. Criteria for the Validity of the Independent Curriculum Teaching Module

Interval	Validity Criteria
90% - 00%	Very Valid
70% - 89%	Valid
50% - 69%	Valid Enough
30% - 49%	Less Valid
20% - 29%	Invalid

Source: (Fitriani & Andriani, 2020: 82)

The analysis of the practicality of this teaching module was carried out to determine whether the teaching module developed was practical to use or not. The practicality of the teaching module is assessed from the results of the Likert scale observation sheet by the observer during learning activities and the results of the positive response of students. The formula used to calculate the expected percentage value of the Likert scale results of the assessment of the sustainability of learning with teaching modules in terms of the results of the observer sheet is:

$$Percentage = \frac{score\ obtained}{highest\ score}\ x\ 100\%$$

The interval for determining the criteria for assessing the implementation of learning with teachingmodules based on the percentage obtained from the assessment results is as follows:

Table 2 Criteria for the Practicality of the Independent Curriculum Teaching Module

Interval	Criteria
90% - 100%	Very good
70% - 89%	Good
50% - 69%	Simply
30% - 49%	Less
20% - 29%	Very Less

Source: (Fitriani & Andriani, 2020: 82)

Determining the percentage of learner responses that provide responses in accordance withthe criteria can be determined by the following formula:

$$Percentage = \frac{score\ obtained}{highest\ score}\ x\ 100\%$$

The interpretation of the average questionnaire score using the Likert scale of the developedteaching module is:

Table 3. Categories of Learner Response in Learning Activities

Percentage of learner response	Category
81-100	Very positive
61-80	Positive
41-60	Positive enough
21-40	Not positive
0-20	Not very positive

Source: (Hasibuan et al., 2020: 92)

Learning devices are categorized as effective if the learning outcomes using the developed learning devices achieve classical student learning completeness. Hasibuan et al., (2020: 92). Before looking for the results of classical student learning completeness, what must be done first is to determine individual learning completeness. The results of students' learning completeness are obtained from the results of students' learning achievements during the learning process, whether the participants' scores have met the KKM at school or not. The KKM at SMAN 1 Muara Batu class X math lesson is 75. The value given will be adjusted to the assessment criteria in the teaching module. To find the results of learning completeness (individual) the formula is used:

$$PKB = \frac{T}{T_i}\ x\ 100\%$$

Description:
PKB : Percentage of Learning Completeness
T : Number of scores obtained by students
T_i : Total score

Table 4. Criteria for Individual Learning Completeness of Students

Interval	Criteria
0% ≤ PKB< 75%	Students have not completed their learning
75% ≤ PKB≤ 100%	Students complete learning

Source: (Hasibuan et al., 2020: 92)

After getting the results of individual student learning completeness, then determining the results of classical learning completeness. The results of classical student learning completeness can be calculated using the formula:

$$PKK = \frac{\sum x_i}{n_i} \; x \; 100\%$$

Description:

PKK	: Percentage of Classical Completeness
$\sum x_i$	: Number of students who complete learning
n_i	: Total number of students

The development of teaching modules based on the *Realistic Mathematics Education* (RME) approach integrated with GeoGebra *software* is said to be effective if the results of classical studentlearning completeness reach at least 75% (Hasibuan et al., 2020: 92).

4. RESULT AND DISCUSSION

Curriculum analysis was conducted to find out how the learning system applied at SMAN 1 Muara Batu. From the results of the interview, it was obtained that currently SMAN 1 Muara Batu has implemented the independent curriculum starting from the 2022/2023 school year where previously the school implemented the 2013 curriculum as a reference for learning activities. This curriculum change was carried out by the government's direction as an effort to overcome the learning crisis that has been ongoing in Indonesia since COVID-19.

Analysis of learning tools is done by reviewing the needs of students and identifying learning tools used by teachers in the process of learning mathematics in the classroom, especially on vector material. Researchers interviewed one of the math teachers there to identify the learning tools used,one of which is teaching modules and learning media. During the interview with the teacher, he said that the independent curriculum teaching module used by the teacher was still using the independent curriculum teaching module downloaded from the internet with little development and the teacher had not utilized learning media that could support learning activities to be easier and more enjoyable. The teaching modules used are still not varied using learning approaches or learning media that can help to arouse students' enthusiasm in the mathematics teaching and learning process.

Based on the results of the needs analysis obtained, it can be concluded that a learning tool is needed that uses a learning approach and supporting media so that it can make the learning process more interesting and easy for students to understand. The learning tool that can be developed is an independent curriculum teaching module based on the *Realistic Mathematics Education* (RME) approach integrated with GeoGebra *software*.

Based on the results of researchers' observations of the mathematical ability of vector material in 20 students of class XII IPA 2, it turns out that researchers obtained only 30% (6 students) who could solve the problem correctly, while other students were still unable to solve the problem. Therefore, it is necessary to develop teaching modules that will be used as a reference in the learning process into teaching modules using the right learning approach and utilizing the use of learning media.

The independent curriculum teaching module is divided into 3 components, namely the introduction, this component, and the closing. Each component has the following subsections:

- General information contains subcomponents such as module author identity, initial competencies, Pancasila learner profile, facilities and infrastructure, target learners, and learning model.
- The core component contains subcomponents such as learning objectives, understanding meaning, triggering questions, learning activities, assessment,

enrichment, and remedial.

- The Appendix component contains subcomponents such as reading materials, Learner Worksheets (LKPD), glossary, and bibliography.

After the teaching module is designed, the next stage is the development stage. At this third stage, the development of teaching modules based on the *Realistic Mathematics Education* (RME) approach integrated with GeoGebra *software* on vector material was carried out. The steps taken in the development are drafting teaching modules, editing teaching module drafts, teaching module validation, teaching module revision, and small group trials. The results of these steps include: the teaching module design that has previously been designed is arranged by describing all the parts that must be in the teaching module.

In the independent curriculum teaching module developed, there are learning steps and theuse of GeoGebra adapted to the RME approach. The following are the details of the assessment results by material expert validators for all aspects of the material validation assessment can be seen in the table below:

Table 5. Average Material Expert Validation Results

Aspects	Average score	Percentage %	Criteria
Material assessment	3,75	93,75	Very valid
Presentation feasibility	3,6	90	Very valid
Assessment of independent curriculum teaching modules	3,6	90	Very valid
RME Assessment	3,6	90	Very valid
GeoGebra *software* Assessment	3,625	90,62	Very valid
Average	**3,635**	**90,87%**	**Very valid**

Data analysis of the average validation results conducted by material experts can be seen in Figure 1 below:

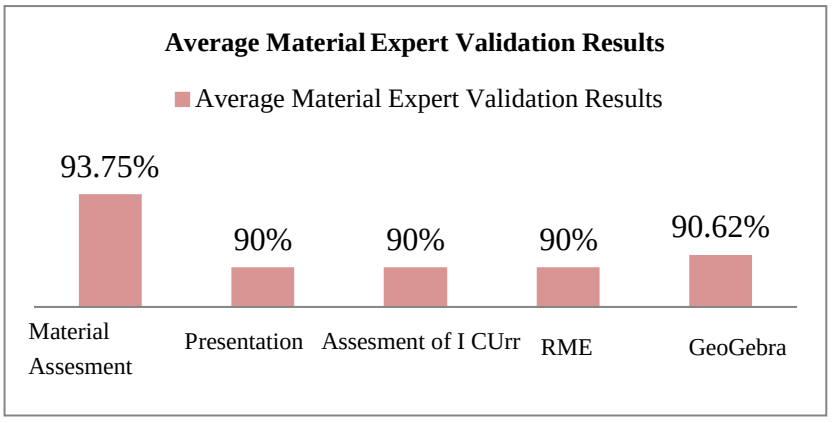


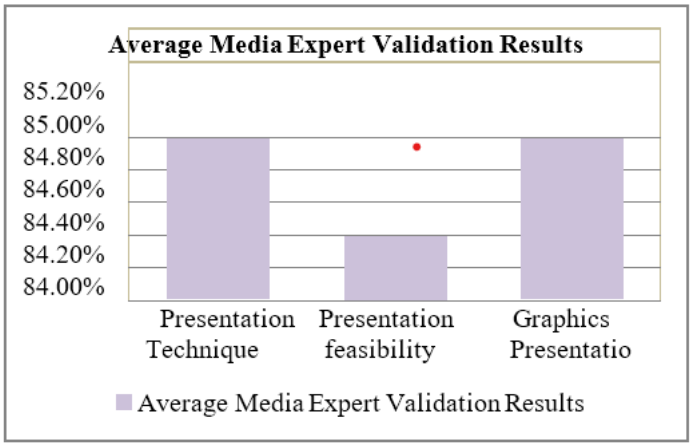
Figure 1 Diagram of Average Material Expert Validation Score

In the independent curriculum teaching module developed, there are media or images contained in the sheets. The following are details of the assessment results by media expert validators:

Table 6. Average Media Expert Validation Results

Aspects	Average score	Percentage %	Criteria
Presentation technique	3,4	85	Valid
Presentation feasibility	3,37	84,37	Valid
Graphics feasibility	3,4	85	Valid
Average	**3,39**	**84,79%**	**Valid**

Thus the media or images contained in the teaching module sheets developed are very valid/fit for testing. Data analysis of the average validation results conducted by media experts canbe seen in Figure 2 below:



To be considered valid, the criteria for the validity of the teaching module developed must reach at least the valid level category. The small group trial was conducted after the independent curriculum teaching module developed was revised and declared valid by the validator. The small group trial was conducted on 9 students of class XI MIA 5 SMAN 1 Muara Batu. The results of the response questionnaire areas follows:

Table 7. Results of Small Group Trial Learner Responses

No.	Learner's initials	Total	Average score	Percentage %	Criteria
1	KR	67	3.72	93,05	Very positive
2	US	69	3.83	95,83	Very positive
3	NR	69	3.83	95,83	Very positive
4	UN	63	3.5	87,5	Very positive
5	US	68	3.77	94,44	Very positive
6	DF	70	3.88	97,22	Very positive
7	CF	71	3.94	98,61	Very positive
8	ASA	72	4	100	Very positive
9	NI	62	3,44	86,11	Very positive
Average		**67,88**	**3,77**	**94,29%**	**Very positive**

At the implementation stage, a large group trial was conducted to get the response of students and observers to the continuity of learning to see the practicality of the teaching module developed. Based on the results of the percentage of responses from 33 students, an average percentage of 81.94% was obtained with very positive criteria. The diagram of the results of the large group trial for students' responses can be seen:

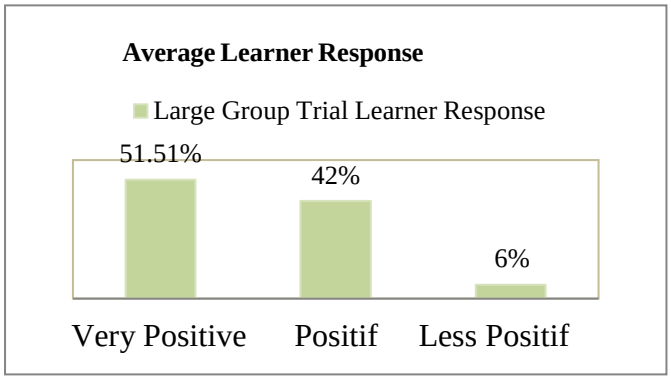


Figure 3. Average Diagram of Large Group Learner Response

In addition to the results of students' responses, observer responses to learning continuity are also needed to be a practical assessment of this independent curriculum teaching module. In this case, 3 people became observers, and the observer's response to learning continuity can be seen in the following table:

Table 7. Results of Observer Responses to Learning Sustainability

Observer	Total	Average score	Percentage %	Criteria
O_1	73	3.47	86,90	Good
O_2	78	3.71	92,86	Very good
O_3	79	3.76	94,05	Very good
Average	**76,66**	**3,65**	**91,26%**	**Very good**

This has met the practical criteria for developing teaching modules, so it can be concluded that the teaching module for the independent curriculum based on the GeoGebra-integrated RME approach is very practical to be applied to mathematics learning, especially on vector material.

At the large group trial stage, the results of classical student learning completeness were also seen to conclude whether this teaching module was effective or not to be used during the learning process specifically on vector material. from the average number of LKPD 1, and LKPD 2 scores, and the final evaluation test of students. The results of individual student learning completeness can be seen in the table below:

Table 8. Results of Individual Learning Completeness

No.	Learner's initials	LKPD 1	LKPD 2	Test Results	Total	Percentage %	Criteria
1	MY	95	80	75	250	83.33	Completed
2	CID	95	80	90	265	88.33	Completed
3	SSa	95	80	80	255	85	Completed
4	Ra	95	80	88	263	87.66	Completed
5	Mhr	95	80	75	250	83.33	Completed
6	AT	95	80	95	270	90	Completed
7	Ard	95	80	70	245	81.66	Completed
8	MS	90	80	80	250	83.33	Completed
9	UN	90	80	95	265	88.33	Completed
10	ARi	90	80	85	255	85	Completed
11	MF	90	80	65	235	78.33	Completed
12	RAr	90	80	70	240	80	Completed
13	ZA	90	80	90	260	86.66	Completed
14	MK	90	80	70	240	80	Completed
15	ARa	100	95	90	285	95	Completed
16	TA	100	95	90	285	95	Completed
17	Mta	100	95	100	295	98.33	Completed
18	MI	100	95	80	275	91.66	Completed
19	TAF	100	95	85	280	93.33	Completed
20	CRD	100	95	89	284	94.66	Completed
21	IM	100	95	87	282	94	Completed
22	Nfa	100	100	100	300	100	Completed
23	SSy	100	100	100	300	100	Completed
24	SU	100	100	90	290	96.66	Completed
25	SNA	100	100	88	288	96	Completed
26	VWS	100	100	85	285	95	Completed
27	ARl	100	100	95	295	98.33	Completed
28	AM	95	80	70	245	81.66	Completed
29	LA	95	80	80	255	85	Completed
30	Mnr	95	80	85	260	86.66	Completed
31	NdF	95	80	90	265	88.33	Completed
32	NAS	95	80	100	275	91.66	Completed
33	UK	95	80	89	264	88	Completed
Total		**3165**	**2865**	**2821**	**8851**	**2950.33**	**Completed**
Average		**95.90**	**86.81**	**85.48**	**268.21**	**89.40**	**Completed**

Based on the results of individual learning completeness, the percentage of 33 students obtained an average percentage of 89.40% with complete criteria. With the results of individual learning completeness, the results of classical completeness can be determined. The following is the result of classical learning completeness can be seen in the following table:

Table 9. Results of Classical Learning Completeness

Number of Completers	Number Who Have Not Completed	Number of Learners	Percentage %	Criteria
33	0	33	100	Completed

Based on the table above, it is known that classical learning completeness obtained a percentage of 100% with complete criteria. The development of teaching modules based on the *Realistic Mathematics Education* (RME) approach integrated with GeoGebra *software* is said to beeffective if the results of classical student learning completeness reach at least 75%. So because the results of classical student learning completeness reach more than 75%, the independent curriculum teaching module based on the *Realistic Mathematics Education* (RME) approach integrated with GeoGebra *software* is effective for use in the learning process, especially on vectormaterial.

The evaluation stage is the final stage of this development. After the validation and implementation stages of the independent curriculum teaching module based on the *Realistic Mathematics Education* (RME) approach integrated with GeoGebra *software*, the teaching module has been declared valid for material and media experts. The teaching modules developed also obtained very positive response results from students and very good responses by observers which showed that the teaching modules developed were very practical to use. In addition, the use of this teaching module also produces classical student learning completeness, which shows that the teaching module developed has been effectively applied to the learning process, especially in vector material. So from the results obtained, it can be stated that the teaching module of the independent curriculum teaching module based on the *Realistic Mathematics Education* (RME) approach integrated with GeoGebra *software* on vector material has been developed and completed to produce a final product.

The research procedure in this study uses the ADDIE development model which consists of five stages which include: *analysis*, *design*, *development*, *implementation*, and *evaluation*. In the early stages of development, researchers first analyzed observations and interviews of learning device needs and gave test questions to determine the ability of students to solve vector problems to XII IPA 2 class students who had previously learned vector material.

The results of the initial analysis show that the school still uses textbooks provided by the school as the main learning resource in the learning process, learning tools such as teaching modules are also still using teaching modules downloaded from the internet with little development and do not use models or learning approaches that can support learning activities to be more interesting. The available school facilities have also not been utilized properly so students feel bored whenlearning takes place, as a result, students' understanding of vector material is still very poor. This is evidenced by the results of the researcher's observations, namely from 20 students who were given test questions on vector material, only 30% (6 people) could solve it correctly. Based on the results of the analysis, researchers developed a teaching module based on the RME approach integrated with GeoGebra at SMAN 1 Muara Batu.

After knowing the problems and design solutions from researchers, researchers continue the development stage at the second stage, namely the design stage. At this stage, researchers prepare references that can be used as a reference source for materials and questions that will be used in reading materials and LKPD in teaching modules. In addition, researchers also compiled a teaching module framework to be developed. The framework starts with general information, core components, and attachment components. Researchers also compiled teaching module assessment instruments that would be used to assess the validity of the teaching modules developed by the pre-existing assessment grids. The validation sheet, the assessment instrument also includes an observer's assessment sheet for learning continuity and a student response questionnaire sheet. Furthermore, the assessment instrument that has been prepared by the researcher will be validated by the supervisor to get a valid assessment instrument.

5. CONCLUSSION

Researchers have carried out every process in the research on the development of independent curriculum teaching modules based on the *Realistic Mathematics Education* (RME) approach integrated with GeoGebra *software* on this vector material. So based on the data that has been obtained on the results and discussion of the development of an independent curriculum teaching module based on the RME approach integrated with GeoGebra on class X vector material at SMAN 1 Muara Batu, it can be concluded as follows:

1. The validity of the independent curriculum teaching module based on the *Realistic Mathematics Education* (RME) approach integrated with GeoGebra *software* on vector material was validated by material and media expert validators. The results of the material expert validation test (V1) and (V2) obtained an average percentage of 90.87% with very valid criteria, and for the results of the media expert validation test (V3) and (V4) obtained an average percentage of 84.79% with valid criteria. Thus the independent curriculum teaching module based on the *Realistic Mathematics Education* (RME) approach integrated with GeoGebra *software* on vector material is "valid" to be used in the process of learning mathematics at school, especially on vector material.
2. The practicality of the teaching module of the independent curriculum based on the *Realistic Mathematics Education* (RME) approach integrated with GeoGebra *software* on vector material is obtained from the results of positive student responses and good observer responses to learning continuity. The results of the student response questionnaire in the large group trial obtained an average percentage of 81.94% with very positive criteria and the results of the observer's response to learning continuity obtained an average percentage of 91.26% with very good criteria. Thus, the independent curriculum teaching module based on the *Realistic Mathematics Education* (RME) approach integrated with GeoGebra *software* on vector material is "very practical" to be used in the process of learning mathematics at school, especially on vector material.
3. The effectiveness of the independent curriculum teaching module based on the *Realistic Mathematics Education* (RME) approach integrated with GeoGebra *software* on vector material is obtained from the results of classical student learning completeness. The teaching module is said to be effective if the results of students' learning completeness reach at least 75%. The results of students' learning completeness in this study reached an average of 100% with complete criteria. Thus the teaching module of the independent curriculum based on the *Realistic Mathematics Education* (RME) approach integrated with GeoGebra.

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