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The Need Analysis of Learning Module Development Using Self Organized Learning Environment (Sole) Assisted by Augmented Reality on Rotational Dynamics and Rigid Body Equilibrium

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Abstract

This study aims to analyze the need for the development of learning module using the *Self Organized Learning Environment* (SOLE) model assisted by *Augmented Reality* on rotational dynamics and rigid body equilibrium. This type of research is a survey research and literature study which later can be the basis for further development research. The research instrument used was a needs analysis questionnaire with 20 questions given to 72 respondents who were students and 3 respondents who were teachers of class XI MIPA from SMA Negeri 5 Bengkulu City, SMA Negeri 4 Bengkulu City and SMA Negeri 9 Bengkulu City. In this research the data analysis uses descriptive statistics. Based on the results of the data obtained it can be concluded that currently students are in dire need of computer-based learning media, one of which is by using Augmented Reality. This is based on data obtained that 76,26 % of students answered Strongly Agree and 77,92 % of teachers answered Strongly Agree to the need for the development of the development of learning module using the *Self Organized Learning Environment* (SOLE) model assisted by *Augmented Reality* on rotational dynamics and rigid body equilibrium. We know that the development of digital technology in the current Industrial 4.0 era has brought changes and influenced various aspects of human life, including in the field of education. Augmented Reality are technologies that can be developed to provide alternative instructional media provided previously and to see the effectiveness of these media if used in learning activities.

Keywords**:** *Augmented Reality, learning media, Self Organized Learning Environtment (SOLE)*

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Introduction

Law No. 20 of 2003 on National Education System, Article 1 section 1 states that education is a conscious and planned effort to create an atmosphere of learning and the learning process so that students actively develop their potential to have religious spiritual strength, self-control, personality, intelligence, noble character, and skills needed by themselves, society, nation and state (Putri, Risdianto, Rohadi, 2019).

In learning, one of the most needed components is teaching materials. Teaching materials are all materials (both information, tools, and texts) arranged systematically, which displays a complete figure of the competencies that will be mastered by students and used in the learning process with the aim of planning and studying the implementation of learning, for example textbooks, modules, handouts, worksheets, models or miniatures, audio teaching materials, interactive teaching materials and so on (Prastowo, 2015).

Module is a learning unit that is arranged systematically, directed, operationally using language that is easy to understand to support the independent and conventional learning process to achieve learning objectives (Handayani & Nursetiwati, 2020)

Making teaching materials in the form of learning modules can be done using technology in the field of education because technology in teaching assist the students in learning (Anggitasari, et al. 2020; Azwandi, et al. 2020; Handayani, et al. 2020; Septinawati, et al. 2020; Syafryadin, et al. 2021), one of which is the use of Augmented Reality technology. Augmented Reality is a technology that combines computer-made objects, two-dimensional or three-dimensional, into the real environment around the user in real time. AR-displayed objects assist the user in generating new perceptions that allow them to interact with the real environment (Ani, 2019).

The advantages of Augmented Reality are as follows: (1) the interaction feels so real, because the virtual object is shown in real time to the user's device screen, users can interact with these virtual objects directly. (2) cheaper implementation, AR does not require a special device which of course makes implementing an AR system much cheaper. (3) There is less likelihood to jam in the displayed system, AR-based systems, the system will only render a specific object when viewing a sign or at the right location. This of course makes the AR system much lighter, the possibility of system jamming when running is much smaller [5]. While the disadvantages of Augmented Reality are: 1) Sensitive to changes in perspective, 2)

There aren't too many makers yet, 3) Requires a lot of memory on the installed equipment (Irzain, et al. 2017).

In Ministrial Decree of Education and Culture of the Republic of Indonesia Number 65 of 2013, The Basic Framework and Structure of the Senior High School Curriculum that the 2013 Curriculum is developed by improving the mindset related to learning patterns, that is: (1) learner-centered; (2) interactive learning (interactive teacher-students-community-natural environment, sources / other media); (3) learning is designed in a networked way (students can gain knowledge from anyone and from anywhere that can be contacted and obtained via the internet); (4) learning is active-seeking (active learners seeking are further strengthened by the learning model of the scientific approach); (5) group learning (team based); (6) multimedia-based learning; (7) learning based on customer needs (users) by strengthening the development of the special potential that each student has; (8) learning patterns become multidisciplines; and (9) critical learning (Kemendikbud, 2013).

With the learning module, students can learn independently, in other words, learning is carried out using the *Self Organized Learning Environment* model (SOLE). *Self-Organized Learning Environments* (SOLE) is a learning model in which students organize themselves in groups and learn using computers connected to the internet with minimal teacher support. The *Self Organized Learning Environment* (SOLE) learning model focuses on the independent learning process carried out by anyone who wishes to learn by utilizing the internet and their smart devices. The competencies expected through the SOLE learning model, are (1) creative thinking, (2) critical thinking and (3) communicate capability (Mitra & Crawley, 2014).

Based on preliminary observations made at SMA Negeri 5 Kota Bengkulu, SMA Negeri 4 Kota Bengkulu and SMA Negeri 9 Kota Bengkulu, it is known that modules are one of the teaching materials that are very rarely used by teachers in the learning process. Classroom learning is only limited to material in textbooks, while the number of textbooks available in schools is very inadequate. This condition causes learning to be less effective because most students do not have books as a learning resource. Reflecting on these problems, it is necessary to think about what solutions are appropriate and can be offered to overcome existing problems. The researcher try to provide recommendations for the development of learning modules as a solution. But before that, the researcher must first analyze the students' needs for the development of learning modules as alternative teaching

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materials that can be used later. Therefore, the formulation of the problem of this research is the need to develop a learning module using the *Self Organized Learning Environment* (SOLE) learning model assisted by *Augmented Reality*. So based on the formulation of the problem, the purpose of this study is to analyze the needs of students for the development of learning modules using the *Self Organized Learning Environment* (SOLE) learning model assisted by *Augmented Reality* on rotational dynamics and rigid body equilibrium.

Research Method

The study was conducted in 3 schools, that is SMA Negeri 5 Kota Bengkulu, SMA Negeri 4 Kota Bengkulu and SMA Negeri 9 Kota Bengkulu in November-December 2020. The population taken was all students and physics teachers of class XI Mathematical and Natural Science of senior Highschool in Bengkulu City with a sample of 72 students and 3 physics teachers who each came from class XI MIPA in SMA Negeri 5 Kota Bengkulu totaling 29 students and 1 teacher, SMA Negeri 4 Bengkulu City totaling 28 students and 1 teacher and SMA Negeri 9 Bengkulu City totaling 15 students and 1 teacher. The data collection techniques used in this needs analysis research consisted of three parts, which was observation of the implementation of learning, student and teacher response questionnaires and literature study. The research instruments used in this needs analysis research were observation sheets, student and teacher questionnaire sheets and literature related to the development of learning modules using the *Self Organized Learning Environment* (SOLE) learning model assisted by *Augmented Reality* on rotational dynamics and rigid body equilibrium. The data analysis technique used was descriptive statistical analysis. Needs analysis was performed on the data obtained in the form of a percentage. The percentage was obtained based on the modified Likert scale calculation. With a Likert scale, the variables to be measured were translated into variable indicators.

Furthermore, these indicators are used as guidelines in compiling items in the form of questions or statements. For positive sentences, each instrument item is given a quantitative value as in Table 1 below:

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Table 1 Likert Scale Calculation

Assessment	Scale Value
Strongly agree	4
Agree	3
Disagree	2
Strongly disagree	1

Whereas for negative sentences, the score is the opposite (Risdianto & Kusuma, 2016).

To calculate the percentage using a formula:

$$\text{interpretation of scores (\%)} = \frac{\text{Posotive Statements} + \text{Negative Statements}}{\text{Total Maximum}} x100\%$$

Table 2 Interpretation of Student Response Scores (Sugiyono, 2010).

Percentage (%)	Category
0 % - 25 %	Strongly Disagree
26 % - 50 %	Disagree
51 % - 75 %	Agree
76 % - 100 %	Strongly Agree

Result and Discussion

Needs analysis aims to collect information about the problems contained in learning physics and their causes, the implementation of learning and the obstacles that occur, the use of teaching materials and their shortcomings (Yudhi, 2017). The results of the needs analysis are used as the basis for determining alternative solutions and recommendations for the specifications of the learning modules to be developed. In the observations that have been carried out that all schools have used the 2013 curriculum. The teaching materials used are still using printed books from schools. The learning models used are various, such as *Blended Learning, Discovery Learning* and so on, but the material delivery system uses more conventional learning methods such as lectures and the use of technology-based learning media is not so much. So, in the learning process there was little response and enthusiasm of students when learning physics.

Based on observations at school students need a learning module using the *Self Organized Learning Environment* (SOLE) learning model which contains the stages of *question, investigation* and *review* and is assisted by Augmented Reality to arouse students'

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enthusiasm in the learning process. Analysis of the student needs questionnaire is used to strengthen the results of researchers' observations on solutions in the implementation of learning, which is the development of learning modules using the *Self Organized Learning Environment* (SOLE) model assisted by *Augmented Reality* on rotational dynamics and rigid body equilibrium. The questionnaire was filled in by 72 students of class XI MIPA at SMAN 5 Bengkulu City, SMAN 4 Bengkulu City and SMAN 9 Bengkulu City as many as 72 students and 3 physics teachers.

Based on the results of filling out a questionnaire on the analysis of the needs for module development, an overview of students' responses to physics subjects used 4 statements which all fell into the agree and strongly agree categories as shown in table 3.

Table 3 Student Responses to Physics Subjects

Statements	Percentage		Criteria
	+	-	
Students do not like physics lessons		69,44 %	Agree
Students feel bored when physics learning is in progress		71,20 %	Agree
Students cannot understand physics material well during learning		59,72 %	Agree
Students have difficulty learning the material on Rotational Dynamics and Rigid Body Equilibrium		55,20 %	Agree

Meanwhile, the description of the teacher's response to physics subjects uses 3 statements which all fall into the agree and strongly agree categories as shown in table 4.

Table 1 Teacher Response to Physics Subjects

Statements	Percentage		Criteria
	+	-	
Teachers sometimes find it difficult to teach physics		50 %	Disagree
Teachers sometimes find it difficult to explain the dynamics of rotational and rigid body equilibrium		66,66 %	Agree
Teachers find it difficult because teaching materials and learning media are inadequate		50 %	Disagree

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An overview of student responses to the experience of using teaching materials, learning models and learning media uses 6 statements and the two statements fall into the strongly agree category as shown in table 5.

Table 2 Student responses to experiences using teaching materials, learning models and learning media in class

Statements	Percentage		Criteria
	+	-	
Teachers always use textbooks	63,54 %		Agree
All students have textbooks to support the learning process in the classroom	83,33 %		Strongly Agree
Teachers rarely provide modules when learning physics		70,49 %	Agree
Physics learning in schools is carried out by combining face-to-face learning with independent learning outside the classroom	72,22 %		Agree
The modules used in schools have not used the SOLE Learning Model		55,55 %	Agree
The modules used in schools have not made learning videos that can be accessed with Android / Smartphone / Mobile		57,99 %	Agree

Meanwhile, the description of the teacher's response to the experience of using teaching materials, learning models and learning media uses 9 statements and the two statements fall into the strongly agree category as shown in table 6.

Table 3 Teacher responses to the experience of using teaching materials, learning models and learning media

Statements	Percentage		Criteria
	+	-	
Every meeting in the physics learning process the teacher always provides teaching materials to students	75 %		Agree
The teaching materials provided are in the form of learning modules	66,66 %		Agree
Teachers always make Learning Modules according to the needs of students	66,66 %		Agree
During the physics learning process the teacher uses the lecture method, the Problem Based Learning model (problem-based learning), or others.	75 %		Agree
The method or model that the teacher uses has helped students understand the material	66,66 %		Agree

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The teacher once used SOLE (*Self Organized Learning Environment*) based learning models in the physics learning process	50 %	Disagree
Teachers always use learning media when learning Physics	83,33 %	Strongly Agree
Teachers always make use of the Internet when learning Physics	75 %	Agree
The teacher has used Augmented Reality media when teaching Physics	50 %	Disagree

An overview of student responses to the learning module using the SOLE model assisted by Augmented Reality on the material of rotational dynamics and rigid body equilibrium to be developed is shown through 10 statements which all fall into the agree and strongly agree categories as shown in table 7.

Table 4 Student Responses to Learning Modules using the SOLE Model assisted by Augmented Reality on Rotational Dynamics and Rigid Body Equilibrium to be Developed

Statements	Percentage		Criteria
	+	-	
Students need other teaching materials as an alternative to the currently available teaching materials	86,11 %		Strongly Agree
Students need teaching materials using the SOLE Learning Model	80,20 %		Strongly Agree
Students need teaching materials that contain videos and images that can be accessed with Android / Smartphone / Mobile	85,76 %		Strongly Agree
Students need teaching materials that use Augmented Reality (which contains videos and images) that can be accessed with Android / Smartphone / Mobile	81,60 %		Strongly Agree
Students need teaching materials that can help me in face-to-face learning and independent study outside the classroom	88,88 %		Strongly Agree
Students need an interesting Physics Learning Module to help understand the subject matter	89,93 %		Strongly Agree
Students need a Physics Learning Module as a learning resource that can help me understand the Rotational Dynamics and Rigid BBody equilibrium	89,23 %		Strongly Agree
Students need teaching materials that can train me in providing simple explanations about Rotational Dynamics and Rigid Body equilibrium	89,93 %		Strongly Agree

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Statements	Percentage		Criteria
	+	-	
Students need other teaching materials as an alternative to the currently available teaching materials	86,11 %		Strongly Agree
Students need teaching materials using the SOLE Learning Model	80,20 %		Strongly Agree
Students need teaching materials that contain videos and images that can be accessed with Android / Smartphone / Mobile	85,76 %		Strongly Agree
Students need teaching materials that can train me to think critically about the Rotational Dynamics and Rigid Body Equilibrium	88,88 %		Strongly Agree
Students encourage the development of learning modules using the SOLE (Self Learning Environment) model assisted by Augmented Reality on Rotational Dynamics and Rigid Body Equilibrium	86,11 %		Strongly Agree

Students encourage the development of learning modules using the SOLE (Self Learning Environment) model assisted by Augmented Reality on Rotational Dynamics and Rigid Body Equilibrium.

Table 5 an overview of the teacher's response to the learning module using the SOLE model assisted by Augmented Reality on the material of rotational dynamics and rigid object balance to be developed

Statements	Percentage		Criteria
	+	-	
Teachers need the latest Learning Modules that suit the needs of students and the 2013 Curriculum	100 %		Strongly Agree
Teachers need a Learning Module with the latest learning models that can help in teaching	100 %		Strongly Agree
Teachers need SOLE-based Learning Media (*Self Organized Learning Environment*) to assist in teaching	91,66 %		Strongly Agree
Teachers need the latest learning media to make students interested in learning physics	100 %		Strongly Agree
Teachers need Augmented Reality-assisted learning media as the latest media for teaching that can be accessed with Android / Smartphone / Mobile	100 %		Strongly Agree
The teacher supports the development of learning modules using the SOLE (Self Learning Environment) model assisted by	100 %		Strongly Agree

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Statements	Percentage		Criteria
	+	-	
Teachers need the latest Learning Modules that suit the needs of students and the 2013 Curriculum	100 %		Strongly Agree
Teachers need a Learning Module with the latest learning models that can help in teaching	100 %		Strongly Agree
Augmented Reality on Rotational Dynamics and Rigid Body Equilibrium			

Based on the analysis of the student needs analysis questionnaire, it was found that 76.26% of students strongly agreed and 77.92% of teachers strongly agreed the need for the development of learning modules using the *Self Organized Learning Environment* (SOLE) learning model assisted by *Augmented Reality* on Rotational Dynamics and Rigid Body Equilibrium. Apart from using the needs analysis questionnaire data, the research results were also obtained by conducting a literature study on previous research related to the research topic being carried out, some of the literature studied is as follows: 1) Research by (Aris Dermawan Siahaan, Rosane Medriati, Eko Risdianto, 2019) on practicum guides using augmented reality technology that has been developed is in the very good category with an average percentage of 86.74% of 100% (Siahaan, et al. 2019). 2) Research by (Isnawati Amir, 2017) on the development of textbooks and Augmented Reality on the concept of high school storytelling with an average score of 4.3 valid categories of 2 validators and the average prescription of teacher response scores of 4.4 (good category)(Isnawati, 2017). 3) Research by (Daniel Indrayana, 2019 & Fatwatush, 2019) on the design of a web-based SOLE (*Self Organized Learning Environment*) learning system with VAK learning styles to improve cognitive understanding of students who get a student response percentage of 86.09% which is in the "Very Good" category (Daniel, 2019). Research by (Scholihah Ana Fatwasuh, 2019) on SOLE (*Self Organized Learning Environment*) Learning in Completion of Tasks at SMP Negeri 9 Semarang shows that SOLE learning can develop response compilation, higher-order thinking, task completion strategies and into mastering student material.

Overall, both from survey data through questionnaires or literature studies state that it is necessary to develop a learning module using the *Self Organized Learning Environment* (SOLE) learning model assisted by *Augmented Reality* on Rotational Dynamics and rigid Body Equilibrium.

Conclusion

Based on the research that has been done, it can be concluded that the development of learning modules using the *Self Organized Learning Environment* (SOLE) model assisted by *Augmented Reality* on Rotational Dynamics and Rigid Body Equilibrium is needed. For further research, the number of samples taken could be even more and from different schools.

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