E-MODULE USING COMPUTATIONAL THINKING APPROACH ON CIRCULAR MOTION FOR HIGH SCHOOL STUDENTS

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Abstract. In the 2022 PISA survey, the survey stated that Indonesian students were ranked very low in the three existing categories, namely mathematics, science and reading. Computational thinking can be developed to answer the challenges of the 21st century and have a good effect on physics teaching because it is closely related to calculations. Therefore, there is a need for innovation to increase student learning literacy by using a computational thinking approach that is in accordance with the current curriculum. The aim of this research is explaining the product and feasibility of e-modules using a computational thinking approach on circular motion material for high school students.. The method used in this research consists of 3 stages of planning, creation and assessment by validators. This product bagian sintaks co,mputational thimking The data analysis used in the research is quantitative analysis and explained in qualitative descriptions. The total score obtained is 169 out of 172, so this product is feasible and can be used in learning to improve students' literacy skills using a computational thinking approach.

Keywords: e-module, Computational Thinking,circular motion

INTRODUCTION

The results of the Program for International Student Assessment (PISA) survey stated that Indonesia had an unsatisfactory ranking. The 2022 survey stated that Indonesian students were ranked very low in three existing categories, namely mathematics, science and reading, in the reading category Indonesia was ranked 12th lowest (70th out of 81 countries) with an average score of 371 which means it has decreased if previously in 2015 it was ranked 64th, in the mathematics category it was ranked 13th lowest (69 out of 81 countries) with an average score of 379 which means it also experienced a decrease compared to 2015, Indonesia was ranked 63rd and in the science category, Indonesia was in the 15th lowest ranking (67th out of 81 countries) with an average score of 396. In this category, Indonesia also experienced a decline compared to the previous year in 2015, Indonesia was ranked 62nd. This is also in line with Mardhiyah (2021) Education in Indonesia is a country where the quality of education is still relatively low compared to other countries. As time goes by, students' abilities need to be improved with new approaches to student learning. Entering the 21st century, computational thinking has become a basic skill that all students must have, such as the ability to read, write and count. Developing computational thinking as an answer to the challenges of the times certainly has its own impact on physics considering that computational thinking is closely related to calculation algorithms (Weintrop, 2016). As time goes by, the field of education really needs changes that can adapt to current developments. Many things must be adjusted, such as learning media, teaching materials and how to teach them to students to answer the increasingly stringent challenges of the times (Mardhiyah, 2021). One tool that can be used is to use learning modules (Sukimiandari, 2015). E-module was chosen because it has many advantages. including making the learning process more interesting, interactive, can be done anytime and anywhere and can improve the quality of learning (Cecep & Bambang, 2013)

Learning physics can have the meaning of a learning process to study various events that exist in the universe and life. Teachers can make efforts to help students understand the nature of physics learning by using various methods and learning tools. Physics learning must essentially include the process and results of studying events in the universe so that it has benefits for students' science process skills and learning outcomes.

A module is a teaching and learning tool in written or printed form that contains learning objectives, indicators to be achieved, methods, learning materials and instructions for using the module so that students can carry out independent learning activities and there are practice questions

to test students' understanding. (Hamdani, 2011). Another opinion expressed by (Harta, 2016) states that a module is a tool or means that contains materials, methods, limitations and evaluations which are arranged mathematically so that the stated goals are achieved. Based on the presentation from various sources, it can be interpreted that a module is a means that contains methods, materials, questions and evaluations that are arranged mathematically to achieve goals and students can also carry out learning activities independently.A module is a type of module that contains writing, images, graphics, animation and video that can be used at various times and places. (Fauziah, 2016). Meanwhile, according to the definition expressed (Herawati and Muhtadi, 2018) E-modules or electronic modules are digital modules that contain written images or both and contain material equipped with simulations that can be used in the student learning process. Therefore, E-Module can be interpreted as a digital module that can be used anywhere and at any time. E-Modules can now be displayed in the form of a flipbook. According to (Diena, 2010) Flipbook is a classic type of animation composed of thick book paper, on the pages of which there are moving and animated processes.

According to Daryanto (2013: 9) E-modules are said to be good if they fulfill 4 characteristics including self-instruction, self-contained, stand alone, adaptive and user friendly. Self instruction, namely e-modules must have correct and clear instructions so that a module used by students can be understood and used as well as possible to achieve the specified learning objectives. Self contained, namely the material content contained in the module must be correct in accordance with existing concepts and complete so that it can build student understanding. Stand alone, namely the E-module must stand alone, not depend on other teaching materials and not require other supporting tools for its use. Adaptive, namely the e-module used must adapt to existing technological developments. E-modules are said to be adaptive if the E-modules are in accordance with the technology used today so that students find it easier to use e-modules. User friendly, that is, every instruction in the e-module must be easy for students to understand. The existing language must be adapted to the e-module user object so that the e-module can help students in learning.

RESEARCH METHOD

Proses There are 3 methods used in this manufacturing process, namely the design, manufacturing and assessment processes. The assessment is carried out using validation by experts from the aspects of material, appearance and language. The questionnaire used is a questionnaire with a Likert scale. The data obtained will then be analyzed using quantitative techniques and explained descriptively qualitatively

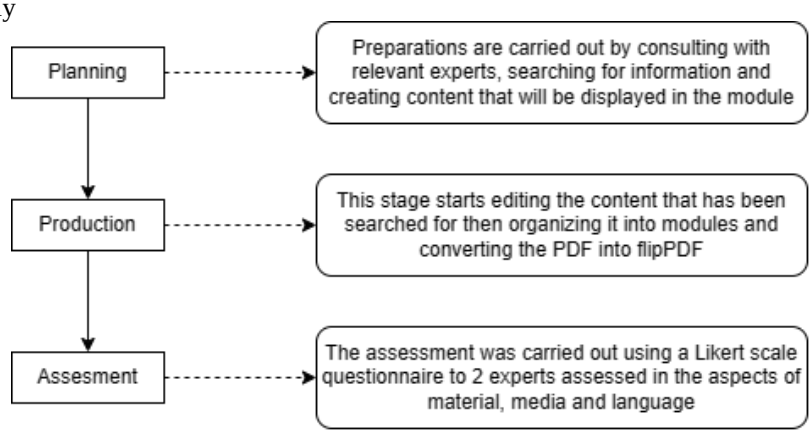

Fig 1. stages of e-module manufacturing

The writing method used is quantitative descriptive. Quantitative descriptive is the activity of describing, researching and explaining something studied as it is and drawing conclusions from phenomena that can be observed using numbers. Quantitative descriptive writing is research that only describes the contents of a variable without testing a particular hypothesis

1.Validation of learning module material aspect

The material aspect validation sheet is grouped into 5 sub-aspects, namely material completeness, material suitability, evaluation feasibility, computational thinking stages, and instrument completeness. The number of questions in the validation of material aspects was 13 items. The following are the results of validation of material aspects.

Table 1. Distribution of presentation of material aspect assessment criteria.

No	Sub Aspect	Number of Question Items	Number of Choices	Real Maximum Score	Real Minimum Score	Mi	Sbi
1	Material Completeness	3	4	12	3	7,5	1,5
2	Material Suitability	7	4	28	7	17,5	3,5
3	Feasibility Evaluation	1	4	4	1	2,5	0,5
4	Stages of Computational Thinking	1	4	4	1	2,5	0,5
5	Instrument Completeness	1	4	4	1	2,5	0,5
6	Total	13	4	52	13	32,5	6,5

From the results of this assessment, assessment material categories can be obtained for the e-module with the assessment criteria in table 2

Table 2. Material Aspect Assessment Criteria

Value Interval	Criteria
$42,25 < X$	Very good
$35,75 < X \leq 42,25$	Good
$29,25 < X \leq 35,75$	Enough
$22,75 < X \leq 29,25$	Not enough
$X \leq 22,75$	Very less

2. Validation of the Media aspect Learning Module

The validation sheet for material aspect is grouped into 3 sub-aspects, namely module design, presentation techniques and visual communication. The number of questions in the validation of material aspects was 9 items. The following are the results of the media aspect validation in table 3

Table 3. Distribution of Presentation of Media Aspects

No	Sub Aspect	Number of Question Items	Number of Choices	Real Maximum Score	Real Minimum Score	Mi	Sbi
1	Module Design	3	4	12	3	7,5	1,5
2	Presentation Techniques	4	4	16	4	10	2
3	Visual Communication	2	4	8	2	5	1
	Total	`9	12	36	9	22,5	4,5

From the results of this assessment, assessment media categories can be obtained for the e-module with the assessment criteria in table 4

Table 4. Media Aspect Assessment Criteria

Value Interval	Criteria
$29,25 < X$	Very good
$24,75 < X \leq 29,25$	Good

20,25 < X ≤ 24,75	Enough
15,75 < X ≤ 20,25	Not enough
X ≤ 15,75	Very less

3. Validation of the Language aspect Learning Module

The validation sheet for material aspect is grouped into 1 sub-aspect, namely language. The number of questions in the validation of material aspects is 3 items. The following are the results of the language aspect validation in table 5

Table 5. Distribution of Presentation of Languange Aspect

No	Sub Aspect	Number of Question Items	Number of Choices	Real Maximum Score	Real Minimum Score	Mi	Sbi
1	language	3	4	12	3	7,5	1,5
	Total	3	4	12	3	7,5	1,5

From the results of this assessment, assessment languange categories can be obtained for the e-module with the assessment criteria in table 6

Table 6. Languange Aspect Assessment Criteria

Value Interval	Criteria
9,75 < X	Very good
8,25 < X ≤ 9,75	Good
6,75 < X ≤ 8,25	Enough
5,25 < X ≤ 6,75	Not enough
X ≤ 5,25	Very less

4.Total Product Assessment

The total assessment was carried out by combining 3 aspects, namely material, media and language. The total number of questions in the validation was 23 items. The following results of the total product assessment are in table 4.7

Table 7. Distribution of Presentation of Total Product Assessment Aspects

No	Sub Aspect	Number of Question Items	Number of Choices	Real Maximum Score	Real Minimum Score	Mi	Sbi
1	Material	13	4	52	13	32,5	6,5
2	Media	9	4	36	9	22,5	4,5
3	Languange	3	4	12	3	7,5	1,5
	Total	25	4	172	43	62,5	12,5

From the results of this assessment, assessment categories can be obtained for the e-module with the assessment criteria in table 8

Table 8. Total Product Aspects Assessment Criteria

Value Interval	Criteria
81,25 < X	Very good
68,75 < X ≤ 81,25	Good
56,25 < X ≤ 68,75	Enough
43,75 < X ≤ 56,25	Not enough
X ≤ 43,75	Very less

RESULT AND ANALYSIS

The resulting e-Module can be accessed online on the website using a cellphone or laptop. The structure of the E-moodule consists of an introduction, instructions for using the e-module, circular motion concept map, learning activities 1 and 2, reflection, circular motion material, project, evaluation, bibliography and author's biodata. The e-module has been created using a computational thinking approach. The computational thinking syntax can be seen in Fig 4 parts circled in blue.

Fig 2. Cover display e-module

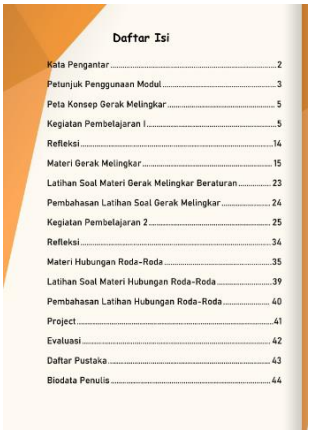

Fig. 3. E-module Table of Contents display

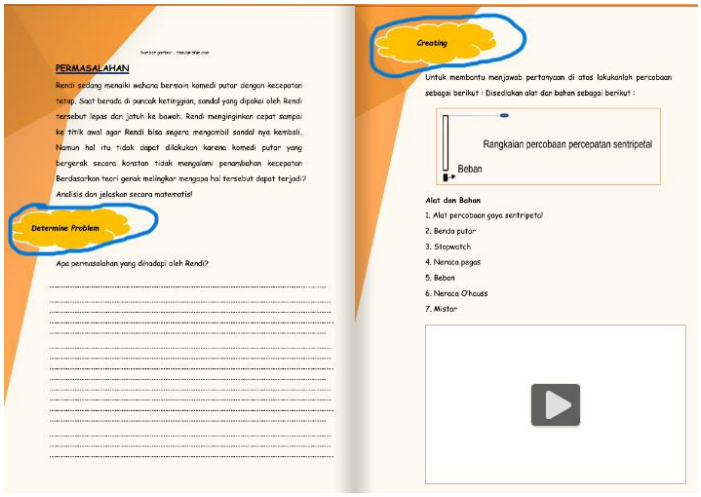

Fig. 4 e-module computational thinking syntax section

The completed e-module product is validated by an expert, in this case the supervisor, validates the e-module that has been created. Validation is carried out by providing validation instrument questionnaires to lecturers. Aspects measured include material aspects, module appearance and language. Based on the validation data that has been collected from the validator of the supervising lecturer, validation scores for material aspects, medical aspects and language aspects are obtained as follows: **Table 9.** Final Score Assesment of E-modul

No	Sub Aspect	Score
1	Material	49
2	Media	36
3	Languange	12
	Total	169

The data that has been collected from the expert material validation sheet, namely the supervising lecturer, for the material aspect obtained a result 49 out of a total score of 52. So it can be concluded that the material aspect of this e-module is in the very good category. The revisions obtained from the material aspect were related to the lack of similarities in the material of cars moving on an inclined plane and errors in connecting arrows on the concept map. In the video aspect, based on the data obtained from the media aspect validation sheet by the expert, namely the supervisor, the result was 36 out of 36. So it can be concluded that this e-module in the media aspect is in the very good category. In the languange aspect, based on the data obtained from the media aspect validation sheet by the expert, namely the supervisor, the result was 12 out of 12. So it can be concluded that this e-module in the media aspect is in the very good category.

The total assessment of the modules developed aims to determine the suitability of the physics e-module for testing. The e-module product assessment is categorized based on the total score from all aspects of the assessment. Based on the data obtained from the validation sheet, a score of 169 out of 172 was obtained, it can be concluded that the e-module with a computational thinking approach using flip pdf corporate software on circular motion material for class XI high school students meets the criteria for an excellent module

CONCLUSION

The resulting product is an e-module with a computational thinking approach to circular motion material. This e-module consists of an introduction, instructions for using the e-module, circular motion concept map, learning activities 1 and 2, reflection, circular motion material, project, evaluation, bibliography and author's biodata. The e-module is connected to the internet so it can be

accessed online using a mobile phone or laptop. Based on the results of the data that has been obtained, it can be concluded that the e-moSdule with the computational thinking approach is categorized as very good from the validation results by experts, physics teachers and students at schools. This e-Module is suitable for use in physics learning, according to the results obtained from the data above.

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