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Development Physics Module Based on Project Based Learning Integrated with Local Wisdom on Rotational Dynamics and Equilibrium of a Rigid Body

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ABSTRACT

Teaching aids are a component of learning. Teaching aids are resources for both teachers and students. However, in reality, teachers who continue to employ the direct learning paradigm have limited access to educational resources and achieve poor student learning outcomes, for example, while teaching rotational dynamics and rigid body equilibrium. This study intends to assess the viability of a project-based physics module for senior high school class XI rotational dynamics and equilibrium of a rigid body. This kind of research is known as design research. The research techniques used were self-evaluation assessment sheets, expert validation sheets. The product validation data analysis approach employs Aiken's V index. Research findings indicate that the rigid body project-based learning module on rotational dynamics and equilibrium has an astounding average module validation grade of 0.83 in the very good. The rotational dynamics and equilibrium of a rigid body material project-based learning combined with local knowledge module for physics may therefore be inferred to be appropriate for usage by instructors and students throughout the learning process.

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INTRODUCTION

A key component of learning is the use of teaching materials. In learning a teacher needs to prepare teaching materials. The purpose of instructional materials is to support both teachers and students in their learning (Magdalena et al., 2020). Without teaching materials, teachers tend to use lecture learning or direct learning. Teachers can prepare pupils for learning using the instructional resources. Teaching resources come in a variety of printed media, including handouts, books, modules, brochures, and pamphlets (Mulyasa, 2018). One of the teaching materials that can be used is the module.

A sort of instructional material known as modules is a collection of planned and prepared learning activities to aid students in mastering particular learning objectives. Modules are packed as a whole and methodically (Daryanto, 2013). Learning skills may be enhanced by the use of modules as teaching resources for physics lessons. The advantages of the module are that the learning activities of students are according to speed and ability, students can study independently, and students are able to find out their own learning outcomes. Students actively participate in the learning process, pursue autonomous learning, and assist other students in understanding concepts through the fishing module.

The school curriculum in Indonesia is always evolving. The government consistently seeks to modify the curriculum for education to meet the demands of the modern world. Indonesia now follows the Curriculum 2013 curriculum. A focus on attitudes, balanced knowledge, and skills is emphasized throughout the program. It is the goal of policy preparation to address different flaws in prior curricula. The 2013 curriculum was developed as part of the current administration's curriculum development: 1) Strengthening character education, which comprises of five characters including religious, nationalist, independent, and cooperative, 2) The 4C skills (Creativity, Critical Thinking, Collaborative, and Communicative), and 3) The literacy movement, was incorporated by the government into the revised 2013 curriculum (Mulyasa, 2018). Students will be inspired by this course material to become more engaged in their studies. One of the recommended models is the project-based learning model.

The PjBL model can be interpreted as a learner centered learning model (student center), innovative, project based and positions educators as effective facilitators in contextual learning related to real life situations (Ratnasaril, et al., 2018). The PjBL model has six stages, namely basic questions, designing product plans, compiling production schedules, monitoring project activity and progress, testing results and evaluating learning experiences. The PjBL model has an effect on physics learning outcomes because in each stage of the project based learning model requires students to be more active, critical and responsible in the learning process so that they can train students in finding ideas (Halimah, et al., 2022). In order to solve problems (find answers), students are guided by this learning approach to locate, comprehend, modify, or even revise preexisting knowledge or issues (Kumaidi, 2014). The adoption of a project-based learning strategy can enhance student problem-solving, according to Lismidarni's research (2020); it can also help students become more competent in terms of attitudes, knowledge, and abilities (Nelson, et al., 2022). Learning materials must be tied to phenomena in the students' immediate environment, for instance, by using local wisdom, in order to prepare students for successful learning outcomes.

In the revised 2013 curriculum, the government integrated four things in learning, known as; 1) Strengthening Character Education, the strengthened character consists of five characters, known as: religious, nationalist, independence, mutual cooperation and integrity, 2) 4C skills (Creative, Critical Thinking, Communicative, and Collaborative), 3) literacy movement which consists of the ability to access, understand. The demands of the 2013 Curriculum where the government has made maximum efforts to improve the quality of student learning, but the reality that occurs in the field is not as expected. Preliminary study activities were carried out at Senior High School. The results of observation and distribution of questionnaires to students of class XI Science 5 obtained several facts related to the learning process. First, based on observations at school, researchers found the fact that teachers rarely use learning models that can make students learn to be active and able to solve problem solving. The learning model used in learning uses the lecture method. This learning model makes students less actively involved in the learning process. This learning model is clearly ineffective because learning becomes meaningless for students and students become less interested in learning. Second, based on the technique of distributing questionnaires to students, it was found that the teaching materials were limited. Teachers have not used special teaching materials in learning so that students easily understand lessons. In learning the teacher only uses the textbooks available at school. The textbook used by the teacher only contains material and exercises so that students are still passive in learning activities. Third, seen from the value of students' daily tests. Based on the daily test scores, it was found that students who did not complete the dynamics of rotation and balance of rigid bodies were 60.46%, 44.18% in elasticity and Hooke's law, and 39.53% in static fluid. The low understanding in analyzing questions makes students not take the questions seriously, so that the score obtained has not reached the Minimum Mastery Learning Standard.

Develop modules with project-based learning syntax coupled with local wisdom as one answer to the situations in the field that have been discovered. Project based learning modules that are integrated with local knowledge may make it easier for teachers to impart information to students and for students to comprehend that information. The benefits of project-based learning modules are integrated with local wisdom, specifically that it can engage students in responding to or solving each problem in the module while also connecting the difficulties to the context of daily life or local knowledge (Astuti et al., 2021). The development of project-based learning modules combined with local knowledge is crucial for fostering student-centered learning that will make learners more engaged and increase learning outcomes.

Based on the description that has been provided, the researcher has created a physics module for class XI senior high school based on project-based learning integrated with local knowledge on the dynamics of rotation and balance of rigid bodies that meets validity, i.e. fulfilling effectiveness. Due to this, the study's title is " Development Physics Module Based on Project Based Learning Integrated with Local Wisdom on Rotational Dynamics and Equilibrium of a Rigid Body."

METHODS

This type of research is development research. The research paradigm employed is the Plomp model, which claims that development research is necessary to design and create an intervention (such as programs, learning tools and techniques, products and systems) as a response to challenging research issues and to advance science. The Plomp model which consists of three phases, namely (1) the preliminary research phase, (2) the development/prototyping phase, (3) the assessment phase (Plomp, 2010). The object of this research is a physics module based on project-based learning integrated with local wisdom on the rotational dynamics and equilibrium of a rigid body material for Senior High School class XI. This module consists of competencies 3.1 The application of the concepts of torque, moment of inertia, center of gravity, and angular momentum on rigid bodies (static and dynamic) in daily life, such as in sports and 4.1 Create artwork that incorporates the center of gravity and rigid body balance concepts.

In this study, the Plomp model consists of three stages. However, in the development of a physics module based on project-based learning integrated with local wisdom, the stages carried out will be limited to stages, namely (1) the preliminary research stage and (2) the development/prototyping phase which includes formative evaluation. This initial research is the stage for needs analysis and context analysis, reviewing the literature, developing a conceptual or theoretical framework for research. The prototype stage consists of several stages as a formative evaluation. The stages of formative evaluation are self-evaluation, expert review, one to one, small group, and field tests (Kusuman, 2016). The development of this module will be limited to expert review. Formative evaluation stages (Tessmer, 1993) are shown in Figure 1.

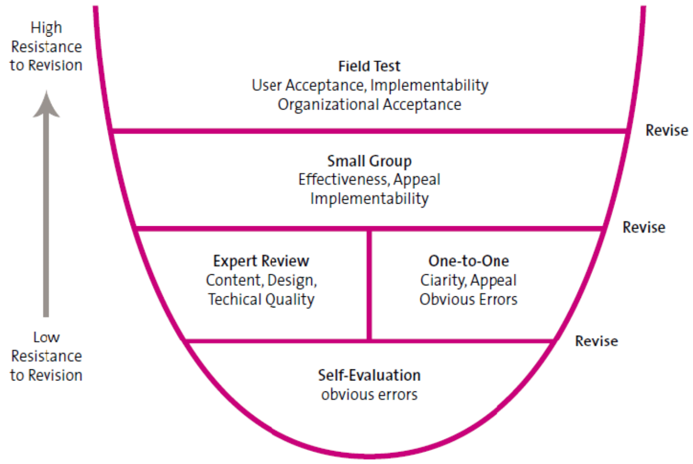

Figure 1. Formative evaluation stage

The analysis technique used is descriptive statistical analysis. Descriptive statistics can be presented by presenting data through tables and graphs. In order to determine the content validity coefficient based on the findings of research from a panel of experts consisting of up to n people on a question item, it is necessary to compute the value weight using the Aiken's V formula. This calculation determines how well the question item may reflect the construct being measured (Aiken, 1985). The research was conducted by giving numbers, namely 1 (irrelevant), 2 (less relevant), 3 (quite relevant), 4 (relevant), and 5 (very relevant) (Retnawati, 2016). The V number range is from 0-1, $V = \sum s / [n(c-1)]$ (Anwar, 2015). In this equation, s= r-lo, r = score given by an evaluator, lo = low validity rating score (in this case = 1), n = number of validators (in this case = 3), and c = low validity rating score (in this case = 5). Interpretation of data validity based on: 1) ≤ 0.4 (invalid), 2) 0.4 < V ≤0.8, and 0.8 < V (very valid) (Retnawati, 2016).

RESULTS AND DISCUSSION

Self-Evaluation

Self-evaluation is an examination done by the researcher themselves to see whether their creation is comprehensive and feasible. This evaluation makes use of a questionnaire that is read, checked for accuracy, corrected of any mistakes, and added to if any parts are still missing by the researcher. This format for self-evaluation is a checklist (√).The outcomes at this point are as follows: 1) The project based learning module in physics already has a module structure based on the 2008 Ministry of National Education, which includes titles, competencies to be met, learning objectives, study instructions, material descriptions, supporting information, practice questions, work instructions, or can also be in the form of worksheets, evaluation, and answer keys, 2) The physics module's appearance has been made appealing, 3) There were grammatical, spelling, and punctuation problems that have been fixed, 4) The module's overly repetitive use of writing typefaces has been changed, and 5) The arrangement of the display colors in the module already appears striking and appealing. Results from the study of the self-evaluation sheet fell into the very good category.

One to One Assessment

A questionnaire was completed by three students with varying levels of ability, and the results of the one-on-one assessment of the physics module based on project-based learning integrated with local wisdom were supplied. The results of the one-to-one assessment are used to assess the strengths and weaknesses of the modules that have been made. Based on the assessment questionnaire used, there are four components assessed from the module, namely material components, learning design components, implementation components, and technical components. The first element that needs to be evaluated is the content, which has four indicators, namely 1) ease of understanding of the material, 2) clarity of the material, 3) suitability of the material, and 4) updating of the material. Figure 2 displays the findings of the value plot of the four material component indicators in the one to one assessment.

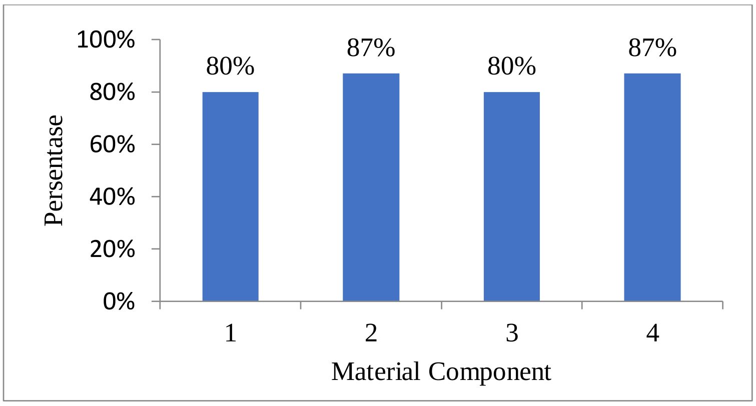

Figure 2. Assessment result of the Component Assessment Material One to One

The values of each indicator of the material component, which vary from 80% to 87%, are explained in Figure 2. The two indications with the highest marks among the four are the clarity of the material and the updating of the material (87% each). The average assessment result on the material component is 84%. Material components are in very good criteria.

The second aspect, learning design, consists of four indicators: 1) The content in the physics module is readable and uses project-based learning combined with local wisdom; 2) The objectives of the physics module based on project-based learning linked with local wisdom are clear; 3) The learning process is consistent; and 4) The presenting method is appealing. In Figure 3, the findings of the plot of the four indicators of the learning design elements in the one-to-one evaluation are displayed.

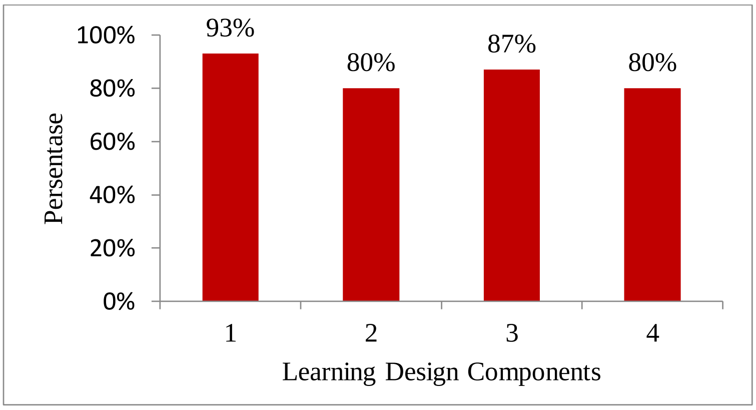

Figure 3. Assessment result of Learning Design Components One to One Assessment

Figure 3 explains the values of each indication of the learning design component, which range from 80% to 93%. The module's text readability, which has a content score of 93%, is the indicator with the greatest value out of the four. The results of the average assessment of the material component is 85%. Material components are in very good criteria.

The implementation component, the third element, consists of three indications, namely 1) Ease of use of the physics module based on project-based learning integrated with local wisdom, 2) The time needed to understand the Module is not too long, and 3) Utilization of the Module in the future. The results of the plot of the values of the three implementation component indicators in the one-to-one assessment are shown in Figure 4.

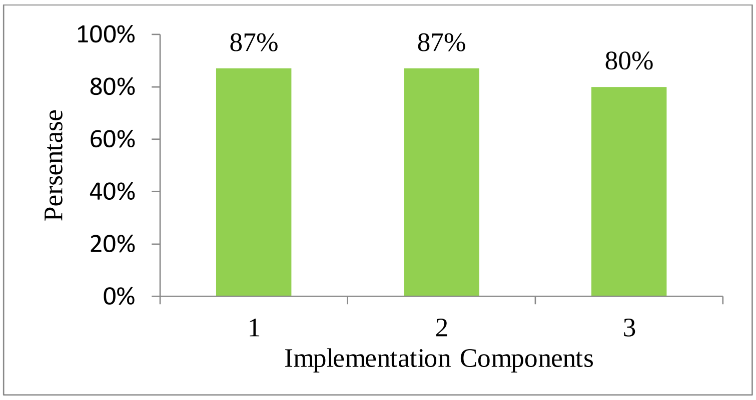

Figure 4. Assessment result of One-to-One Assessment Implementation Components

The values of each indication of the implementation component, which vary from 80% to 87%, are explained in Figure 4. Two of the three indicators have the highest scores out of the three, namely the ease of use of physics-based modules project-based learning is integrated with local wisdom and the time needed to understand the module is not too long at 87%. The results of the average assessment of the material component is 85%. Material components are in very good criteria.

The fourth element is a technical element with six indicators: 1) Image clarity in the physics module based on project based learning combined with local wisdom, 2) Color clarity on the module's cover for physics, which incorporates project based learning and local wisdom, 3) Image color accuracy, 4) The placement of layout elements, including as titles, subtitles, drawings, photos, and charts, is consistent throughout, 5) The Color Clarity on Cover Physics Module based on Project Based Learning that is Integrated with Local Wisdom, and 6) Use printed letters rather than Latin or Roman letters, and make your modules look appealing. The results of the value plot of the six technical component indicators in the one-to-one assessment are shown in Figure 5.

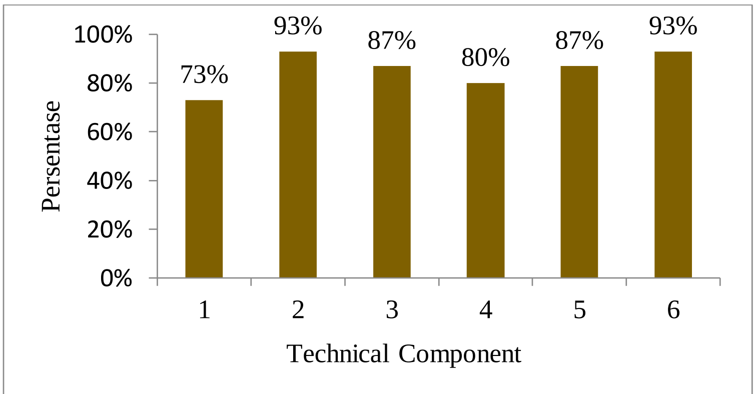

Figure 5. Assessment result of Technical Components One to One Assessment

The values of each technical component indicator, which vary from 73% to 93%, are explained in Figure 5. The two indicators with the highest values out of the six are, namely color clarity on cover physics-based module project-based learning integrated with local wisdom, and an attractive display module of 93%. The average assessment result on the technical component is 86%. The tangible components are of the highest caliber. Figure 6 shows the average value of the results from the component of the one-to-one assessment in the Color Clarity on Cover Physics module based on project-based learning combined with local wisdom on rotational dynamics and equilibrium of a rigid body.

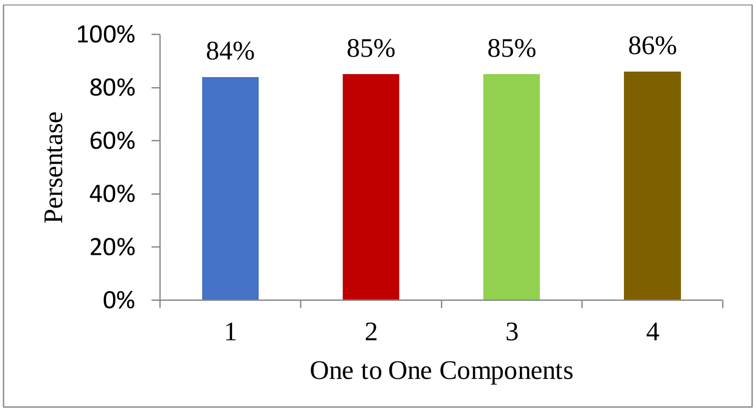

Figure 6. Graph of One-to-One Assessment Results

Figure 6 describes the average value of each one-to-one assessment component ranging from 84% to 86% with an average component value of 85%. The four components of the one-to-one assessment are very good.

Validation Assessment Result

The 2008 Ministry of National Education's recommendations for the development of teaching materials, one of which is the module, serve as a reference for the construction of the physics module, which is based on project-based learning combined with local expertise. The structure of this module includes 1) title, 2) study instructions, 3) competencies to be achieved, 4) supporting information, 5) exercises, 6) work instructions, 6) evaluation (Depdiknas, 2008). And the activities and steps of project-based learning as shown in Figure 7.

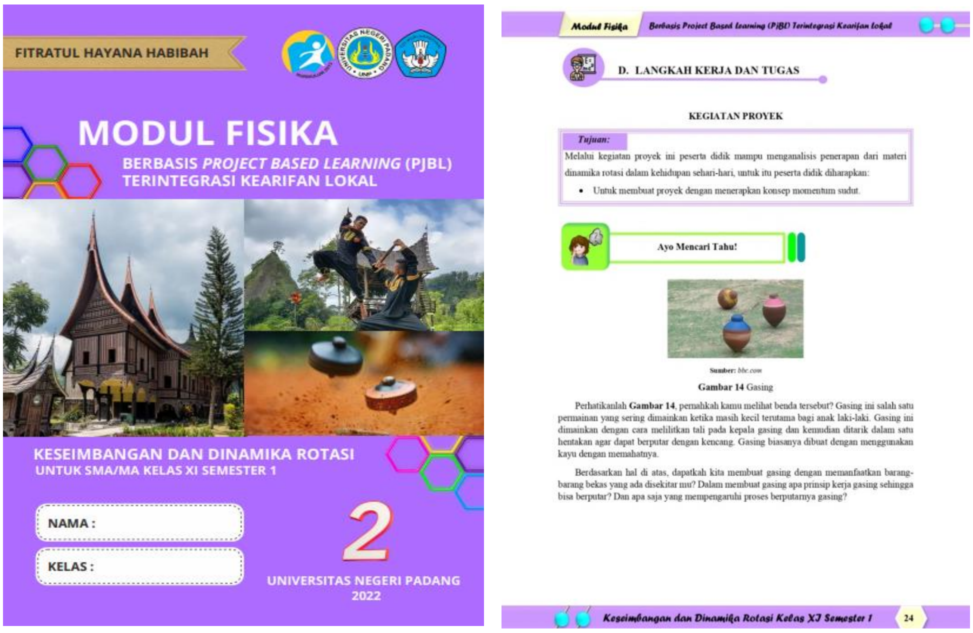

Figure 7. Activities and Work Steps in the Module

Three physics instructors from FMIPA UNP who served as validators completed a questionnaire that provided the results of the project-based learning (PjBL) evaluation for the physics module. The average value of the validation component is obtained from the average value of the indicators for all components. Based on the assessment questionnaire used, there are six components that are assessed from the module, namely content feasibility components, language feasibility components, presentation feasibility components, and graphic feasibility components (Depdiknas, 2008), component-based learning models project based learning and local wisdom components. The first is the content eligibility component, which has six indicators 1) compliance with core competencies, basic competencies, 2) compliance with student development, 3) more criteria are adherence to the requirements of instructional materials, 4) the truth of the material's content, 5) benefits for enhancing understanding, and 6) adherence to moral and social standards.

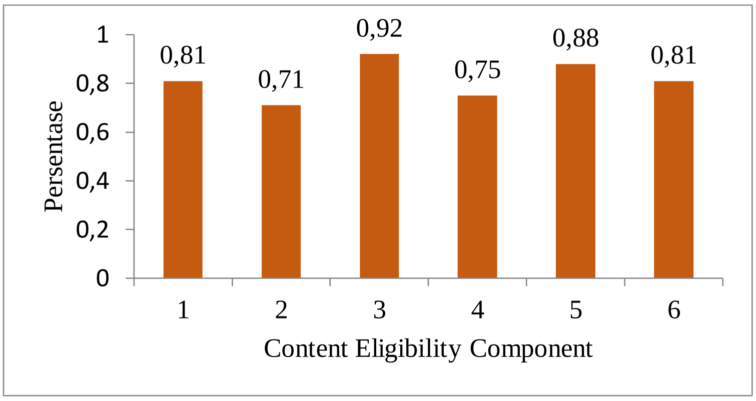

Figure 8. Module Content Feasibility Component Validation Assessment

Data in Figure 8 explains that each component's value for content eligibility spans from 0.71 to 0.92. From the six indicators on the eligibility component of the module content, it was found that they were valid and very valid. The valid category goes from 0.71 to 0.75, while the extremely valid category is between 0.81 and 0.92. The content feasibility component's average value was 0.81. In light of this, the content feasibility component falls under the extremely valid group.

The second component is linguistic feasibility, which has four indicators: 1) readability, 2) clarity of information, 3) adherence to good and 4) proper Indonesian grammar, and effective and efficient language use. The results of the plot of the values of the four language feasibility component indicators are shown in Figure 9.

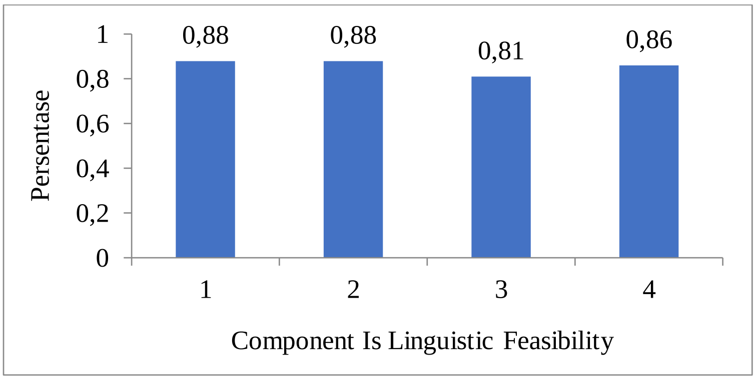

Figure 9. Module Language Feasibility Component Validation Assessment

The values of each indication of the linguistic feasibility component, which vary from 0.81 to 0.88, can be understood based on Figure 9. One category of the four indicators in the module's linguistic feasibility assessment is particularly useful. The average result for the component's linguistic viability is 0.85. The linguistic feasibility element falls under the heading of being highly valid.

Third, the presentation feasibility component includes five characteristics: 1) Clarity of objectives (indicators to be accomplished), 2) Order of Presentation, 3) Offering Motivation and Attractiveness, 4) Interaction (providing Stimulus and Response), and 5) Completeness of Information. Figure 10 displays the findings of the value plot of the five feasibility component indicators.

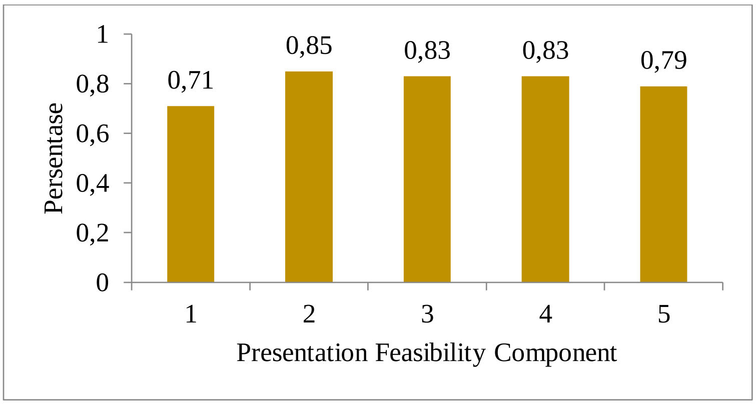

Figure 10. Assessment result of Feasibility Component Presentation Validation Module

Figure 10 explains each indicator's value, which varies from 0.71 to 0.85 for the presentation feasibility component. Two categories of the five indications in the presentation feasibility assessment module are extremely valid and valid. The valid category goes from 0.71 to 0.79, while the extremely valid category is between 0.83 and 0.85. For the presenting feasibility component, an average value of 0.8 was found. The presenting feasibility component falls under the heading of being valid.

Fourth, the graphical feasibility component which consists of four indicators, namely 1) Use of fonts; type and size, 2) Lay out or layout, 3) Illustrations, graphics, pictures, photos, and 4) Display design. The results of the plot of the four graphical feasibility component indicators are shown in Figure 11.

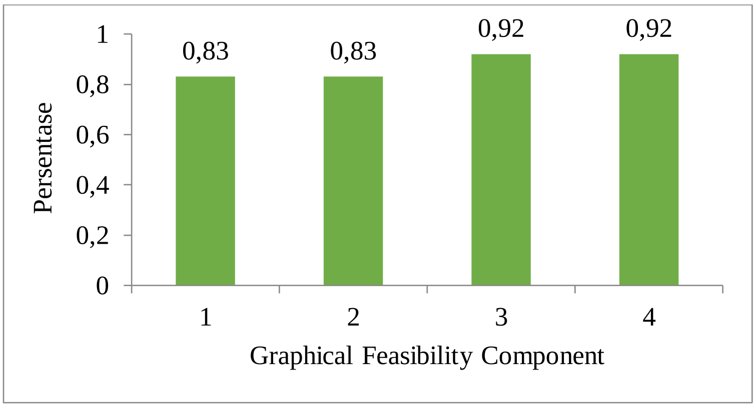

Figure 11. Module Graphical Feasibility Component Validation Assessment

The values of each indication of the graphical feasibility component, which vary from 0.83 to 0.92, can be understood based on Figure 11. There is one category among the four indicators in the module's graphical feasibility assessment that is extremely valid. The graphical component's average value was determined as 0.87. As a result, the graphical feasibility component qualifies as being extremely valid.

Fifth, the component of the project based learning model which consists of seven indicators, namely 1) There are syntaxes of the learning model Project Based Learning (determination of fundamental questions, planning project, making schedules, implementation and monitoring project, test results, and evaluation) (Kusuman, 2016) on work activities in the module, 2) The syntax for determining basic questions in the module can already build knowledge and direct students to do a project, 3) Syntax for designing project in the module can provide independence and freedom for students to be creative in designing their own projects, 4) The syntax of compiling a schedule of activities in the module can direct students to determine the schedule for completing the project independently, structured and on time, 5) The syntax of implementing and monitoring project in the module has been able to guide students in carrying out project creation in a systematic and directed manner with the initials/responses from the teacher, 6) The syntax for testing results in the module has been able to facilitate teachers in measuring achievement of competency standards and evaluating the progress of each student through preparing reports and presentations on projects that have been made, and 7) The module's assessment syntax can help students assess and enhance their previous work. The results of the plot of the values of the seven component indicators of the project-based learning model are shown in Figure 12.

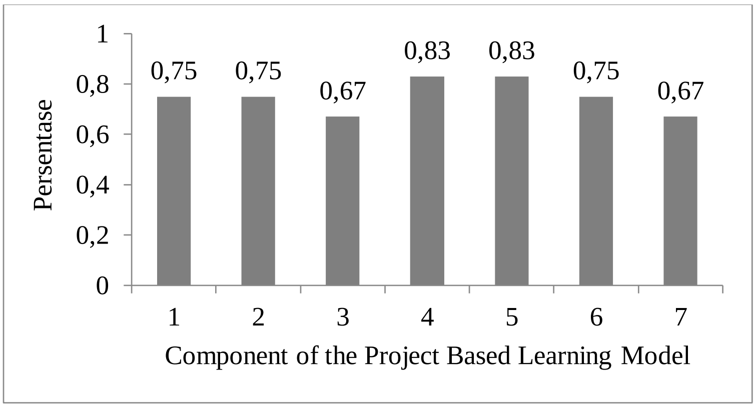

Figure 12. Component Validation Assessment Model Project Based Learning Module

Figure 12 explains the values of each indicator of the model's project-based learning components, which range from 0.67 to 0.83. There are two categories, valid and highly valid, out of the seven indications in the model evaluation component project-based learning in the module. The valid category spans from 0.67 to 0.75, whereas the extremely valid category ranges from 0.83. The model's average value for the project-based learning component is 0.75. Thus, the model components project-based learning is in the valid category.

Sixth, the local wisdom component consists of two indicators: 1) Local wisdom is present in the module's supporting information, and 2) Local wisdom is demonstrated in the module's evaluation questions. The results of the plot of the values of the two local wisdom component indicators are shown Figure 13.

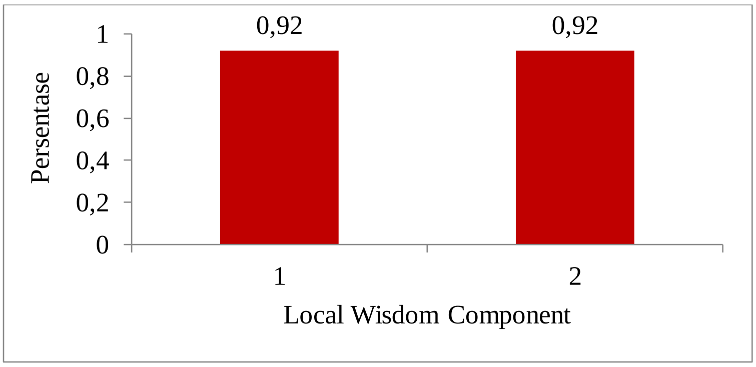

Figure 13. Assessment result of Module Local Wisdom Component Validation

Figure 13 provides an explanation of each indicator's value for the local wisdom component, which varies from 0.92. One category of the two indications in the module's component for assessing local wisdom is extremely valid. The local wisdom component's average value was found to be 0.92. The local wisdom element falls under the extremely valid category as a result. Figure 14 illustrates the outcomes of the average value validation of the physics module's components based on project-based learning integrated with local wisdom.

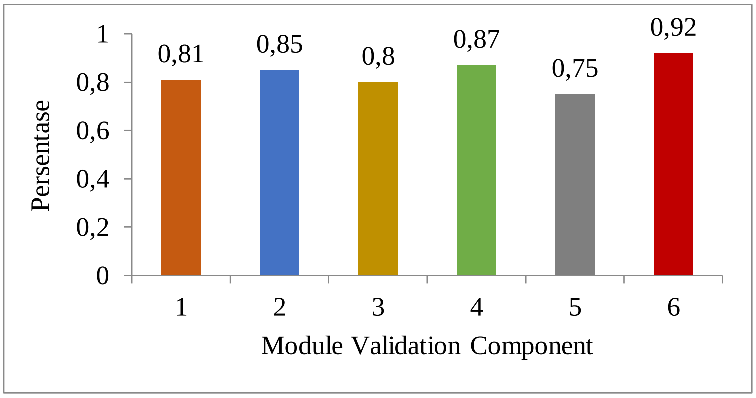

Figure 14. Graph of Module Validation Results

Figure 14 explains that the range of values for each component of the validation assessment is 0.75 to 0.92. There are two categories of the six indicators in the module validation assessment: valid and highly valid. The valid category goes from 0.75 to 0.8, whereas the extremely valid category is between 0.81 and 0.92. The validation assessment's typical result was 0.83. Thus, the components in the validation assessment have a very valid category. Thus, it can be concluded that the physics module produced in this study using project-based learning integrated with local wisdom on the material rotational dynamics and equilibrium of a rigid body is very valid and suitable for use by instructors and students in learning.

Discussion

Physics based module project-based learning integrated local wisdom carried out self-evaluation assessment by the researchers themselves, one to one test, and validation test by experts. Self-evaluation aims to find out the shortcomings and incompleteness of the module. Results self-evaluation the obtained design is made for module-based project-based learning integrated local wisdom according to the steps for writing and module structure based on the 2008 Ministry of National Education. The components contained in the module are as follows: 1) titles, 2) competencies achieved, 3) learning objectives, 4) material descriptions, 5) information support, 6) practice questions, 7) work instructions or worksheets, 8) evaluation, and 9) answer keys (Depdiknas, 2008). Then the researcher adjusted the structure of the module to the based learning model project-based learning. Syntax project-based learning namely 1) basic questions, 2) designing product plans, 3) compiling schedules, 4) monitoring and project progress, 5) testing results, and 6) evaluating learning experiences (Halimah, et al., 2022).

Once done self-evaluation then tested the validity of the product by expert review. Test the validity of the module-based project-based learning integrated local wisdom aims to see the validity of the product. Before the module-based validation sheet project-based learning integrated local wisdom is used, the validation sheet is assessed in advance by experts. Validation was carried out by three validators, namely 3 Physics lecturers at Padang State University. The assessment of the module validation sheet lasts for 1 month. Researchers must make the theory of the instrument to be used. This aims to match the theory of the instrument with the instruments used (Sugiyono, 2017). After the instrument theory is said to be complete by the validator, then the validator provides suggestions and input to module validation instrument project-based learning integrated local wisdom. These suggestions and input are corrected and given back to the validator to provide an assessment of the validity of the instrument. The results of the assessment of the module validation sheet project-based learning integrated local wisdom by experts, namely 85% are in the very decent category. Module sheet project-based learning This integrated local wisdom is used to validate the product being developed. Product validation project-based learning This integrated local wisdom lasts 1 month. Validation assessment component project-based learning integrated local wisdom includes content feasibility components, language feasibility components, presentation feasibility components, activity feasibility components, model components project-based learning, and components of local wisdom (Depdiknas, 2008).

Based on the validation results of physics-based modules project-based learning integrated local wisdom, there are several indicators on the content feasibility component, there are the lowest and highest scores for this component. The indicator of conformity with the development of students gets the lowest score of all indicators in the content feasibility component, which is equal to 0.71. This is because the modules presented still provide little material description according to the level of knowledge (cognitive domain), psychomotor development, creative development and emotional development of students. Aspects of student development are distinguished by several main aspects, namely cognitive, physical, psychomotor, moral, emotional, social, and language (Agustina, 2018).

The highest value of the content feasibility component, namely the indicator of suitability with the needs of teaching materials, is 0.92 in the valid category. The module presented already contains the basic concepts of physics, examples of applying physics material, facilitating students to think creatively and providing sample questions so students can easily understand the physics material being studied. This is also supported by the opinion that in developing teaching materials there are several principles, namely the material presented starts from easy to understand difficult, strengthens students' understanding, and learning motivation (Depdiknas, 2008).

Based on several indicators on the language component, there are the lowest and highest scores for that component. The indicator that has the lowest score compared to the other indicators is the indicator of conformity with good and correct Indonesian language rules with a value of 0.81. This is because in writing modules there are still errors in using vocabulary, writing punctuation, and writing terms used in the module. The requirements for an effective sentence are 1) the choice of words is precise, clear, common, 2) the structure shows unity, parallelism, thrift, firmness, and variety, 3) the sentence is in accordance with reason/logical thinking, and 4) the application of the spelling rules is correct (Heryani, 2019).

The highest scores for the language feasibility component are two indicators, namely indicators 1) readability and 2) clarity of information with a value of 0.88 for each indicator. The modules made use language that is easy for students to understand starting from the material presented, instructions for using the module, steps for project activities, supporting information, and evaluation questions so that the information presented is clear. The presentation component must include indicators of readability, clarity of information, compliance with Indonesian language rules, and effective and efficient use of language (Depdiknas, 2008).

Based on several indicators in the presentation feasibility component, there are the lowest and highest scores for that component. The indicator that has the lowest value compared to the other indicators is the clarity of purpose indicator (indicator) to be achieved with a value of 0.71. This is because the objectives (indicators) to be achieved in the module still do not describe the learning process, and the operational verbs that are formulated do not include the knowledge, attitudes and skills that students will achieve. Seven indicators of learning are said to be effective, namely: 1) good material organization, 2) effective communication, 3) mastery and enthusiasm for subject matter, 4) positive attitude towards students, 5) giving fair grades, 6) flexibility in the learning approach, and 7) good student learning outcomes (Hamzah, 2011). The highest value is found in the serving order indicator with a value of 0.85. This is because the modules that have been made are in accordance with the structure of the module, the sequence of material presented is in accordance with the formulation of indicators, and the instructions/work steps have given directions in learning activities. The structure of the module consists of titles, study guides, basic competence, supporting information, exercises, work steps, and evaluation/assessment (Depdiknas, 2008).

Based on several graphic indicators, the lowest and highest values for the graphic component are obtained. There are two indicators that have the lowest value compared to the others, namely the use of fonts; type and size and lay out or layout that is equal to 0.83 for each indicator. This is because in writing modules there are still errors in writing physics equations such as the symbol of the moment of τ , F and others as well as the writing of foreign words. To make a module must pay attention to the graphics of the developed module. The quality of the letters that make the letters read properly and understood by readers (Anto, 2017).

The highest value of the graphical feasibility component is found in two indicators, namely illustrations, graphics, images, photos, and display design indicators of 0.92 for each indicator. The modules that are presented starting from illustrations, graphics, pictures, photos and display designs are appropriate according to the material discussed and according to user needs not excessive. This is in accordance with the opinion of the content aspect of teaching materials consisting of complete layout elements, color combinations and illustrations and pictures (Kusuman, 2016).

Based on several project-based learning indicators, the lowest and highest values were obtained for the graphic component. There are two indicators that have the lowest value compared to the others, namely the designing syntax indicator project in the module can provide independence and freedom for students to be creative in designing their own projects and the evaluation syntax indicators in the module can guide students to evaluate and improve the work that has been made, which is equal to 0.67 for each indicator. This is because the module still does not guide students to be independent in designing projects and in evaluation activities. To produce a product, you have to prepare a design first. Designing the project needs to be done, namely to determine the tools and materials needed to complete the project (Halimah, et al., 2022).

The highest value of the component project based learning There are two indicators, namely the syntax indicator for compiling a schedule of activities in the module can direct students to determine the schedule for completing the project independently, structured and on time and execution and monitoring syntax project in the module have been able to guide students in carrying out project creation in a systematic and directed manner with the teacher's initial/response of 0.83 for each indicator. This is because the module already meets the syntax of project-based learning. The preparation of a project implementation schedule is carried out to determine how long the project must be completed and monitoring activities are carried out to monitor student activities in carrying out project assignments (Hosnan, 2014).

Based on several indicators on the local wisdom component, a high score was obtained for the local wisdom component. Of the four indicators on the local wisdom component, it has the same value of 0.92. This is because each indicator has the same discussion, namely regarding local wisdom in the physics-based module project-based learning integrated local wisdom. The use of local culture, traditions, practices, beliefs and native languages can help improve students' attitudes toward science. Based on the validation results, an average validation value of 0.84 is obtained, it can be concluded that the physics module produced is valid for use in the physics learning process (Morales, 2015).

The validity value obtained is not all components reach a perfect score so that the module needs to be further revised. The revisions were made based on suggestions from the validator so that the modules used met the criteria for each component, including the components of content feasibility, language feasibility, presentation feasibility, graphic feasibility, project-based learning based learning models, and local wisdom. After revisions were made, teaching materials were produced that were better than the previous ones so that teaching materials could be tested for practicality.

Before the practicality test, the researcher conducted a One-to-One test, this assessment was carried out by 3 students who had high, medium, and low abilities. The sample used is students who have studied the dynamics of rotation and balance of rigid bodies, namely class XI. So that the comments and suggestions given by students can be used for further module improvement. There are four components that will be evaluated by students, namely material components, learning design components, implementation components, and technical components. Test results One to One physics-based module project-based learning integrated local wisdom on the dynamics of rotation and balance of rigid bodies with an average value of 85% with very good criteria from the four components. Suggestions given by students are in terms of the appearance of the color of the module used and information on the image that needs to be added so that the module can be used properly and easily understood by students.

This research is not easy to get perfect results because of constraints and limitations. The obstacles experienced during the research were 1) The modules made were still limited to one basic competency in class XI semester 1, namely basic competency 3.1 Applying the concepts of torque, moment of inertia, center of gravity, and angular momentum on rigid bodies (static and dynamic) in everyday life -days eg in sports. This was due to limited research time in making a one semester module, 2) The module was validated by only three validators, three experts namely physics lecturers at Padang State University, and 3) The research phase only reached practicality according to teachers and students in one school. This is due to the limited research time.

CONCLUSION

Based on the findings of the study and the discussions held, a physics module based on project-based learning and local knowledge was developed. The results of the content feasibility component are in the very valid category, the language feasibility component is in the very valid category, the presentation feasibility component is in the valid category, the graphical component is in the very valid category, the project based learning model component is in the valid category, and the local wisdom component is in the valid category, according to the validity assessment of the physics module, which includes project based learning integrated with local wisdom. The created module can therefore be applied to the process of teaching physics in classrooms, particularly to enhance students' critical thinking abilities in the dynamics of rotation and balance of rigid bodies.

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