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# Electronic Module Design with Scientifically Character-Charged Approach on Kinematics Material Learning to Improve Holistic Competence of High School Students in 10th Grade

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**Abstract.** The availability of modules in schools is currently lacking. Learners have not used the module as a source in the learning process. In accordance with the demands of the 2013 curriculum, that learning should be conducted using a scientific approach and loaded with character values as well as learning using interactive learning resources. The solution of this problem is to create an interactive module with a scientifically charged character approach. This interactive module can be used by learners outside the classroom or in the classroom. This interactive module contains straight motion material, parabolic motion and circular motion of high school physics class X semester 1. The purpose of this research is to produce an interactive module with a scientific approach charged with character and determine the validity and practicality. The research is Research and Development. This study was conducted only until the validity test and practice test. The validity test was conducted by three lecturers of Physics of FMIPA UNP as experts. The instruments used in this research are validation sheet and worksheet sheet. Data analysis technique used is product validity analysis. The object of this research is electronic module, while the subject of this research is three validator.

## 1. Introduction

The 2013 curriculum is a character-based and competency-based curriculum. Through education is expected to the character and competence of learners can be formed in a better direction. In learning, learners are guided by educators to participate in self-useful to establish the competence and character of learners. Educators are expected to have high creativity and innovation in creating a fun learning environment. In the formation of competence and character of learners requires a quiet and enjoyable learning. Lessons learned in the 2013 curriculum include the attitudinal competencies, knowledge and skills available in all fields of study at every level of education. According to Permendikbud Number 59 of 2014, the learning pattern of curriculum 2013 is centered on students, interactive learning that allows learners to obtain information from anywhere as a source of learning.

The module is one of the learning resources that can direct the students to master the four core competencies contained in the curriculum of 2013 as a whole. The interactive module is a module equipped with various media so that it is expected to facilitate learners' learning styles. The use of varied media can provide a quiet and enjoyable learning environment and learners can interact actively



in learning as expected by the 2013 curriculum. One approach that can actively involve learners is the scientific approach.

The scientific approach is an approach that engages learners actively in the learning process. A scientific approach can involve the learner's skills in the process such as observing, questioning, trying / gathering information, reasoning and communicating. With a scientific approach is expected to form the ability of learners in solving problems.

Based on the observations that researchers do in SMA Negeri 3 Bukittinggi, it is found that overall learners stated in the learning has not been using interactive module. Learning resources used in the form of modules in print and only 10% of learners who can understand the material presented in the module. So that learners prefer to receive material explanation from teacher only, while in curriculum 2013 expected some interaction in learning process that is learners interaction with educator, learners with learners, learners with learning resources. In fact the interaction of students with the source of learning that is still in print form provided the school is still lacking so that the learners are less active in the learning process.

Seeing the importance of interesting learning resources in the learning process and can guide the character of learners, the interactive module is expected to improve the spirit of learners learn. So that the competence of learners can be improved holistically through the learning process using this interactive module. In this interactive module can load video, audio, simulation, animation and drawing so hopefully more fun learning atmosphere.

This interactive module is designed with a scientific approach consisting of the process of observing, asking, trying / gathering information, reasoning and communicating. Physics is a science that studies natural phenomena so that scientific approach suitable for use in learning physics. Application of this scientific approach will make learners will be more focused in understanding the concept of physics itself. In addition, the 2013 curriculum emphasizes on improving the knowledge, attitudes, and skills of learners. One way to improve the ability of learners holistically is to use interactive modules with scientific and character-filled approaches. The module will increase the knowledge and faith of learners to God Almighty accompanied by changes in spiritual and social attitudes towards the better.

Previous research on module making has been done by Ike Evi Yunita [7], Mukhayyarotin Niswati R. J [8], and Eka Lestari and Abdur Rahman [9]. Research conducted by Ike Evi Yunita, Eka Lestari and Mukhayyarotin Niswati indicate that the module is already in the category valid and very suitable for use in learning. The difference of this research with the previous research is the module that is made an interactive module that contains the character values. The software used in creating interactive modules is Adobe flash CS6. The kinematics material is chosen as the material in making this interactive module. In accordance with the 2013 curriculum, interactive modules are created following the steps of a scientific approach.

This paper describes the results of Research and Development (R & D) research with the title of developing character-based interactive module with a scientific approach to kinematics materials to improve the holistic competence of high school students of class X. R & D are a research method used to produce a particular product, and test to effective the product [11]. A feasibility test in the form of validity and practicality needs to be done so that the interactive module made has good quality.

## **2. Research Methods**

The type of research used is research and development or Research and Development (R & D). According to Sugiyono (2007: 407), R & D is a process or steps to develop a new product or refine an existing product, where all its activities can be accounted for, also can be interpreted as research used to produce certain product and test the effectiveness of the product. Based on the development model used, the procedure in this research consists of five stages: potential and problems, data collection, product design, design validation, design revision, product trial, product revision, product revision, trial usage, product revision, and mass production but, in this study the stages are carried out only until the revision of the product.

Interactive module that has been validated and revised, tested on one class of students class X SMA Negeri 3 Bukittinggi. The limited trial subjects consisted of 3 Physics lecturers as validators, and 2 Physics teachers as a parent. The interactive teaching experiment was conducted in SMA Negeri 3 Bukittinggi. This research data in the form of quantitative data and qualitative data. Quantitative data is the value of the interactive module validation and the test value of the practicality of the interactive module. Qualitative data is the result of interviews with teachers and learners on the implementation of interactive modules.

Data collection is an important work in a study. Correct conclusions can only be obtained from the correct data collection. Therefore, errors in collecting data will lead to erroneous conclusions.

The data collection instruments used in this study consisted of instruments of validity and instrument of interactive module practice. The creation of interactive modules containing characters with a scientific approach must be validated first by experts to determine the accuracy of the constituent components. Instrument validity includes several aspects, namely: 1) material substance aspect, 2) display aspect, 3) grammatical aspects, 4) design aspect, 5) aspect of software utilization and 6) aspect of module of interactive.

Instruments of practicality are used to collect practicality test data of the learning process with ease of using characteristic interactive module with scientific approach. Practical tools are filled by teachers and learners. Practicality instruments filled by teachers aim to get responses and suggestions for product improvement so that the resulting nteraktif module becomes a practical product used in supporting learning. The instrument of practicality consists of five aspects: 1) completeness of interactive module, 2) interactive module coverage, 3) presentation of interactive module, 4) benefit of interactive module and 5) implementation of interactive module.

Data analysis technique is related to the calculation to answer the formulation of the problem and testing the hypothesis proposed. In this study, used data analysis techniques, namely validation analysis and practicality analysis. Interactive module validation analysis was assessed by lecturer of Physics Department of State University of Padang. The statistical test performed in validity is the descriptive analysis depicted through the table. Weighting is done on a Likert scale. Likert scale is used to measure attitudes, opinions, and perceptions of a person about social phenomena. Validity analysis using Likert scale with steps as follows: (1) give score for each item of answer, (2) summing score of each validator for all indicator, (3) giving validity value is done by using an equation (1):

$$Score = \frac{\text{bobot total}}{\text{bobot maksimum}} \times 100 \quad (1)$$

The analysis of the practicality of the interactive module is characterized by the scientific approach according to the teacher based on the practicality instrument is done by the following steps: (1) give the score for each answer item, (2) sum up the score of each validator for all indicators, and (3) give practicality value by using the formula:

$$Final\ Score = \frac{\text{jumlahskor}}{\text{SkorMaksimum}} \times 100 \quad (2)$$

### 3. Research Results and Discussion

#### 3.1 Research Results

In the research that has been done there are two main results. The results of this research include: interactive module design with characteristic scientific approach and quality of interactive module from the aspect of validity and practicality.

#### 3.2 Form of Interactive Module Design

The design of an interactive module with a characteristic scientific approach to the kinematics material is made in accordance with the steps that have been prepared. This interactive module created using Adobe Flash CS6 application as main software and Photoshop, Format Factory, Audacity as supporting software, then this interactive module will be publish with exe format.

The design of this interactive module uses different types of writing. The type of writing used is adapted to its use. In writing the title using the type of writing Arial because this type of writing is not complicated and easy to read. In the material description section use the type of tuition century ghotic because this type of paper is easy to read. The colors used in this interactive module are bright and soft colors. Color selection is done based on the wishes of learners obtained from the questionnaire observation.

This interactive module contains the values of characters that can be trained in the learning process. The value of the characters contained is religious, honest, disciplined, hard work, independent, curiosity and careful guided by KI1 and KI2. The value of this character will be shown in the steps of the learning activity, the evaluation page, as well as on the part of the experimental activity using the simulation. So in every activity undertaken learners will display the values of characters that can guide learners in work. With the value of this character is expected to change the behavior of learners to a better direction along with the increase of knowledge it has.

The interactive module created has instructional instructions for educators and learners that can be read before using this interactive module. This interactive module has an evaluation question that can give the scores obtained by the learners as feedback. Each learner will score differently and depending on the answers given by the learner. This interactive module also includes simulations that can be varied variables. With this simulation learners can better understand the concept of the given material.

In the presentation of interactive module materials using scientific steps. The steps start from: (1) observe, in this step learners are given animation or video related material; (2) asks, in this step learners are given the opportunity to write questions or answer questions that have been provided based on the animation or video that has been seen earlier; (3) collect information, in this step peserta educated given information in the form of material that can increase understanding of learners; (4) reasoning, in this step learners are given a workable problem if learners already understand the material obtained in the previous step; (5) communicate, in this step learners are required to be able to communicate the results of activities that have been done in front of the class.

This interactive module has several main components, namely: opening menu, main menu, module instruction manual, KI, KD, indicator, learning objectives, learning activities, and evaluation questions, and experimental activities using virtual lab in the form of swf. The main components each have a button to be accessible directly. This interactive module contains animations, simulations, music, videos and bright colors that can add to the charm of this interactive module.

The opening menu of the interactive module contains the module title, author name, UNP logo, and buttons to access the main menu. The background opening menu has an abstract blend of colors and edited images using Adobe Photoshop CS6. The title is created using an Arial font with a 30 letter size. The opening menu can be seen in Figure 1.



**Figure 1.** The opening menu.



This interactive module uses the background with bright and attractive colors. This is based on the favorite colors of learners obtained from the observations that have been done. On the opening page is shown a picture of the train and coconut fell because the events in the picture relate to the material that is straight irregular motion and straight-changing motion irregularly.

The main menu view contains slide titles, main menu buttons, exit buttons, UNP logos, main menu hints. The main menu button can make it easy to access other desired pages. The buttons consist of: (1) Usage Button, this button connects to the page about module usage instructions for learners and teachers; (2) KI buttons, KD, indicators and learning objectives, these buttons are linked to pages containing the competencies of the material to be learned as well as the objectives of the learning to be performed; (3) Button of learning activities, this button is connected to a page that presents the material in a learning activity that uses scientific steps; (4) evaluation button; the button is linked to a page containing the evaluation to test the learners' understanding; (5) Profile button, this button connects to the interactive module author's profile page.

In the main menu view of this learner can choose the desired page by clicking one of the main menu buttons. This page has a music instrument that can add to the attraction of this interactive module. The music contained on this page can be turned off by clicking the sound button above the exit button.

The KI, KD and indicator views have buttons linking with multiple pages to display core competencies, basic competencies, indicators and learning objectives that are appropriate to the material to be covered. On this page there is also a Home button to return to the main menu. On each page description of core competencies, basic competencies, indicators and learning objectives have font size 20 and type of writing Arial. Background writing is made using colors that are more in contrast to writing. When a button is clicked or assigned to the mouse it will produce a sound that can add attraction from the interactive module. The material menu display begins with a page that leads learners to pray. This page contains the home, next and exit buttons. The exit buttons are made to make it easy to close interactive modules. The writing background is colored in contrast to the text. At the bottom there is a running banner, it contains the author's name and the title of the interactive module. The next view of the learning activity is the sub-material page to be discussed. On this page there are two sub-material buttons that connect to the presentation page of the material. This button has a sound when designated and clicked and the button color will change when designated with the mouse. Back, next, exit and home buttons are also present on this page for the purpose of making it easier to access other pages. This sub-material button will link to the page that will present the material. At the beginning of the presentation of this material there are learning reference buttons, materials and experiments using virtual lab.

In the initial view of the presentation of this material learners can trace the character values listed on the interactive module. Learners can choose the page you want to read with the navigation buttons like the next, previous and home buttons. In the view of scientific steps consists of several pages of learning activities with a scientific step. This scientific step consists of several activities that start from observing, asking, gathering information, reasoning and communicating. On the page observing the learners are asked to observe the animation or the video provided. The animations and videos contained on this page are not given an explanation, because after observing the learners are expected to generate questions related to the animation he saw earlier.

In the ask view load the back, next, blanks and exit buttons. Empty columns are reserved for where learners write questions. When learners want to go back to the page of observing it can be done by clicking a button back. Halaman also provides buttons linked to a page that displays the question that has been provided in the interactive modules. This question will lead learners to the material to be studied. Once given the questions learners can see the available explanations to help answer questions.

The initial view of the information gathering activity consists of several buttons linked to the page containing information about the material. In this information gathering display contains material that is accompanied by examples of questions that can increase the understanding of learners. On the pages of reasoning contains questions that can be done by learners. This question is given with the aim of

looking at the students' reasoning abilities and using the concepts that have been obtained at the stage of collecting information. Problem given can train learners in using the concept that has been studied. Learners are asked to write answers on their respective exercise books.

At the stage of communicating the students are asked to present the results of activities that have been done. The character values are also listed on this page and can be trained by the learner. On this page there is a linking button on the page that contains material musings. After completion until communicating stage, then learners can see the reflection of the material that has been studied.

In this experimental activity view, learners perform simple experiments using virtual labs from the swf. On this page there are back, home, exit, and work step buttons linked to the page describing the trial procedure to be performed. On the work step page learners can see which part will be made during the experiment later with the picture included in the work step. In the virtual lab page learners can do a simple experiment by varying the acceleration and speed that have been provided. To retrieve the data repeatedly learners can use the reset button located on the screen. After completion of the experiment the learners are asked to create a report. Learners are required to make a report in accordance with the structure that has been given. Each group is responsible for sending group representatives to present in front of the class.

In the evaluation view the learners are first asked to write the name and class. Before starting to work on the problem learners can read the instructions and the value of characters that are loaded. This page has musical instruments that add to the charm of this interactive module. On the opening page of the evaluation there are two navigation buttons are the start and home buttons. To start answering questions learners can press the start button, but if you want to re-read the material learners can press the home button. Problems contained in this interactive module are multiple choice questions. Learners can answer the question by clicking one of the options provided answers. After choosing the correct answer, then the learners will receive feedback.

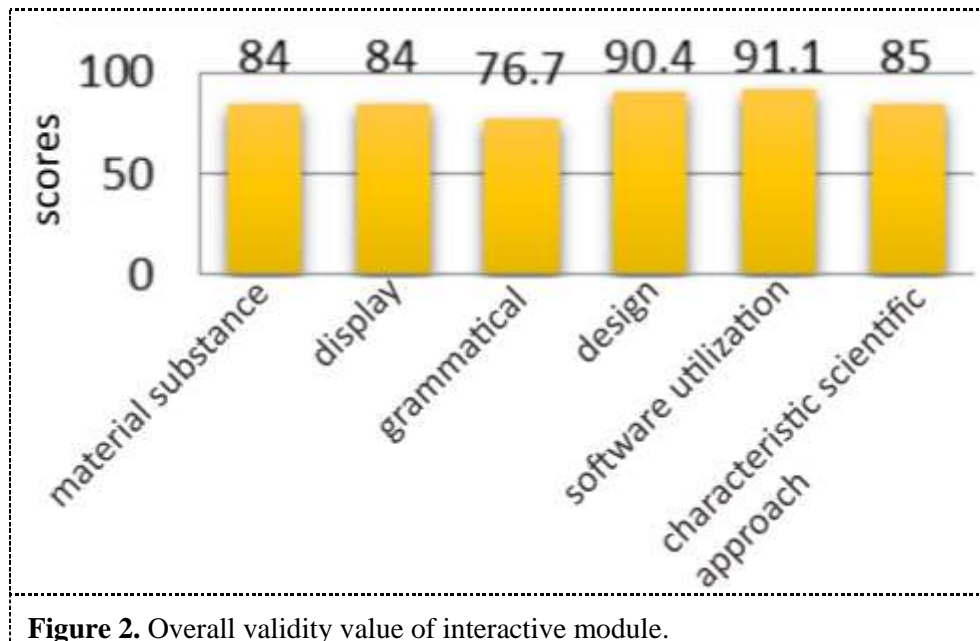
On the feedback page learners can see the scores obtained at the top right corner. When learners answer the question correctly, then the score will increase automatically, but when the answer given is wrong then the score remains. To answer the next problem learners can press the next button. After completing the problem, then the learners will get the final score. On the final display page of the evaluation the learner can see the total score obtained after answering all questions. If the score score is not satisfactory, the student can press the replay button. The replay button on this page serves to repeat the problem. When this problem is done at home, then learners can submit the printed final score of this page by using the snipping tool. When finished doing the question then learners can press the home button to return to the main menu.

### *3.3. Validity Test Results*

The result of validity is obtained from validation instruments filled by experts. This validation result is used as a guide in improving interactive modules and to determine the eligibility of the interactive module. The validation instrument used contains six aspects of the assessment of the interactive module. Assessment aspects contained in the validation instrument are the substance of the material, the appearance, the grammar, the module design, the utilization of the software, the founder of the interactive module.

In the process of validating this interactive module the number of experts involved as many as three lecturers of physics FMIPA UNP. In each aspect the scoring has the lowest score of 1 and the highest score 5. The scores obtained will be converted in the form of numbers from range 1 to 100. Determining an assessment can be seen from the average value of indicators contained in the aspect of the assessment of the interactive module. Based on the validation instrument used in the material substance aspect there are three indicators. This aspect indicator is on the horizontal axis of the graph. Indicators are: 1) interactive module made not deviate from the truth of science, 2) interactive module presented in accordance with the depth of material, 3) interactive module presented in accordance with the development of science.

Based on the validation results it is found that the average percentage of the material substance aspect is 84.4%, the average percentage of the display aspect is 84%, the average percentage of the grammatical aspects is 76.7%, the average percentage of the design aspect is 90.4%, the average percentage of the software utilization aspect is 91.1% and the average percentage of the interactive learning faculty aspect is 85%. The overall Validation value can be seen in Figure 2.



**Figure 2.** Overall validity value of interactive module.

From Figure 2 we can see the percentage of average validity of interactive module with characteristic scientific approach is 85.2% with very valid criteria. It shows that interactive module with characteristic of scientific approach to the kinematics material is valid, both from material susceptibility aspect, display, grammar, design, software utilization and interactive module feature so that this interactive module can be used in learning.

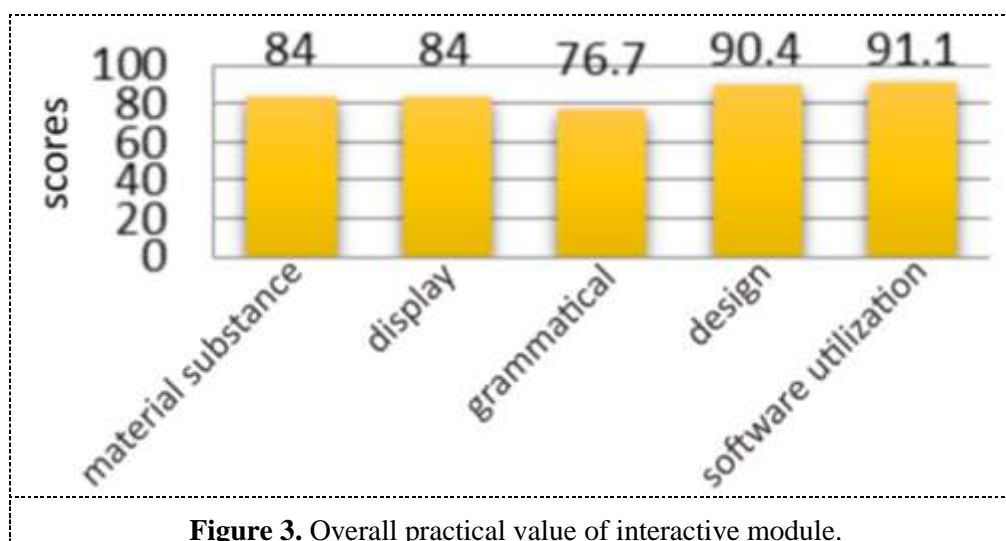
### 3.4. Practicality Test Results

The results of practicality test obtained from the analysis of instruments used. This practicality test aims to find out the practical level of interactive module with characteristic scientific approach. In assessing the practicality of this interactive module involved two physics teachers of SMA 3 Bukittinggi. The results of this practice will serve as guidelines for improving interactive modules that have been designed.

The instrument of practicality consists of five aspects of assessment. These aspects include: 1) completeness of the module, 2) module coverage, 3) module presentation, 4) module benefits, 5) module implementation opportunities. In every aspect there is an assessment indicator of the interactive module. Each indicator is scored 1 through 5. The scores obtained will be converted in percentage form. For the assessment of one instrument, it is obtained from the average of each indicator in the interactive module assessment aspect.

Based on the teacher's response to the interactive module provided it is found that the average percentage on the completeness aspect is 80%, the average percentage on the coverage aspect is 80%, the average percentage on the presentation aspect is 80%, the average percentage on the benefit aspect is 76.7%, and the average percentage on the aspect of the interactive module implementation opportunity is 83%. The overall value of practice can be seen in Figure 3.





**Figure 3.** Overall practical value of interactive module.

From the data above, the percentage of the average practice of interactive module with characteristic scientific approach is 80%. It shows that the interactive module is characterized by a scientific approach to practical kinematics material from aspects of completeness, coverage, presentation, benefits, and implementation opportunities. Thus, this interactive module made is practical for teachers to use in learning.

#### 4. Discussion

The main purpose of this research is to produce interactive module design and to know the quality of interactive module in terms of its validity and its practicability. This interactive module can be used in learning physics class X semester 1 on kinematics material. This interactive module can be operated with a computer / laptop so that it can be used out of the classroom by the learners. This interactive module contains the value of characters that can be trained by learners in learning. The value of the characters contained is religious, honest, disciplined, hard work, independent, curiosity and meticulous. The character values contained in this interactive module are guided by KI1 and KI2. Given the value of characters in this interactive module is expected learners can apply good character in learning.

This research is based on research and development (R&D) consisting of ten stages, that is knowing potential and problem, collecting information, designing product, design validation, design revision, product trial, product revision, trial usage, product revision, and mass production (Sugiyono, 2012). However, this study was conducted until the seventh stage. Based on research procedures that have been done can be explained the results achieved in research, constraints and limitations encountered, as well as some alternative solutions to overcome the constraints and limitations in the study. The results of this study include product design, validation results by experts and test results practicability by educators, as well as product revisions based on suggestions given validators and practitioners.

Based on the validation results by three experts it can be seen that the average validity score is 85.2% so that the interactive module made is categorized very valid for use in Physics learning process. This is in accordance with Sugiyono (2012), states that the validation is done by experts who are experienced in the field under investigation. The assessment component in the validity of this product consists of material substance, appearance, grammar, module design, software utilization and interactive module identifier. From the results of validation and suggestions given can be seen that this interactive module still needs improvement. Improvements made according to the validator's suggestions are on the objectives and reference of learning that have not been included, the value of the character of the material, and the selection of colors more interesting. As Borg and Gall (2003)

argue, in development research, the initial product developed must be validated or revised based on the input of experts prior to use. After making improvements then produced a better interactive module.

Based on the results of practical test conducted at SMA 3 Bukittinggi can be concluded that the interactive module is practically used with an average value of 80%. This practicality test is performed using a practical instrument that will be filled by the educator. This interactive module is practically used judged from module completeness aspects, module coverage, module presentation, module benefits, and module implementation opportunities. After analyzing the results of practical test, it can be concluded that this interactive module can be used in physics learning as teaching material and can improve students' competence holistically. This is in line with the opinion Purwanto (2009) a product is said to have good practicality if the possibility to use the product is large. In addition to this, the product is said to be practically seen from its ease of use and the benefits of using the product.

From the results of practical tests that have been done there are suggestions given by practitioners. Improvements that have been made based on suggestions provided are, adding photos and videos that are more supportive and complete the material presented in the interactive module. After making improvements, the resulting interactive module is better than ever so it can facilitate learners in understanding the material.

In the implementation of learning using interactive module is still experiencing constraints. The constraint is a limitation on the material presented. This interactive module contains only straight uniform motion and straight uniform motion, circular motion, and parabolic motion. The solution that can be done to overcome this limitation is by developing class X material in this interactive module. Another obstacle is the limitations of laptops / computers that provide schools, so that learners less than the maximum in using interactive modules. Solutions that can be done to overcome this limitation is to form small groups in learning, so learners can learn to use interactive modules.

## 5. Conclusions

Based on the results of research and discussion that has been done can be put forward several conclusions as follows: An interactive module is an animation, audio, video, and simulation module created using R & D (Research and Development) steps. The steps taken are to identify potentials and problems, gather information, design products, design validation, design revisions, product trials, and product revisions. An interactive module created using a scientific approach with Adobe Flash CS6 application. Interactive modules containing characters with a scientific approach on kinematics material that is made are in the criteria very valid and practical, used to improve the holistic competence of learners. With the percentage of each of the criteria of 85.2% and 80%

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