Practicality of the interactive multimedia development integrated science with inquiry based learning model of simple machine themes on human muscular and skeleton system integrated 21st century learning

Nurhafifah, Ratnawulan*, Ahmad Fauzi

Department of Physics, Faculty of Mathematics and Natural Science, Universitas Negeri Padang. Jl. Prof Hamka, Padang 25131, Indonesia

*ratnawulan@fmipa.unp.ac.id

Abstract. The 21st century learning is learning that combines literacy skills, knowledge skills, skills and attitudes, as well as mastery of information and communication technology. 21st century learning requires students to be able to find solutions to problems based on their knowledge by using thinking skills. However, from the preliminary research, it was seen that students only studied science with low competence. To overcome this problem, it is necessary to update student learning resources. One example of using media to make it more meaningful is by using interactive multimedia. Because interactive multimedia is able to provide feedback for teachers and students who use it, teaching materials can be used independently by students. Interactive multimedia that has been developed based on the inquiry learning model can increase students’ active participation in learning and can increase the competence of students’ attitudes, knowledge and skills. The quality of integrated science interactive multimedia development of inquiry learning models with the theme of simple planes on the 21st century skew integrated human muscle and system framework that has been developed can be used if it meets several appropriate criteria, namely aspects of validity, practicality, effectiveness. the validity of integrated science interactive multimedia is included in the valid criteria with an average value of 0.84. Practicality for one to one evaluations is 90.97% and practicality for small group students is 92.53% with very practical category.

1. Introduction
Science and technology are the basis of 21st century development. Besides that, every country needs human resources capable of mastering various skills, one of which is critical thinking skills and problem solving from various forms of increasing life problems. Education in Indonesia is based on Pancasila education and the 1945 constitution, which is rooted in the nations culture that puts forward the character that is very necessary in facing the challenges of the 21st century. 21st century learning is learning that combination integrated literacy skill, knowledge skill, skill, and attitude, as well as mastery of information and communication technology. 21st century learning prepares skills that accordance with the demands of work in the future. These skills needed in the 21st century are (1) life and career skills, (2) learning and innovation skills, and (3) information media and technology skills[1]. However, the most important skills must mastered by students in 21st century learning are
four Cs or 4C skill. Among them are creativity thinking and innovation, critical thinking and problem solving, communication, and collaboration.

The 21st century learning requires students to be able to find solution to problems based on their knowledge by using thinking skills. In 21st century learning, it measures the competence from low other thinking skills (LOTS) of students to high other thinking skills (HOTS) of students [2]. However, integrated science learning in schools tends to learn by memorizing concepts, theories and laws. So that science learning as a scientific process and scientific attitude does not work well in learning. Students only learn science at low competence even though 21st century learning requires high competence or high level skills. Learning that takes place to be teacher center because students are passive during learning.

To solve this problem, it is need to update the learning resources of students. Teachers can use other teaching materials that are able to invite students become active in learning. One of them is the use of learning media in the form of interactive multimedia. Along with technological developments in 21st century, the world of education also takes advantage of these developments in order to achieve educational goals effectively and efficiently. A hot topic in education related to the use of technology is use various media (multimedia). Called multimedia because this media is a combination of various media, namely using audio, video, graphics, and so on [3]. An example of using media to make it more meaningful is using interactive multimedia. Because interactive multimedia is able to provide feedback for teachers and students who use it. Interactive multimedia also has a variety of visual projections capable of describing subject matter effectively and efficiently. From the results of research in 2019 on student analysis and learning media analysis it was concluded that students have a high interest in integrated science learning and the ability to use ICT is quite high. This is the basic capital to expect 21st century integrated learning [4]. Therefore, Integrated Science interactive multimedia needs to be developed to help teachers and attract students’ interest in learning.

Multimedia is defined as a computer system consisting of hardware and software makes it easy for users to combine images, video, photograpy, graphics and animation with sound, text, and data controlled by computer programs [5]. In addition, the meaning of multimedia teaching materials is learning media based on multimedia technology. Learning using multimedia is quite extensive in the world of education, not only in tertiary institutions, but also in schools [6]. The simplest and most widely used multimedia-based teaching materials are presentation materials using PowerPoint. So in general, multimedia is a technology-based learning media that combines images, text, animation, video, sound, data etc.

In learning using multimedia, students can learn teaching material and equipped with quizzes for practice. Students can use it repeatedly, individually or in groups until the material can be understood. Students can also evaluate learning achievement through interactive quizzes. As with other types of teaching materials, the main principle in making multimedia-based teaching materials must be in accordance with the goals and objectives of learning and teaching materials. These teaching materials can also interact with students with or without teacher assistance. This means that the teaching materials can be used independently by students.

The preparation of ICT-based teaching materials must contain at least: 1) Identity, including title, class, semester, and compiler identity. In general, this identity is located on the home page. 2) Core competencies and basic competencies. This competency must be listed so that it becomes a user's reference regarding the competencies that students must achieve after studying the material on the teaching material. 3) Achievement indicators. The achievement indicators describe the results that must be achieved by students which emphasize the aspects of learning outcomes which are the stages to achieve competence. 4) Material. The material must pay attention to the level of interactivity of teaching materials. As needed with the aspects of complexity, urgency, complexity. 5) Exercises. Exercise questions are useful for increasing understanding of the material through discussion together. 6) Competency test. Competency tests are arranged based on a grid that is adjusted to KI, KD, and achievement indicators. This competency test question is accompanied by feedback so that students know which competencies have been achieved and which have not been achieved. 7) Reference.
Reference as a reference in making teaching materials. Inclusion of these references is important to avoid plagiarism [7].

Integrated science learning using interactive multimedia can be carried out well and effectively, so a learning model in multimedia is needed. One learning model that can make students active in investigative activities is the inquiry based learning model. In accordance with 2013 curriculum. Learning in the classroom uses directed learning steps in accordance with the learning model used by the teacher. Interactive multimedia that has been increase based in the inquiry learning model that can increase students active participation in learning and can increase the competence of students attitudes, knowledge and skills.

Inquiry learning emphasizes the process of searching and finding. Content the subject is not given directly. Students play a role in finding and finding their content subject matter, while teachers act as facilitators and guides for students to learn. Inquiry learning is a series of learning activities that emphasize critical and analytical thinking processes for seeking and finding the answers to a question in question. [8]. Inquiry is a learning activity that maximally involves all students abilities to seek and investigate systematically, critically, logically, and analyse, so that they can formulate their own findings with confidence. The main targets of inquiry learning are (1) the maximum involvement of students in the learning process, (2) the direction of learning logically and systematically on the learning objectives; and (3) develop students’ confident attitude about what is found in the inquiry process [9].

In an effort to instill the concept, for example the science concept, the subject of interdependence on students is not enough just a lecture. Learning will be more meaningful if students are given the advantage to know and actively involved finding concepts from facts seen from the environment with teacher guidance.

The steps for implementing inquiry learning are orientation, formulating hypotheses, collecting data, testing hypotheses, and formulation conclusions[8]. The benefits of using the inquiry learning model are as follows. First, attract students interest in learning science. Second, improve students conceptual understanding. Third, understanding the nature of scientific knowledge. Fourth, facilitate collaboration between students. Fifth, develop students experimental skills. In addition to the inquiry learning model, it can create more meaningful and permanent knowledge in students.

The quality of integrated science interactive multimedia development of inquiry based learning models with the theme of simple planes on the framework system and human muscles intergraded 21st century leaning that has been developed can be used if it meets several appropriate criteria, namely aspects of validity, practicality, effectiveness. An instrument can be said to be valid if the instrument used is able to measure what you want to measure [10]. In line with this, validity is a measure that shows the level of legality and validity of an instrument. Based on the above opinion regarding validity it can be concluded that validity is a criterion used to determine the validity of an instrument used [11].

The validity tested under development interactive multimedia includes the validity of content, presentation, graphics, and language. Content validity includes conformity with KI and KD, suitability with child development, the need for teaching materials, the correctness of the substance of learning materials, benefits for adding insight, and conformity with moral and social values. The components of language validity include readability, clarity of information, and suitability with EYD. The component of validity of the presentation includes the clarity of the objectives to be achieved, the order of the presentation, the provision of motivation, attractiveness, interaction, and completeness of information. While the graphic component includes the use of font type and size, layout, illustrations, and display design [12].

Validation instrument based on validity analysis. The integrated science interactive multimedia validation instrument was used to determine the validity value of the intergraded science multimedia that was develop. This validation instrument uses questionnaire sheet in the form of list of questions. The validation questionnaire is filled out by lecture and teachers with predetermined and develop
criteria. The validation test is carried out by experts and users. Product validation can be done by experienced experts to assess the weaknesses and strengths of the resulting product [13].

Practicality is the level of usability of a product by users with regard to convenience and compatibility with time. Practicality test is carried out to assess the practicality of a product. Practicality means ease in preparing, using, processing and interpreting as well as administering it. Test the practicality of multimedia interactive from the responses of small group students using student response questionnaires. The teacher response questionnaire was given to find the teachers response to the interactive multimedia that had been developed. The teacher response questionnaire is compiled from several indicators, namely easy to understanding, interesting, and efficient.

2. Research Methods
The type of research to be carried out is research and development. Research and development is a research method used to produce a product to test the effectiveness of the product. This research will conduct product development as a solution in learning. This study aims to develop teaching materials, namely development studies. Therefore, this type of research is a design research type of development studies. The teaching material developed is interactive multimedia Integrated Science using an inquiry based learning model with the theme of a simple plane on the muscle system and human skeleton integrated 21st century learning with valid and practical criteria.

Development research using the Plomp development model consist of 3 stages, namely the preliminary research, the prototype making stage, and the assessment stage. The product assessment is based on the validation sheet that has been filled in by the experts and then analysed to determine the validity level of the product that has been develop. The validity analysis uses a likert scale with the following steps: 1) giving a score for each item the answer is very good(4), good(3), sufficient(2), and less(1), 2) add up the total score of each validator for all indicators, 3) provide a validity value using the Aiken’s V formula, that is.

\[
V = \frac{\sum s}{n(c-1)}
\]

Explanation:
S = r - l_o
l_o = the lowest number of validity assessments
c = the highest number of validity assessments
r = number given by the validator

The validity category is valid if it is worth more than 0.60 [13].

Analysis of practical questionnaire data for physics learning tools based on questionnaires of teachers and students with the following steps: 1) giving a score for each item the answer is strongly agree(4), agree(3), normal(2), and disagree(1), 2) Add up the score of each validator for all indicators. 3) Granting validity values by using the formula:

\[
P = \frac{f}{N} \times 100%
\]

explanation:
P = Final score
f = Score acquisition
N = Skor maksimum

Practicality categories are (0-20) very impractical, (21-40) not practical, (41-60) less practical, (61-80) practical, (81-100) very practical [14].
3. Result and Discussion

Research development using the Plomp development model consists of 3 stages, namely preliminary research, prototyping phase, and assessment phase. The preliminary research stage was presented last year, then what was done was the development and manufacture of a prototype. At this stage the prototype is developed, evaluated, revised repeatedly (cycle). The design results at this stage produce a prototype. Then performed a formative evaluation of the prototype. Formative evaluation is an evaluation that is proposed for improvement, found in all phases and cycles of repetitive design research. The formative evaluation has several stages including: self-evaluation, expert review, one to one evaluation, small group evaluation.

Self-Evaluation Assessment, Self-evaluation was carried out by the author and two friends who also did product development. The assessment of the validity of the integrated science interactive multimedia was carried out using a previously validated assessment instrument. Integrated science interactive multimedia validation includes four components of the assessment including appropriateness of content, presentation, language, graphics. In doing the validation, there were some inputs that were also given by the validator to improve the development of interactive multimedia science inquiry based learning models with the theme of simple aircraft on the framework system and human muscles integrated 21st century learning carried out. Based on the validation that has been done, the result are in the table below.

| Component       | value validation | Criteria |
|-----------------|------------------|----------|
| Feasibility Of Contents | 0.85          | Valid    |
| Construct       | 0.85             | Valid    |
| Linguistic      | 0.83             | Valid    |
| Graphical       | 0.81             | Valid    |
| Average         | 0.84             | Valid    |

Based on Table 1 above, it can be seen as a whole that the validity of integrated science interactive multimedia is included in the valid criteria with 0.84 value average.

The next stage is Evaluation One to One. Improvement is done by evaluating each person. This evaluation is in the form of input from students. Individual evaluation was carried out on 3 students using practicality instruments. Interactive multimedia is shown to students of class VIII b SMP Negeri 1 Kampar who have moderate and low abilities. Students are asked to read the Integrated Natural Science interactive multimedia without being taught first by the teacher. Students are given a practicality questionnaire in the form of questions after reading interactive multimedia. For the practical result of one to one evaluation can be seen in the table below.

| Indicator     | Value (%) |
|---------------|-----------|
| Easy to understand | 90.27%    |
| Benefits      | 87.50%    |
| Efficient     | 94.44%    |
| Interesting   | 91.67%    |
| Average       | 90.97%    |

The material on integrated Ipa interactive multimedia is considered clear with a good readability level, interactive, interesting to read and the color composition of multimedia is considered contrasting and bright, making students 'interest active in learning Integrated Science learning so that it helps improve 21st century students' skills. Next is the Small Group Evaluation stage. Small group evaluations were carried out after the one to one evaluation was completed. Small group evaluation is done by practicing interactive multimedia that has been valid in a group of students consisting of 9
people. Small group evaluation was carried out on students of class VIII b SMP Negeri 1 Kampar who came from randomized abilities. The analysis can be seen in Table 3 results of the Practicality Assessment of Small Group Student Responses.

| Indicator          | Value (%) |
|--------------------|-----------|
| Easy to understand | 91.94%    |
| Benefits           | 90.41%    |
| Efficient          | 94.44%    |
| Interesting        | 93.33%    |
| **Average**        | **92.53%**|

The results of the practicality of students responses in small group to integrated Science Interactive Multimedia which are seen in Table 4 show that the integrated Science interactive Multimedia developed is very practical to be used in the Integrated Science learning process with a practicality value of 92.53%. With details, it can be seen that the interactive multimedia small group that has been developed has a very practical practical value. With the Easy to understand category having a value of 91.94%, Benefits having a value of 90.41%, Efficient with a value of 94.44%, and Interesting with a value of 93.33%.

Teacher response questionnaires were given to determine teacher responses to interactive multimedia that had been developed. In summary, the practical results of the teachers response can be seen in Table 4.

| Indicator          | Value (%) |
|--------------------|-----------|
| Easy to understand | 93.05%    |
| Benefits           | 91.67%    |
| Efficient          | 88.89%    |
| Interesting        | 91.67%    |
| **Average**        | **91.31%**|

It can be seen that the interactive multimedia that has been developed has a very practical practical value. With the Easy to understand category having a value of 93.05%, Benefits with a value of 91.67%, Efficient with a value of 88.89%, and Interesting with a value of 91.67%. The results of the practicality of the teacher's response to the integrated science interactive multimedia which is shown in Table 4 show that the integrated science interactive multimedia developed is very practical for use in the integrated science learning process with a practicality value of 91.31%.

4. Conclusion
Based on the results that have been presented, the integrated IPA interactive multimedia inquiry-based learning model with the theme of a simple plane on the human skeletal system and muscles has fulfilled the validity of the content, language, presentation, and graphic validity components. So that integrated IPA interactive multimedia has valid criteria. And for the practical aspect it has also fulfilled the aspects of ease, attractiveness, and efficiency so that the integrated IPA interactive multimedia inquiry based learning model with the theme of a simple plane on the human skeletal system and muscles has practical criteria.

References
[1] Etistika Yuni Wijaya, Dwi Agus Sudjimat dan Amat Nyoto. 2016. Transformasi Pendidikan Abad 21 Sebagai Tuntutan Pengembangan Sumber Daya Manusia Di Era Global. Prosiding Seminar Nasional Pendidikan Matematika 2016 Universitas Kanjuruhan Malang. (1) – ISSN 2528-259X
[2] Rahima Syabrina Sarmi and Ratnawulan. 2020. *J. Phys.: Conf. Ser.* **1481** 012117

[3] Kustandi, Cecep dan Bambang Sutjipto. (2011). Media Pembelajaran Manual Dan Digital. Bogor: Ghalia Indonesia

[4] Nurhafifah and Ratnawulan. 2020. *J. Phys.: Conf. Ser.* **1481** 012053

[5] Rusman, (2012). Belajar dan Pembelajaran Berbasis Komputer (Mengembangkan Profesionalisme Abad 21). Bandung: Alfabet

[6] Ashar, Rayandra. (2012). Kreatif pengembangan media pembelajaran. Jakarta: Referensi Jakarta

[7] Depdiknas. (2010). *Panduan Penyusunan Bahan Ajar Berbasis TIK*. Jakarta: Depdiknas Direktorat Jendral Pendidikan Dasar dan Menengah Direktorat Pembinaan Sekolah Menengah Atas

[8] Hosnan. (2014). Pendekatan Scientific dan Kontekstual dalam Pembelajaran Abad 21. Ghalia Indonesia. Bogor.

[9] Trianto. (2010). Mendesain Model Pembelajaran Inovatif-Progresif: Konsep Landasan, Dan Implemntasinya Pada KTSP. Jakarta: Kencana Prenada Media Group

[10] Sugiyono. (2012). *Metode Penelitian Pendidikan Pendekatan Kuantitatif, Kualitatif, dan R&D*. Bandung: Alfabet.

[11] Arikunto, Suharsimi. (2010). *Dasar-dasar Evaluasi Pendidikan*. Bumi Aksara: Jakarta

[12] Depdiknas, (2008). *Panduan Pengembangan Bahan Ajar*. Jakarta: Depdiknas Direktorat Jendral Pendidikan Dasar dan Menengah Direktorat Pembinaan Sekolah Menengah Atas

[13] Zaitul Hidayat and Ratnawulan. 2020 *J. Phys.: Conf. Ser.* **1481** 012116

[14] Riduwan. (2009). *Belajar Mudah Penelitian untuk Guru, Karya. Suwan, dan Peneliti Pemula*. Bandung: Alfabet