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Trends in the Development of Physics Learning Multimedia in Indonesia: A Literature Review

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Abstract *– This study aims to analyze the development of multimedia technology in physics learning based on the needs of the process and learning outcomes. This research is a literature review research. The research subjects consisted of ten journal articles selected from the Scopus Index database in the last five years. The results of data analysis show that learning physics with multimedia can stimulate students' learning abilities well. The trend of research development shows that the use of multimedia in physics learning in Indonesia is growing rapidly at this time. In addition, multimedia learning physics is more on the content of introduction to solid matter physics, earth and space science, multimedia learning physics, experimental physics, electricity, modern physics, introduction to core physics, and quantum physics. The conclusion obtained from this analysis is that the level of multimedia needs in physics learning in Indonesia is still very high.*

Keywords: *learning multimedia; learning technology; physics learning*

I. INTRODUCTION

The influence of rapid development of information technology on the world of education has been unavoidable in the current era of globalization. Global demands require the world of education to always adapt technological developments to efforts in improving the quality of education, especially adjusting the use of ICT for the world of education, especially in the learning process (Ma'ruf et al., 2019).

Therefore, the demand for a change in the human mindset of the 21st century demands a very big change in national education, which we know our education is a legacy of the old education system whose contents are memorizing facts without meaning. Changing the Indonesian education system is not an easy job (Ma'ruf et al.,

2018). The Indonesian education system is one of the largest education systems in the world, which includes about 30 million students, 200 thousand educational institutions, and 4 million educators, spread over an area almost the size of the European continent. But this change is a must if we don't want to be run over by the changing global era (Guruz, 2011).

Partnership for 21st Century Learning develops a learning framework in the 21st century that requires students to have skills, knowledge and abilities in the fields of technology, media and information, learning and innovation skills as well as life and career skills (Mishra & Kereluik, 2011). This framework also describes the skills, knowledge and expertise that must be mastered in order to be successful in life and world of work.

The trend of change and innovation in the world of education will continue to occur and develop in entering the 21st century today. These changes include: it is easier to find learning resources, more options for using and utilizing media, the increasing role of media and multimedia in learning activities, more flexible learning time, the use of computer-based learning, the use of television/video media, mobile learning, e-learning, online curriculum, e-library. The trend of change and innovation has very broad implications in the world of education, namely changes in renewal programs and learning technology, changes in learning and learning, more control over learning to students, and demands the integration of media in learning activities (Morgan, 2007).

This change in demands makes the world of education require innovation and creativity in the learning process because many people propose reforms in education, especially physics learning, but very few people talk about problem-solving solutions about the learning and teaching process that are in accordance with the global demands of the 20th century. 21 at the moment. In various studies and research it is stated that education is an indicator of the glory of the nation, as well as teachers play an important role in teaching students. Therefore, teacher learning is a key indicator of educational success. Entering the twenty-first century, teachers/lecturers as the main learning resources are deemed inadequate, teacher learning resources must be integrated with other learning resources, namely print, audio, audio-visual, and computer learning resources. It is even necessary to use mobile phones as mobile learning (Tanjung, 2021).

The position of the teacher in learning activities can function as an artist or scientist who is able to design and implement learning, manage learning resources. Therefore, knowledge, attitudes, and skills are needed to design physics learning well, especially to solve problems in basic physics courses so that the quality of learning increases, especially in the theoretical and

practical aspects of learning (Potkonjak et al., 2016).

Multimedia is the use of various types of media (text, sound, graphics, animation, and video). Interactive multimedia adds a sixth element, namely the interactive aspect, while in non-interactive multimedia, the user acts passively and watches scene by scene sequentially. In interactive multimedia, the user can actively select the desired scene. Users can also play with the simulations and games provided (Rahmawati & Dewi, 2019).

Another opinion Interactive multimedia is a multimedia that is equipped with a controller that can be operated by the user, so that the user can choose what he wants for the next process. Through that process there is reciprocity between users and multimedia (Ma'ruf et al., 2019). Meanwhile, according to Hofstetter et al. (2006) interactive multimedia is the use of computers to create and combine text, graphics, audio, moving images (video and animation) by combining links and tools that allow users to navigate, interact, create and communicate.

According to Siddik (2018) types of interactive multimedia are divided into two, namely online interactive multimedia that can be used online on the internet network and can be controlled by the user, an example of this type of multimedia is a website. This type of multimedia has a wide range of people and targets. The second is offline interactive multimedia that can be controlled by the user but not through the internet network, examples of this type of multimedia include interactive learning multimedia, game applications, and others (Mayer, 2017). This type of multimedia only covers people and targets that are not too broad and only in certain areas.

According to Muslimat (2021), multimedia is a basic skill that is very important in 21st century life as well as reading. in fact, multimedia is changing the way reading itself. multimedia does not limit the presentation of linear text as in books, but makes the reading process dynamic so that users can expand the text to learn about a topic. This is achieved not only by providing text alone but also by using sound, images, music and video. Multimedia also uses links to quickly navigate all linked information. Even in a study by Computer Technology Research (CTR), it is stated that a person gets 20% of seeing and 30% of hearing. but they can remember 50% of seeing and hearing, and 80% of seeing, hearing and doing simultaneously. This proves that multimedia is an important tool in teaching and learning.

Interactive multimedia in learning is very much needed due to several factors including absorption of 1.5% through touch, 3.5% through smell, 11% through hearing, 83% through sight (Loper et al., 2019). The memory of people who read alone is ± 1%. This memory can be increased again to 25-30% through television, while the use of hypermedia can increase memory as much as 60% (Nurlela et al., 2019).

II. METHODS

The research method used is Systematic Literature Review (Hamilton et al., 2021). The research subject is reputable international articles through the Scopus Index database (Borrego et al., 2014). There were ten articles used in this research.

Literature selection uses the Scopus Application Programming Interface (API), and Scimago Journal & Country Rank to obtain titles, authors, and abstracts, full text papers, journal ratings and indexation levels (Harzing, 2007).

The research procedure used is the identification, screening, eligibility, analysis and synthesis stages with four stages of activity as shown in Figure 1 below:

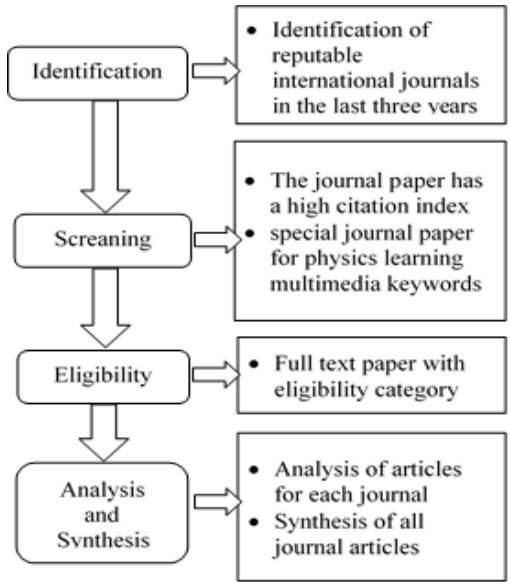

Figure 1. Literature review stages

III. RESULTS AND DISCUSSION

Based on the results of the analysis of the journal articles reviewed, the following data were obtained, namely paper (1) Compact Disk-Online as a project-based physics learning medium which is an online interactive learning media. Students are also very responsive to the use of CD-O, so it can increase motivation to learn physics.

Paper (2) An interactive multimedia model based on learning styles to improve mastery of preliminary concepts of solid-state physics where the results show that the use of interactive multimedia-based learning styles is more effective than conventional learning in increasing mastery of preliminary concepts of solid-state physics. Paper (3) Collaborative Ranking Tasks (CRT) assisted by e-learning to improve the science generic skills of prospective physics teacher students. The result is that the application of CRT assisted by e-learning in IPBA lectures has a positive and significant effect on increasing students' mastery of concepts and Generic Science Ability. Paper (4) trains critical thinking skills through Facebook in multimedia courses for physics students. The result is that learning through Facebook can be used to train students' critical thinking skills based on the assessments of lecturers and students who give good assessments (analyzing 80%, synthesizing 70%, evaluating 75%, applying 90%, generating ideas 85%, expressing ideas 80%, and problems solving 62%).

Paper (5) development of physics experimental lectures with multimedia technology. The result is that learning with multimedia technology in physics experimental subjects using VBL and SBL

can improve students' conceptual abilities and skills. Paper (6) interactive multimedia in electric concept learning for prospective teachers, the result is that the average level of mastery of students' electrical concepts in the experimental group is higher than the control group. This shows that the use of interactive multimedia effectively supports the physics learning process for prospective teachers. Paper (7) problem-based learning model assisted by computer simulations to improve critical thinking skills of prospective physics teachers. The result is that lecturers and students give positive responses to problem-based learning models assisted by computer simulations on static electricity material. Problem-based learning model has a positive influence in an effort to improve students' critical thinking skills.

Paper (8) the development of adobe flash-based learning media for modern physics courses on black body radiation. The result is that the use of this learning media can help students understand the material about black body radiation. This can be seen in the results of the student material understanding test where the percentage of students who have an understanding level that is in the very good and good categories is 81.36%. The rest, 18.64% are in the category of a sufficient level of understanding, and there are no students who have a level of understanding in the category of less or very less. In addition, the results of the student motivation survey after using this learning media show that the percentage of students who have very high and high motivation levels are 94.73%, and 5.26% have moderate levels of motivation. There are absolutely no students who have a level of motivation in the low or very low category. This shows that this learning media product can motivate students to study black body radiation.

Paper (9) the development of web-based e-learning learning media for the introductory core physics course, the result is that the developed e-learning web product meets the validity and practicality requirements to be used as a learning medium for the core physics introduction course. The last paper (10) introductory learning of quantum physics by utilizing PHET simulation and LKM media through a scientific approach: the impact on students' interest and mastery of concepts, the result is a scientific approach assisted by computer simulations and worksheets, namely: 1) Student interest during learning with an approach scientific aids with simulation media and worksheets, increased from 73.33%, 86.66%, to 90.00%; 2) students' mastery of concepts in general the trend continues to increase, although not too significant. Starting at 62.30%; 79.60%; up to 80.30%.

Based on the results of the synthesis of reviewed journal articles, it is known that the development of research on multimedia learning physics from five years in Indonesia shows that there are various forms of multimedia products developed, including

CD-O (compact disk-online), interactive multimedia based on learning styles, collaborative ranking tasks (CRT) assisted by e-learning, VBL and SBL, problem-based learning model assisted by computer simulation, adobe flash-based learning media, web-based e-learning learning media, and phet simulation media. These multimedia products are mostly used to measure the following variables, namely learning motivation, mastery of concepts, science generic skills, critical thinking skills, as well as conceptual abilities and skills.

Multimedia learning physics is more on introductory content of solid-state physics, IPBA, multimedia learning physics, physics experiments, electricity, modern physics (black body radiation), introduction to core physics, and quantum physics. Most of this physics learning multimedia research design is developmental (3) and quantitative research (6). one classroom action research (1). The terms used in research on multimedia learning physics vary, namely interactive multimedia project-based physics learning, interactive multimedia based on learning styles, e-learning, multimedia technology, computer simulation, adobe flash-based learning media, web-based e-learning learning media, and media. phet simulation. all these terms, basically to describe the idea, or the idea of multimedia.

IV. CONCLUSION AND SUGGESTION

Based on the content analysis of journal articles, it can be concluded that the level of multimedia needs in physics learning is still very high. This is also influenced by the development of media technology in physics learning where the trend of developing multimedia technology starts from multimedia related to computers (but not online), and growing towards the online ones either through the website, digital apps, or android apps.

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