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Analysis Student Needs for the Development of Contextual-Based STEM Approach Learning Media in Online Learning: An Evidence from Universities in Jambi, Indonesia

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Abstract

In 2020, higher education must implement online learning because of the pandemic COVID 19. However, learning with the science, technology, engineering, and mathematics (STEM) approach is rarely done in online learning. Therefore, the first step in implementing the STEM approach on campus in online learning is to develop contextual learning media based on the STEM approach. This study analyzes students' needs for contextual learning media based on the STEM approach in Basic Physics courses in online learning. This research method is a descriptive study with research subjects are 141 (71.94 % of the population) with second and third-year students of the Physics Education Program of Universitas Jambi and the State Islamic University of Sulthan Thaha Saefudin Jambi. The subject has completed basic physics courses. Data collection was carried out from preliminary observations, and the use of a student needs analysis questionnaire. The results showed that students found it difficult to understand several topics in basic physics subjects. It is caused by a lack of instructional media, a lack of descriptions, a less detailed description of formulas, inadequate use of the STEM approach, and a lack of higher-order thinking skills for student practice. The questionnaire results also found that students needed learning media with a contextual-based STEM approach to help them understand the topics of Basic Physics courses in online learning.

Keywords: Student's needs, Contextual Based STEM Approach, Fundamental of Physics

INTRODUCTION

The next education policy in Indonesia after the COVID-19 pandemic period is to blend offline learning in class with online learning. However, not all blended learning can be applied in Indonesian universities. Implementing this blended learning depended on the readiness of information and communication technology prepared in the campus to support its online learning: sufficient internet quota, enough computer laboratories, and other equipment. The existence of the COVID 19 pandemic in 2020 has changed the direction of the blended learning education policy to digital-based learning. This policy direction creates new problems. The teachers or lecturers must teach from home, and students must learn from home. During the COVID 19 pandemic, teachers, lecturers, and students were forced to follow the COVID 19 protocol in learning and teaching from home. Digital learning creates an important problem in the area of STEM education since the subjects must have laboratory practicums. If this practicum learning is not carried out, it is feared that graduates' competence will decline.

The solution to this problem, a learning device need using a learning approach that can make students learn independently at home. Learning tools developed such as semester learning plans, learning media, textbooks, learning modules, practicum modules, and others must be done at home. Learning tools

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must be adapted to a learning approach or a developing model. The development of teaching materials based on a learning approach from year to year continues to develop depending on learning theory.

tine, lockdown, confinement, any mitigation forms, and social distancing will make anxiety and fear worsened (De Giorgio, 2020). Social mitigation during the COVID-19 pandemic will give a big threat to physical human connection, individual mental health, motivation, and brain profile in general (Hagerty & Williams, 2020).

Social isolation during the COVID-19 pandemic had a tremendous impact on our daily life satisfaction. Going through distress and crisis need social support and group communities. Social isolation has a threat to survival. Social distancing can cause loneliness. Loneliness will make a psychological downward cycle, depress the immune systems, and cognitive function. In the severe form, it increases suicide rates. Decreasing social interaction will reduce memory performance and brain connectivity functions. People who have some social groups are less likely to develop depression. Social groups can be sports, religious, hobby, or charity groups. Social interactions increase the natural killer cell and endorphin systems. Meanwhile, there will be lower levels of blood pressure, body mass index, and C-reactive protein. On the other side, social isolation changes the prefrontal cortex function (Bzdok & Dunbar, 2020).

Loneliness will cause underexpression of antiinflammatory-genes and overexpression of pro-inflammatory immune responses. Limited social stimulation is related to loneliness. In loneliness, there will be decreasing in the information processing (Bzdok & Dunbar, 2020).

The ventromedial and dorsomedial prefrontal cortex, also striatal nucleus accumbens have a special role in social stimulation. The amygdala and hippocampus size are greater in people with larger social networks. They showed growth trajectories. The closer relation yields a more reactive amygdala. The amygdala lesion will diminish the sense of suitable private space with other people. The grey matter of the amygdala, the lower fiber tract integrity, the grey and white matter tissue has a smaller volume in social phobia. Social isolation lowers gene expression in the amygdala. The amygdala triggers the emotional reaction and regulates private physical distance (Bzdok & Dunbar, 2020).

Social isolation and distancing have big impacts on the public. There will be changes in neurobiological architecture and functional brain. Antisocial behavior will develop. When social isolation happens on a large scale, there will disturb community stability and social cohesion. Loneliness for a long time may predispose to neurodegenerative diseases like Alzheimer's disease in the elderly. A longitudinal study of 332 adults showed there was improved empathy after being given regular training of cognitive skills. The improvement was in affective state and perspective-taking. In this condition, the results revealed structural remodeling in the brain region, especially in the social brain network. The brain network involved is the frontoinsular network. When the training was given every day, there was thickening of the right anterior and middle of the insula. Compassion ratings were increased significantly. Joining the social club, singing (choirs), community, and hobby group was known to have an immediate effect on sense of the social engagement. Video conference in digital communication is very important to increase the social bonding between family and friends. Although they are in virtual space, the bonding is good. The visual component in video conference has an essential role in increasing social interaction (Bzdok & Dunbar, 2020).

All people have their specific backgrounds. However, the experiences and feelings with the COVID-19 pandemic are very unique. The affected feelings might last for a long time and become maladaptive after the COVID-19 pandemic subsided. Pain, loss, grief, anxiety, and stress are all the feelings during the COVID-19 pandemic. A feeling has an emotional and neurobiological cascade. The cascade will let our body ready to respond and do an adaptation. Stress and fear will reduce brain function, mood regulation, decision making, and cognitive performance (W. D. Taylor & Blackford, 2020). On the other side, positive emotion increases creativity (Spitzer, 2020). In the end, long term of negative feeling will change autonomic, endocrine, and immune system function

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in systemic physiology. Immune suppression, heart disease, and obesity will increase the risk for depression, post-traumatic stress disorder, and addiction (W. D. Taylor & Blackford, 2020).

LITERATURE REVIEW

Online Learning

Online learning began with the growing development of information technology. As a result, online learning made learning more effective. In 2018, research conducted by (Chen, B., Bastedo, K., & Howard, W. 2018) with online survey research examined the factors that influence online study in STEM major universities in the southeastern United States. This study concludes that online learning is carried out to make learning effective. In addition, in 2019, research conducted by (Kefalis, Chrysovalantis, and Drigas Athanasios, 2019) reviewed web and online applications to teach STEM. As a result, all web and online applications made learning more effective.

The COVID-19 pandemic at the beginning of 2020 forced learning done online. Research conducted by (Mpu, Yolanda, 2020), and (I. Chirikov, et al., 2020) developed virtual learning media to teach STEM. It was done with online and blended learning. However, studies related to contextual-based online learning research or online education used materials obtained from the surrounding environment are still limited.

Constructivism Theory

Constructivism theory was very close to the STEM approach. Constructivism in education emerged after the behaviorist movement to assume that student-centered learning was active in the teaching and learning process (Jones, M Gail, et al. 2002). Constructivism learning theory was a relatively new cognitive learning theory developed in the field of educational psychology. Constructivism learning theory states that students must find, develop knowledge, and update information about the development of existing knowledge. According to Khadijah (2014), constructivism was the preparation of learning from real experiences through joint activities, reflection, and interpretation. This activity allows students to have a different understanding of their knowledge. All knowledge depends on the experience and the perspective used in interpreting it.

Sa'ud (2013) explains constructivism theory was one of the views that states acquire knowledge. An educational problem preceded it. This problem was solved with the initial knowledge possessed by students. At the end of the learning process, students will understand knowledge through their interactive experiences with their environment. Meanwhile, as the foundation stone of constructivism, Piaget said that this theory views knowledge as understood in students' minds through assimilation and accommodation. Assimilation is the process of taking new information in mind, while accommodation is a restructuring of thoughts built through the assimilation process (Yudawati and Haryanto, 2011).

The focus of education needs to be shifted by building student knowledge. According to V, Dagar& A, Vaday (2016), if the focus of learning can be shifted from teaching students to producing knowledge products, students do not need to concentrate on memorizing and cramming exams. The products of this knowledge can be essays, papers, project reports, research papers, videos, posters, slides, portfolios, or any product that students might create. One of the most important challenges for pedagogy is developing appropriate curricula and teaching methods. The constructivism learning approach requires a completely different approach to assessment, which must be qualitative. Constructivism's emphasis on student learning makes many of the final products of learning.

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Scientific Approach in Learning

In Indonesia, physical science was a branch of science that is studied at all levels of education, from elementary to higher education. Different education levels or different learning topics in studying physics require other learning models, learning approaches, or learning strategies. The selection of suitable learning models, learning approaches, or learning strategies affects student learning outcomes and classroom processes. The developments of learning media must be based on technology. The learning media used must have a learning approach, such as the scientific approach, STEM, HOTS, and others. The scientific approach defined learning based on facts to develop students' abilities in cognitive, attitude, or affective aspects, and skills or psychomotor aspects. According to Sodik, Fajar et al. (2017), in learning with a scientific approach, there were five learning steps such as observing, questioning, associating, experimenting, and communicating. The Indonesian government policy has changed the curriculum at the primary and secondary education level to the 2013 curriculum (Regulation of the Minister of Education and Cultural Education Number 70 of 2013).

The challenge was the application of a scientific approach as a characteristic of the 2013 curriculum in primary and secondary education. According to Said, Isa Muhammad., et al. (2016), At a vocation school in Malang (region in Indonesia), students feel bored with learning theory & practice directly in the classroom. They need new learning methods and teaching materials in their classrooms. Hasibuan (2012) studied the implementation of inquiry-based learning by secondary chemistry teachers in Indonesia. The results of his research explained that all teachers were able to carry out experiments, half were able to apply advanced features and inquiry skills. His study results suggest that these teachers had pedagogical skills for an inquiry like their counterparts in developed countries but lacked pedagogical content knowledge prior to the intervention.

Wimen, Carl & Gilbert, Sarah (2015) studied a Scientific Approach connected with Science Education. This research looks at the impact of learning biology with a scientific approach in biology classrooms. It was inspired by cognitive psychology research that studies the limits of short-term working memory. Price, Allen (2016) studied the Scientific Approach in Higher Education with Physics Education Research examples. The results of giving the recommended studies for college courses choose activities and how they are used in the classroom should be done with experienced faculty guidance. There are many topic activities with materials needed to make a scientific approach in the classroom.

The scientific approach was closely related to student's cognitive abilities, especially higher-order thinking skills. Educator's direct students to the lower-level cognitive domain or Lower Order Thinking Skill (LOTS) and the Higher Order Thinking Skills (HOTS) in scientific learning. Therefore, one indicator of the success of scientific learning is the increase in students' higher order of thinking skills. The increase in HOTS abilities of these students is in accordance with Wahyuni (2018) research by implementing scientific learning in an optical material. The research results obtained decision-making skills by 56%, creative thinking skills by 66%, critical thinking skills by 66%, and problem-solving skills by 91%, with the conclusion that scientific learning can train and improve students' high-level thinking skills.

Previous research has also been carried out by Puspitasari and Cahyanti (2018), who developed teaching materials for Basic Physics courses based on a scientific approach showing that the implementation of teaching materials development can improve students' high-level thinking skills (HOTS). HOTS 'ability can be seen by enhancing students' logic, reasoning, analysis, evaluation, and creative skills. From the explanation above, it can be seen that the implementation of the scientific approach can increase the HOTS ability of students.

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Science, Technology, Engineering, and Mathematics (STEM) Approach in Learning

21st-century learning emphasizes cooperation, problem-solving, critical thinking skills, and communication skills to implement integrated learning. Integrated learning that is following current education is STEM integrated learning. All levels of noble education, from primary school to Middle School, are trying to implement integrated learning science, technology, engineering, and mathematic (STEM).

In 21st century learning, learning must apply information and communication technology. Knowledge is no longer traditional as it was in the past. Education today must be based on science, technology, engineering, and mathematic (M, Felder, et al., 2016). All levels and types of education are STEM integrated. Education in the fields of religion, culture, and society has also been integrated with STEM. Research conducted by Sumarni, Woro, et al. (2020) sees the urgency of religion and culture in STEM education. This study uses a literature review method.

RESEARCH METHOD

This research was descriptive qualitative research with a survey method. Descriptive study describes and interprets objects appropriate to the situation. Descriptive study aims to describe the facts and characteristics of objects precisely (Hermawan I, 2019). This research was conducted at Universitas Jambi and University Islam State Sulthan Thaha Jambi. The subjects of this study were 141 Physics Education students who had completed the fundamental of physics courses. The research data were obtained from the results of initial observation, and student needs questionnaires. The questionnaires were adapted from research by (Kurniawan, et al. 2018). Initial observations aim to determine the problems by giving students pre-test basic physics courses. The pre-test question was taken from the question national exam senior high school in Indonesia. Then, using IBM SPSS Statistic 23, the normality test and homogeneity test of the questions used were carried out. The results showed that the questions were typically distributed because the sig value of the normality test was 0.06> 0.05. In addition, the questions used were homogeneous because the sig value of the homogeneity test was 0.737> 0.05.

Meanwhile, needs analysis aims to determine the right solution in solving students' problems related to the teaching materials needed by students. The data obtained from the distribution of initial observation and needs analysis questionnaires are qualitative and quantitative data. The validity of the instrument used was calculated by the equation:

Percent=(total score/maximum score)100%.....(1)

From the calculation, results obtained a percentage of 73.51% with good criteria (BSNP, 2016). While the reliability value with the Cronbach alpha value of 0.974 or r_{count} was greater than r_{table} 0.531 for the 5% significance level.

FINDINGS AND DISCUSSION

Identifying the abilities possessed by learners to achieve the expected goals. In addition to learners, the topics or material to be studied were also analyzed. This analysis maps the skills or concepts that learners have and shows the relationship between these concept skills in general. The analysis of students' ability to identify the innate abilities required for the learner to achieve the expected instructional goals.

The learner's ability was carried out by giving high-order thinking skills (HOTS) oriented questions that learner's ability was carried out by providing high-order thinking skills (HOTS) oriented questions taken from high school national exam questions. This question was valid for the HOTS-oriented question

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from the Minister of education and culture Indonesia. These were the same quality as on Fundamental of Physics material. The results obtained from 11 questions were tested as in figure 1.

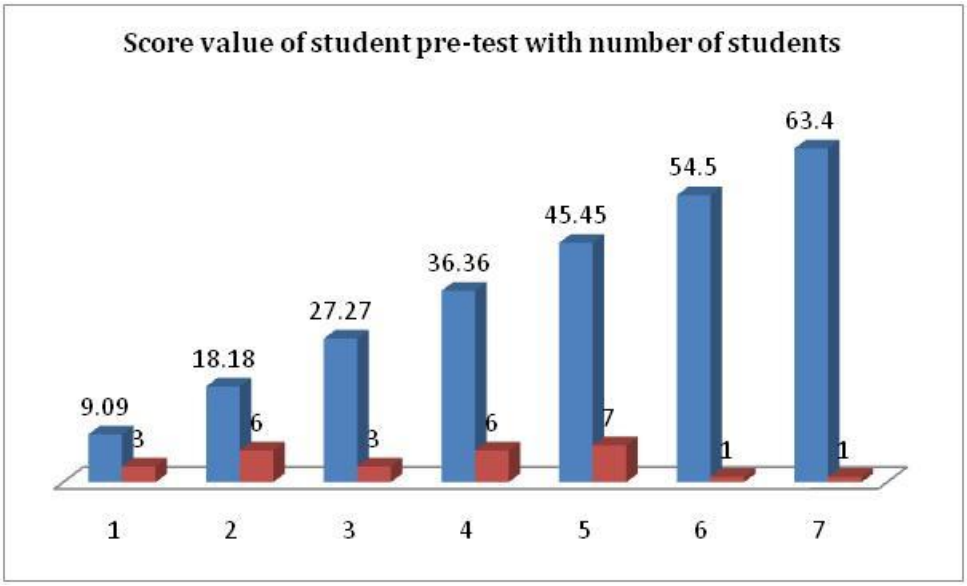

Figure 1. The results of the pre-test of cognitive abilities of Physics Education Study Program students on Fundamental of Physics

Based on the results of distributing the students' ability, we can see 100% of students that the material of national exam was difficult to understand. The highest score just 63.4, with one number of students get it or 4,35%. Likewise, with a value of 54.5, only 1 person got it with 4.35%. Meanwhile, the highest score obtained by students was 45.45 with 7 students or 30.43%. None of the 23 students scored 70 for grade B.

Analysis of students' needs of learning media that can support the course of the fundamental of physics was conducted using the student's ability observation distributing and a students' needs questionnaire. The students' needs questionnaires were distributed to 141 Physics Education students who had completed the Fundamental of Physics course. The results of the students' needs analysis questionnaire were shown in table 1dan table 2. Table 1 about Students Understanding to Fundamental of Physics Course and table 2 about students need fundamental of physics course learning media.

Table 1. Students Understanding to Fundamental of Physics Course

1.	Did you like the fundamental of physics course material?z	• Yes (93,6%) • No (6,4 %)
2.	Was the fundamental of the physics course a subject with material challenging to understand?	• Yes (66%) • No (34%)
3.	Do you have any learning media for fundamental physics courses?	• Yes (75.9%) • No (24.1%)
4.	were the learning media you use enough for you to understand the system?	• Yes (19,9%) • No (80.1%)

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5.	Do you need additional study material to support learning in this course in online learning?	• Yes (98,6%) • No (1,4%)
6.	Have you ever used learning media based on an approach to learning fundamental physics courses?	• Yes (31,2%) • No (68.8%)

Based on the distribution of students understanding to fundamental physics course questionnaires in table1, we can see that 93.6% of students liked the fundamental physics course and 66 % of students stated that the material in Fundamental of Physics courses was difficult to understand. 75.9% of students have learning material Fundamental of Physics course, but their current learning media were still unable to assist them in understanding the material of Fundamental of Physics. 19% of students not enough to understand the course with their learning material. Thus, 98.6 % of students need additional teaching materials in the course of Fundamentals of Physics. The Teaching materials can help them to understand the concept of Fundamental of Physics course. We can also see 92.9 students required, and 7.1 % of students were not required to develop contextual-based science, technology, engineering, and mathematic (STEM) approach teaching material. It was expected to be able to assist them in understanding the material Fundamental of Physics. Specific learning media students need can see in table 2.

Table 2. Students Need Fundamental of Physics Course Learning Material

1.	What additional content do you expect to be contained in the learning media contextual based on Science, Technology, Engineering and Mathematics (STEM) in online learning?	• Figure (4.3%) • Detailed formula description (36.9%) • There were examples of engineering and technology in the material and questions (41.8%) • Question based on HOTS Approach (12.1%) • Others (all choices, items 2,3, and 4 only, items 1 and 2 only (5.6%)
2.	Are you interested in using learning media contextual based on Science, Technology, Engineering and Mathematics (STEM) in fundamental of physics courses in online learning?	• Very disinterested (2.8%) • Not Interested (0.7%) • Interested (34.8%) • Enough Interested (42.6%) • Very Interested (19,1%)
3.	In your opinion, what are the criteria for learning media needed in contextual-based Science, Technology, Engineering and Mathematics (STEM) in online learning?	• Material difficult to understand (66.7%) • Material with many formulas (24.1%) • Other (select two options 9.2 %)
4.	In the basic physics course, what materials do you think are suitable for making teaching materials using contextual based on Science, Technology, Engineering and Mathematics (STEM) in online learning?	• Magnitude and Measurement (2.8%) • Vector (5.7%) • Kinematics (5.7%) • Dinamicof particel (6.4%) • Worksand energy (6,4%) • Wave and optic (11,3%) • Temperature and heat (2,8%) • Rigid body equilibrium (2,1%) • Static and dynamic fluid (11,3%) • Electricty and magnet (12,8%) • Atom and nuclear physics (4,3%) • Fundamental of modern physics (19,1% • Impulse and momentum (2,1%) • All of material (15,7%)

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5.	Did the lecturers in the fundamental of physics course use models, methods, approaches, or learning strategies?	• Yes (88,6%) • No (11,4%)
6.	According to you, do the learning models, methods, approaches, and strategies need to be used in the process of lecturing fundamental of physics courses in online learning?	• Yes (97,9%) • No (2,1%)
7.	In your opinion, were learning media contextual based the Science, Technology, Engineering and Mathematics (STEM) approaches suitable for use in the lecture process of fundamental of physics courses in online learning?	• Yes (97,9%) • No (2,1%)

From table 2, we can see that students need additional learning media in the course of Fundamentals of Physics with Figure 4,3%, detailed formula description36,9%, there were examples of engineering and technology in the material and questions41,8%, and question based on HOTS Approach 12,1%. They need to use simple language to deliver the concepts in fundamental physics course and provide simple examples and problems and interesting illustrations. All of the criteria can seen in STEM Approach. 34,8%Students interested, 42,6%enough interested, and 19,1%very interested with learning media contextual-based STEM.

Students need additional learning media in the course of Fundamentals of Physics followed by 2,8% magnitude and measurement, 5.7% vector, 5.7% kinematics, 6.4%dynamic of particle, 6.4% works and energy, 11.3% wave and optic, 2.8% temperature and heat, 2.1% rigid body equilibrium, 11.3% static and dynamic fluid, 12.8% electricity and magnet, 4.3% fundamental of atom and nuclear physics, 19.1% fundamental of modern physics, 2.1% impulse and momentum, and 15.7% all of material. The highest need in fundamental of modern physics.

From data in table 2, we can see 88.6% of lecturers used learning tools in their lectures. However, students still want to used learning tools-based approach. The result was 97.9% of students want contextual based STEM learning tools, especially in online learning. This data was taken when students are conducting online lectures.

This problem arises from several factors such as the equation were not derived in detail. It made it students difficult to understand the concept mathematically in fundamental of physics course. Moreover, the lack of examples in contextual made students find difficulties to solve exercises and problems. Therefore, most students agree on developing teaching materials contextual-based STEM that can help them understand the concept of Fundamental of Physics. Teaching materials that use provide examples and problems with derivates formula with contextual based STEM, question based High order thinking skills, and interesting illustrations or figure with contextual based STEM.

The other research connects with research and development with many of effect. Research conducted by Hendripides and hikmah (2018) with using of simple language and interesting illustrations in teaching materials was effectively used in the learning process. Moreover, the other research says that interesting teaching materials will be able to that interesting teaching materials will improve student concepts (Ridhwan R,et.al, 2019). The other research conducted by Ellizarthat using teaching material based scientific approach made learning effective and can help students understand and help students understand the concept of materials (Ellizar E, et al. 2018). Another research conducted by hasja that using scientific approach-based teaching material can increase students and teachers using scientific approach-

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based teaching material can increase students' and teachers' motivation in the learning process (Hasja Y, et.al. 2020). Moreover, the other research saw that using teaching materials based on a scientific approach is feasible to practice students ' science process skills (Simamora R, et al. 2020).

CONCLUSION

Based on the results of distributing of the ability of students in fundamental of physics course and students' needs analysis, it can be concluded that it was necessary to develop learning media that can assist students in understanding the materials in Fundamental of Physics course at the Physics Education program of Universitas Jambi and University Islam Stated Sulthan Thaha Saefudin Jambi. Students need contextual-based STEM approach learning media. The learning media must provide examples and problems with derivated formula with contextual based STEM, question based High order thinking skills, and interesting illustrations or figure with contextual based STEM. From literature review, it showed that there were studies that have not been researched about contextual-based online learning or online learning used materials obtained from the surrounding environment. Online learning used information technology without materials from the environment.

LIMITATION & FURTHER RESEARCH

This research was the initial stage of research on the development of learning media contextual based STEM that will be used in fundamental of physics course in the Physics education program of Jambi University and University Islam Stated SulthanThaha Saefudin Jambi. Further research is developing learning media contextual based STEM in the Fundamental of Physics course.

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