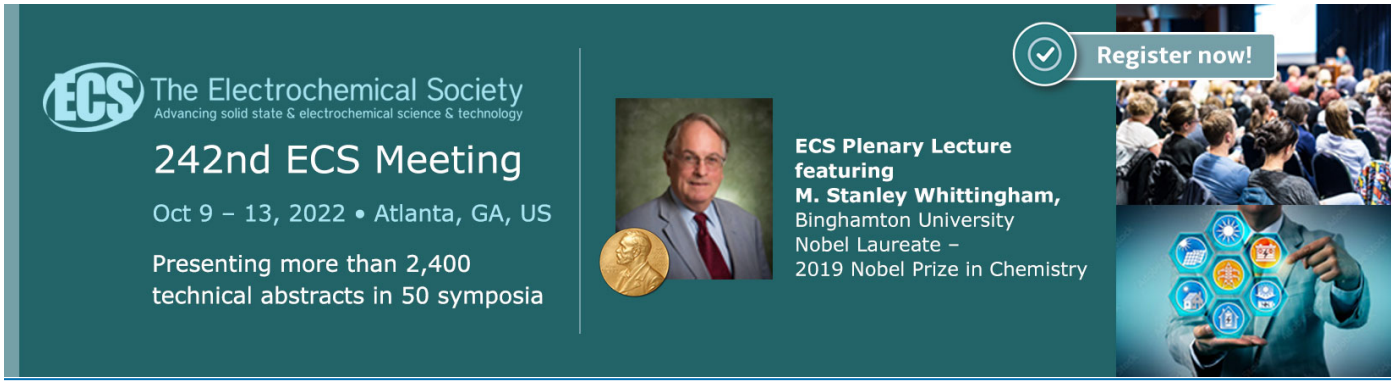
Preliminary Research: Developing Physics Electronic Student Worksheet Based on ExPRession model with the STEM approach



Preliminary Research: Developing Physics Electronic Student Worksheet Based on ExPRession model with the STEM approach

Putri Mardiana Sari[1*], Kartini Herlina[1], Abdurrahman[1]

[1] Department of Physics Education, Universitas Lampung, Indonesia

*Corresponding author: kartini.herlina@fkip.unila.ac.id

Abstract. The media and teaching materials had been developed based on the needs of students and teachers who needed immediate and precise solutions. For this reason, this study aimed to analyze students' perspectives on physics learning and teachers' views on electronic student worksheets (*e-LKPD*) based on the ExPRession model with the STEM approach to see the opportunities for developing physics teaching materials, especially optical geometric. This study involved 102 high school students and 6 physics teachers in Lampung province. This study was a descriptive qualitative study with questionnaires and interviews as the research instruments. Based on the results of the analysis, it can be concluded that the electronic student worksheet based on the ExPRession model with the STEM approach needs to be developed to improve the communication and collaboration skills, especially in physics material.
Keywords: collaboration skills, communication skills, expression model, STEM.

1. Introduction

In the 21st-century, learning success is not only seen from the cognitive aspect [1,2]. Affective and psychomotor aspects are also important considerations to overcome the 21st-century challenges [3,4]. The world of education is required to produce a generation that can compete globally. 21st-century skills, such as communication and collaboration skills, are also important points in improving the quality of learning [5,6]. It is believed that one of the factors that influence the success of learning is the learning process. A good learning process can be done by applying a learning model and media that are relevant to the learning indicators and objectives [7–9]. The low skills and abilities of students are caused by many factors, apart from internal factors that come from interest and enthusiasm for learning, there are also external factors related to the learning process.

It cannot be denied that students can be easily bored during learning processes. However, teachers always try to find things that can increase students' enthusiasm [10]. In physics learning, there is a trend of integrating the learning process with the STEM (science, technology, engineering, and mathematics) approach [11,12] such as Li Y's research which states that STEM's position in education is increasingly important in international status [13] and Pricilia who had successfully integrated an electronic module with STEM [14]. Learning with the STEM approach is believed to be able to bridge the gap between education and job skills required in the 21st-century [15–17]. Based on the previous research, STEM has been able to improve students' skills, such as argumentation skills [18], learning outcomes [19], critical thinking [20], creative thinking [21] and many more.

Combining learning models is also a success factor in learning. Learning models have syntaxes that can support the learning process to be more effective and fun but still relevant to the learning objectives. Based on K Herlina's research, one of the suitable learning models for physics learning, especially in optical geometry, is the ExPRession learning model [22]. The ExPRession learning model has been developed and modified based on the theories by Polya (1957) and Heller and Heller (1992) [22]. The ExPRession model has five stages of learning steps, namely the orientation stage, the expression stage, the investigation stage, the evaluation stage, and the generalization stage.

The STEM approach and the ExPRession model can be combined to produce good teaching materials because the success of the learning process is supported by a good teaching material that is relevant to the learning objectives. The student worksheet is one example. It has been widely developed by teachers and researchers to innovate the learning process [23–25]. To facilitate access to learning, many student worksheets have been developed in electronic form which is commonly referred to as e-student worksheet [26–29]. Based on previous research, the researchers saw an opportunity to develop an e-worksheet by adding novelty such as using the ExPRession model and STEM approach so that it could become an innovation and produce competent teaching materials in physics, especially optical geometric. Before that, the researchers wanted to see how the students' perspectives in physics learning so far and how the teachers viewed the teaching materials to be developed so that the results of this study can be used as a reference in the development of the teaching material.

2. Method

This study was a qualitative-descriptive study with a questionnaire and interview sheets as the research instruments. The research subjects consisted of 102 high school students and 6 teachers in Lampung province. The questionnaires were used to obtain data from students and interviews were used to obtain data from teachers. The data were analyzed using the Milles and Huberman model which consisted of three stages, namely data reduction, data presentation, and verification. The questions of the questionnaire can be seen in table 1.

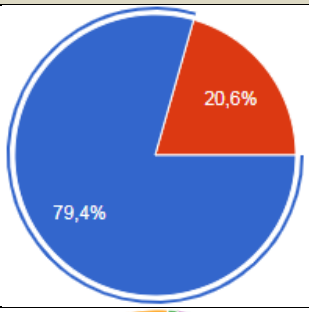
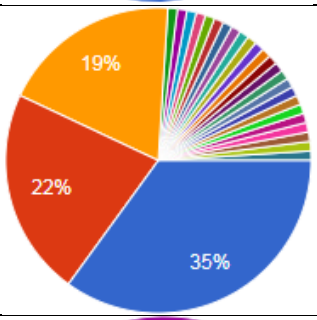
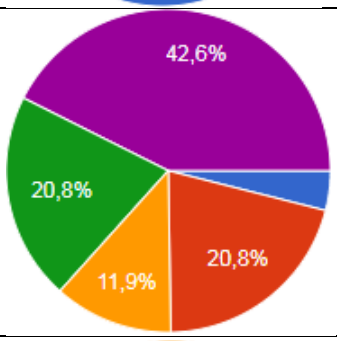
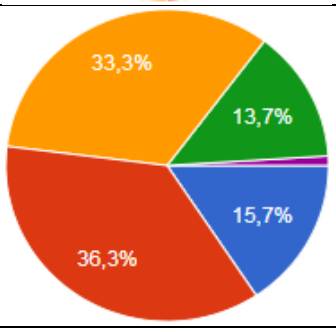
Table 1. The Questions of the Questionnaire

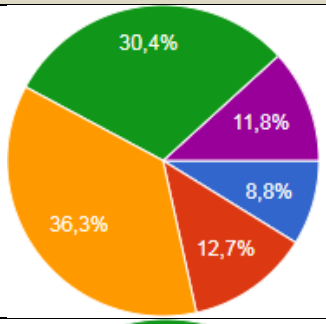
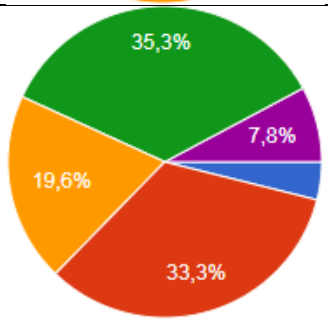
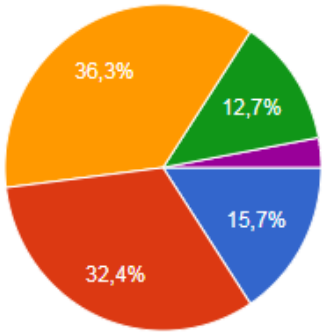
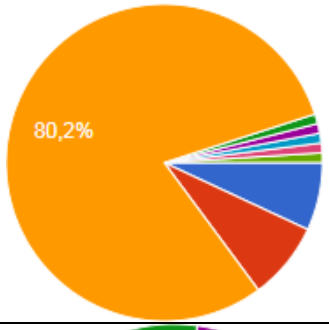
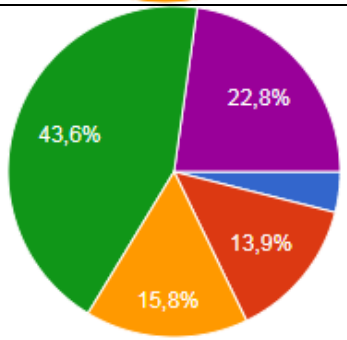
No	Question
1	Do you like physics?
2	What are the factors that make you like learning physics?
3	Which of the following materials is considered the most difficult in physics?
4	Has the learning process already implemented technology-based learning media?
5	Is the physics learning process fun and cooperative?
6	The learning process uses the discussion method and group presentations
7	The learning process uses the experimental method
8	Which of the teaching materials below that is most widely used in the learning process?
9	The learning process has used electronic-based or online teaching materials
10	Are you satisfied with the physics learning process so far?
11	Are you one of the students who are active in the physics learning process?
12	What are your expectations for the next physics learning?

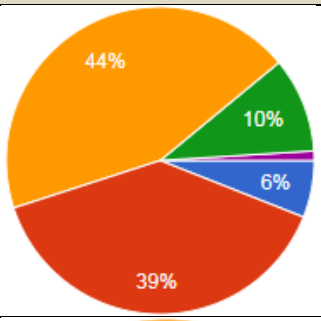
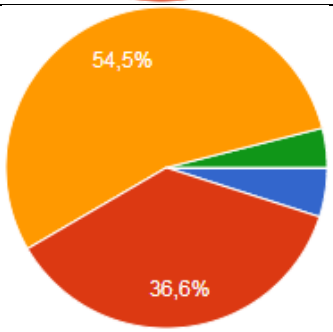
3. Result and Discussion

The results of the questionnaires distributed to students can be seen in Table 2.

Table 2. Students' Questionnaire Responses

No	Questions	Results
1	Do students like physics?	
2	What are the factors that make you like learning physics?	
3	Which of the following materials is considered the most difficult in physics?	
4	The learning process is already using technology-based learning media	

No	Questions	Results
5	The physics learning process is fun and cooperative	
6	The learning process uses the discussion method and group presentations	
7	The learning process uses the experimental method	
8	Which of the teaching materials below that is most widely used in the learning process?	
9	The learning process has used electronic-based or online teaching materials	

No	Questions	Results
10	Are you satisfied with the physics learning process so far?	
11	Are you one of the students who are active in the physics learning process?	

The first question indicated that 79.4% of students liked physics lessons and 20.6% of them disliked physics lessons. The second question investigated three factors that served as the reasons for liking physics lessons, 35% of students stated that they liked physics lesson because of the material, 22% because of the media, and 19% because of the teacher. In the third question, 42.6% of students stated that the material that was considered difficult was the optical geometric. Therefore, researchers intended to develop an e-student worksheet on optical geometry material. The optical geometry was considered difficult [31–33]. In the fourth question, according to students, 36.3% of students stated that the teachers rarely used technology-based media. The fifth question found that 36.3% of students stated that sometimes physics learning was carried out in a fun and cooperative manner.

The sixth question discovered that 35,3 % of students stated that the discussion method was frequently used while 33.3% of students said that it was seldom. The seventh question discovered that 36.3% of students stated that the experimental method had been used. In the eighth question, 80.2% of students agreed that the teaching materials used by teachers were books. The eighth question indicated the growing importance of teaching materials to innovate new teaching materials [34]. In the ninth question, 43.6% of students stated that the teacher had used electronic/online-based teaching materials. The tenth question regarding satisfaction with the physics learning process indicated that 44% of students felt normal, 39% were satisfied, 10% were not satisfied, and 6% were very satisfied. The eleventh question investigated the activeness of students in the physics learning process where 54.5% of students stated that they felt normal, 36.6% of students stated that they were active, 5% of students were very active, and 4% of students stated that they were not active. The twelfth question investigated the students' expectations of the learning material to be developed in the future. They stated that they expect the physics learning to take place with the help of teaching materials other than books. Also, they needed better physics learning and easy-to-understand delivery by teachers dominated by experimental and practicum activities. This indicated that students expect practical and fun learning.

The result of the interview with the teachers found that four teachers were familiar with STEM and considered this as a great opportunity to develop an e-student worksheet based on the ExPRession model. Questions regarding collaboration and communication skills resulted in 3 teachers were sure about practicing these skills while the other 3 teachers were not sure that the learning process should contain communication and collaboration skills.

The e-student worksheet teaching materials to be developed are based on the ExPRession learning model with the STEM approach. A brief description of the combination of the ExPRession model with the STEM approach is described in Figure 1.

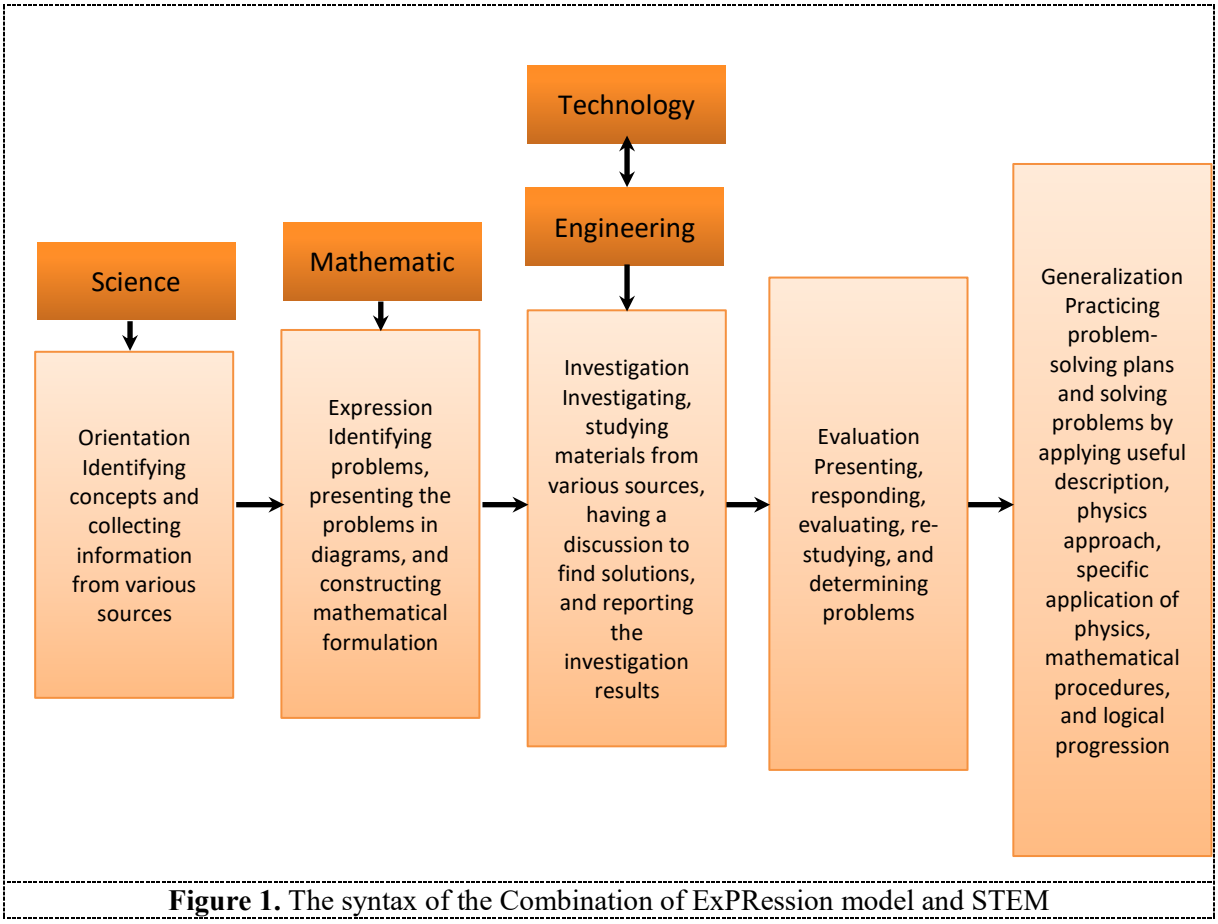


Figure 1. The syntax of the Combination of ExPRession model and STEM

Before conducting the interview, the researcher provided an overview such as the combination of the ExPRession model and the STEM approach to be included in the e-student worksheet. Overall, Figure 1 is believed to be able to improve communication and collaboration skills based on the researchers' and teachers' expectations.

4. Conclusion

The physics learning process required the development of teaching materials, especially related to practice and experimentation. Students expected fun and easy to understand the learning material. The teachers expected the development of teaching materials that are appropriate and based on the needs of 21st-century students which include communication and collaboration skills. It can be concluded that the development of an e-student worksheet based on the ExPRession model with the STEM approach needed to be done to develop students' communication and collaboration skills, especially in optical geometry material. This research can be used as an initial description or a reference for further development research..

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