The development of elasticity experiment module assisted virtual laboratory

[1]N Arifin[1, a], P H Winingsih[1] and W Budhi[1]

[1]Physics Education Department of Sarjanawiyata Tamansiswa University
Kusumanegara No 157, Yogyakarta 55165, Indonesia

[a]arifnnur48@gmail.com

Abstract. The research was conducted to produce the module of elasticity experiment which was virtual laboratory assisted and to prove the compatibility between experimental results using modules and virtual laboratory assistance. According to Sugiyono, it was research and development. This study was tested in grade XI IPA SMA. The result of the research showed that the validity test of elasticity experiment module with virtual laboratory assisted by 3 experts can be said that was valid with the percentage of the truth of concept 84,5%, experimental level 85,5%, module design 84,75%, and language 80,5%. Test legibility with the percentage of truth concepts 78.5%, experimental level of 77%, design module 79%, and language 77.5%. The verification results indicated that there was the suitability between the experimental results using the module and using the virtual laboratory. So it can be said that the elaboration module of virtual laboratory assisted elasticity developed feasible to be used as teaching material.

1. Introduction

Education is a process that has a function and purpose in the implementation. According to UU No.20 2013 about the challenging of the national education system, the function of education is to develop the ability and form the character and civilization of a dignified nation in order to educate the life of the nation. The aim of the education is for the development of potential learners in order to become human beings who believe and cautious to God Almighty, noble, healthy, knowledgeable, capable, creative, independent, and become citizens of a democratic and responsible. We cannot be separated from the learning process to realize the function and purpose of the national education.

Learning is inseparable from education. Physics learning is the process of understanding the concepts that exist within the scope of physics. Basically, physics learning needs to be adjusted to the way physicists used to gain knowledge. Physics learning should be directed to find out and act so that it can help the students gain a deeper mastery [6]. Student-centered learning causes different levels of the student understanding. As in the subject of elasticity, many students assume that the subject of elasticity is difficult to understand if only explained in theory and a few of them who understand this subject. Therefore the students should be given more direct experience in learning, one of them with the experiments. The experiment is one of the right ways to make it easier for the students to understand a theory [11]. The experiment is one of the learning strategies that can attract the student's interest in developing concepts because the lab can provide direct experience to students to observe a phenomenon that occurs so that students will better understand the concept that is taught [4]. It needs a module to facilitate the student in doing practicum activity.

The Module is one form of teaching materials that are packed in a complete and systematic. It contains a set of the planned learning experience and is designed to help students master specific learning objectives [2]. The stages of module writing include module requirements analysis, design, implementation, assessment, evaluation and validation, and quality assurance [2]. The availability of modules can assist the students in obtaining information about learning materials [8]. However, in the practicum implementation in various schools, the practicum module used is still theoretical verification and book recipe. It is in line with what happens in most schools, as evidenced by the absence of an integrated practicum module used in the practicum process. The results of observations indicate that in the implementation of learning in SMA Negeri 1 Piyungan rarely performed practicum, although the equipment of laboratory owned by the school is complete enough used to conduct lab work.

In the previous study mentioned that the development of practice manuals can increase the student motivation up to 92.45% [3]. On the use of practical guide can make the process of active learning activities and train the students' scientific work [10]. The use of guidance, as well as practicum, may increase the understanding of significant concepts [7].

While in the process, the experimental activities require a tool to measure the validity of data obtained. One of them is by using the virtual laboratory. According to Gunawan, a virtual lab is a computer simulation that allows experimental function on a practicum [1]. The results obtained from the use of virtual lab have been adjusted to the actual experiment so as to have a high enough level of truth. Therefore in this study virtual laboratory used to verify data obtained from experiments using modules. Previous research suggested that the use of virtual labs influences students 'mastery of concepts and students' critical thinking skills [5]. With the above problems, the researcher conducts research on the Development of Experimental Elasticity Module of Virtual Laboratory.

2. Method

Research and development were used in this research. The development procedure used in this research is Sugiyono' development procedure. The research flow can be seen from Figure 1.

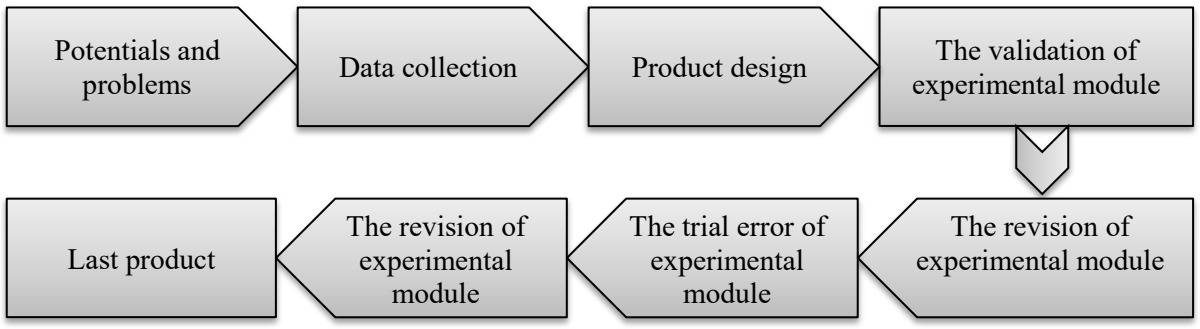


Figure 1. Stages of research development.

The data collection techniques used were observation techniques, interviews, and questionnaires. Observations made in this study were conducted directly in SMA Negeri 1 Piyungan which will be used as a place of research implementation. The interviews are conducted by interviewing teachers who teach in the classroom to find out how the learning process works. In this study, the questionnaire was given to the validator and the students as the respondents as an input to complete the inquiry assisted module before becoming the final product. The questionnaire used using rating scale or scale.

3. Results and Discussion

The research on the development of virtual laboratory-assisted elasticity experiment module uses the development of Sugiyono through 8 stages of potential and problems, data collection, product design, design validation, design revision, product testing, product revision, and final product [9].

3.1. Potentials and problems

The appropriate the subject matter taught.Some text. The schools and teachers have excellent potential, with a very deep mastery of the material by the teacher so as to provide a clear understanding to the students. The problems arise when the students are not too familiar with the subjects that require direct observation and practicum activities. The schools have adequate laboratory equipment but in the process of observation obtained the information that the implementation of the lab has not been maximized. The teachers only use guidance manuals that exist on the student worksheet which is only a recipe book and data verification, so that the understanding received by the students becomes less than the maximum.

3.2. Data collection

The data collection in this research used some techniques were an interview, observation, and questionnaire. Questionnaires were used to determine the feasibility of the virtual laboratory assisted elasticity experimental module from 3 experts and students' responses to the virtual laboratory-assisted elasticity experiment module.

3.3. Product design

In conducting the design the researcher uses A4 paper with the following modules: front cover, introduction, table of contents, concept map, first experiment (Hooke's Law), second experiment (series on a spring), and a third experiment (parallel circuit of spring). While in each experiment there were elements as follows: objectives, problem formulation, basic theory, hypotheses, experimental procedures, experimental results, methods of data analysis, and conclusions.

3.4. Validation of design

Design validation was done by 3 validators. From the validation results of the three validator results obtained as written in table 1.

Table 1. The validator rating score.

No	Evaluation aspect	Percentage (%)	Category
1	The truth of the concept	84,5	Valid
2	The implementation level of the experiment	85,5	Valid
3	Design	84,75	Valid
4	The language	80,5	Valid

3.5. Design revision

The revisions made to the design of the virtual laboratory-assisted elasticity experiment module according to the advice of the validator are as follows.

1) Addition of material about plastic
2) Writing Hooke Law using minus sign (-)
3) Addition of drawing of spring circuit on the base of series and parallel series circuit.
4) Addition of literature.
5) Improvement of the grammar

3.6. Product trial

The elasticity experimental module of virtual laboratory-assisted was tested in limited to 25 students of 11th grade IPA, and from the limited trials to the students, the results were obtained on table 2.

Table 2. The assessment of student responses.

No	Evaluation aspect	Percentage (%)	Category
1	The truth of the concept	78,5	Valid
2	The implementation level of the experiment	77	Valid
3	Design	79	Valid
4	The language	77,5	Valid

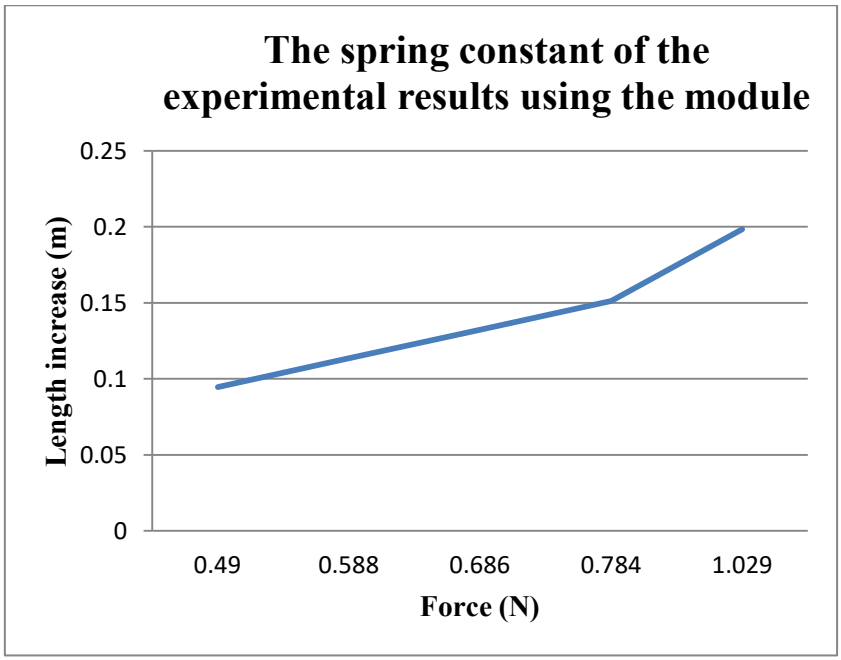
3.7. Design revisions

From the result of student's response to the module that was developed, it was done to improve the design to perfect the virtual laboratory assisted elasticity experiment module.

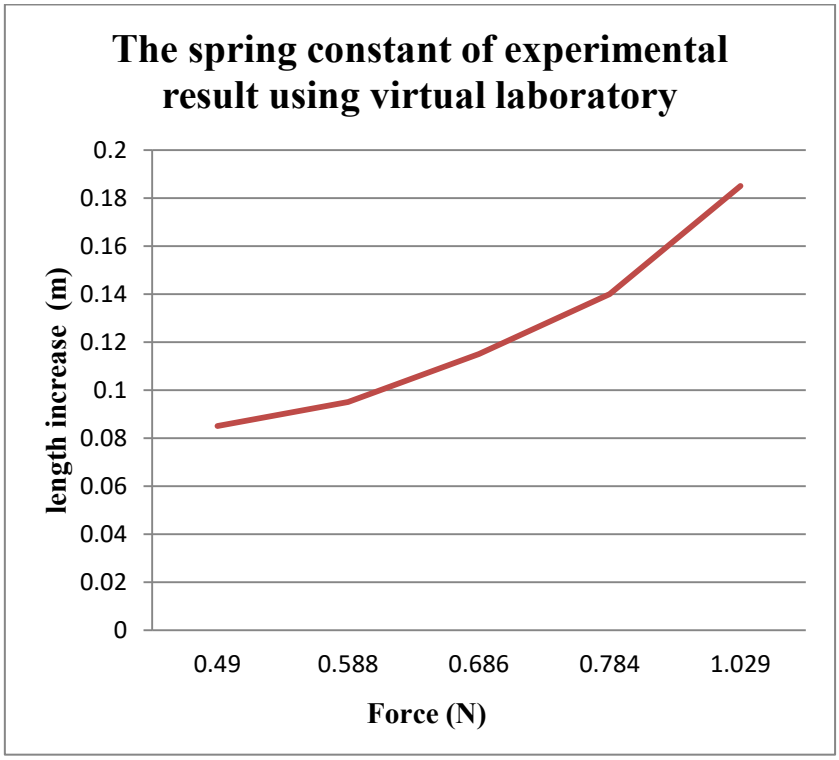
3.8. Final product

The final product obtained is a virtual laboratory assisted elasticity experiment module that can be used as a teaching material.

From the results that have been obtained from the implementation of experiments using virtual laboratory assisted elasticity experimental module performed verification of the results by using virtual laboratory from Education and Culture Ministry. From the results, it obtained from the experiment using a virtual lab assisted elasticity experiment module and using virtual lab obtained the similarity of results that can be seen from the graph of spring constant obtained.



(a)



(b)

Figure 2. Graph of experimental spring constants using (a) modules (b) using a virtual laboratory.

4. Conclusions

From the results of the research that has been done can be concluded that this research produce a module of elasticity experiment with a virtual laboratory which is suitable to be used as teaching material and there is suitable result between experiment manual using experiment module of elasticity assisted virtual laboratory with the experiment result using the virtual laboratory.

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