PASSING for experiment tool in elasticity and hooke's law concept on springs arranged in series and parallel

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Abstract. This study aims to analyze the feasibility of learning media PASSING (String Series Parallel) for concept elasticity and Hooke's law. The method used in this study is ADDIE developed by Robert Marie Branch. The stages are Analysis, Design, Development, Implementation, and Evaluation. The steps of this study are: 1) Curriculum analysis, analysis of the results of interviews and questionnaires of students, and analysis of literature studies, 2) Designing learning media PASSING, 3) Realizing PASSING practicum tools 4) Performing expert validation tests 5) Product revisions. The results of the study obtained a tool validation value of 90.47% with a feasible category. This study concluded that PASSING is feasible to be used as a learning media in the concept of elasticity and Hooke's law.

1. Introduction
Attractive and fun media are expected to facilitate students in understanding the subject matter and be able to make students think in an abstract way [1]. Through learning media can make the learning process more active and meaningful [2]. One way to create interactive learning is to develop learning media in the form of teaching aids [3].

One concept that can use learning media in the form of teaching aids or labs is concept elasticity and Hooke's law. Learning experiences of students will be more concrete using learning media in the form of teaching aids [4]. In addition to understanding the concept in class, the application of concept elasticity and the law of Hooke's can be found in everyday life [5].

Based on the results of the preliminary study in the school, information was obtained that there was no practical instrument on the elasticity and Hooke's law concept regarding the determination of the replacement constants for series spring arrangement and parallel spring arrangement. The practicum in the school only explains the single spring arrangement, there is no tool integrated into one system.

According to the explanation above, it is necessary to develop learning media in the form of practical tools in the concept of elasticity and Hooke's law. PASSING (String Series Parallel) is a development tool from the tools made by [6], which is a spring arrangement practicum in the elasticity concept. This study aims to obtain information about the feasibility of the tool based on the relationship with teaching concepts, the value of education, resilience, accuracy, efficiency, security for students and the aesthetics of the tool.
2. Experimental method
This type of research is development research. Research and development functions to validate and develop products. Validating the product means that the product already exists, and the researcher only tests the effectiveness or validity of the product. Developing products in the broadest sense can be in the form of updating existing products (so that they become more practical, effective, and efficient) or creating new products (which have never before existed) [7]. The method used in this study is ADDIE. ADDIE first appeared in 1975 by Branson, which was later developed in 1978 by Dick and Cary and revised by Russeel Watson in 1981 [8]. According to [9] that ADDIE is used as a way of looking at developing a learning design and is an acronym of Analyze, Design, Develop, Implement and Evaluate. Sources of research data are teachers and students in several schools in the city of Bandung. Data collection techniques in this study consisted of interview sheets, student questionnaires, laboratory test sheets, validation sheets, field test sheets, and student response sheets.

3. Result and discussions
The results of the research on the development of learning media in the concept of elasticity and hooke law that have been carried out are in the form of practicum products. The development phase of the PASSING practicum tool is as follows:

3.1. Analyze
The analysis phase was conducted three times, namely curriculum analysis, analysis of the results of teacher interviews and student questionnaires, and the last analysis of literature studies. Based on the analysis obtained information that the use of learning media in the form of practical tools is still rarely used, whereas according to the national curriculum the teacher must be able to create an active and meaningful learning atmosphere. Learning will be meaningful if students get direct experience in receiving the concept delivered by the teacher so that the use of learning media practical tools is needed by students.

3.2. Design
The design of the practicum tool is made according to the learning media needs in the school. At this stage, namely the stage of designing a practical instrument, this design is the development of the tools made by [6]. The design can be seen in the picture below:

![PASSING props design](image)

**Figure 1.** PASSING props design.

3.3. Development
The development stage is the product realization stage, at this stage the tool is made and developed according to the design that has been made. After the tool is made, it will then be validated by the
validator, the physics lecturer and physics subject teacher. Based on the results of validation, if the practicum is not feasible, revisions will be made. The design of the development of PASSING was made by considering the basic competencies of 3.2 and 4.2 of the 2013 curriculum, in accordance with these basic competencies. It is expected that students can distinguish the arrangement of spring springs and parallel to the concept elasticity and hooke’s law.

The practicum has been validated by media expert lecturers, concept experts, and physics subject teachers. Validation test sheets are made based on the Guidelines for Making High School Physics Teaching Aids [10]. The results of the validation test are obtained based on the percentage of feasibility results. The percentage of values obtained is then categorized based on table 1 [11].

| Percentage Score | Category          |
|------------------|-------------------|
| 80%-100%         | Valid/Feasible    |
| 60%-79,99%       | Quite Valid/Quite Feasible |
| 50%-59,99%       | Less Valid/Less Feasible |

Validation tests by expert lecturers get a value of 91.67%, based on the feasibility table props are included in the Valid / Eligible category. Details of the evaluation can be seen in Figure 2 below:

![Validation Results by Media Expert](image)

**Figure 2.** Validation results diagram by media expert.

On the other hand, the value of the feasibility of the tools obtained from concept experts is 84.52% in the Valid / Eligible category. The value is smaller than that of media experts, because there are some disadvantages that must be corrected in PASSING, namely the placement of a ruler on the PASSING that is not straight between the top and bottom of the tool and the size of the tool must be minimized. Details of the assessment can be seen in Figure 3.
3.4. Implementation
This stage is the trial of PASSING practicum tools for students. PASSING is implemented in students in one of Bandung's regional schools. Students who conducted PASSING trials were 36 people, so that the time was effective was divided into 6 groups. When testing the tool takes place, students are required to fill in the worksheet at the time of testing the tool takes place.

3.5. Evaluation
The PASSING practicum is equipped with student worksheet which has been adapted to the Guidelines for the Development of Teaching Materials [12] with the title structure, instruction / practicum instructions, competencies achieved, supporting information, and assignments. The analysis of student worksheet is that students are still not able to carry out an analysis of the practicum carried out and have not been able to provide conclusions that are correct in accordance with the learning objectives.
However, overall students are able to do practicum using the PASSING seen from the ability of students in obtaining and processing practicum data in accordance with the concept of physics. In addition to filling in the passbooks, students are also required to fill out the questionnaire responses of students regarding the use of PASSING practicum tools in learning, students think that PASSING has an interesting form and students agree that PASSING is used as a learning medium. This is in line with the research conducted by [13], simple teaching aids can be used as a variety of learning media to increase motivation and understanding of students' concepts.

4. Conclusion

Based on the explanation of the results of the above research, PASSING practicum tools can be categorized as feasible as learning media in the concept of elasticity and Hooke’s law. The mean value obtained from the three validators is 90.47% with valid / feasible categories according to the relationship with teaching concepts, the value of education, resilience, accuracy, efficiency, security for students and the aesthetics of the tool.

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