Development of Web Student Worksheet Based on Science, Technology and Society (STS) on Optic Material in Senior High School

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Development of Web Student Worksheet Based on Science, Technology and Society (STS) on Optic Material in Senior High School

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Abstract. This research aims to create web student worksheet based on STS (science, technology and society) as a learning on Optic material for senior high school student grade XI. The method used in this research is the development research use 4D model. The steps of this research consisting of three main steps, are preliminary study, planning and designing and developing. Validation is done by expert lecturers, physics teachers, and peers. The validation consists of two parts: subject matter contents aspect and media aspect. The result of this research shows that the developed of web student worksheet is valid according to the average of evaluation score from content experts, which is 92%, the average of evaluation score from media experts, which is 80%, the average of evaluation score from physics teachers, which is 85% and the average of evaluation score from peer reviewer, which is 82,2%. It was concluded that web student worksheet based on STS can be used and distributed as learning media in physics learning for senior high school student grade XI.

1. Introduction

Technological use skills are important nowadays. Everything becomes unlimited, because of the influence of the internet and digital technology [1]. The education sector continues to separate in order to increase. The learning system preparation is something that must be improved to get this era of glory. One important element is innovative learning. The problems of ability, adaptation, leadership, collaboration and creativity and innovation are needed [2]. The use of learning media becomes important and becomes one of the factors of the learning process's negativity [3][4]. Interactive and creative learning media are needed in order to be able to combine with increasingly easy technology. The use of media can be a way to make learning interesting and the use of technology to be maximized, especially in the aspect of education. The use of learning media is a tool to be able to train problem solving skills for students by linking the physical concepts that exist in the daily environment of students. The use of LKPD is still in the form of printing. Print teaching materials are practical, but sometimes there are obstacles that are obtained. Whereas in today's digital era, students can use technology to find information, so that learning resources become more diverse [5]. The use of printed LKPD has shortcomings, among others, limited learning resources from reading offerings available in

LKPD so that opportunities for exploration of other sources are still limited. If you want to explore, students need time to find resources in other books [6].The comparison of printed teaching materials with electronic or online [7] is presented in table 1.

Table 1. Comparison of Online and Print Teaching Materials

Online Teaching Material	Print Teaching Material
Learners can search for learning resources by clicking on various kinds of site addresses	Students seek from various print learning sources
Learning by participation through chat rooms and online discussions	Learning through small groups of students
Have computer skills	Computers are not used in learning

The use of teaching materials used in a number of schools in Kotabumi from publishers led to other findings. Seeing the average daily score of the students indicated that for the optical tool material students still experience obstacles to achieving the target value of the KKM. In fact, optical devices are one of the physical materials that students experience difficulties [8] because they are considered to be technical and have high complexity even though they are related to everyday life problems [9]. So that the difficulties of students in learning physics, especially optical devices also vary, ranging from the difficulty of understanding the material and the relationship between concepts [10].

On the other hand, the use of computers in a number of schools in Kotabumi is very adequate. Internet network facilities provided by the school also support students to be able to access all information in a short time. Based on the results of observations and findings in the field, the use of computers and internet networks in schools is still limited to computer subjects and the rest of the students use internet facilities with smart phones to access their social media. Whereas the integrated use of interactive computers in the teaching of science can contribute to significant improvements in the teaching and learning process [11].

Responding to the findings above, this study was delivered as a solution to the above problems. The solution of the above problems becomes important not only so that students can get good physics learning achievements, but also students can understand that the realities of physical matter are in their daily lives both in the aspect of science itself, its relation to technology as well as in their social aspects. It trains problem solving skills which is one of the competencies that must be possessed in the development of the present time. So that collaboration from physics learning and the use of technology can be a provision for students to be able to face the challenges of advancing the times and adjust to the revolutionary era 4.0.

The development of technology in learning by linking physical material, especially optical devices with aspects of science itself, technology and its social impacts become a new thing as a solution to the problems above. In order to become an active learner expert, technology-based teaching and learning mechanisms and information and skills in learning planning, implementing planned learning and evaluating the impact of the implementation of applied learning are important [12][13][14]. The use of web-based student worksheet is a solution so students can utilize technology as learning material and to achieve other things expected, such as an increase in physics learning outcomes. Therefore, learning with the web can help students enrich additional materials that are linked to web-based teaching materials [15].

Student worksheets used are expected to facilitate access to learning by students, one of which is with student worksheets that utilize information technology. Student worksheets used by students are also expected to include elements of technological progress in them, such as student worksheets connected to the internet so that students have more opportunities to explore and enrich their understanding. The use of student worksheets becomes effective in solving problems and understanding concepts in physics subjects [16]. So that technology helps students in guiding them to learn in a more effective way [17].

Student worksheet collaboration which is packaged in the form of web and equivalent values of science, technology and society (STS) in it raises new views of students about learning experiences with the STS approach to learning science, especially physics [18]. The application of the STS approach can be used to develop student-student skills in solving problems that exist in daily life and completing assigned tasks [19][20]. The use of the STS approach leads students to understand the concept [21]. So that the development of student worksheet is needed in the form of a web containing Science, Technology and Society (STS).

2. Method

The method used in this research is research and development. In this research, the methods is planned to create a web student worksheet based on science, technology and society (STS). The research design used in this research 4D [22]. Procedures for the development include (1) define (learning needs analysis); (2) design product; (3) develop (expert judgment, product trial and product revision); (4) disseminate (dissemination of the final product).

Involved as research subjects were four experts, two teachers, and three peer reviews and eighteen students class XI in SMAN 1 Kotabumi for restricted testing of the research product. The research objects were the quality and feasibility of the web student worksheet according to content experts, media experts, physics teacher and respons the students for the product. Instrumen in this research for data collecting are needs analysis and questionnaire. Validation score was taken by expert lecturers, physics teachers, and peers. Data analyze with percentage and percentage agreement. According to the assesment, the score is averaged for each item. After that, the average score is referred to interval score to determine the quality of web student worksheet as shown in table 2 below:

Table 2. Score Interpretation

Score	Interpretation
$80\% \leq p \leq 100\%$	Worth and no revisions needed
$60\% \leq p \leq 80\%$	Worth enough and no revisions needed
$50\% \leq p \leq 60\%$	Less than worth and need revision
$p \leq 50\%$	Unworthy and should be a total revision

A learning media can be categorized as worth and ready to be tested if the final score is obtained more than 60% and media revisions pay attention to validator suggestions and comments. If the final score is obtained below 50% then the media must be revised totally with due regard to the suggestions and comments from the validator.

The product quality measuring instrument was constructed with each item having a guttman scale ranging “yes” or “no” judgment in the validation by the aforesaid expert lecturers, physics teachers, and peers. The results of the validation were analyzed by percentage and percentage agreement. The analysis resulted in information of the product quality and improvement done on the web student worksheet based on STS on the expert’s evaluation. What resulted from the revision of web student worksheet based on STS evaluated by the expert lecturers, physics teachers, and peers then tried out on eleven students of grade XI at SMAN 1 Kotabumi.

3. Result and Discussion

One way to improve learning motivation and learning outcomes of students are using technology-based instructional media. The use of web-based learning resources is more beneficial because of its interactivity and accessibility, and can enhance the students' active independence in learning. This is in line with the research conducted by Nurita [23] that the use of student worksheet can condition students to use information or knowledge that has been published to understand new concepts.Then, web student worksheet become an option as learning media.

The development of this media is in line with research conducted by Rosmiati [24] which shows that the content that supports education today is the use of information technology that is equipped

with educational features. In addition, according to Hadjerrouit [25] that web-based learning has the potential as a useful tool to improve the learning process and teach in schools. This is in line with research conducted by Sujarittham [26] that the use of the web can make student learning more effective. Therefore, the development of student worksheet in the form of this web becomes a new solution in the development of integrated teaching materials with technological developments.

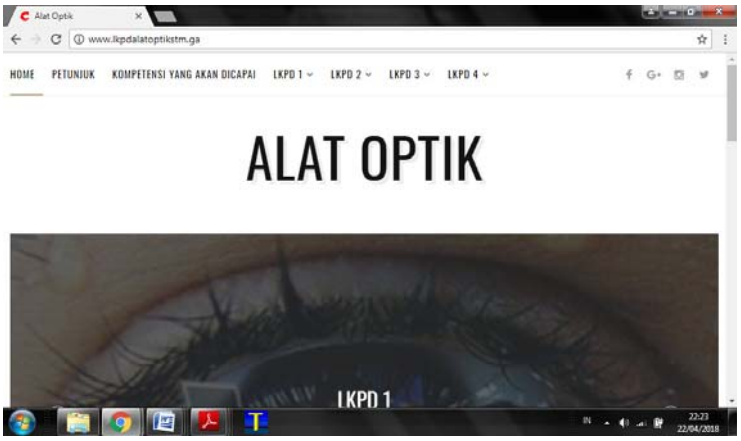

Figure 1. Main website of web student worksheet

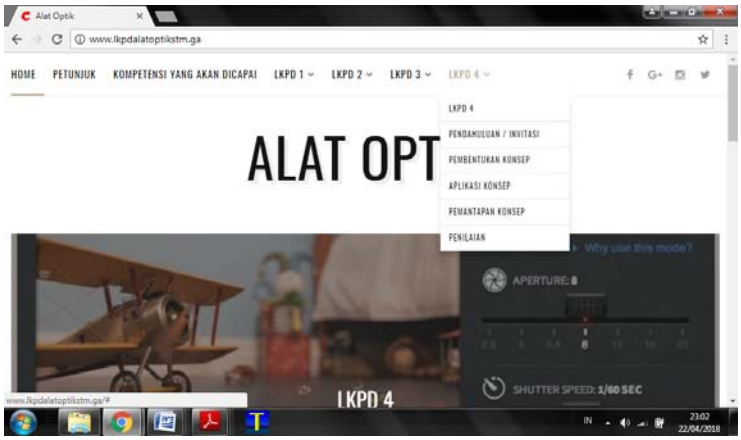

Figure 2. The option menu in each activity of student worksheet use STS sintax

The development of web student worksheet based on STS was adopted to high school physics curriculum (K-13). Developing of web student worksheet based on STS was done by making a scheme and storyboard first. The aim of making scheme was in order to result of media has an easy to use and understanding to students. The menu listed at the top of website are (1) title; (2) home page; (3) instruction menu; (4) the competension who will gain; (5) the worksheet which use STS's sintax. Validation and assessment carried out by expert judgement. Then, proceed assessment by peer reviewer and physics teacher. Media product that have been validated then tested in restricted testing.

3.1. Result of Product Validation

Result of product valition from expert judgment, teacher and peer reviewer shown in figure 3.

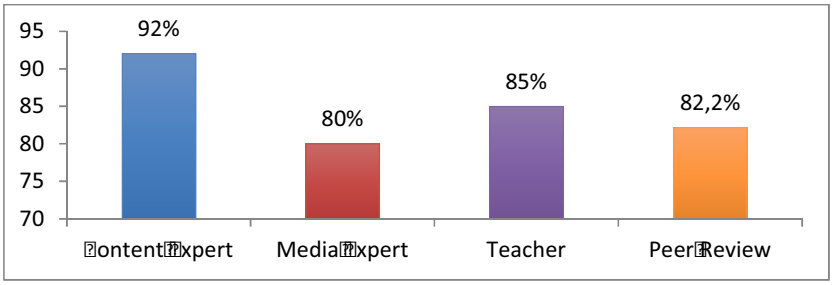

Figure 3. Validation Result from content expert, media expert, teacher and peer reviewer

Figure 3 show that the result to web student worksheet from the expert. Content expert give the average score 92% with criteria "Worth and no revisions needed", media expert result average is 80% with criteria "Worth and no revisions needed", from teacher result average is 85% with criteria "Worth and no revisions needed" and from the peer reviewer result average is 82,2% with criteria "Worth and no revisions needed". Overall, the developing of web student worksheet based on STS state valid and worth as learning media. The result of worth and no revisions needed in content based on content expert's judgment because the web student worksheet contain optical material and STS itself. Based on Akcay's study, science can be taught in ways consistens with the visions of current reforms, and able to master as many basic science concepts as students who focus upon coverage of similar topics in more situations [27], so web student worksheet based on STS can be applied in material contained the relation how the student's process in understanding and performing activities [28] include optical material.

3.2. Result of Student's Respons

Result of student's respons shown in figure 4.

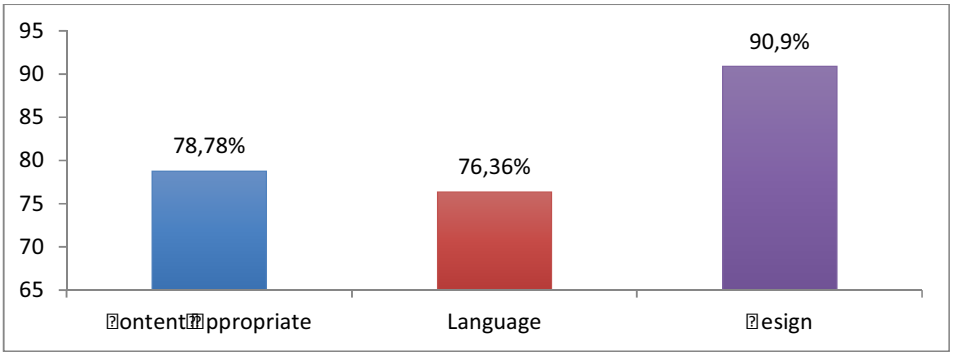

Figure 4. Result of field test of students in small scale based on content appropriate, language and design

Figure 5 show that student's respons from the product. Content appropriate give the average score 78,78% with criteria "Worth enough and no revisions needed", language aspect average score is 76,36% with criteria "Worth enough and no revisions needed", and design aspect average score is 90,9% with criteria "Worth and no revisions needed".

Overall, the developing of web student worksheet based on STS state valid and worth as learning media based on result of field test of students in restricted testing. Based on Barniol's study, show evidence of the effectiveness of the worksheet [29] and using the web to enhance information literacy and may be characterized as brief learning guides and may include information abou resources, instructions for their use, search examples and tips. Then, development of web student worksheet is

very decent to support learning for physics resource in high school and can based STS on the worksheet can increase motivation to learn and critical thinking skills, support the approaches based STS could motivate students in their science lessons [30]. The result of this research states that web student worksheet based on STS can be used and the development of physics teaching learning activities using the web can be done as an alternative in physics learning [31].

4. Conclusion

Based on research and discussion, it can be concluded that web student worksheet based on STS was successfully and can be used as learning material for senior highschool student grade XI in optic material. This media is one of the learning media based on web. The learning material developed in this media is a optical material. The results of media validation and material conducted by expert lecturers, physics teachers, and peers, this media belongs to the category worth. So it can be concluded that web student worksheet based on STS can be used as learning media in senior high school.

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