The Development of Website-Based Physics Test Instrument for Senior High School

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Abstract

Implementation using a written test and answering in writing requires a lot of time in the correction process, so that in submitting the test results you have to wait quite a long time, the risk of fraud is high. So the product is developed as an alternative media for this problem besides the existing internet media. This study developed a website-based physics test instrument product and obtained information about its feasibility. Products are used in physics learning in high schools as a system that facilitates the process of implementing tests and their assessments. This research design is 4-D development. The results of the validators' assessment of 2 material experts and 2 media experts with CVR, namely 1 and CVI, namely 0.1, were categorized as very good and the feasibility percentage was 89%. as well as a limited trial of 40 respondents, namely 2 teachers and 38 students in one of the public Madrasah Aliyah at Jepara city stated that they agreed with the calculation of the CVR value of 1 and the CVI value of 0.1 which was categorized as very good. Based on the results of the analysis and discussion, it can be concluded that the product being developed is categorized as feasible.

Keywords: Physics test instrument; computer-based test; website

INTRODUCTION

Madrasah Aliyah is a secondary education level in formal education in Indonesia which is equivalent to high school. Basically, the Madrasah Aliyah curriculum is the same as the high school curriculum, and it's just that in Madrasah Aliyah, there is a greater portion of Islamic religious education. Education has an essential role in shaping competent humans to build a developed country (Livingstone, 2015). The effort to create capable resources is to change the traditional learning system to a more modern learning system by developing science and technology. One of the applications of the development of science and technology in the field of education is online-based examinations (Bakri & Muliyati, 2017).

The development of telecommunications and informatics (IT) in Indonesia has been quick. Based on data published by the Indonesian Internet Service Providers Association (APJII), in early 2018, 171.17 million Indonesians were using the internet out of a total population of 264.16 million (APJII, 2019). Based on the data, internet penetration in Indonesia is currently around 64.8% of Indonesia's total population.

At the end of 2019, the world was shocked by a new type of disease caused by a virus. Severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), better known as the Coronavirus, is a new type of coronavirus that is transmitted to humans. Even though it mostly affects the elderly, this virus can actually affect anyone, from babies, children, to adults, including pregnant women and nursing mothers (Rothan & Byrareddy, 2020). This virus spreads very quickly and has spread to almost all countries, including Indonesia, in just a few months (Liu et al., 2020). Education in Indonesia has also become one of the sectors affected by the covid-19 Pandemic. The government implements a policy of limiting interactions, namely Work from Home (WFH). The Ministry of Education also issued a policy, specifically by dismissing schools and replacing the Teaching and Learning Activities process by using an online system. This situation forces the teacher to think that all learning processes are still carried out well, even though it is done online. All the implementation of learning shifts from conventional face-to-face classes to the use of the internet so that students and teachers must be forced to adapt to this situation. One of the obstacles faced in the implementation of test evaluation which inevitably also has to be done online (Siahaan, 2020).

The success of online learning in Indonesia during the COVID-19 Pandemic was determined by the readiness of technology in line with the national humanist curriculum, support and collaboration from all stakeholders, including government, schools, teachers, parents and the community (Rasmitadila et al., 2020).

One of the impacts of this Pandemic, especially in the field of communication, was that there were recorded 175.4 million Indonesians using the internet out of a population of 272.1 million. This data is an increase recorded during the pandemic period, from March to June 2020. Of these, internet penetration in Indonesia has increased by around 17% of Indonesia's total population (We Are Social, 2020). One area that has contributed to the rapid use of the internet in Indonesia during this period is education. This is because all learning is carried out online, from primary education to university level.

Physics is a branch of Natural Science. Physics is not just knowledge in the form of facts, concepts, and principles, but also a learning process that provides students with direct experience in understanding the natural environment scientifically. Learning Physics has a goal so that students can think more with a scientific mindset at all, especially for the natural surroundings (Wahyuningsih et al., 2016).

One of the activities that cannot be separated from learning activities is assessment. Assessment is a process of collecting, reporting, and using information about student learning outcomes obtained through measurements to analyze or explain student performance or achievement in doing related tasks (Depdiknas, 2003).

Paper-Based Test (PBT) or what is widely known as a written test is a form of test that uses paper and writing as the main tool for both providing test questions and test answers. In its

implementation, this test uses written questions, and answers to them must also be written (Santi & Prajana, 2019). For example, it takes a lot of time in the correction process, so that in submitting the test results you have to wait quite a long time, the risk of fraud is high (Santi & Prajana, 2019). Based on the above problems, an alternative is needed in the assessment that can overcome these problems.

Assessment using the website has advantages when compared to manual tests. One of them is that this test can check the results of solving questions automatically so that the test results can come out faster and reduce fraud in judgments (Perwitasari, 2015). Educators find it easier to prepare, process and make academic policies for students whose scores are still below the minimum completeness criteria (KKM).

Based on the description above, an assessment system is needed that can be an alternative for teachers to facilitate the process of problem sets documentation, administration, and evaluation, all of which can be done online. Therefore, this study was developed a website-based physics test instrument product and obtained information about its feasibility.

METHOD

This research is a research and development (R&D) using the 4-D development design shown in Figure 1 by Thiagarajan et al. (1974) in the article (Kurniawan & Dewi, 2017). This research was conducted in July - October 2020 in one of the public Madrasah Aliyah at Jepara. The subjects of this study were 38 students of class X MIPA 5 for a limited trial.
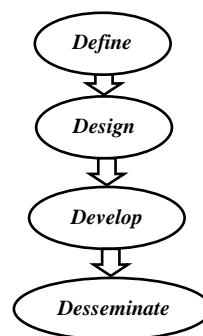
Figures 1 4-D development design

Data analysis techniques for analyzing the feasibility of website-based test instrument products on work and energy materials use the Content Validity Ratio (CVR) and Content Validity Index (CVI) to media and material experts as well as limited testing.

$$CVR = \frac{\left(N_e - \frac{N}{2}\right)}{\frac{N}{2}} \qquad (1)$$

$$CVI = \frac{Total\ of\ CVR}{Total\ of\ questionnaire} \qquad (2)$$

(Lawshe, 1975)

The validator assessment data obtained in the form of a checklist with the criteria as presented in Table 1.

Table 1 Criteria index score

Criteria Score	Score	Index	Criteria Index
Very Good	4		
Good	3	3	Agree
Poor	2	2	Doubt
Very Poor	1	1	Disagree

The range of results for CVR and CVI values is -1 <x <1. Thus, these numbers can be categorized as follows:

1< x < 0	= not good
0	= good
0 < x < 1	= very good

(Lawshe, 1975)

RESULT AND DISCUSSION

The product of developing website-based test instruments on work and energy materials uses a design using UML (Unified Modeling Language) by depicting Use Case Diagrams, Class Diagrams, Sequence Diagrams, and Activity Diagrams. UML consists of grouping system diagrams according to certain aspects or points of view (Hariyanto, 2004). The following displays the product shown in Figure 2 and Figure 3.
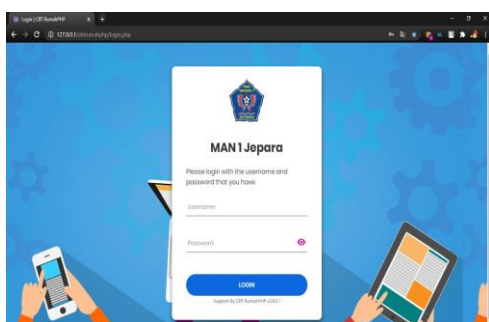
Figures 2 Display login on students
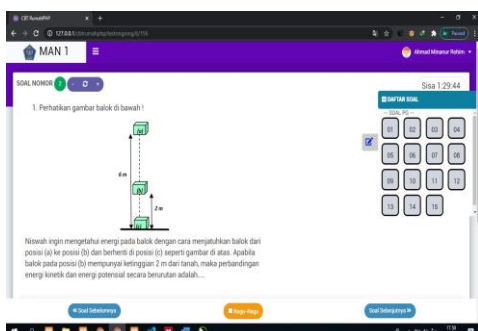
Figures 3 Display questions on students

The definition of the use case diagram in the system is obtained from the teacher and student data management page, the class data management page, the subject data management page, the question bank data management page, the exam schedule data management page, the score data recap page, the exam card printing page, the page announcements, exam pages containing questions, and exam results pages. Use case diagrams are modelling for the behaviour of the

information system to be made (Wira et al., 2019).

The results of the use case diagram are described in the form of a class diagram to see the relationship between classes of the design model of a system. The interactions that occur between objects based on time are shown using the principal sequence diagrams on login, student examination, and logout. The functionality of a use case or between use cases is illustrated by an activity diagram that will describe the activities of the actors.

The system database is made based on the results of class diagrams into tables used in website-based test instrument products on work and energy materials with the name of the database used, namely rumahphp_cbt4.

The validity of material and media experts on website-based test instrument products on work and energy materials. Data from an expert validation analysis can be seen in Table 2.

Table 2 Results of the material and media expert validation analysis

Indicator	Index	Index Criteria	
		Expert 1	Expert 2
Material Construction Language Media	3	Agree	Agree

Based on the input received from the validity data validator, the results of the calculation of the CVR value are 1, and the CVI is 0.1 which is categorized as "Very good", and the percentage of feasibility is 89%. The advice given by media experts is to improve the grammar in the product to make it more effective. Meanwhile, the advice from material experts for writing question stem needs to be corrected so that it is easier for students to understand.

The test is a measuring tool to collect information on the characteristics

of an object in the form of participant learning outcomes. The test requires the answer or response of students in the form of right or wrong. According to the scoring system, the test is divided into two categories, namely objective tests and subjective tests (Dachliyani, 2019).

Limited testing was carried out on 40 respondents who had tried using this website-based test instrument product, namely 38 student respondents and 2 teacher respondents who then answered the questions on the questionnaire with the results in Table 3 and Table 4.

Table 3 Results of the teacher's questionnaire analysis

Indicator	Index	Index Criteria	
		Teacher 1	Teacher 2
Material Construction Language Media	3	Agree	Agree

Based on table 3, the limited testing of the two validators, namely the teacher as a user, gets an index of 3 which is obtained by the criteria for the index "Agree" and the results of the calculation of the CVR value of 1 and the CVI value of 0.1 can be categorized as "Very good" on the product of the website-based test instrument on the material effort and energy.

Table 4 Results of student questionnaire analysis

Indicator	Index	Index Criteria
Material Construction Language Media	3	Agree

Assessment is an activity carried out systematically by obtaining, analyzing, and interpreting student learning data (Dewi et al., 2019). One of the instruments for assessing student learning outcomes is a test instrument (Rofiah et al., 2013).

Further limited testing for students of class X MIPA 5 in one of the public Madrasah Aliyah at Jepara totalling 38 who have filled out a questionnaire that was distributed to get index 3 obtained by the index criteria "Agree" and the results of the calculation of the CVR value of 1 and the CVI value of 0.1 can be categorized as "Very good "on website-based test instrument products on work and energy materials.

Research that has been conducted by Purba (2019) on increasing student learning concentration through the use of Quizizz learning evaluations in the Physical Chemistry course I. The results of data analysis obtained from the pre-test and post-test show an increase in student learning concentration through the utilization of Quizizz learning evaluation in Physics Chemistry I course is 0.45, with moderate improvement interpretation (Purba, 2019). The study obtained evaluation data only points and scores. The evaluation data cannot show information on the increase or decrease in student achievement in doing directly related tasks. If a follow-up evaluation is held, the teacher must process the first evaluation data manually through excel or other applications.

Goddard et al. (2015) in their research stated that assessment is a process of collecting, reporting, and using information about student learning outcomes obtained through measurements to analyze or explain student performance or achievement in doing related tasks. Depdiknas (2003) states that assessments must be able to provide comprehensive information that helps teachers improve their teaching abilities and helps students achieve optimal educational development.

The development of website-based physical instrument products on work and energy materials has resulted in a product that can show the overall analysis of evaluation data directly on the website. Based on the limited test

results on the product of website-based test instruments on work and energy materials that has been done, it is categorized as very good and feasible to be disseminated to other schools.

CONCLUSION

The development of website-based physics test instrument products on work and energy materials has been tested on an evaluation in class X MIPA 5 in one of the public Madrasah Aliyah at Jepara. Based on a questionnaire that has been distributed after the trials that have been carried out, respondents agree, then the product is categorized as feasible. The weakness of this website-based test instrument product requires a large server for use on students on a large scale. This product can help teachers get test data and question analysis quickly, as well as assessments that provide comprehensive information to improve their teaching abilities and help students achieve optimal educational development.

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