The Development of Online Physics Test System at SMA CT Foundation Medan

Yul Ifda Tanjung¹, Dewi Wulandari¹, Abu Bakar¹, Irham Ramadhanil

¹Department of Physics, Faculty of Mathematics and Natural Sciences, Universitas Negeri Medan, Jl. Willem Iskandar Pasar V, Medan 20221, Indonesia

Abstract. The objective of this research is to design and develop the online physics test system which is conducted at SMA CT Foundation Medan. This research is a part of Research and Development (R&D) which accommodates Van de Akker method in the development stages. The subject of this research is class XII consisting of 48 students who interest in natural sciences majors. This research consists of four stages namely: preliminary research; prototyping; summative evaluation and reflection stages. This research instrument consists of validation instruments and tests. The results of this research are: i) the online test system product is feasible to use because it fills the standard of system eligibility indicators including content, interface, navigation, configuration, and security with the percentage of 86.60% which is in a decent category; ii) the product also satisfy the media feasibility standard including correctness, reliability, integrity, and usability with the percentage 81.30% which is in a good category; iii) the results of student response testing including indicators of correctness, reliability, integrity, usability, and usefulness give percentage 86.90% which is a very good category. Thus, this online test system can be used to as a medium to measure students’ abilities in physics subjects.

Keyword: Research and Development, Online Test, Physics

1. Introduction

In early 2020, the world has experienced a health threat situation from the Coronavirus outbreak (Covid-19) which infects almost all countries in the world. WHO declared the world into a global emergency [1]. This also happened in Indonesia, so that the Government has issued disaster emergency status started from 29 February 2020 to 29 May 2020. One of the policies that must be obeyed in all learning activities at school and activities outside the home must be replaced with online learning and work from home. The ended of these activities cannot be predicted. It should refer to the situation of spreading Coronavirus. Thus, the development and application of the learning process based online involving the examination process are expected to be carried out well [2].

Especially for the implementation of an online-based assessment system is carried out by carrying out Computer-Based Tests (CBT). During this time the test is conventional with a Paper-Based Test (PBT). Current conventional exams with paper media are no longer effective and should shift towards computerization [3]. Therefore, along with the development of the times, it should be that tests can be carried out by utilizing information technology and in this corona era, the implementation of online-based CBT can greatly help the assessment process of students.
One of the high schools/ vocational schools that also implemented online learning during the Corona pandemic is SMA Unggulan CT Foundation which is located at Jl. Veteran Pasar VII, Manunggal, Labuhan Deli, Helvetia, Kec. Labuhan Deli, Deli Serdang Regency, North Sumatra. The school has been established since 2015 with all the facilities that schools have such as computer labs, language labs, physics labs, chemistry, biology, libraries, healthy canteens, polyclinics, basketball courts, and volleyball courts. Especially for IT facilities, this school has wifi for smooth online learning and for school information can visit the website that is smactf.sch.id. Based on an online interview with one of the Physics teachers, Mr. Ricky Prayogi, S.SI.,M.Pd obtained school information continuously trying to adjust the curriculum applied to the development of Science and Technology, one of which is online learning but for the implementation of online-based exams is still just discourse and has not been fully implemented.

The online questionnaire result of 25 students in grade I at SMA Unggulan CT Foundation in the academic year 2020/2021 revealed that 76% of students claimed dissatisfied with the assessments of physics subjects made by teachers. The students gave the reason that this is because the assessment still focused on subjective perspective (sometimes among lecturers gave different grades for the same answers of students) and also students rarely get feedback from the results of the assignments and examinations. Another negative aspect of the used test was that students had a chance to collaborate among themselves for answering questions, particularly if the questions were tested in only one type and the other was that the use of test time was difficult to control properly. This problem arises due to the used method of test is still conventional, namely the Paper-Based Testing (PBT) method. The conventional test formats such as PBT have several weaknesses, namely: (a) the assessment process becomes less strict so that assessment errors occur, (b) the instruments are less effective and less efficient, and (c) the tests are difficult to update [4]. Further investigation, states that the PBT method give a negative impact on the individual character both for educator and student for instance: dishonest in doing examination and the possibility of giving or offering of a bribe in answering problems in the examination process [5].

In the development of education, assessment systems must be able to adapt the advanced technology using computer media such as Computerized Based Testing (CBT). CBT is a transformation that changes learning and curriculum aspects in the world of education [6]. This has been developed rapidly, particularly in the assessment process of education [7]. CBT instruments have several positive values compared to PBT that have been revealed in the following aspects [8]. Firstly, CBT instruments are able to package questions to be more effective and efficient just in a compact soft file so this will reduce the use of paper and other types of equipment. Secondly, In CBT provides scoring facilities, thus the assessment process will be easier and more precise and the scores are immediately known by the test taker. This result can be used as a basis for self-evaluation. Thirdly, doing a test using a CBT instrument has a particular time duration. If the time is over, the test will stop automatically. This can encourage the student to answer questions more focused. Due to the limitation of time, students do not have the opportunity to cheat. Furthermore, CBT is not only an alternative method of assessment, CBT is able to train student's confidence both before and after conducting tests [9].

The implementation of the CBT test in the Physics course is expected to encourage students to be more independent and more focus by continuing to train themselves using technology in the learning process. This because students are required for doing assignment questions and exams use the CBT-based assessment method. Students who are not adept in using computers will try harder to practice and students who are already skilled will continue to enrich themselves with technological developments, especially the use of computers [10]. The students' efforts indirectly can improve the conceptual knowledge of physics materials and build their own character. The use of computers as media in the implementation of tasks and examinations is an effort in familiarizing students interacting with technology, utilizing Information and Communication Technology (ICT) to conduct self-assessment, improving ICT-literacy and ICT-usability and strengthening the learning process through test practice (learn by the test)[11-12].
Based on the background of the problem, it is necessary to develop an online-based CBT system for Physics materials at the high school level, especially SMA CT Foundation Medan so that school can carry out a maximum assessment of the learning process during coronavirus outbreak. In addition, the implementation of exams with CBT system can streamline and streamline testing and assessment activities and be able to adapt to current technological advances.

2. Method
The research method was a research development with the stages of Van de Akker [11], namely the Preliminary Research stage, the Prototyping Stage, Summative Evaluation, Systematic Reflection, and Documentation. The result of this article just presents a part of the research to develop an online physics test system. The subject of this research is class XII consisting of 48 students who interest in natural sciences majors at SMA CT Foundation Medan. This research consists of four stages namely: preliminary research; prototyping; summative evaluation and reflection stages. The process of research begins with the preliminary research stage involving the study of both literature and school/student characteristic. The Prototyping Stage provides the following activities: i) designing both of the questions and the application system for proper test instruments; ii) validation tests by an information technology (IT) team and media experts; iii) online test trials to analyze the use of the system for the user (students). While in the summative evaluation stage provides the form of tests or responses from students as evaluation of the final product. Finally, reflection stages are dedicated to the evaluation of all research stages as a systematic reflection to do better in developing the final product. The research instruments consist of a validation questionnaire and a test with 30 questions.

3. Result and Discussion
The initial stage is preliminary research. At this stage, data is collected on the needs of the test taker, core competency formula and basic competency, research instrument in the form of validation sheet of the test instrument, and response sheet of the test taker. The data was obtained from SMA CT Foundation Medan. The second stage is the prototyping stage. At this stage obtained the results of the draft 30-item question item, the results of validation of test instruments by the validator of the physical material field, the design of the system application, validation of the system by the expert validator of the IT field, and the learning media as well as the results of the system trials to see the student’s response to the use of online-based physics test systems.

Specialized in the development of online-based Physics test systems. Researchers created diagrams of system building blocks and program functions for referrals to create source code. Furthermore, the development of the system with three designs, namely use case program design, data flow diagram design, and database design. The program's use case design is used to describe the functionality and features of the application. The data flow diagram design serves to describe the process of data flow from the developed system. While the database design serves to store data and relationships between data.

Researchers developed a system with a special domain with a choice of link http://Physicssmart.com. Here's how the page looks when the user accesses and logs into the system in Figure 1.
To start the quiz students must input the TOKEN code (Password) starting the exam, as in Figure 2, and students will be directed to the test homepage to start the exam, as in Figure 1.

**Figure 1. Initial Display Design**

**Figure 2. Initial Test Display**
Figure 3. Test Display

Students who have completed all the questions can click the Finish button to end the test. After this, students will no longer be able to automatically resume the test of the student's grades displayed on the system. The final view of the test can be seen in Figure 4 and the final test value display in Figure 5.

Figure 4. Final Test Display
In order for this CBT system application to be used, the system must be tested according to a team of IT and media experts. System feasibility test results based on IT field assessments are presented in Table 1.

**Table 1. IT Assessment Results**

| Assessment Components | Percentage (%) | Category |
|-----------------------|----------------|----------|
| Content               | 70.8           | Good     |
| Interface             | 96.6           | Very Good|
| Navigation            | 87.5           | Very Good|
| Configuration         | 75             | Good     |
| Security              | 91.7           | Very Good|
| Average               | 86.6           | Very Good|

Based on Table 1 known percentage for the Content aspect of the 70.8% good category, the Interface aspect of 96.6% excellent category, Navigation aspect of 87.5% excellent category, configuration aspect of 75% good category, and security aspect of 91.7% excellent category. Based on the average value of all aspects that can be summed up the feasibility level of CBT system of 86.6% in the category is very good.

An improvement description of the IT field assessment on some indicators is that the initial view has not met the test activity indicator, the final score view is unreadable, the interface view is less attractive and less interactive. In indicator content, there are syntax errors such as error typing sentences on the system, navigation layout, content, and functions that have not been placed properly so as to make it difficult for the user. Based on these suggestions, the developer made improvements to the test system and subsequently re-conducted testing by media experts covering aspects of correctness, reliability, integrity, and usability obtained results in Table 2.

**Table 2. Media Assessment Result**

| Assessment Components | Percentage (%) | Category |
|-----------------------|----------------|----------|
| Correctness           | 72.5           | Good     |
| Reliability           | 90             | Very Good|
| Integrity             | 85.5           | Very Good|
| Usability             | 77             | Good     |
| Average               | 81.3           | Very Good|
Table 2 shows media field assessment includes Correctness of 72.5% with good category, reliability of 90% with excellent category, the integrity of 85.5% with excellent category, and usability of 77% with an excellent category so that the average for overall media assessment is obtained 81.3% with an excellent category. Based on IT and Media field assessments, online-based CBT products are eligible for use in students.

Furthermore, a trial of 48 students from SMA CT Foundation Medan was conducted based on indicators of correctness, reliability, integrity, usability, and usefulness assessment. Student response trial results are presented in Table 3.

| Assessment Components | Percentage (%) | Category       |
|-----------------------|----------------|---------------|
| Correctness           | 70.8           | Good          |
| Reliability           | 96.6           | Very Good     |
| Integrity             | 87.5           | Very Good     |
| Usability             | 75             | Good          |
| Usefulness            | 91.7           | Very Good     |
| **Average**           | **86.9**       | **Very Good** |

The results obtained from this user response test of 86.9% means that the user responds very well to cbt system products.

4. Conclusions
An online-based CBT system has been developed on Physics materials that meet the eligibility of IT experts, media feasibility, and student response. In terms of IT utilization and media feasibility, the system developed has met the criteria very well with a score of 86.6% and 81.3%. This shows that the system can be relied on to measure students' conceptual knowledge. The reliability of the system is also reflected in 86.9% of respondents from SMA CT Foundation Medan who stated that the CBT system was very well developed and made it easier for students to take online tests. These three findings indicate that the online test system can be used as a medium to measure the ability of the student in terms of physics subject.

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