International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

Implementation Computer Based Test for Science Olympiad Simulation

Susilo Veri Yulianto[1], Lutfiyah Dwi Setia[2], Mochamat Bayu Aji[3], Gus Nanang Syaifuddiin[4]
[1]Software Engineering Technology, Polytechnic State of Madiun, Madiun, Indonesia, 60133
[2]Information Technology, Polytechnic State of Madiun, Madiun, Indonesia, 60133
[3]Information Technology, Polytechnic State of Madiun, Madiun, Indonesia, 60133
[4]Software Engineering Technology, Polytechnic State of Madiun, Madiun, Indonesia, 60133

Abstract**—** *The National Science Olympiad or called OSN is a strategic forum for improving the quality of the Mathematics and Natural Science learning process so that students become more creative and innovative. In practice, Science Olympiad activities are held using computer applications. Elementary school students are given the opportunity to practice using the application in a relatively short time, so that students' readiness is not optimal. The Computer Based Test (CBT) application, which was developed to support Science Olympiad training or simulations, can make students better trained and better prepared to face the Science Olympiad. The CBT application developed is divided into 2 parts, namely: application for teachers and application for students. With this CBT application, teachers can help students by managing practice questions and arranging practice schedules for elementary school students.*

Keywords**—** *Science, olympiad, computer, assisted, test, simulation.*

I. INTRODUCTION

The National Science Olympiad or in Indonesia called "Olimpiade Sains Nasional (OSN)", is a Science Competition event intended for Elementary School, Junior High School and Senior High School students throughout Indonesia which is organized by the National Achievement Center. OSN for Elementary Schools is an improvement in the quality of education in Mathematics and Science competitions, including through holding Mathematics and Science competitions. This activity is a strategic forum for improving the quality of the Mathematics and Science learning process so that students become more creative and innovative [1].

The general aim of OSN for elementary school in 2024 is competition in the Mathematics and Natural Sciences competition branch, for elementary school students and/or equivalent to improve the quality of education, especially in the field of science which is based on character education. includes religiosity, integrity, nationalism, independence and cooperation. Apart from these general objectives, the 2024 implementation also has specific objectives. The specific objectives according to are as follows [1]:

1. Providing a vehicle for elementary school and/or equivalent students to develop talents in Mathematics and Science competitions so that students can be creative, skilled, solve problems, and be able to develop all aspects of their personality.
2. Motivate elementary school students and/or equivalent to always improve their spiritual, emotional and intellectual abilities based on good norms and values.
3. Motivate elementary school students and/or equivalent to apply knowledge of Mathematics and Science competition branches in everyday life.
4. Motivate teachers to improve the quality and creativity of Mathematics and Science learning in elementary schools and/or equivalent.
5. Motivate educational institutions/institutions to improve the quality of education delivery.
6. Motivate stakeholders to socialize and instill spiritual, emotional and intellectual values in the environment for which they are responsible.

The OSN for elementary school competition or competition is carried out using an Android application which can be downloaded and installed from Playstore using an Android smartphone. The selection process is carried out in stages in 3 levels, namely: city/district level, provincial level, and national level.

Before the selection process is carried out, elementary school students are given the opportunity to practice doing questions through the application in a relatively short time. This can result in elementary school students not having thorough preparation in taking part in the next selection process. Based on these problems, this research will focus on how to create a Computer Based Test (CBT) application that can be used by elementary schools to help their students prepare more thoroughly to take part in the OSN for elementary school selection process. CBT is an exam using a computer that can improve students' ability to access the results online [2].

The CBT application created is a web application. Web applications are computer applications that run using a web browser, such as: Chrome, Mozilla, Safari, etc. Web applications are a client-server interaction model using browser software [3].

A CBT application requires a web server and a database server. A web server is a host computer configured and connected to the Internet to serve web pages on demand [4]. The web server is used to run the CBT program.

To store data, the CBT application uses a database server. The purpose of CBT is to store data in the form of a database. A database server is a computer program that provides data services to computers or other computer programs [5].

Susilo Veri Yulianto, Lutfiyah Dwi Setia, Mochamat Bayu Aji, and Gus Nanang Syaifuddiin, "Implementation Computer Based Test for Science Olympiad Simulation," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 4, pp. 182-185, 2024.

International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

II. METHODOLOGY

The methodology of this research can be viewed in figure 1 (Fig. 1).

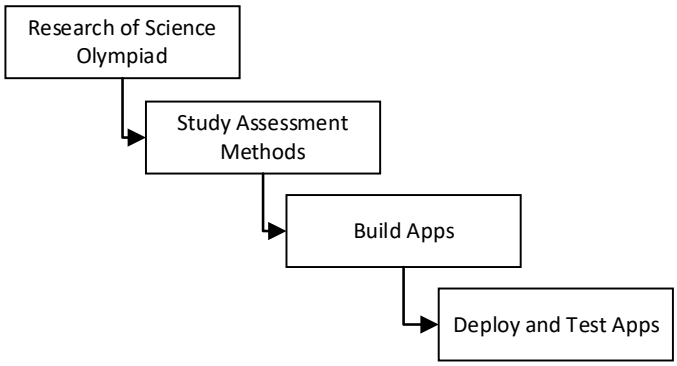

Fig. 1. Methodology

The research methodology diagram above can be explained as follows:

A. *Research of Science Olympiad*

At this stage, we study the technical implementation of OSN activities including the application platform used for these activities.

B. *Study Assessment Method*

OSN at the elementary school level has an assessment method, at this stage learning how to assess the results of the participants' work.

C. *Build apps*

The application building stage can use one of the software development methodologies.

D. *Deploy and test apps*

The results of application development are deployed and tested in the actual environment.

III. RESULT

OSN at the elementary school level is divided into 2 categories, namely: Mathematics and Natural Sciences. Both categories have different scoring methods:

A. *Mathematics*

The Mathematics section consists of 30 multiple choice questions: 8 easy questions, 14 medium questions and 8 difficult questions [6]. Each type of question has an assessment weight which can be viewed in TABLE I.

TABLE I. Mathematics Question Weight

No	Type of Question	Weight
1	Easy	1
2	Medium	1.25
3	Difficult	1.5

For each answer to the question has points which can be viewed in TABLE II.

TABLE II. Mathematics Answer Poin

No	Answer	Point
1	Correct	+4
2	Wrong	-1
3	No Answer	0

For each question, if the answer to the question is correct you will get a score:

$$score = 4\ x\ question\ scale$$

However, if the answer to the question is wrong, you will get a mark of -1. And if the question is not answered, you will get a score of 0 [6]. So, the maximum score for the mathematics category can be viewed in TABLE III.

TABLE III. Maximum Score of Mathematics

No	Type of Question	Amount	Weight	Correct Answer (4 x Amount x Weight)
1	Easy	8	1	32
2	Medium	14	1.25	70
3	Difficult	8	1.5	48
Maximum Score				**150**

The minimum score for the mathematics category can be viewed in TABLE IV.

TABLE IV. Minimum Score of Mathematics

No	Type of Question	Amount	Weight	Wrong Answer (-1 x Amount)
1	Easy	8	1	-8
2	Medium	14	1.25	-14
3	Difficult	8	1.5	-8
Minimum Score				**-30**

B. *Natural Sciences*

The science category has 30 multiple choice questions consisting of: 20 easy questions, 20 medium questions and 20 difficult questions [6]. Each type of question has an assessment weight which can be viewed in TABLE V.

TABLE V. Natural Sciences Question Weight

No	Type of Question	Weight
1	Easy	1
2	Medium	1.25
3	Difficult	1.5

For each answer to the question has points which can be viewed in TABLE VI.

TABLE VI. Natural Sciences Answer Poin

No	Answer	Point
1	Correct	+4
2	Wrong	-1
3	No Answer	0

The duration of the questions is also a weight in the assessment. The assessment weights based on processing time can be viewed in TABLE VII.

TABLE VII. Time Weight

No	Time (second)	Weight
1	$0 < time \leq 30$	1.5
2	$30 < time \leq 60$	1.25
3	$60 < time$	1

Susilo Veri Yulianto, Lutfiyah Dwi Setia, Mochamat Bayu Aji, and Gus Nanang Syaifuddiin, "Implementation Computer Based Test for Science Olympiad Simulation," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 4, pp. 182-185, 2024.

International Research Journal of Advanced Engineering and Science
ISSN (Online): 2455-9024

For each question, if the answer to the question is correct you will get a score:

$$score = 4\ x\ question\ scale\ x\ time\ scale$$

However, if the answer to the question is wrong, you will get a mark of -1. And if the question is not answered, you will get a score of 0 [6]. So, the maximum score for the mathematics category can be viewed in TABLE VIII.

TABLE VIII. Maximum Score of Natural Sciences

No	Type of Question	Amount	Weight	Correct Answer (4 x Amount x Weight x 1.5)
1	Easy	20	1	32
2	Medium	20	1.25	70
3	Difficult	20	1.5	48
Maximum Score				**450**

The minimum score for the mathematics category can be viewed in TABLE IX.

TABLE IX. Minimum Score of Natural Sciences

No	Type of Question	Amount	Weight	Wrong Answer (-1 x Amount)
1	Easy	20	1	-20
2	Medium	20	1.25	-20
3	Difficult	20	1.5	-20
Minimum Score				**-60**

OSN exam simulation using the CBT application. The CBT application created is a web-based application. The CBT application is installed on a server. Then the CBT application is accessed by teachers and students using a web browser on a computer connected to the internet network.

The concept of CBT application implementation can be viewed in Figure 2 (Fig. 2).

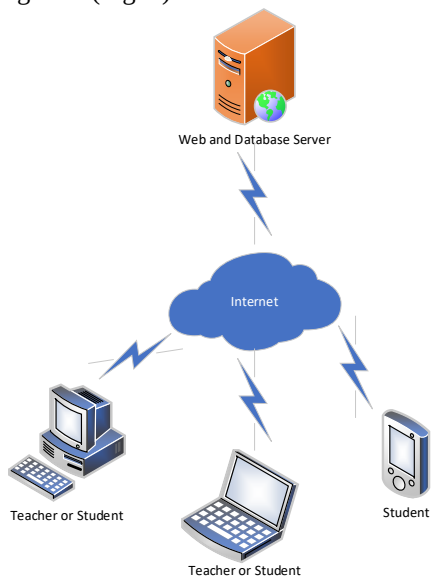

Fig. 2. The concept of CBT application

In figure 2 (Fig. 2) there is a server that acts as a web server and database server. The CBT application is installed on the server. CBT applications are divided into 2, namely applications for teachers and applications for students. The CBT application can be accessed by teachers and students using a web browser on a computer or smartphone connected to the internet network.

The CBT application has 4 types of users, namely: Superadmin, School Operator, Teacher, and Student. Superadmin has access to manage school data and school operators. School operators have access to manage teacher, student, question bank and simulation exam data. Teacher users have access like School Operators, except for teacher data. An example of a question bank menu page can be viewed in figure 3 (Fig. 3).

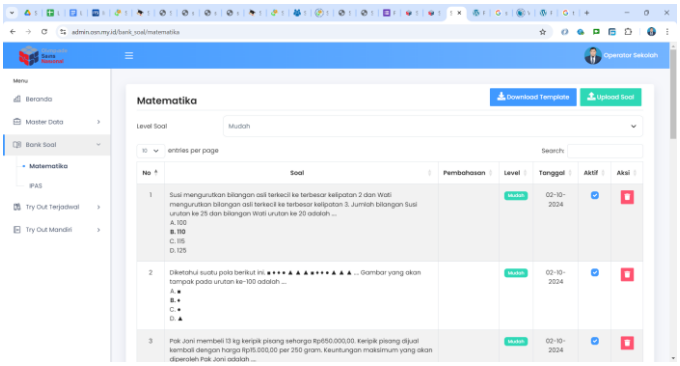

Fig. 3. Question Bank Page

Student users have access to take part in OSN exam simulations. The OSN exam simulation page can be viewed in figure 4 (Fig. 4).

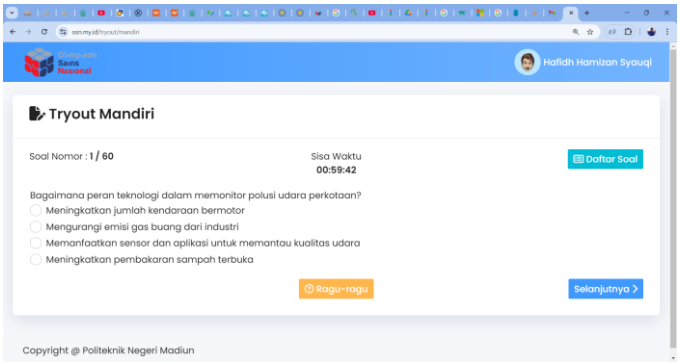

Fig. 4. Exam Simulation Page

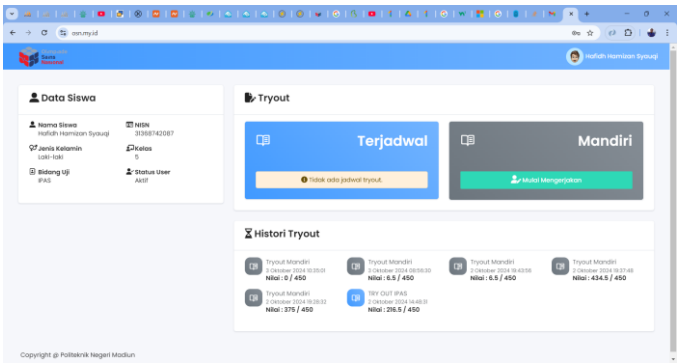

Fig. 5. Scheduled and Independent Simulation Page

The OSN simulation exam is divided into 2, namely scheduled simulation and independent simulation. Teachers can organize scheduled simulation, namely by determining the

Susilo Veri Yulianto, Lutfiyah Dwi Setia, Mochamat Bayu Aji, and Gus Nanang Syaifuddiin, "Implementation Computer Based Test for Science Olympiad Simulation," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 4, pp. 182-185, 2024.

question bank, students, and the time the scheduled simulation starts. With scheduled simulation, students can take exams together. Different from scheduled simulation, independent simulation can be taken by students anytime and anywhere. So that independent simulation can increase student learning intensity. The scheduled and independent simulation page display can be viewed in figure 5 (Fig. 5).

IV. CONCLUSION

The CBT application really helps teachers and students to prepare students to take the OSN exam. In scheduled simulations, teachers can determine the question bank, students, and simulation exam time so that students can take part together. Different from scheduled simulations, independent simulations can be followed by students anytime and anywhere. The teacher only provides questions in the question bank. The more questions the teacher provides, the more varied the questions students get.

REFERENCES

[1] F. Saleh, L. Ambarwati, R. Fahdiran, "Pendahuluan," in *Pedoman Olimpiade Sains Nasional 2024, 1*st ed. Jakarta, Indonesia
[2] S.O. Bandele. "Evaluation of General Studies Computer Based Tests in Universities in South West Nigeria," *International Journal of Interdisciplinary Research Methods*, vol. 6, issue 3, pp. 19-28, 2019.
[3] A. I. Dzhangarov, K. K. Pakhaev, N. V. Potapova, "Modern Web Application Development Technologies," in *IOP Conference Series: Materials Science and Engineering*, Montreal., MTL. Canada, pp. *1-6*, 2021.
[4] S. B. A., "Web Server Security and Survey on Web Application Security", *IJRITCC*, vol. 2, no. 1, pp. 114 –, Jan. 2014.
[5] S. Widiono, "Experiments and Descriptive Analysis in The MariaDB Database Cluster System to Prepare Data Availability", *IJETS*, vol. 1, no. 1, pp. 42-48, Jul. 2019.
[6] F. Saleh, L. Ambarwati, R. Fahdiran, "Penyelenggaraan," in *Pedoman Olimpiade Sains Nasional 2024, 11*th ed. Jakarta, Indonesia

Susilo Veri Yulianto, Lutfiyah Dwi Setia, Mochamat Bayu Aji, and Gus Nanang Syaifuddiin, "Implementation Computer Based Test for Science Olympiad Simulation," *International Research Journal of Advanced Engineering and Science*, Volume 9, Issue 4, pp. 182-185, 2024.