P-ISSN: 2776-7329, E-ISSN: 2776-7310
Proceedings
5th Vocational Education International Conference
Semarang, 13 July 2023

Design of Web-Based Interactive Whiteboard Application to Facilitate Online Learning

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ABSTRACT
Online learning has received special attention recently, particularly post-COVID-19. This approach proved to be the only option that could be applied in the pandemic era. New tools have been introduced to support teaching and learning activities. This study suggests creating an online interactive whiteboard application for the web to raise the standard of online education services. The research method used was research and development, which translates concepts into applied applications. Teacher approval levels using questionnaires were involved to ensure that the application meets user requirements. Online interactive whiteboard innovation solutions by utilizing the Internet network present collaborative learning that is interesting and widely accessible. Online interactive whiteboards are able to increase student engagement in class, motivate students, and increase enthusiasm for learning.

Keywords: *Web-based interactive whiteboard, Online learning.*

1. INTRODUCTION

Significant changes to various facets of human life have been brought about by the information and communication technology (ICT) industry's rapid growth. In particular, every human activity inevitably becomes data collection in the digital information era. One of the basic sectors that take important benefits from ICT is education. ICT plays a significant role in education, especially in the learning process. It has been demonstrated that a number of ICT solutions can contribute to raising the calibre of educational and learning services [1][2]. The online learning model is utilized to facilitate students who have barriers to coming to class. The online approach has real benefits during the COVID-19 pandemic era [3].

Online learning offers several advantages, such as flexibility in scheduling and location independence. The ability to participate in classes remotely gave students the flexibility to juggle their other obligations with their studies. Furthermore, online education gives students access to a variety of programs and courses., often with diverse resources and multimedia content [4]. This variety enhances the learning experience and caters to different learning styles. Additionally, online learning fosters self-discipline and independence as students are responsible for managing their time and staying motivated [5]. Through virtual classrooms, students can engage in discussions, collaborate on projects, and receive feedback from instructors and peers. Overall, online learning has revolutionized the education landscape, providing individuals with accessible and convenient opportunities to acquire knowledge and skills.

The limitations of learning media features are one of the unique issues that still require attention behind the benefits provided by online learning [6]. Real-time visual communication is crucial for creating a productive learning environment in online learning [7][8]. However, instant messaging programs can only be used for text-based communication. Due to this circumstance, information was presented in a less digestible way, particularly when it came to illustrations, sketches, and modelling. For instance, it is currently challenging to fit an explanation of a sketch or model into online chat communication. Therefore, learning media solutions are needed that are more flexible and can be used collaboratively in virtual classes.

This study suggests creating a web-based interactive whiteboard online application to help improve distance education services in light of the current issues. The interactive whiteboard feature of this application is what sets it apart from other communication tools like chat. This facility enables educators to interactively write down text and create drawings, sketches, and models that

can be shared with all distance education participants, similar to whiteboards in the classroom. This strategy can address some of the drawbacks of the current chat platforms, particularly with regard to handwritten explanations made on the spot. The use of online interactive whiteboards has a number of benefits for learning, including boosting participation in class, inspiring students, and fostering an enjoyment of learning [9][10].

Interactive content is an interesting approach to improving collaborative learning [11]. In a lecture or classroom setting, an interactive whiteboard could be used to encourage interactive communication by incorporating writing, images, and sketches. There is significant potential to boost both educators' and students' productivity through the use of interactive whiteboards in conjunction with Internet services [12]. When used to support already-available services like chat rooms or discussion forums, interactive whiteboard technology is a perfect fit.

Due to the new chances it offers to enhance the learning content and test compound cognitive abilities, the incorporation of computer technology into educational activities has become a trend that cannot be avoided [13]. To practice interactive content in various learning contexts, such as in-person (conventional) classroom settings, online (e-learning), or blended learning environments, there are many opportunities provided by computer-based programs with Internet support.

However, web-based interactive whiteboards have emerged as a viable technological option to assist diverse learning scenarios, including those that may occur in the aftermath of the COVID-19 pandemic. These interactive whiteboards, accessible via the Internet, offer a range of features and tools to facilitate learning in various contexts. By incorporating web-based interactive whiteboards, educators can support engaging and interactive learning experiences, regardless of the learning environment. This technology enables real-time collaboration, resource sharing, visual presentations, and fostering knowledge sharing among students. Moreover, the flexibility of web-based interactive whiteboards allows educational institutions to adapt to future learning scenarios beyond the post-COVID-19 era.

2. RELATED WORKS

Several previous studies have utilized online whiteboard applications to support learning activities. Rojanarata [14] identified the use of whiteboard applications in students' collaborative learning. This study reports that online whiteboard applications improve digital skills and teamwork skills. Li's research [15] investigates the application of online whiteboards from a social interaction perspective. The findings demonstrate both the benefits and shortcomings of using an online whiteboard to support participants' online collaborative design activities.

In their research, Kabil & Ilyas [16] suggested that the use of new platforms, such as online whiteboards, requires adequate initial training to ensure students' familiarity with digital platforms. Additionally, Kabil noted how the use of online whiteboards is advancing our understanding of digitally enabled learning and its capacity to raise student happiness in online learning settings

This research is different from several previous studies related to the design of the online whiteboard application offered. Specifically, this online whiteboard application allows teachers to interact with students in an interactive environment. If necessary, students could also provide feedback for further discussion.

3. METHODOLOGY

3.1. Research Design

This research method uses a type of development research (or engineering) in which the concept of a system is represented by implementing an application or learning system to help improve distance education services. Software system development is carried out by referring to software engineering rules and conventions.

The software process model approach used is the waterfall (or so-called linear sequential model), as depicted in Figure 1. The reason underlying the selection of this model is that the specification of the software requirements to be developed is quite clear. Thus, the software development phase can be carried out in stages, starting from analysis, design, implementation, and testing.

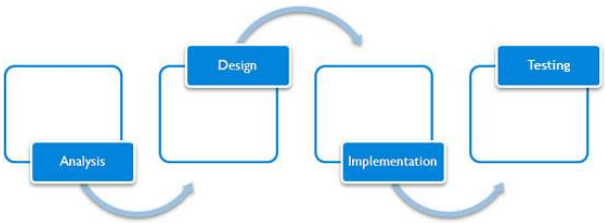

Figure 1 Application Development Stage.

3.2. Instruments

The responses provided by teachers during teaching activities were examined using a questionnaire instrument, as shown in Table 1. The involved questionnaire is composed of five statements for each user. Based on a six-point Likert scale, each statement was assessed using the following scoring criteria: 1 indicated a strong disagreement, 2 indicated disagreement, 3 indicated a slight disagreement, 4

indicated a slight agreement, five indicated agreement, and 6 indicated a strong agreement.

Table 1. Teachers' questionnaires.

No	Statements
1	The online interactive whiteboard application helps teaching activities.
2	The interactive whiteboard online application makes it easy to convey material that requires illustration.
3	Interactive features in the whiteboard online application encourage students to quickly understand learning material.
4	Interactive online applications can be run easily and have a fast response time
5	Interactive online applications are very suitable for supporting online learning, especially in the COVID-19 and post-COVID-19 eras

For the purpose of evaluating the consistency level of the two instructor reviewers, the intraclass correlation coefficient (ICC) was utilized. Since the score from the assessment results is a continuum, this measuring tool is used. The statistical significance value in the present study was defined as a *p*-value of 0.05 or higher.

4. RESULTS AND DISCUSSION

The implementation of the main interface of the interactive whiteboard application was designed simply without involving many navigation menus. The main page display of the application is shown in Figure 2.

Figure 2 Main user interface of online whiteboard.

The users' whiteboard page is an embodiment of a typical blackboard, and the design is intended to resemble that of the actual object. A student-to-student or student-to-student chat page is also available on the whiteboard page. Dashboard pages for educators are special because they provide the ability to write or draw on the board, as shown in Figure 3.

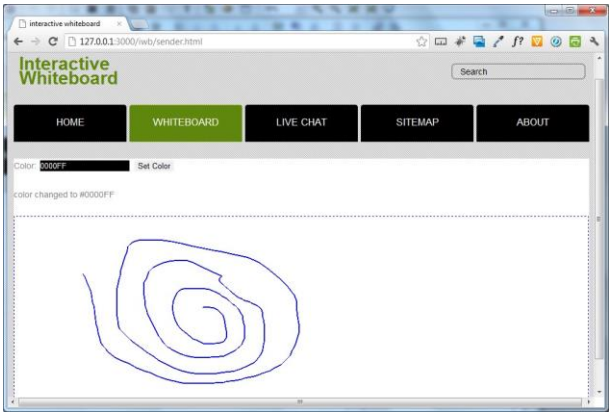

Figure 3 Teacher main interface.

Every teacher's whiteboard activity will be captured in real-time on every student's whiteboard page. This idea represents a virtual classroom where students can be anywhere that has access to the application rather than being restricted to a specific space. Figure 4 provides an example of how the teacher's page will appear on the student room display.

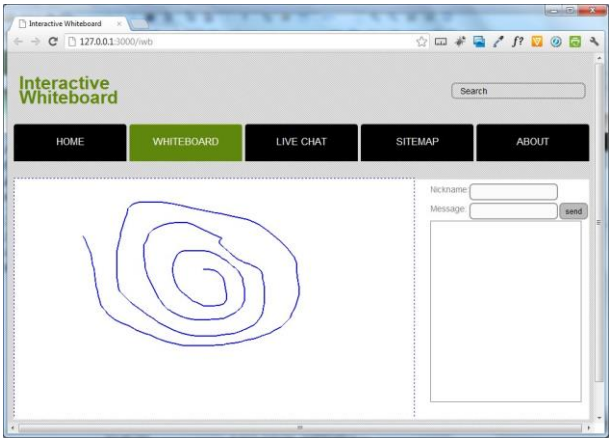

Figure 4 Students' main interface.

Furthermore, filling out the questionnaire was carried out by two experts after they used the online interactive whiteboard application directly. The results of questionnaires conducted by two teachers as experts are shown in Table 2.

Table 2. Teachers' questionnaires results

No	Rater 1	Rater 2
1	6	6
2	5	6
3	5	5
4	5	6
5	5	6

The teacher survey responses were subjected to further analysis using the ICC (Intra-class Correlation) analysis. The obtained alpha reliability rating of 0.83 indicates a good level of reliability for the survey instrument. These results confirm that interactive model content such as this whiteboard has the potential to be

used to support learning. In line with previous studies, users have a positive response to the development of whiteboard applications [15][16].

5. CONCLUSION

The development of online interactive whiteboard applications has the potential to help improve online learning services. This application provides the ability to build web-based virtual classes that can be widely accessed anytime and anywhere, making it very suitable for Indonesia's geographical conditions. The results of expert testing show that the online interactive whiteboard application is feasible to use.

It is important to be aware of the limitations of this study. First, because it was too small, it needed to be expanded in order to produce results that were more precise. Second, students who are actual users of the research might be included. The small number of survey items used to measure teachers' and students' attitudes must be expanded in order to provide more comprehensive data.

ACKNOWLEDGMENTS

This research is supported by the Department of Electrical Engineering and Informatics, Faculty of Engineering, Universitas Negeri Malang (UM).

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