A learnability study on Wordwall.net: Online educational tool for mathematics learning

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Abstract

Background: Schools were compelled to switch to distance learning due to community quarantine measures and lockdowns imposed during the global health crisis. In this context, Wordwall.net emerged as a valuable platform, enabling users to independently create interactive games, thereby supporting the remote learning process.

Aim: The purpose of this study is to demonstrate how online teaching tools such as Wordwall.net can help teachers enable interactive learning when used correctly.

Method: This study employs a cross-sectional analysis to evaluate the effectiveness, efficiency, and user satisfaction of utilizing Wordwall.net as a learning medium for Basic Integration material. This approach encompasses both classroom and online learning, with a particular focus on trigonometry as the final topic mandated by the curriculum. A total of 268 randomly selected volunteer students participated in this research.

Result: Using Wordwall.net as a teaching resource for fundamental integration meets the needs of all students, regardless of their background. Furthermore, the findings provide insight into the instructional material's usability in terms of efficiency, efficacy, and satisfaction.

Conclusion: Wordwall.net was effective in teaching the essential integration lesson. Therefore Wordwall.net allows teachers to create interactive games and printed classroom resources.

INTRODUCTION

Due to community quarantine restrictions and lockdowns caused by the global health crisis, all educational institutions had to adapt to remote learning. The worldwide health crisis prompted these limitations and lockdowns. Indonesia's Education Ministry restricts classroom activities that require physical attendance. These requirements safeguard student and instructor health and safety. An "academic freeze" to stop the "victorious" adoption of classrooms with many distance learning modes failed (Dahlan et al., 2022). Teachers work despite continuous stress. Despite module quality, internet connection, and classroom and home safety difficulties, they were able to develop and deliver the lectures meticulously. This happened online and in-person (Nuzula, 2021). These problems, especially those linked to gadgets and internet connectivity, keep teachers searching for the best solutions to make online learning enjoyable and productive.

The according to Winanti et al. (2018), teachers' main concerns include education delivery. In addition to their inadequate ICT knowledge, they worry about blending inquiry-based and experiential learning with technology. Their poor ICT understanding exacerbates these issues. Teachers need to be more confident using technology while following the instructional layout, because technology evolves continually. Unexpected Internet issues can

cause students to miss crucial synchronous talks (Utami, 2021). Most lectures, especially those on important topics like mathematics, require supplementary explanations and demonstrations, which is a hurdle for both professors and students.

Nisa and Susanto (2022) found that most people think arithmetic is hard even in simple situations. In Indonesia, todays' instructional has not stopped concerns about teaching and learning this subject since the first day of school. Septiani et al. (2020) claimed that technological platforms are not as effective as face-to-face education for teaching mathematics. Technological platforms let distant learners initiate conversations and share ideas. Consider the following teaching a variety of disciplines requires students and teachers to talk, present, and explain learning outcomes. However, teaching mathematics needs the teacher to write words and symbolic language on the blackboard and talk to the students. Teaching math is different from other subjects. Distance learning is difficult (Albay & Aquino, 2024). Separated students may find it harder to learn math. They crave the face-to-face interaction with teachers and students that, for some reason, make learning exciting and engaging despite the subject matter's challenges. Efriani et al. (2023) also dislike long screen times, especially in online synchronous classes where they must watch the teacher teach and participate through minimal chats, reactions, or oral recitations while struggling to get a good internet connection and staying focused despite home distractions. Students must watch the teacher teach and participate with limited discussions, comments, or oral recitations. Students are required to listen to the teacher and minimally chat, react, or recite what they've heard. 78.3% of students surveyed said they would not continue mathematics through distant learning in the future (Imanulhaq & Pratowo, 2022).

This isn't surprising given online distance learning's limitations threaten all students' capacity to master subject matter and achieve learning outcomes (Wahlstorm, 2021). Even though a recent study found that students can adapt to remote learning by finding a good space and time to connect to the internet and borrowing learning resources when their gadgets lack enough features, remote learning during a crisis can stress students out. Students may have distinct support systems than in class (Ulya et al., 2024). Students must be able to educate themselves freely using flexible remote education, according to recent studies, especially during todays' instructional. They can choose convenient times to study, review, complete tasks, and submit assignments due to this distribution approach. Additionally, Cronsberry (2020) found that kids are open to new digital technologies, particularly teacher-used programs. The abrupt switch to online learning platforms makes them used to learning IT, even though they require more instruction (Nilmanee et al., 2024; Patricia, 2021). There is no doubt that mathematics teachers are under increasing pressure to adapt to new ways of learning and use innovative technologies to provide quality education to students of all ages and backgrounds. Connectivity, simplicity of access, engagement, and course mastery drive them to create the best programs and innovative ways that fit learning with school goals. Wahyuningsih et al. (2024) believe technology-enhanced mathematics instructors' roles change frequently. The way they see technology, how much they know about it as a teaching tool, and how they teach math are all important when generating learning tasks.

Flexibility, mobility, cooperation, and participation characterized pre-outbreak schooling (Ivanenko et al., 2024). Mobile learning is current, relevant, and more essential (Rahman et al., 2023), and the educational system promotes individual learning. Even if technology and internet

concerns may hinder learning. This forces teachers to create new methods to improve e-learning content, design, and media. Web-based educational technology should encourage cooperation, and teachers should provide a variety of extra materials (Serly, 2022). E-learning benefits students in various ways. Every student is guaranteed the freedom to attend class whenever and wherever they want. It analyzes each student's unique features, such as their preference to focus on certain subject areas (Mir et al., 2024). Some like repeating the material. Students can learn at their own pace because these exercises can be done anytime they want. Asynchronous activities increase happiness and reduce stress in students (Utami, 2021). This environment also forces students to rely on themselves. This is because students can receive information elsewhere besides schools and teachers.

Building instructional software and websites is necessary because of the increasing need for additional educational resources (Karaferye, 2024). Users can acquire educational content on websites from any point in the world. Learners are allowed to watch videos pertinent to the course as often as they believe is required to comprehend the material thoroughly. Diyora (2022) and Nuzula (2021) mentioned these findings in their work. However, it is essential to keep in mind that websites that are employed for e-learning are anticipated to encourage interactivity and personalization to retain the learners' continuous involvement in the process. The students, not the teachers, should be the primary focus of attention because this will substantially influence the special education the students receive (Kunwar et al., 2023).

Many research studies have examined popular web applications, such as Kahoot and Quizlet (Akerson Ed., et al., 2022; Patricia, 2021). Though some research has looked into the efficacy of online resources like Wordwall.net, the results are mixed. Because of the abundance of studies that have looked at the efficacy of popular web-based applications, such as Quizlet and Kahoot, this poses a problem. The website Wordwall.net, meanwhile, lets users create a plethora of games that can be played alone or in multiplayer modes. Additionally, the website offers educational entertainment to its customers. The teachers can create their own games from scratch using pre-made templates and then add their own text and graphics, or they can utilize games that have already been created by other educators. According to Joon Woei et al. (2021), when educators create their own games, they often make use of pre-made templates. Other websites, like Wordwall.net, can incorporate these interesting instructional tasks. The online teaching resources on Wordwall.net, when used together, may be a powerful tool for educators looking to empower students to take part in interactive learning.

These findings contribute to the understanding of how interactive media like Wordwall.net can enhance the learning experience. However, research on the application of Wordwall.net in the context of mathematics education remains limited. This study aims to bridge that gap by exploring how the use of Wordwall.net as a dynamic and interactive learning medium can assist students, particularly in trigonometry. Through this research, we hope to expand the discourse on integrating digital media in education. Therefore, this study seeks to examine how online teaching tools like Wordwall.net can support teachers in mathematics instruction.

METHODS

Design

The study employed a cross-sectional analysis to determine Wordwall.net as an educational medium for learning Basic Integration in terms of how effective, efficient, and satisfying online distance learning is (Hu et al., 2017). The data were collected by administering questionnaires (for effective, efficient, and satisfactory instructional resources) for online distance learning. The design study can be described in the Figure 1 below.
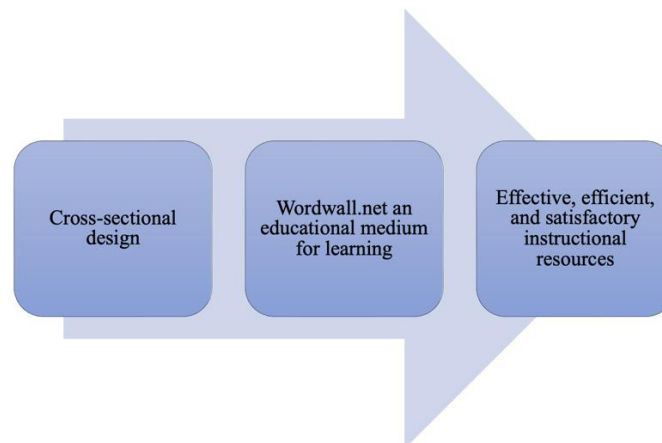
Cross-sectional design → Wordwall.net an educational medium for learning → Effective, efficient, and satisfactory instructional resources

Figure 1. The Study Design

Participants

When it was conducted field this survey was completed by high school seniors in Indonesia enrolled in their final year of secondary education (Creswell, 2014). They have used a blended learning strategy to study trigonometry during the second semester of the academic year 2020-2021. This approach consisted of both traditional classroom instruction and distant online learning. While this research was being carried out, they explicitly examined the critical learning competencies of trigonometry, which was the final topic for the subject outlined in the curriculum standards. This was the last topic for the issue drafted in the curriculum standards. A total of 268 student volunteers were chosen to participate in the study after going through the convenience sampling process.

Instruments

The scale used was a modified SUS (System Usability Scale) established by Connie (2020). The SUS was originally a 10-item questionnaire with five different response options for respondents to choose from when it was first administered. In the current study, the instrument consists of three sections and fifteen questions designed to evaluate the participants' opinions based on their user experiences. Each section of the instrument consists of five questions, while the total is fifteen. Because the quantitative data that the researchers obtained were on an ordinal scale, they were required to use the median as a measure of central tendency to adequately describe the usability of the instructional material in terms of its efficiency, effectiveness, and level of satisfaction (Winnelle, 2021).

Data Analysis

Upon initial inspection, the mathematics instructors noted that the pupils faced numerous obstacles in their pursuit of mathematical knowledge, particularly in the area of trigonometry. The 11th graders needed help with focusing on the class discussion, which was mostly due to the remote learning format, on top of their fear and disinterest in the material as a result of the topic's intricacy. This was a contributing element to the student's struggles. More student engagement was required in the synchronous online classes, and a small number of students complained of being removed from the network on occasion as a result of uncontrolled problems. Furthermore, a few students expressed a need for assistance in navigating the online platform. These considerations led the researchers to consider doing this case study, developing an instructional tool, and assessing the product's worth. In order to help students with self-directed learning and alleviate subject anxiety through the use of interactive games, they were given the task of creating a unique idea for an online instructional resource that they could access whenever they liked. All of their efforts were directed toward this one goal.

RESULTS AND DISCUSSION

Result

This study compiles the quantitative data that the researchers obtained on an ordinal scale; they were forced to employ the median as a measure of central tendency to appropriately explain the usability of the instructional material in terms of its efficiency, effectiveness, and satisfaction.

Table 1. The Effectiveness of Wordwall.net as an Instuctional Tool

Effectiveness	SA	A	D	SD	Mean	Interpretation
	4	3	2	1		
	Frequency					
The educational materials that may be found on this website are plentiful and significant.	183	83	2	0	4	Strongly Agree
The training is presented in a manner that is both comprehensible and well-organized.	180	85	3	0	4	Strongly Agree
I was able to accomplish the goals of the lesson with the assistance of the instructional videos.	186	77	5	0	4	Strongly Agree
The games and activities are appropriate for assessing the knowledge that has been acquired and are pertinent to the topic.	185	73	8	2	4	Strongly Agree
I was able to finish the activities and exercises that were necessary for each of the lessons.	146	102	16	4	4	Strongly Agree
Using the site resulted in either very few or no issues at all for me.	100	107	50	11	3	Agree

Note: SA: Strongly Agree; A: Agree; D: Disagree; SD: Strongly Disagree

The effectiveness of using Wordwall.net as an instructional tool is separated into categories and presented in Table 1. It was discovered that the learning materials of the online instructional tool, such as the conversations and instructive films, were laid out and organized methodically. The educational goals for the class were included in the planned games and activities, which helped the students work toward accomplishing those goals. The educational website was simple for the participants to navigate. In addition, the findings demonstrated that they had either a minimal number of errors or none at all while using the instructional materials. In general, it was determined that the online educational materials effectively met the lesson's objectives on the study of essential integration.

Table 2. The Efficiency of Wordwall.net as an Instructional Tool

Efficiency	SA	A	D	SD	Mean	Interpretation
	4	**3**	**2**	**1**		
		Frequency				
The training material can be utilized quickly and does not present any difficulties.	161	91	12	4	4	Strongly Agree
The site's many different functionalities all work together in a unified and coherent manner.	155	97	15	3	4	Strongly Agree
The change from one page to the next is accomplished in a seamless manner.	133	104	27	4	3	Agree
For me to be able to utilize this website, I did not require the assistance of a technical person in any way.	179	75	13	2	4	Strongly Agree
I feel that the majority of individuals would have no trouble learning how to use this website.	171	84	10	3	4	Strongly Agree

Note: SA: Strongly Agree; A: Agree; D: Disagree; SD: Strongly Disagree

The efficiency of utilizing Wordwall.net as an instructional tool is demonstrated in Table 2, which can be seen here. It was discovered that even without the assistance of a technical specialist, the participants found the website simple to navigate and utilize. This suggests that the students can independently navigate the website on their own. According to them, the website had seamless transitions and remained consistent throughout its activities. In addition, the respondents are likely to promote the website to other people since affordances may be easily perceived without the need to examine the functionality of the various aspects of the website. In conclusion, Wordwall.net is widely recognized as one of the most effective instructional tools for mastering fundamental integration.

Table 2. The Students' Satisfication of Wordwall.net as an Instructional Tool

Satisfaction	SA	A	D	SD	Mean	Interpretation
	4	**3**	**2**	**1**		
		Frequency				
The general layouts, designs, and features are pleasing to the eye and interesting to use.	170	90	8	0	4	Strongly Agree
When I was using the website, I had no concerns.	152	97	18	1	4	Strongly Agree
I believe that I would enjoy making frequent use of the website.	129	120	14	5	3	Strongly Agree
I have no doubt that the website in question is an instructive resource of high quality and credibility.	201	56	9	2	4	Strongly Agree

Note: SA: Strongly Agree; A: Agree; D: Disagree; SD: Strongly Disagree

Table 3 presents the results of a survey that asked students to rate how satisfied they were with the educational tool Wordwall.net. When asked about the tool, this satisfaction was determined by the student's degree of contentment. The needs of the students were successfully satisfied, as evidenced by the overwhelming amount of favorable feedback received from the students regarding the instructional materials, both in terms of the materials' effectiveness and efficiency. It was decided that the website's design, style, and features were pleasant and engaging, making it more user-friendly for those who participated in the study. Students were able to gain confidence in their ability to navigate the educational website, which led to a desire on their part to utilize the teaching resources more consistently. In addition to this, students were able to gain confidence in their ability to navigate the educational website. As a result, the

requirements that the students needed to fulfill to master the fundamental integration lesson successfully were met by Wordwall.net in its capacity as a teaching resource.

Discussion

After the online instructional tool and usability survey were finished, five students who had given a one (1) or a response indicating strong disagreement on most of the survey questions were interviewed for a review. Each of the five respondents gave a positive response when asked if the course materials were useful; additional inquiry revealed that they all thought the tool was simple and easy to understand. In a similar vein, many who took part in the festivities expressed their satisfaction with them. It was clear that the vast majority of them had no trouble finding their way around the instructional webpage. More than that, pupils liked the fact that the physical activities were presented to them as games, according to Yuthika (2021). According to their findings, the games provided a more interesting and interactive learning environment than traditional methods of assessment.

Even still, according to Pratama (2022), some participants need assistance in using the controls of the educational tool, especially those using mobile phones. According to the data gathered during the debriefing session, a few students had trouble finding their way around the website and pressing certain buttons. Furthermore, a student voiced his concern that the instructions might have been more concise since they were too wordy, making it hard for him to answer correctly. The interviewees also offered some suggestions for improving the website's readability, making the navigation buttons larger, and making it compatible with all sorts of devices, including mobile phones. According to Bueno et al (2022), these modifications may result in a better user-friendly website.

Students can learn new abilities, like symbols and numbers, and expand on what they already know with the use of instructional tools like Wordwall.net and certain teaching approaches. The study by Majid and Akhsan (2021) found that a variety of pupils and teenagers can benefit from an active, ongoing learning framework that is based on Wordwall.net. The original intent of Wordwall.net was to provide students with a resource to enhance their mathematics understanding. Consequently, they would also be better able to resolve issues. We reasoned this way because we thought the word wall would make kids better mathematicians. Wordwall.net taught pupils the reasoning behind mathematics problems and helped them become more independent learners. Students taking part in the design process should use them as a guide (Fuad, 2021). Andri (2019) provides numerous suggestions for making a word wall more meaningful for students.

Some students require assistance connecting to the internet at the same time as their synchronous online lectures, therefore asynchronous learning, also known as self-paced independent learning, is crucial. The researchers reached this conclusion after going over the previously published materials; it led them to the conclusion that new "virtual" teaching methods are needed to make mathematics accessible to all students. Furthermore, the researchers assume that students' ability to learn even when they are not physically present might be greatly impacted by the creation of interactive educational websites, especially Wordwall.net (Mertha, 2019). Reason being, academics think that making instructional websites that students can interact with can greatly impact how much they can learn even when

they can't be physically present. After giving it some thought, the researchers came up with arithmetic lesson plans that used both platforms (Pradani, 2022).

Teachers can make their own printable classroom tools and interactive activities on Wordwall.net (Winnelle, 2021). Teachers' only role on this platform is to enter content; the software takes care of everything else. This program offers a ton of discussion topics and activities to choose from, so you can tailor it to your class's curriculum. Any internet-enabled device—a desktop computer, laptop, tablet, smartphone, or even an interactive whiteboard—can play the interactives. Either the students or the professors can give a presentation in front of the class, with each group taking turns speaking. The printouts, on the other hand, are available to students in two formats: instant print and Portable Document Format (PDF) download. You have the choice between the two options. Students have the option to use them alongside the interactive activities or even on their own (Fushshilat, 2019).

The exercises on Wordwall.net are created using a system that relies on pre-existing templates (Mestyana, 2020). You may manage your lessons with features like seat rearranging and play arcade games like Maze Chase and Airplane on the go with this app. Furthermore, according to Dastyck (2017), instructors can easily transition between available templates with just one click. This feature allows teachers to reduce process time while still differentiate jobs. According to Frisila (2022), educators have the freedom to adapt any activity to better suit their lesson plans and pedagogical stance. You may customize the gameplay and set a timer using this app. It also has a variety of themes to choose from, each with its own mix of images, fonts, and noises. Furthermore, this software offers a variety of colors from which to choose (Purwitasari, 2022).

Implication

The results of the usability scale indicated that the learning components, such as the chats and the lecture videos, are helpful in effectively accomplishing the objectives that were established for the class. The fact that the respondents could navigate the website without the assistance of a technical specialist and without encountering any difficulties demonstrates that the online teaching tool is user-friendly. In addition, the students who participated in the research discovered that the online teaching tool met their requirements for mastering the essential integration lesson. This was something that the students found to be very satisfying.

Limitation and Suggestion for Further Research

During the debriefing, participants shared their challenges and provided solutions to enhance the website's educational capacity. They voiced the need to enhance the site's compatibility and functionality across all accessible platforms, with a focus on mobile phones, after several of them had problems accessing it. Your feedback will be carefully considered in order to enhance the quality of this online teaching material based on the responses you provided.

CONCLUSIONS

Wordwall.net successfully provided the expected results in terms of its usability while learning the fundamental integration lesson. This was evidenced by the fact that the results were achieved. On the other hand, the findings of this study need to provide more evidence to support the formal conclusion that the utilization of Wordwall.net as an instructional tool in the process

of learning fundamental integration will be able to meet the needs of all students regardless of any other factors. This conclusion was reached because the findings of this study did not provide sufficient evidence to support the formal conclusion that the utilization of Wordwall.net as an instructional tool in learning fundamental integration. This is a result of the many different factors that truly affect how successful the kind of instruction known as online learning is. These elements include, but are not limited to, the accessibility of the necessary resources, the dependability of the internet connection, the interoperability of the various digital devices, and so on. In the context of todays' instructional, this essay aimed to demonstrate that it is possible to use Wordwall.net as an instructional instrument contributing to fundamental integration education. This article describes tests and analyses of the online educational tool's usefulness, efficiency, and the degree to which it serves the students' demands.

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AUTHOR CONTRIBUTIONS STATEMENT

WN developed the theoretical formalism, performed analytical calculations, and conducted numerical simulations. ES supervised the project. Both authors, WN and ES, contributed to the final version of the manuscript.

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