The Influence of Web-Centric Course in Learning Basic Mathematics toward the Digital Literacy Skills of Preservice Mathematics Teachers

D W Utomo¹, W Barathayomi¹, H Pujiaustuti*³, R Haryadi¹

¹Universitas Sultan Agung Tirtayasa, Indonesia

*Corresponding author: henipujiaustuti@untirta.ac.id

Abstract. This study aimed to improve digital literacy skills through web-centric course learning for preservice teachers of Sultan Ageng Tirtayasa University. The method used in this study was a quasi-experiment through a pre-test and a post-test group design. The instrument used in this study was a digital literacy skills test in the Mathematical Profession English course, which was in the form of 20 essay tests. The material tested was the result of learning basic mathematics. In the process of learning mathematics, the preservice mathematics teacher had been introduced to number operations using English as opposed to the usual medium process of learning mathematics in the Indonesian Language. Furthermore, the instrument was tested on 20 preservice mathematics teachers of the said university. The average N-gain result for preservice mathematics teachers was 0.56 which belonged to the moderate category. So, it can be concluded that digital literacy skills in learning mathematics can be improved through the course.

1. Introduction

Media is used to channel messages and can stimulate the mind, arouse enthusiasm, attention, and willingness so that it can encourage the learning process in students [1]. Almost every learning situation involves media that includes verbal and visual information such as text and images that must be presented and continuously analyzed and processed by students [2]. Educational media programming trends for adults and children have used several media platforms that present both interactive and non-interactive media; interactive increases various types of learning rather than non-interactive [3]. Learning media makes learning activities more effective and efficient, using this learning media is expected to make students understand easily the material [4]. Media plays an important role in the learning process and before it is used in the learning process the media must meet several conditions. These conditions are educative meaning which implies that the media must contain knowledge that is unknown to students; practical meaning that is easy to use for the teachers and students; its efficiency that means the media can improve student learning outcomes and is appropriate [5,6].

The importance of the media was proved by the needs of students and teachers in the use of learning and teaching. We can see that when teachers use media in the learning process, learning is heightened and interesting at the same time students can enjoy the learning experience more fun so that the acquisition of knowledge is no longer boring [7]. The media becomes an intermediary for the
teacher in presenting learning material that cannot be seen directly by students, but it can be portrayed indirectly through the media wherein students are expected to understand better and comprehend the learning objectives to be achieved [8].

The use of instructional media in Indonesia is said to be minimal and limited due to internal and external factors that make learning media disintegrated in the learning process [9]. Internal factors that do not support the use of instructional media are the lack of teacher knowledge in using technology to create attractive and innovative learning media and the external factor is the lack of allocation of funds from the government to schools to practice learning media for them to provide the modest learning media facilities needed [10]. The students' skills in learning based on this technology must also be supported by the possessed skills of the teacher and the media or teaching material used, this is because that learning is the process of communication between teaching and teaching materials [11].

To increase the effectiveness and efficiency of the learning process, various creative and innovative learning methods need to be developed so that learning can be more interesting and not dull or boring [12]. Therefore, we need the supplementation of technology where media in teaching is a good and powerful tool wherein students can learn by mastering competency-oriented technology-based learning media such as Web-centric Course (WCC) [13].

Web-centric Course is web-based learning where some learning materials, discussions, consultations, assignments, and exercises are delivered via the internet while examinations and some consultations, discussions, and exercises are done face-to-face. Although in the learning process some are done face-to-face which is usually in the form of tutorials, the percentage of face-to-face remains smaller than the percentage of the learning process via the internet. So the web is flexible, it can not only be operated via desktop but flexible to automatically adapt web pages from desktop presentations to mobile phones [14].

The website is the most important educational tool and it is the main interface to use for searching for information. Online programs and web user satisfaction with web design and information usage on the web must also be considered [15]. This web technology will provide the basis for most future software systems, students must have marketable expertise that is based on a good web-centric curriculum that can enhance student knowledge so that with web service knowledge for example they will be able to introduce and utilize the distribution of counting and integrating applications both within organizations and among business partners and; perhaps without a web-centric based curriculum, students do not have the opportunity to fully understand the web service-oriented framework or recommend web service solutions [16,17]. If a website wants to be successful, it must be following the needs and desires of the user because we cannot always predict so it is important to study the web before designing the website [18]. Many challenges must overcome in this web supplementation but the benefits of this web technology outweigh the benefits of traditional learning if used and applied in the right way [19].

Web-centric course assisted learning media is an alternative interactive learning media that can develop an independent and creative active attitude [20]. In mathematics journal research, it turns out that web-centric course is very helpful in the learning process such as better understanding of student concepts, better student learning independence and web-centric course that can be a method of learning at school, providing a different atmosphere to attract students' interest and make students not bored of learning [21]. There is also a research on the web-centric course but in the case of diseases that interfere with health namely diabetes, so in this study, it is explained that Diabetes Web-Centric Information and Support Environment (D-WISE) is a health application that offers these functions through a web-based interface interactive for doctors, the patient's self-management program and behavior related interventions delivered through smart mobile devices so that later it will be easier for doctors and patients to communicate [22]. The students also identified the web as a variety of effective teaching strategies from this approach because it develops understanding [23].

Furthermore, the novelty of this study is the use of learning media using web applications that can be accessed easily by preservice mathematics teacher because the Web-centric Course (WCC) is learning that combines two methods of learning, the first is face-to-face learning and the second is
online learning that can be accessed by students anytime and anywhere. It also contains material, exercises, assignments, and evaluation.

This study aimed to improve digital literacy skills through web-centric course learning for preservice teachers of Sultan Ageng Tirtayasa University. Digital literacy is defined as the skills to understand and use information in various forms from a very wide variety of sources that are accessed through computer devices [24]. The concept of digital literacy overshadows and becomes an important foundation for the skills to understand the devices of technology, information, and communication [25,26]. Digital literacy refers to technical skills that enable the active involvement of community components in line with the development of digital-based cultural and public services [27,28]. Digital literacy focuses on one aspect of knowledge, such as the skills to map, identify, process, and use digital information optimally [29,30]. Therefore, digital literacy is a life skill that not only involves the skills to use technological devices, information, and communication, but also the skills to socialize, the skills to learn, and have the attitude, critical thinking, creative, and inspiring as digital competencies [31,32].

2. Research Method
This research was a quasi-experimental research with one group pre-test-post-test design. This study did not use a class comparison but used a preliminary test so that the magnitude of the effect of using the web-centric course learning media can be known with certainty. In this study, the research subjects were first given a preliminary test to find out the extent of the students' initial skills before being given mathematics learning by using web-centric course learning media. After being given a preliminary test, the students were then given treatment, namely learning the English mathematical profession using web-centric course learning media. After completing mathematics learning with web-centric course learning media, all students were given a final test to find out the extent of the influence of English learning in the mathematics profession using web-centric course media on digital literacy skills. Furthermore, the research design used can be seen in Figure 1 below [33].

![Figure 1. One Group Pre-test Post-test Design](image-url)

The subjects of this study were preservice mathematics teachers of Sultan Ageng Tirtayasa University with a total of 20 students. All students had heterogeneous characteristics. The research subjects were taken by purposive sampling. The instrument used in this study was a digital literacy skills test in the form of essay questions. The instrument was given twice, namely at the pre-test and post-test. 20 questions had been made. The material tested was the result of learning basic mathematics. In the process of learning mathematics, preservice mathematics teachers are introduced to number operations using English. So far, the process of learning mathematics uses Indonesian, but in this case, preservice mathematics teachers were taught using English. So the effectiveness of using English in learning basic mathematics can be seen. In this mathematics learning, WCC was used as
learning media. Furthermore, after obtaining data from the pre-test and post-test results, then the normalized gain score formula (N-Gain) was used to determine the increase in digital literacy skills. Through the normalized gain score (N-Gain), an overview of the improvement in the digital literacy skills of students before and after treatment can be determined. The formula used can be seen in Figure 2 below [34].

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N\text{-Gain} = \frac{\text{Post-test score} - \text{Pre-test Score}}{\text{Maximum score} - \text{Pre-test Score}}
\]

**Figure 2.** formula of N-Gain

Then, the criteria for increasing digital literacy skills before and after learning the English mathematical profession by using web-centric course learning media can be seen in Table 1 below.

| N-Gain     | Improvement Classification |
|------------|---------------------------|
| g > 0.70   | High                      |
| 0.30 < g ≤ 0.70 | Medium                  |
| g ≤ 0.30   | Low                       |

### 3. Result And Discussion

#### 3.1. Understanding of Digital Literacy

Based on the results of the study, the obtained data results namely pre-test and post-test data. Furthermore, the results of the digital literacy skills of preservice mathematics teachers can be seen in Figure 3 below.

![Figure 3. Digital Literacy Skills Results](image)

In Figure 3, the N-Gain result of the digital literacy skills was 56% or 0.56. This showed that the digital literacy skills of students who receive treatment from mathematics learning using web-centric course learning media were in the medium category. Based on the results of the N-Gain, learning using web-centric course media can improve digital literacy skills.

Furthermore, the results of each aspect of digital literacy skills can be seen in Figure 4.
Figure 4. The Preservice Teachers’ Digital Literacy Skills

From Figure 4, the learning of mathematics by using web-centric course learning media can improve the digital literacy skills of the preservice mathematics teacher. Based on the N-gain results obtained, the technical skill aspect of 0.63 was included in the moderate or sufficient category. From the results of observations during learning, students already had individual awareness, attitudes, and skills to collect, identify, access, manage, integrate, evaluate, and analyze using digital tools and facilities appropriately, build new knowledge, and communicate with other students.

Furthermore, the results of critical understanding indicated that critical understanding skills were included in the medium category. From the results of observations during learning, students already had cognitive skills in using media such as the skills to understand, analyze, and evaluate media content. Students already had the skills needed to achieve digital competence, critical, and confident use of information technology for work, study, and communication. Critical understanding is a basic skill such as using a computer to search, access, save, create, present, and exchange information to communicate and participate in collaborative relationships through the internet.

The stage of social competence skills was included in the medium category. From the results of observations during learning, students already had the skills to communicate and participate through the media. Student social competence is a skill that complements students in socializing with their environment. This competency is more focused on the manifestation of personal competence.

Based on the data above, the web-centric course is a learning medium that is feasible to be used in the learning process because it uses the internet which combines distance learning and face-to-face learning. Then, during the learning process, part of the material can be delivered via the internet and partly through face-to-face meetings. In the process of learning, the teachers provided instructions to students to learn subject matter through the web. The students were also given directions to look for other sources from relevant websites. When face-to-face meetings occurred, students and lecturers discussed the content of material that had been learned through the internet. The students were very active when asking for the study and will be studied materials.

Furthermore, it can also be said that learning in the classroom is no longer dominated by traditional learning patterns, but already must use the internet as part of learning because the web-centric course is a media as a learning process towards internet-based learning. However, the percentage of face-to-face meetings is still more than the use of the internet because it is still at the introductory level. The presence of web-centric courses in education is inevitable. Almost all elements of education and learning are carried out by implementing a web-centric course in it. By using the web-centric course as a learning medium, the result is that students have good digital literacy skills as a form of effort in their lives to face 21st-century skills [35]. Digital literacy aims to introduce and provide students with
skills in understanding and applying computers as learning media [36]. The use of web-centric courses in learning serves to facilitate students in achieving learning goals. The similarity of this research with previous research is using web-centric course media in the learning process. However, what is different from previous research is the use of different materials and different research subjects, so that its effects need to be tested and proven.

4. Conclusion
Based on the results and discussion above, the web-centric course can improve the digital literacy skills of preservice mathematics teachers. It can be seen that the N-gain value was 56%. These results indicate that the web-centric course is suitable to be used in mathematics learning. It is suggested to carry out a web-centric course development stage on other materials. It is also necessary to see the influence of the web-centric course on the other mathematics learning.

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