

# Critical Success Factors for Enhancing Digital Literacy Among Undergraduate Students

Primasa Minerva Nagari<sup>1</sup>, Sheerad Sahid<sup>2\*</sup>, Muhammad Hussin<sup>3</sup>

<sup>1-3</sup>Faculty of Education, Universiti Kebangsaan Malaysia, Bangi 43600, Selangor, Malaysia

## Abstract

Digital literacy among undergraduate student is very important, because in the current digital era, the younger generation is expected to be able to master digital literacy for various benefits for learning and their future. The objective of this paper is to identify the success factors for enhancing digital literacy among undergraduate students. To address this issue, we used PRISMA flowchart, which offers a methodological framework and reporting procedure for the current review. There were 20 articles which reviewed in this paper. These findings show that seven main factors have emerged to answer the objective of this study, namely digital knowledge, communication skill, collaboration skill, ICT infrastructure, social environment, social media, and learning activity. This paper is expected to foster the interest of other researchers and reveal other factors that can influence factors for enhancing digital literacy among undergraduate students, because many other factors can also be raised in research on digital literacy in the world of education.

**Keywords:** digital literacy, undergraduate students, systematic review, education.

## INTRODUCTION

Digital literacy is something that widely discussed in the digital era, especially in the world of education. Digital literacy is indispensable for students, because digital literacy can help students in acquiring and developing digital cognitive and technical skills, which can be used as provisions after graduating from university (Techataweewan & Prasertsin, 2018; Tiernan & Farren, 2017). Digital literacy is becoming digital populations, where each person is responsible for how they use technology to interact with the environment around them. Digital literacy means acquiring the knowledge required to study, work, and live in a world where communication and information access are being facilitated by digital tools and technology such as social media, mobile devices, and internet platforms (Hosman & Pérez Comisso, 2020). By knowing the importance of digital literacy for students, they can actively and contribute to the country's economy (Vodá et al., 2022).

The extant literature on digital literacy, skills and competencies is rich in definitions and classifications, but there is still no consensus on the larger themes and subsumed themes categories (Tinmaz et al., 2022). For instance, the current assessments of Internet skills are incomplete and oversimplified, conceptually ambiguous (van Deursen et al., 2015), and internet skills are only a part of digital skills. This study article attempts to present a broad framework of digital domains and topics that can best define digital capabilities in the novel context of Industry 4.0 and the faster pandemic-triggered digitalization, despite the fact that there is already a tonne of research in this area. The issues and areas can be the foundation for creating a modern framework for digital literacy.

Digital literacy can be interpreted variously, ranging from understanding the convenience of computers, to understanding how to identify reliable sources of

information on the internet or the ability to move comfortably through social media or designing something digital-based for others. Digital literacy goes beyond the traditional ideas of device ownership and internet access associated with the digital divide and enters the field of understanding one has (Ertl et al., 2020; Venkatesh & Davis, 2000; Yin & Davis, 2007). Digital literacy needs to combine more than just the ability to understand content and information, but also the ability to analyze, modify, and create new trusted content or information. Digital literacy evolved into a way of more than just operating a computer, or understanding where to find information, but also how to critically evaluate information (Lanham, 1995; Öncül, 2020). This involves the awareness of the resources available to solve the necessary tasks that correspond to the goals of the user. Thus, digital literacy becomes a very complex set of skills in the form of knowledge, skills, and practices that use digital-related things (Fázik & Steinerová, 2021; Mahmood et al., 2021). Now is a challenge for undergraduate students, as they are no longer just looking for new knowledge but also have to follow the technology by their self (Clarke, 2018; den Berg, 2020; Rafi et al., 2019).

**Corresponding Author e-mail:** sheerad@ukm.edu.my

<https://orcid.org/0000-0003-2401-4629>; Phone: +60 12-8602 162

**How to cite this article:** Nagari PM, Sahid S, Hussin M. Critical Success Factors for Enhancing Digital Literacy Among Undergraduate Students. Pegem Journal of Education and Instruction, Vol. 13, No. 4, 2023, 249-259.

**Source of support:** None

**Conflict of interest:** Nil.

**DOI:** 10.47750/pegegog.13.04.30

**Received:** 08.11.2022

**Accepted:** 22.01.2023

**Publication:** 01.10.2023

Therefore, the research question for the current study is the success factor, such as digital knowledge, communication, collaboration, ICT infrastructure, social environment, social media, and learning activity for enhancing digital literacy among undergraduate students? To answer this problem, then, in the context of this study, we focused specifically on the undergraduate student digital literacy. This is important because in today’s digital era, the younger generation, especially undergraduate students, is expected to master digital literacy which can be useful for them in learning and the world of work later.

From the existing statement, factors for enhancing digital literacy among undergraduate students needed because students should know. Therefore, this study aims to analyze and identify factors for enhancing digital literacy among undergraduate students, based on research that has been carried out by previous researchers.

**METHOD**

**Procedure**

This study is systematic literature review (SLR), which aims to recognize, review, and evaluate all relevant research so as to answer the questions of a research set (Cooper, 2017; Higgins et al., 2019). This study analyzed a group of studies focused on similar topics or phenomena to produce generalizable results (Walsh & Downe, 2005). In this case, this study was analysed about a topic or phenomena, called factors for enhancing digital literacy among undergraduate students. We used PRISMA flowchart to provide methodological frameworks and reporting procedures for current reviews to conduct searches, study selection, data extraction, and analysis. Figure of the step used PRIMA flowchart, will be explained in figure 1.

**Identifying Relevant Studies**

The search for articles in this study systematically uses databases in the Scopus and World of Science (WoS) indexes in 2002 to 2022. The data collected uses 20 years because

undergraduate students are currently the same generation in the ‘90s and 2000s. The database collected was selected based on a research focus that discusses factors enhancing digital literacy among undergraduate students.

Figure 1 outlines the search approach developed for this investigation utilising the PRISMA flowchart (PRISMA, 2020). Based on the search for articles with PRISMA, 3449 articles with the keyword digital literacy were obtained, with 1923 articles Scopus and 1526 Web of Science (WoS) discussing digital literacy. After being excluded with the criteria of open access, educational research, social sciences, articles, English, and the year (2002 – 2022), 560 articles were obtained. Then from the 560 articles, based on titles and abstracts that correspond to the digital literacy undergraduate student, 78 appropriate articles were obtained, and 64 articles were obtained because 14 articles were the same articles in Scopus and WoS (Web of Science. Then after obtaining 64 articles, the researchers really looked at the articles that can indeed be reviewed about the factor for enhancing digital literacy among undergraduate students are only 20 articles, because 19 articles do not discuss constructs to improve digital literacy, and 25 articles do not discuss digital literacy among undergraduate students.

**Selecting, Mapping Data, and Reporting Results**

The author independently vetted the articles in two steps using the inclusion and exclusion criteria. Filtering the article titles and abstracts found by using the afore mentioned filters was the first step. The viability of articles found in the first step of screening that were deemed relevant after a preliminary evaluation were assessed by a second inspection in the form of a full-text review. Only articles that defined factors that can be success factors for enhancing digital literacy among undergraduate student were included.

The first and second authors independently carried out an assessment technique for the preliminary analysis using a common graph formula that contained data from the paper, such as the publishing year, the author(s), the country of

**Table 1:** Search string for Scopus and WoS in Digital Literacy among Undergraduate Students

<i>Databased</i>	<i>Keyword</i>
Scopus	TITLE-ABS-KEY ( “digital literacy*” OR “ICT Literacy*” OR “digital literacy in education*” ) AND ( LIMIT-TO ( OA, “all” ) ) AND ( LIMIT-TO ( PUBYEAR, 2022 ) OR LIMIT-TO ( PUBYEAR, 2021 ) OR LIMIT-TO ( PUBYEAR, 2020 ) OR LIMIT-TO ( PUBYEAR, 2019 ) OR LIMIT-TO ( PUBYEAR, 2018 ) OR LIMIT-TO ( PUBYEAR, 2017 ) OR LIMIT-TO ( PUBYEAR, 2016 ) OR LIMIT-TO ( PUBYEAR, 2015 ) OR LIMIT-TO ( PUBYEAR, 2014 ) OR LIMIT-TO ( PUBYEAR, 2013 ) OR LIMIT-TO ( PUBYEAR, 2012 ) OR LIMIT-TO ( PUBYEAR, 2011 ) OR LIMIT-TO ( PUBYEAR, 2010 ) OR LIMIT-TO ( PUBYEAR, 2009 ) OR LIMIT-TO ( PUBYEAR, 2008 ) OR LIMIT-TO ( PUBYEAR, 2007 ) OR LIMIT-TO ( PUBYEAR, 2006 ) OR LIMIT-TO ( PUBYEAR, 2005 ) OR LIMIT-TO ( PUBYEAR, 2003 ) OR LIMIT-TO ( PUBYEAR, 2002 ) ) AND ( LIMIT-TO ( SUBJAREA, “SOC” ) ) AND ( LIMIT-TO ( LANGUAGE, “English” ) ) AND ( LIMIT-TO ( DOCTYPE, “ar” ) ) AND ( LIMIT-TO ( PUBSTAGE, “final” ) ) AND ( LIMIT-TO ( EXACTKEYWORD, “Digital Literacy” ) )
WoS	TITLE-ABS-KEY ( “digital literacy*” OR “ICT Literacy*” OR “digital literacy in education*” )

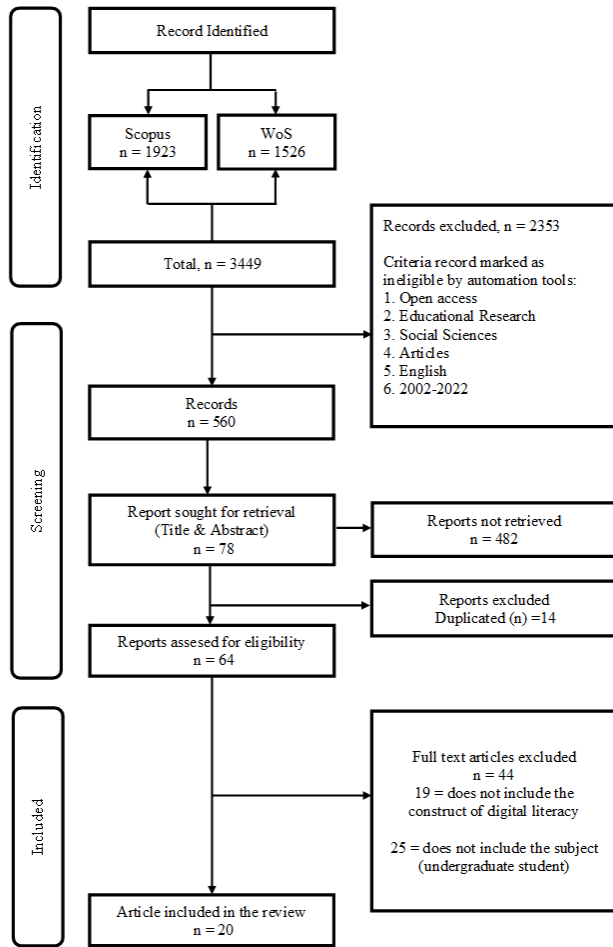


Fig. 1: PRISMA Flowchart Articles in Digital Literacy among Undergraduate Students

publication, and the discussion. The first and second authors then reviewed and evaluated the relevant full-text articles. In order to address the research goals, the accompanying article was systematically extracted in the ensuing analysis. The results of each article’s extraction were examined numerous times to look for patterns and determine whether there were any parallels or differences in the study’s focus on characteristics that could enhance undergraduate students’ digital literacy. As a result of the search and screening process, 20 articles were selected (Table 2).

**FINDINGS**

The Scopus and WoS database searches conducted between 2002 and 2022 using data search strategies through PRISMA flowcharts resulted in 3449 articles. This was done to get accurate information from articles that could be used to resolve problems raised by the study. As noted in the introduction, this problem is related to the success factors for enhancing digital literacy among undergraduate students. 560 articles were screened by looking at the title and abstract for qualification after articles that did not fulfil the requirements were excluded. Then, 78 relevant articles were found among the 560 total articles based on titles and abstracts that were relevant to undergraduate students studying digital literacy, and 64 articles were found because 14 publications appeared in both Scopus and WoS. After collecting 64 articles, the researchers actually looked at the 20 articles that can be reviewed about the factor that enhances undergraduate students’ digital literacy. This is because 19 of the articles did not discuss the constructs to improve digital literacy, and 25 of the articles did not discuss undergraduate students’ digital literacy.

Table 2.: Result of Screening Process Articles in Digital Literacy among Undergraduate Students

Author(s)	Studies
(Ismael Peña-López, 2010)	Analyses policies that emphasise infrastructures (such as laptops) are not the solution because they typically neglect digital literacy, contributing to (or doing little to address) the digital skills gap at universities.
(Tatiana Shopova, 2014)	Develops the opportunity for undergraduate students to succeed in society without falling behind the constantly changing demands of job and life depends on their level of digital literacy.
(Peter Tiernan and Margaret Farren, 2017)	Analyses the ability to succeed in society without falling behind the constantly changing needs of business and life depends on undergraduate students’ degree of digital literacy.
(Wawta Techataweewan and Ujsara Prasertsin, 2018)	Identify Thai society’s true definition, contributing factors, and indicators of digital literacy (undergraduate students).
(Caroline Ball, 2019)	Develop a platform to help undergraduate students develop their public writing abilities as well as their digital literacy and teamwork abilities.
(Ibrar Bhatt and Alison MacKenzie, 2019)	Explores an argument for a social practise approach to digital literacy was made in the knowledge-producing work that undergraduate students produced while they composed course assignments. This method can assist explain how epistemologies of ignorance may be maintained.
(Rıdvan Ata and Kasım Yıldırım, 2019)	Investigate a public university in Turkey, researchers sought to understand undergraduate students’ perceptions of digital literacy as well as the number and composition of first- and second-year preservice teachers’ digital literacy.
(Sedat Akayoğlu, H. Müge Satar, Kenan Dikilitaş, Nazlı Ceren Cirit, and Sibel Korkmazgi, 2020)	Investigated Turkish PTs’ (undergraduate students) conceptualisation of digital literacy.

Author(s)	Studies
(Yehuda Peled, 2021)	Analyses of education-related undergraduate students' digital literacy and readiness.
(Burcu Umut Zan, Huriye Çolaklar, Ahmet Altay, and Nuri Taşkın, 2021)	Analyses undergraduate students' current knowledge of and proficiency with digital literacy.
(Sonja C. Strydom, Helena Wessels, and Casey Anley, 2021)	Describes about course to increase undergraduate students' digital literacy, based on the components they found valuable in the quick course.
(Behailu Atinafu, 2021)	Analyses the degrees of ethical awareness and media appraisal among the five social media literacy skills among undergraduate students were rather low.
(Salim Nabhan, 2021)	Describes about the notions of digital literacy held by pre-service teachers (undergraduate students) and pinpoint pre-service teachers' competencies in relation to the key facets of digital literacy, including critical thinking, online safety skills, digital culture, collaboration and creativity, information seeking, communication, and functional skills.
(Javier Jorge-Vázquez, Sergio Luis Nández Alonso, Washington Raúl Fierro Saltos, and Silvia Pacheco Mendoza, 2021)	Describes about undergraduate students' level of digital literacy proficiency and determine their influencing factors.
(Lan Anh Thuy Nguyen and Anita Habók, 2022)	Investigates undergraduate students' levels of digital literacy at Vietnamese universities are used to gauge their attitudes about using digital technology as well as their perceived skills and knowledge in this area.
(Silvia Farias-Gaytan, Ignacio Aguaded, Maria-Soledad, and Ramirez-Montoya, 2021)	Identify the subjects they examine, the scope of digital literacy transformation in higher education institutions, and the types of research they conduct.
(Rahmat Rizal, Dadi Rusdiana, Wawan Setiawan, and Parsaoran Siahaan, 2022)	Develops of a course-related online learning tool that helps undergraduate students who are pre-service teachers improve their digital literacy.
(Ana Iolanda Voda, Cristina Cautisanu, Camelia Gradinaru, Chris Tanasescu and Gustavo Herminio Salati Marcondes de Moraes, 2022)	Analyses the significant academic gap on digital literacy by setting it in a clear-cut context and looking at many viewpoints that entail this learning, like digital literacy predictors in various subgroups of undergraduate students.
(Tugba Kamali Arslantas and Abdulmenaf Gul, 2022)	Explores Turkish university students' levels of digital literacy (DL), as well as the variables that may have an impact on those levels.
(Hasan Tinmaz, Yoo-Taek Lee, Mina Fanea-Ivanovici and Hasnan Baber, 2022)	Discover the primary topics and divisions found in the studies on digital literacy.

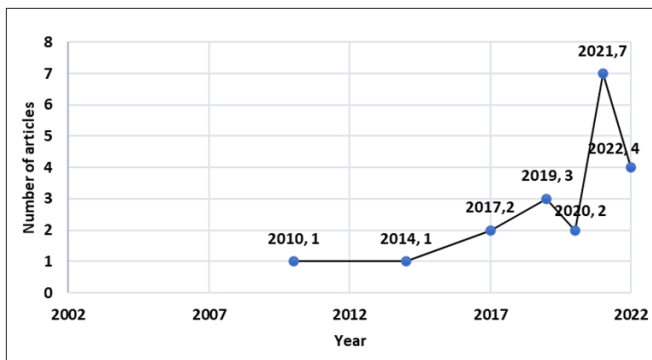


Fig. 2: Yearly Distribution of Related Articles in Digital Literacy among Undergraduate Students

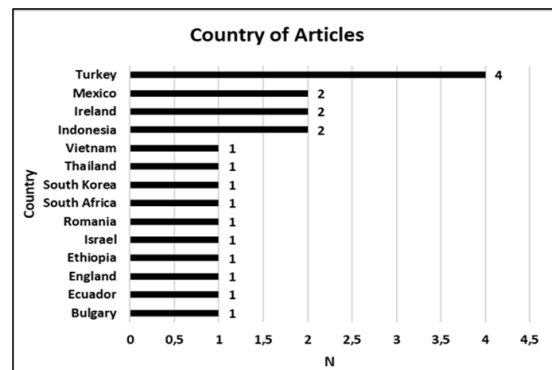


Fig. 3: Countries Distribution of Research in Digital Literacy among Undergraduate Students

Based on figure 2, the greatest number of articles (seven) were published in 2021, with four in 2022, two in both 2017 and 2020, and only one article in both 2010 and 2014. In addition, studies were conducted in 14 countries with a focus on improving digital literacy among undergraduate students, such as Turkey (4 articles), Mexico, Ireland, and Indonesia, with two articles each. In addition to the four countries, Vietnam, Thailand, South Korea, South Africa, Israel, Ethiopia, the United Kingdom, Ecuador and Bulgaria with one article

each. This illustrates that in 2021, many authors are interested in researching about factors to improve digital literacy among undergraduate students, and there are several problems in this regard that need to be researched (see Figure 3).

The seven success factors that appeared in the articles, that met the criteria in the final review and are considered relevant to answer the objectives of this study consist of digital knowledge, communication skill, collaboration skill, ICT infrastructure, social environment, social media and

learning activity. As can be seen in Table 3, the seven factors for enhancing digital literacy among undergraduate student, which is divided into seven factors. The seven factors are digital knowledge (19 studies), communication skill (16 studies), collaboration skill (11 studies), ICT infrastructure (personal in 19 studies and institution in 18 studies), social environment (12 studies), social media (3 studies), and learning activity (10 studies). For some of the primary elements employed in this study to be included in each article, the identification and classification of 20 articles into seven main factors was carried out by recognizing the difficulties and research outcomes in solving the problems.

### Factor 1: Digital Knowledge

There are a total of 19 articles that show that the digital knowledge of undergraduate student has enhancing digital literacy. Digital knowledge enhanced digital literacy among undergraduate student as the most important factor. This is because the digital knowledge is basic concepts for enhancing digital literacy (Ball, 2019; Peled, 2021; Peña-López, 2010; Strydom et al., 2021; Techataweewan & Prasertsin, 2018; Umut Zan et al., 2021) but rarely do we see a vertical approach where the system is considered as a whole. In this paper we relate initiatives that aim to bridge the digital divide in the current

**Table 3:** Findings of Factors for Enhancing Digital Literacy Among Undergraduate Students by Articles

Author(s)	Factors							
	Digital Knowledge	Communication Skill	Collaboration Skill	Personal ICT Infrastructure	Institution ICT Infrastructure	Social Environment	Social Media	Learning Activity
(Ismael Peña-López, 2010)								
(Tatiana Shopova, 2014)								
(Peter Tiernan and Margaret Farren, 2017)								
(Wawta Techataweewan and Ujsara Prasertsin, 2017)								
(Caroline Ball, 2019)								
(Ibrar Bhatt and Alison MacKenzie, 2019)								
(Rıdvan Ata and Kasım Yıldırım, 2019)								
(Sedat Akayoğlu, H. Müge Satar, Kenan Dikilitaş, Nazlı Ceren Cirit, and Sibel Korkmazgi, 2020)								
(Yehuda Peled, 2021)								
(Burcu Umut Zan, Huriye Çolaklar, Ahmet Altay, and Nuri Taşkın, 2021)								
(Sonja C. Strydom, Helena Wessels, and Casey Anley, 2021)								
(Behailu Atinafu, 2021)								
(Salim Nabhan, 2021)								
(Javier Jorge-Vázquez, Sergio Luis Nández Alonso, Washington Raúl Fierro Saltos, and Silvia Pacheco Mendoza, 2021)								
(Lan Anh Thuy Nguyen and Anita Habók, 2021)								
(Silvia Farias-Gaytan, Ignacio Aguaded, Maria-Soledad, and Ramirez-Montoya, 2021)								
(Rahmat Rizal, Dadi Rusdiana, Wawan Setiawan, and Parsaoran Siahaan, 2022)								
(Ana Iolanda Voda, Cristina Cautisanu, Camelia Gradinaru, Chris Tanasescu and Gustavo Herminio Salati Marcondes de Moraes, 2022)								
(Tugba Kamali Arslantas and Abdulmenaf Gul, 2022)								
(Hasan Tinmaz, Yoo-Taek Lee, Mina Fanea-Ivanovici and Hasnan Baber, 2022)								
<b>Total</b>	<b>19</b>	<b>17</b>	<b>11</b>	<b>19</b>	<b>18</b>	<b>12</b>	<b>4</b>	<b>10</b>

situation in higher education. We discuss why policies that focus on infrastructures (e.g. laptops. Digital knowledge can be a basis for undergraduate students to open their eyes in improving digital literacy. In improving digital literacy among undergraduate students, when digital knowledge is understood in depth, it will be very helpful in increasing digital literacy.

Based on 7 articles that have been found, digital knowledge is very necessary for students in improving digital literacy. By getting to know the digital world, it will be easier to understand and apply. Students also need digital knowledge in learning that uses digital (Bhatt & MacKenzie, 2019; Jorge-Vázquez et al., 2021; Nabhan, 2021; Rizal et al., 2022; Shopova, 2014; Tinmaz et al., 2022; Vodá et al., 2022). Previous research (six articles) found that digital knowledge is the basis that undergraduate students must have in increasing digital literacy in daily life and learning activities (Akayoğlu et al., 2020; Arslantas & Gul, 2022; Ata & Yıldırım, 2019; Atinafu, 2021; Nguyen & Habók, 2022).

### Factor 2: Communication Skill

A total of 17 articles were identified as showing that communication skill factor also plays a role for enhancing digital literacy among undergraduate students. This rate of return relates to communication skill factor that enhance digital literacy among undergraduate students. The results of the identification study showed that communication skill are communication skill that must be possessed by undergraduate students in improving digital literacy, because with communication skill, undergraduate students can increase knowledge about the digital world when they are establishing good communication in the university environment and outside the university (Arslantas & Gul, 2022; Nguyen & Habók, 2022; Shopova, 2014; Tarango & Machin-Mastromatteo, 2017; Tiernan & Farren, 2017; Umut Zan et al., 2021).

Another articles (7 articles) shows that when undergraduate students communicate using communication media, such as email or social media, as well as e-learning, the process can show communication skill and activeness in interacting with others using their gadgets, thereby increasing digital literacy (Nabhan, 2021; Peña-López, 2010; Rizal et al., 2022; Strydom et al., 2021; Tinmaz et al., 2022). In addition, when communication skill used in offline, online, and hybrid learning activities are also fundamental, because inevitably undergraduate students have to communicate through digital platforms, so as to improve digital literacy (Akayoğlu et al., 2020; Ata & Yıldırım, 2019; Ball, 2019; Jorge-Vázquez et al., 2021; Peled, 2021; Vodá et al., 2022).

### Factor 3: Collaboration Skill

A total of eleven (11) articles were identified as showing that collaboration skill as a factor for enhancing digital literacy

among undergraduate students. Collaboration skill is the ability to work together, synergize with each other, adapt in different roles and responsibilities, work productively with others, put empathy in its place, and respect different perspectives (Ball, 2019; Nabhan, 2021; Umut Zan et al., 2021). Collaboration skills will involve many people, being open is one of the right ways to improve this ability so that it will also increase digital literacy because undergraduate students can get the latest information from many people (Akayoğlu et al., 2020; Nabhan, 2021; Tinmaz et al., 2022). The main thing for this ability is to instill in our minds that by collaborating, we will work with a variety of people and not all will match our expectations.

Collaboration skills as skill that include the ability to respect and work with different learners. Undergraduate students can work together using collaborative coursework and develop their digital literacy through group learning (Arslantas & Gul, 2022; Peña-López, 2010; Tinmaz et al., 2022). Task-based collaboration skill are skill that can improve digital literacy of undergraduate students, because of the frequency of using collaboration skill in working on tasks, they will be able to improve digital literacy among undergraduate students (Akayoğlu et al., 2020; Jorge-Vázquez et al., 2021; Nguyen & Habók, 2022; Peled, 2021; Tiernan & Farren, 2017).

### Factor 4: ICT Infrastructure

#### *Personal ICT Infrastructure*

A total of 19 articles were identified as showing that personal ICT infrastructure is one of success factor in enhancing digital literacy among undergraduate student by ICT infrastructure. ICT infrastructure from personal is infrastructure that is personally owned by undergraduate students. It can also be called a personal facility of undergraduate students, such as television, laptops, smartphones, as well as private internet networks (Akayoğlu et al., 2020; Farias-Gaytan et al., 2021; Nguyen & Habók, 2022; Peled, 2021; Peña-López, 2010; Rizal et al., 2022; Shopova, 2014).

Personal ICT infrastructure undergraduate students can receive information and anything for academic and non-academic purposes (Arslantas & Gul, 2022; Atinafu, 2021; Bhatt & MacKenzie, 2019; Strydom et al., 2021; Tiernan & Farren, 2017; Tinmaz et al., 2022). Personal ICT infrastructure is a technology-based means and infrastructure, acquisition, storage, transmission, manipulation, management, or reception of data necessary for such purposes (Ata & Yıldırım, 2019; Atinafu, 2021; Nabhan, 2021; Techataweewan & Prasertsin, 2018). With the facilities owned by undergraduate students, then at any time they can use it. The more they use ICT facilities, the more they will understand the digital world. The more ICT facilities that are privately owned by them, and often used, their digital literacy will increase by itself, so that

it can support their learning and for the world of work later (Ball, 2019; Jorge-Vázquez et al., 2021; Rizal et al., 2022; Vodá et al., 2022).

### **Institution ICT Infrastructure**

A total of 18 articles were identified as showing that institution ICT infrastructure is one of success factors for enhancing digital literacy among undergraduate students. ICT infrastructure from institution is infrastructure obtained by undergraduate students from institutions (Akayoğlu et al., 2020; Atinafu, 2021; Ball, 2019; Peled, 2021; Peña-López, 2010). In this case, the government plays a very important role because the government is one of the supporters of funds in providing university infrastructure for undergraduate students (Arslantas & Gul, 2022; Farias-Gaytan et al., 2021; Rizal et al., 2022; Tinmaz et al., 2022).

ICT infrastructure such as computer laboratories, internet networks from universities, and digital libraries are very helpful for undergraduate students in improving digital literacy because with the support of these infrastructures, undergraduate students can hone and be more familiar with the digital world so that they can help them in the learning process in the classroom and outside the classroom, as well as in the future (Ata & Yıldırım, 2019; Bhatt & MacKenzie, 2019; Jorge-Vázquez et al., 2021; Shopova, 2014; Vodá et al., 2022). ICT infrastructure from institutions can help increase access to education, improve digital literacy, and promote the quality of education by making learning and teaching an active process related to real life, so that it can be useful for undergraduate students' learning activities (Nguyen & Habók, 2022; Strydom et al., 2021; Tiernan & Farren, 2017; Umut Zan et al., 2021).

### **Factor 5: Social Environment**

A total of 12 articles were identified as showing that social environment as one of success factors in enhancing digital literacy among undergraduate students. The social environment is the environment in which the daily activities of undergraduate students are carried out (Ata & Yıldırım, 2019; Nabhan, 2021; Umut Zan et al., 2021). The different circumstances of the social environment in each place will affect the digital literacy of students. Social environment aims to shape the personality of the individual for the better, to create a conducive social environment (Farias-Gaytan et al., 2021; Rizal et al., 2022). The social environment both directly and indirectly affects a person's way of thinking, often such an influence is not realized by everyone (Akayoğlu et al., 2020; Arslantas & Gul, 2022; Peled, 2021; Vodá et al., 2022)

The social environment has a relationship with each other; hence the social environment has a function or role in interacting. In fact, the social environment must be able to function or play a role in accordance with applicable rules (Atinafu, 2021; Strydom et al., 2021). The social environment

is an inseparable environment in the life of undergraduate students, because without the support of the environment around them they cannot develop properly, especially in digital literacy (Nabhan, 2021; Tinmaz et al., 2022). A social environment that is less accepting of changes in the digital world, will affect a person's thinking and attitude to lack understanding of digital literacy (Atinafu, 2021; Strydom et al., 2021).

### **Factor 6: Social media**

A total of four articles were identified as suggesting that social media factors in education have a role in enhancing digital literacy among undergraduate students. Because there is still little discussion about this factor, it could be that social media is not the main factor in increasing digital literacy of undergraduate students. Social media is a medium to communicate in various directions, and can provide information quickly in learning something, but it must be with the self-control of each account owner (Akayoğlu et al., 2020; Atinafu, 2021). Social media is also an online media that supports social interaction and social media using web-based technology that turns communication into interactive dialogue so as to increase digital literacy (Akayoğlu et al., 2020; Arslantas & Gul, 2022; Tinmaz et al., 2022)it is no longer sufficient for language teachers and pre-service teachers (PTs).

Social media is a platform for professional development, which will be beneficial to become more competent in digital literacy, as it provides a lot of info about the digital world to undergraduate students (Akayoğlu et al., 2020; Atinafu, 2021). Social media is an online medium, with its users able to take part, share, and create content easily including blogs, social networks, wikis, forums, and cyberspace (Akayoğlu et al., 2020; Arslantas & Gul, 2022; Tinmaz et al., 2022)it is no longer sufficient for language teachers and pre-service teachers (PTs). Communication using social media reduces dependence on others and allows information about digital to come in faster. Four studies explain that undergraduate students have a high level of digital literacy because they have some previous experience using social media (Akayoğlu et al., 2020; Arslantas & Gul, 2022; Atinafu, 2021; Tinmaz et al., 2022)it is no longer sufficient for language teachers and pre-service teachers (PTs).

### **Factor 7: Learning Activity**

A total of ten articles were identified as suggesting that learning activity factors in education have a role in enhancing digital literacy among undergraduate students. Learning activity are undergraduate students' learning activities on campus and off campus (Ata & Yıldırım, 2019; Farias-Gaytan et al., 2021; Strydom et al., 2021; Vodá et al., 2022)digital literacy offers a set of transversal skills that could improve a whole area of activities, from banking operations to civic participation. However, these skills are diverse and vary

according to the development of technologies and society. This study fills an important academic gap on digital literacy by placing it in a specific and well-defined context, analyzing different perspectives that involve such learning, such as predictors of digital literacy in different types of students. In addition, research increases its importance as it is being developed during the pandemic, a period characterized by accelerated technological use and sudden changes. This research used a quantitative design based on the answers to a questionnaire conducted from March 2021 to May 2021. From a methodological perspective, we tested several hypotheses using one-way analysis of variance (ANOVA). Learning activity using digital media is an activity that can enhance the digital literacy of undergraduate students (Ball, 2019; Shopova, 2014; Techataweewan & Prasertsin, 2018). Undergraduate students who carry out learning activities using digital media, and learning activities using the internet and e-learning, they are slowly ensured to be able to increase digital literacy (Nabhan, 2021; Peña-López, 2010; Tiernan & Farren, 2017).

Even learning activities that use digital media can also make undergraduate students learn independently from anywhere, so that their digital literacy will grow by themselves (Akayoğlu et al., 2020; Arslantas & Gul, 2022; Bhatt & MacKenzie, 2019; Nguyen & Habók, 2022; Nur Samsul Bahri et al., 2021; Peled, 2021; Rizal et al., 2022; Umut Zan et al., 2021). Learning activities that can enhance digital literacy are learning activities that utilize all things related to digital, whether these activities are carried out at universities or anywhere (Farias-Gaytan et al., 2021; Tinmaz et al., 2022; Vodă et al., 2022). Undergraduate students who are used to doing learning activities by utilizing digital, will naturally increase their digital literacy and be useful for their learning.

## DISCUSSION

Several elements were discovered for improving digital literacy among undergraduate students, particularly to assist their future, based on the systematic literature review that was conducted. Of the seven main factors used as indicators for enhancing digital literacy among undergraduate students, the seven factors found in 20 articles show that undergraduate students understand how important it is to improve digital literacy for on-campus and off-campus learning. In addition, improving digital literacy can also provide benefits in the lives of undergraduate students in non-academic terms (Arslantas & Gul, 2022; Öncül, 2020). The benefits obtained by undergraduate students include that they can prepare for the future because of the fast information they get, the digital knowledge they can get, and easy adaptation in the surrounding environment because with digital literacy, they easily get new things to find out accordingly (Jorge-Vázquez et al., 2021; Shopova, 2014; Tinmaz et al., 2022).

Factors that can improve digital literacy among undergraduate students can come from individual students as well as from outside. As we know, digital literacy is a scientific ability to locate, evaluate, use, and appropriately utilize media in daily life employing digital tools, media, and telecommunication networks (Saqr, 2021; Triawang & Kurniawan, 2021). Factors of undergraduate students are digital knowledge, communication skills, collaboration skills, ICT infrastructure (personal), and learning activities. Indirect factors or external factors are ICT infrastructure (government), social environment and social media. Both types of factors have an important role in improving digital literacy among undergraduate students.

One of the main factors in improving digital literacy is digital knowledge (Akayoğlu et al., 2020; Ata & Yıldırım, 2019; Peña-López, 2010). With digital knowledge as the basis of undergraduate students' knowledge, undergraduate students can accept if there are new developments regarding the digital world. By knowing new developments and opening up to new developments, their digital literacy will increase by itself. Digital knowledge for undergraduate students can be a factor in increasing digital literacy through learning activities (Bhatt & MacKenzie, 2019; Techataweewan & Prasertsin, 2018; Umut Zan et al., 2021; Vodă et al., 2022). The learning activities in question are learning activities at universities and outside activities. So that learning activities are also one of the important factors in improving digital literacy. Learning activities that use digital media and things that use the internet are learning activities that can increase digital literacy undergraduate students.

The next factor in improving digital literacy of undergraduate students is communication skills and collaboration skills. Communication skills are conveying an idea or idea in simple language (Atinafu, 2021; Jorge-Vázquez et al., 2021; Peled, 2021). Meanwhile, collaboration skills are when undergraduate students work together with one or more people to complete projects or tasks from university or outside the university in developing certain ideas or processes. In a university environment, collaboration occurs when two or more people work together towards a common goal of acquiring knowledge. Communication skills in undergraduate students mean that they have skills by conveying their ideas properly, correctly, and according to conditions. Undergraduate students can use communication skills and collaboration skills to improve digital literacy. The next characteristic of communication skills adjusting means that they can distinguish language styles according to the interlocutor, situation, and conditions. For example, the way of talking to colleagues and superiors will certainly be different, as well as when collaborating formally or informally. A person with communication skills and collaboration skills can improve their digital literacy because these two skills



make it easy for them to get new things about the digital world.

ICT infrastructure is also one of the factors in improving student digital literacy. ICT infrastructure is required for undergraduate students in personal ICT infrastructure and ICT infrastructure from institution. Digital literacy of students such as radio and television, as well as other new digital technologies such as computers and the internet have been endorsed as potentially influential tools for economic renewal and educational change (Strydom et al., 2021; Tiernan & Farren, 2017). If used reasonably, ICT infrastructure can help improve access to education, strengthen the importance of improving the digital workplace, and promote the quality of education by making learning and teaching an active process related to real life, so as it can increase economic growth, because it can support people's knowledge. In the field of education, ICT infrastructure both from personal and institutions can help undergraduate students in improving digital literacy through learning activities.

In the daily life of undergraduate students, of course, we cannot be separated from the social environment. Social environment is one of the important factors in improving digital literacy of undergraduate students (Arslantas & Gul, 2022; Farias-Gaytan et al., 2021; Tinmaz et al., 2022) including the education sector and its members. This transformation is linked to emerging technologies, the digitalization of processes and resources, and the demand for users to upgrade to the latest technological updates. This research aims to analyze digital transformation and media literacy publications that impact higher education. Its purpose is to identify the types of research and topics they address and explore the scope of digital transformation in higher education institutions. The systematic mapping method was used to analyze 298 articles published in two databases, Scopus and Web of Science (WoS). The social environment of undergraduate students can be obtained from the university and the environment outside the university. With a social environment that is also responsive to digital changes, the digital literacy of undergraduate students will also increase. On the other hand, if the social environment of undergraduate students is not responsive and accepts the changes and updates of the digital world, it will also be hampered in increasing digital literacy. The social environment obtained from social media is also very influential because all information about the digital world is also contained in social media platforms owned by undergraduate students. However, based on the four articles that have been written, it turns out that social media does not really support undergraduate students to improve digital literacy (Akayoğlu et al., 2020; Arslantas & Gul, 2022; Atinafu, 2021; Tinmaz et al., 2022) becoming digitally literate is a necessity in order to be able to fully participate

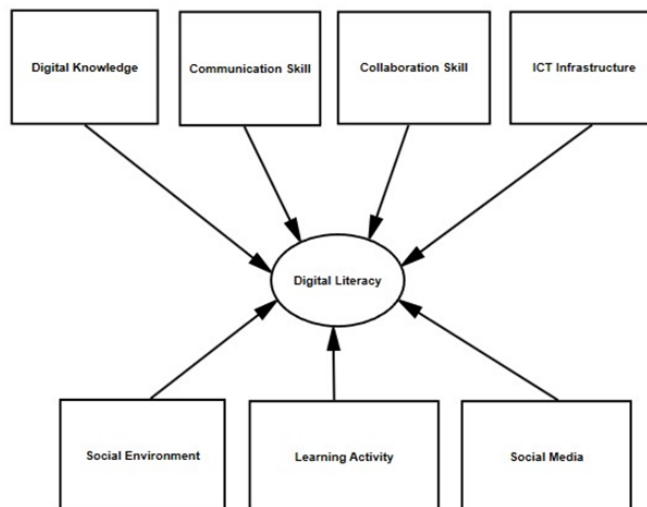


Fig.3: The Development of Conceptual Framework from Article Review Digital Literacy Among Undergraduate Students

in society and to overcome certain educational barriers. This study explores the digital literacy (DL). This is proven by only four articles that mention that social media has an impact on increasing digital literacy of undergraduate students.

From twenty articles on factors affecting digital literacy among undergraduate students, it can form a new research model that can be used as an overview and reference for subsequent authors. Research models that can be further researched (figure 3), make digital knowledge, communication skills, collaboration skills, ICT infrastructure, social environment, learning activity and social media as variables that enhancing digital literacy among undergraduate students.

Therefore, we hope that this research will foster the interest of other researchers and reveal other factors that can influence factors for enhancing digital literacy among undergraduate students, because many other factors can also be raised in research on digital literacy in the world of education.

## CONCLUSION

This study has systematically identified factors for enhancing digital literacy among undergraduate students. In addition, we have reviewed the past 20 years (from 2002 to 2022) of literature on factors for enhancing digital literacy among undergraduate students. The articles identified using PRISMA flowchart. As a result, seven factors are identified as pertaining to digital knowledge, communication skill, collaboration skill, ICT infrastructure, social environment, social media, and learning activity. The 20 articles using these seven factors found many factors that enhance the digital literacy among undergraduate students. Over the years, researchers have identified dominant factors in the for enhancing digital literacy among undergraduate students are digital knowledge and ICT infrastructure.

## SUGGESTION

Another finding of the study is that the implementation of factors for enhancing digital literacy among undergraduate students will be a capital for undergraduate students for their future. Further study is highly recommended, especially considering many other factors for enhancing digital literacy among undergraduate or among society in general.

## LIMITATION

This review only reviews the last 20 years of the article from 2002 to 2022, which talks about digital literacy among undergraduate students.

## REFERENCES

- Akayoğlu, S., Satar, H. M., Dikilitaş, K., Cirit, N. C., & Korkmazgil, S. (2020). Digital literacy practices of Turkish pre-service EFL teachers. *Australasian Journal of Educational Technology*, 36(1), 85–97. <https://doi.org/10.14742/ajet.4711>
- Arslantas, T. K., & Gul, A. (2022). Digital literacy skills of university students with visual impairment: A mixed-methods analysis. *Education and Information Technologies*, 27(4), 5605–5625. <https://doi.org/10.1007/s10639-021-10860-1>
- Ata, R., & Yıldırım, K. (2019). Exploring Turkish pre-service teachers' perceptions and views of digital literacy. *Education Sciences*, 9(1). <https://doi.org/10.3390/educsci9010040>
- Atinafu, B. (2021). Higher education students' social media literacy in Ethiopia: A case of Bahir Dar University. *Journal of Media Literacy Education*, 13(3), 86–96. <https://doi.org/10.23860/JMLE-2021-13-3-7>
- Ball, C. (2019). Wikiliteracy: Enhancing students' digital literacy with wikipedia. *Journal of Information Literacy*, 13(2), 253–271. <https://doi.org/10.11645/13.2.2669>
- Bhatt, I., & MacKenzie, A. (2019). Just Google it! Digital literacy and the epistemology of ignorance. *Teaching in Higher Education*, 24(3), 302–317. <https://doi.org/10.1080/13562517.2018.1547276>
- Clarke, J. (2018). Mobile tools for literacy learning across the curriculum in primary schools. *Mobile Technologies in Children's Language and Literacy: Innovative Pedagogy in Preschool and Primary Education*, 99–118. <https://doi.org/10.1108/978-1-78714-879-620181007>
- Cooper, H. (2017). Research Synthesis and Meta-Analysis. In *Angewandte Chemie International Edition*, 6(11), 951–952. (Fifth). Sage.
- den Berg, L. Van. (2020). 4th Industrial Revolution? Ready, Tech, Go: Reflecting on Sport Students' Digital Literacy Skills when Creating Vlogs for Assessment. *EdMedia+ Innovate Learning*, May. <https://www.learntechlib.org/p/217313/>
- Ertl, B., Csanadi, A., & Tarnai, C. (2020). Getting closer to the digital divide: An analysis of impacts on digital competencies based on the German PIAAC sample. *International Journal of Educational Development*, 78(August), 102259. <https://doi.org/10.1016/j.ijedudev.2020.102259>
- Farias-Gaytan, S., Aguaded, I., & Ramirez-Montoya, M. S. (2021). Transformation and digital literacy: Systematic literature mapping. *Education and Information Technologies*, 27(2), 1417–1437. <https://doi.org/10.1007/s10639-021-10624-x>
- Fázik, J., & Steinerová, J. (2021). Technologies, knowledge and truth: the three dimensions of information literacy of university students in Slovakia. *Journal of Documentation*, 77(1), 285–303. <https://doi.org/10.1108/JD-05-2020-0086>
- Higgins, J. P., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M. J. P., & Welch, V. A. (2019). *Cochrane Handbook for Systematic Reviews of Interventions* (1st ed.). The Cochrane Collaboration and John Wiley & Sons Ltd.
- Hosman, L., & Pérez Comisso, M. A. (2020). How do we understand “meaningful use” of the internet? Of divides, skills and socio-technical awareness. *Journal of Information, Communication and Ethics in Society*, 18(3), 461–479. <https://doi.org/10.1108/JICES-05-2020-0055>
- Jorge-Vázquez, J., Nández Alonso, S. L., Fierro Saltos, W. R., & Pacheco Mendoza, S. (2021). Assessment of digital competencies of university faculty and their conditioning factors: Case study in a technological adoption context. *Education Sciences*, 11(10). <https://doi.org/10.3390/educsci11100637>
- Lanham, R. (1995). “Digital literacy.” *Scientific American*, 273(3), 198–200.
- Mahmood, M., Batool, S. H., Rafiq, M., & Safdar, M. (2021). Examining digital information literacy as a determinant of women's online shopping behavior. *Information Technology and People*. <https://doi.org/10.1108/ITP-05-2021-0397>
- Nabhan, S. (2021). Pre-service teachers' conceptions and competences on digital literacy in an EFL academic writing setting. *Indonesian Journal of Applied Linguistics*, 11(1), 187–199. <https://doi.org/10.17509/ijal.v11i1.34628>
- Nguyen, L. A. T., & Habók, A. (2022). Digital Literacy of EFL Students: An Empirical Study in Vietnamese Universities. *Libri*, 72(1), 53–66. <https://doi.org/10.1515/libri-2020-0165>
- Nur Samsul Bahri, N. S. B., Muhammad Rakib, Muhammad Ihsan Said Ahmad, Rahmatullah, & Muhammad Hasan. (2021). The Influence of Digital Literacy and Entrepreneurial Behavior on Small Business Performance (Study on Culinary Business in Jenepono Regency). *Daengku: Journal of Humanities and Social Sciences Innovation*, 1(2). <https://doi.org/10.35877/454ri.daengku582>
- Öncül, G. (2020). Defining the need: digital literacy skills for first-year university students. *Journal of Applied Research in Higher Education*. <https://doi.org/10.1108/JARHE-06-2020-0179>
- Peled, Y. (2021). Pre-service teacher's self-perception of digital literacy: The case of Israel. *Education and Information Technologies*, 26(3), 2879–2896. <https://doi.org/10.1007/s10639-020-10387-x>
- Peña-López, I. (2010). De los portátiles a las competencias: Superación de la brecha digital en la educación. *Revista de Universidad y Sociedad Del Conocimiento (RUSC)*, 7(1), 1–52. [http://www.uoc.edu/ojs/index.php/rusc/article/view/v7n1\\_pena/v7n1\\_pena](http://www.uoc.edu/ojs/index.php/rusc/article/view/v7n1_pena/v7n1_pena)
- Rafi, M., JianMing, Z., & Ahmad, K. (2019). Technology integration for students' information and digital literacy education in academic libraries. *Information Discovery and Delivery*, 47(4), 203–217. <https://doi.org/10.1108/IDD-07-2019-0049>
- Rizal, R., Rusdiana, D., Setiawan, W., & Siahaan, P. (2022). Learning Management System Supported Smartphone (Lms3): Online Learning Application in Physics for School Course To Enhance Digital Literacy of Pre-Service Physics Teachers. *Journal of Technology and Science Education*, 12(1), 191–203. <https://doi.org/10.3926/JOTSE.1049>

- Saqr, A. K. (2021). The Effect Of Digital Reading on EFL Learners' Reading Comprehension. *International Journal of Education, Technology and Science*, 1(1), 59–70. <https://doi.org/10.25073/2525-2445/vnufs.4214>
- Shopova, T. (2014). Digital literacy of students and its improvement at the university. *Journal on Efficiency and Responsibility in Education and Science*, 7(2), 26–32. <https://doi.org/10.7160/eriesj.2014.070201>
- Strydom, S. C., Wessels, H., & Anley, C. (2021). Moving beyond the tools: Pre-service teachers' views on what they value in a digital literacy short course. *South African Journal of Childhood Education*, 11(1), 1–11. <https://doi.org/10.4102/sajce.v11i1.929>
- Tarango, J., & Machin-Mastromatteo, J. D. (2017). The Role of Information Professionals in the Knowledge Economy. In *Chandos Publishing*. <https://www-sciencedirect-com.ezproxy.napier.ac.uk/science/book/9780128112229>
- Techataweewan, W., & Prasertsin, U. (2018). Development of digital literacy indicators for Thai undergraduate students using mixed method research. *Kasetsart Journal of Social Sciences*, 39(2), 215–221. <https://doi.org/10.1016/j.kjss.2017.07.001>
- Tiernan, P., & Farren, M. (2017). Digital literacy and online video: Undergraduate students' use of online video for coursework. *Education and Information Technologies*, 22(6), 3167–3185. <https://doi.org/10.1007/s10639-017-9575-4>
- Tinmaz, H., Lee, Y.-T., Fanea-Ivanovici, M., & Baber, H. (2022). A systematic review on digital literacy. *Smart Learning Environments*, 9(1). <https://doi.org/10.1186/s40561-022-00204-y>
- Triawang, G., & Kurniawan, E. (2021). The Effect of Digital Literacy Towards The Selection of Social Science Teacher Learning Media. *Pegem Egitim ve Ogretim Dergisi*, 11(4), 316–319. <https://doi.org/10.47750/pegegog.11.04.30>
- Umut Zan, B., Çolaklar, H., Altay, A., & Taşkın, N. (2021). A Study on Digital Literacy Skills of Faculty of Letters Students: Use of University Library. *International Journal of Emerging Technologies in Learning*, 16(1), 152–171. <https://doi.org/10.3991/IJET.V16I01.16567>
- Venkatesh, V., & Davis, F. D. (2000). Theoretical extension of the Technology Acceptance Model: Four longitudinal field studies. *Management Science*, 46(2), 186–204. <https://doi.org/10.1287/mnsc.46.2.186.11926>
- Vodă, A. I., Cautisanu, C., Grădinaru, C., Tănăsescu, C., & de Moraes, G. H. S. M. (2022). Exploring Digital Literacy Skills in Economics and Social Sciences and Humanities Students. *Sustainability (Switzerland)*, 14(5), 1–31. <https://doi.org/10.3390/su14052483>
- Walsh, D., & Downe, S. (2005). Meta-synthesis method for qualitative research: A literature review. *Journal of Advanced Nursing*, 50(2), 204–211. <https://doi.org/10.1111/j.1365-2648.2005.03380.x>
- Yin, R. K., & Davis, D. (2007). Adding new dimensions to case study evaluations: The case of evaluating comprehensive reforms. *New Directions for Evaluation*, 2007(113), 75–93. <https://doi.org/10.1002/ev.216>