The Level of Classroom Teacher Digital Literacy in the Technology Dimension of the Instant Digital Competence Assessment (IDCA)

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Abstract: This study aims to describe the level of digital literacy of elementary school teachers, especially in the technological dimension. Based on the Law of the Republic of Indonesia No. 14 of 2005 concerning Teachers and Lecturers, article 20 verse 2, teachers are required to be able to use technology that supports learning (from the aspects of planning, implementation to evaluation). However, based on survey results in reality, many teachers still have a low ability in using technology. The method used in this research is a quantitativ method with survey approach. The subjects in this study were teachers of grades 1 to 6 coming from six different elementary schools (6 teachers). The classroom teacher's digital literacy level was measured using a test technique. The results of the study showed that teachers of grade 1, grade 2, grade 3, and grade 4 had low digital literacy categories, while teachers of grade 5 had moderate digital literacy categories, and teachers of grade 6 had a very low category of digital literacy. Based on these results, it can be concluded that there is no equality in the digital literacy abilities of classroom teachers in elementary schools. This study recommends that teachers always develop digital literacy skills so that they are able to optimally integrate technology into learning and are able to use technology to develop their own potential. Schools should support teachers in integrating technology in learning as an effort to support the creation of a digitally capable generation to face the challenges of the 21st century.

Keywords: Digital Literacy, Classroom Teachers, Elementary Schools, Technology Dimension, Competence Assessment.

1. Introduction

The development of information and communication technology in the 21st century has made the digital industry a paradigm and a reference in various settings of life (Roza & Mufit, 2022). As a product of the digital industry, digitalization has affected aspects of life, including education (Shidiq & Permanasari, 2020). Indonesia has directed the integration of technology into classroom management and implementation of learning at the elementary school level (Syahid & Nugraha, 2019). Referring to this description, the ability to use technology, or what is known as digital literacy is important for classroom teachers because they are class management policyholders and are responsible for the teaching-learning activity of all the core subjects in their classes.

1.1. Problem Statement

Teachers are expected to be able to adapt to a fast-changing world such as rapid technological developments which require teachers to always be up to date with the latest technology so that teachers can improve their competence quality. Even though technology has developed rapidly, teachers have not utilized technology in learning (Keengwe, et. al., 2014). Teacher competence is defined as a context-bound and process-oriented concept (Caena, 2014), depending on the learning environment and contextual factors such as learning goals, social environment and resources. This is in line with Law no. 14 of 2005 concerning Teachers and Lecturers, article 20 verse 2 stating that "In carrying out professional duties, teachers are obliged to improve and develop academic qualifications and

competencies on an ongoing basis in line with developments in science, technology, and art." Referring to this, the ability to use technology, or what is called digital literacy is important for teachers to develop their competence so that they can carry out professional tasks in line with the digital era. Based on the Law of the Republic of Indonesia Number 14 of 2005 concerning Teachers and Lecturers article 10 verse 1, teacher competencies include pedagogical competence, personal competence, social competence, and professional competence. When teachers have content knowledge, knowledge of the curriculum, and pedagogical knowledge, they have a sound knowledge base.

Pedagogic competence is teachers' ability to manage their teaching-learning activity (Hakim, 2015). Teachers need to have literacy in order to teach literacy to students. Students who do not have sufficient literacy skills at this age will have difficulty acquiring these skills in the coming years (Bozan & Anilan, 2022). According to the Appendix to Regulation of the Minister of National Education, Number 16 of 2007 dated 4 May 2007 concerning Academic Qualification Standards and Teacher Competency, one aspect of pedagogical competences is that teachers use ICT (Information and Communication Technology) to support the implementation of learning. Teachers can use digital technology as a learning resource or learning media, and make the teaching and learning process more interesting, easier, more enjoyable, and more diverse to increase students' learning motivation (Kainama & Latuserimala, 2022). Digital literacy capabilities assist teachers in the teaching-learning process, present learning materials, distinguish learning resources that are correct, significant, and can provide benefits. Besides, digital literacy opens opportunities for teachers to be more productive in creating attractive digital teaching media such as images, audio, video, games, and so on (Buckingham, 2016).

Teacher professional competence is the ability to master learning material broadly and in-depth as a provision for carrying out their duties and roles so that teachers can create quality education and students can obtain optimal learning outcomes (Hamidi & Indrastuti, 2012; Rahman, 2014). Teacher professional competence can be developed through training. Along with the development of technology, training is not only carried out face-to-face but can be done online. Digital literacy is one aspect of teacher competence. Based on teacher core competencies number 5 (pedagogic competence) and 24 (professional competency), teachers are expected to be able to utilize information and communication technology (ICT) to support learning, communication, and self-development. Based on the ICT Competency Framework for Teacher (UNESCO, 2018), teacher information and communication technology (ICT) competencies contain several aspects, one of which is digital literacy.Referring to this, digital literacy can support teachers' professional competence because digital literacy skills can help teachers in utilizing information and communication technology to improve their competence through training that is carried out online through digital devices. Teachers are also expected to have digital competencies (Johannesen, Øgrim, & Giæver, 2014; Redecker, 2017). Teachers know their roles have changed in using new technologies and digital games, but lacking necessary competencies and training, are unsure how to adopt these changes (Allsop & Jessel, 2015).

The Indonesian government has implemented programs in order to increase the digital literacy of its citizens, one of which is by launching the School Literacy Movement which also includes 5 other basic literacy concepts. Nevertheless, this is not always effective because there are still obstacles both from the infrastructure and from the teachers themselves (Al Khateeb, 2017). While problems with facilities and infrastructure cannot be solved all at once, problems related to teachers deserve further attention. Teachers play a role in teaching digital literacy to students, especially those related to socio-emotional and cognitive aspects, for example, the ethics of interacting in the digital world, examining the credibility of digital information, and safety in using technology, which are important things to understand. in the use of digital technology but are rarely taught further in formal education (Güneş & Bahçivan, 2018).

Social competence is teachers' ability to adapt and communicate, both in society and in carrying out their duties as a teacher (Santoso, et. al, 2020). Communication can be done directly or indirectly through digital media. The development of digital media fosters social media which enables people to have intense communication which occurs among those who have known each other and those who have not known each other . There has been an

increase in online socializing, and here too the role of media, especially social media, has expanded. In today's world, one form of technological development can be seen and felt in the presence of various social media features (hereinafter referred to as social media) (Apdillah, et, al. 2022). Interpersonal communication has 'scaled up' with social media (Madianou, & Miller, 2013). Miller et al (2016) argue, yet here too (as with culture, including information seeking) there is a diffuse limit in terms of the hours spent and the number of people one can be tethered or connected to. Therefore, mastering digital literacy can assist teachers in utilizing technology for communication because digital literacy is not only about the use of technology but also about how to behave and how to be responsible for publishing content and interacting on social media. Indirectly, this has shown that digital literacy supports teacher personality competencies because teachers' personality competencies are competencies related to noble values or teacher norms in their everyday behavior both in real and virtual life on social media (Zimmer & Matthews, 2022). To maintain the convenience of digital technology, it is necessary to establish a digital code of ethics (Apdillah, et, al. 2022). The ability to use technology or digital literacy can be measured through various conceptions, such as the Bawden conception, the Digital Literacy Global Framework, the DigCom 2.0 Framework, and the Instant Digital Competence Assessment (IDCA). important for teachers to cope with the effect of technologies in teaching and learning in school, and to understand that this is more than just a matter of technical skills (Julia, 2020).

1.2. Related Research

Teacher digital literacy can support the development of teacher competence in carrying out their professional duties suitable to the challenge of the digital era, but in fact, many teachers still have a low level of mastery of technology or digital literacy. This research is about digital competence and teacher pedagogical competence with sample consisted of 365 teachers working at St. Petersburg, Russia. 238 teachers received advanced training, 127 teachers did not. This study uses the NAFI research center approach. To calculate the ICT Competency Index, which measures teacher readiness to actively use ICT in the educational process, the European Digital Competence Framework of Educators (DigCompEdu) details 22 competencies. 5. The results of this study found that teachers of general education organizations have an average ICT competency level (Zakharov, et al.,2022).

This result of previous study demonstrates that (a) the digital literacy approach is implemented mainly through an ICT learning and media literacy approach while the information literacy approach is undermined; and (b) principals, classroom teachers, and ICT teachers are the three actors who play the most important roles in digital literacy, while librarians play a minor one. The majority of digital literacy training takes place in computer laboratories, while training in classrooms and libraries is less frequent (Suwarto, et., al 2022).

Many lectures and teachings have been held through social media. However, social media has its downside in which when children are not well monitored, it could affect their social media as they will imbibe the negative side. Incidentally, parents are quite busy fending for the family; they do not have enough time to sit and discuss with their children (Adegboyega, 2020). The research conducted by Gelmez Burakgazi et al. (2019) sought to identify the pre-service teachers for the 21st-century learning in Turkey. Technological Pedagogical Content Knowledge (TPCK) has been adopted as the theoretical framework and considered as an integrated part of teacher knowledge, namely pedagogical knowledge, and technological knowledge. However, this research focuses on technological pedagogical knowledge and TPCK (Mishra & Koehler, 2006) since the two aspects can affect teacher decisions on selecting YouTube videos relevant to learning goals and tasks (Krauskopf, Zahn, & Hesse, 2012). Previous research uses the technological, pedagogical, and content knowledge (TPACK) framework to examine the effects of YouTube videos as an educational tool on the discovery learning process. The research findings revealed that the experimental group showed various effects on the acquisition of factual, conceptual, and procedural knowledge. YouTube videos accompanied by discovery learning can the improvement of fifth-grade students' performances in terms of procedural knowledge rather than factual and conceptual knowledge (Koto, 2020).

The result revealed that pre-service teachers in the 21st century had excellent competence levels, and proficiency in a foreign language had a significant effect. In other words, based on these criteria, the pre-service teachers can follow the digital technology in the learning process. In addition, the result shows that the pre-service teacher has the motivation to develop the knowledge and skills for digital technology adaptation in the modern world (Pozas & Letzel, 2021).The results previous study that mastering digital skills will help daily life work; mastering digital culture will help preserve culture and protect creation; mastering digital ethics will avoid many conflicts; and mastering digital safety can be aware of many crimes in the digital world. Students as prospective teachers are expected to know, and understand and master digital literacy for future teaching (Isokratun, et.al., 2022). Based on the findings of previous research, this research has the novelty that teachers in elementary schools have never been tested through the Instant Digital Competence Assessment (IDCA) instrument. The instrument is standardized and has been used on an international scale, but research has never been conducted in elementary schools to measure digital literacy through this instrument.

1.3. Research Objectives

The Instant Digital Competence Assessment (IDCA) is a digital literacy measurement instrument developed by (Calvani, Cartelli, Fini, et al., 2008)c. It is an instrument designed to determine someone's basic skills in using digital technology. IDCA was developed specifically to measure the level of digital literacy in education. This is motivated by Calvani, Cartelli, Fini, & Ranieri's awareness that digital competence stands as an important challenge for the 21st-century education system. The Instant Digital Competence Assessment (IDCA) assesses a person's digital literacy ability by dividing it into 3 dimensions, namely technological, cognitive, and ethical dimensions. The technology dimension consists of competence in recognizing technological problems, identifying interfaces, and choosing the most appropriate solutions for using technology. The technology dimension contains a basic set of skills in using technology. Based on this, this study focuses on the level of digital literacy in the terms of technological dimensions in the Instant Digital Competence Assessment (IDCA).

2. Theoretical Framework

2.1. Digital Literacy

Marsh (2016) defines digital literacy as the social activity that involves reading, writing, and multimodal meaning- making using a variety of digital technologies. Lee (2014) defines digital literacy as the ability to understand and use information in various formats (text, images, audio, video and animation) and from various sources presented via electronic devices. Meanwhile, according to Deakin University's Graduate Learning Outcome 3 (Hegel, 2015), digital literacy is defined as the use of technology to find information, use this information as input for thought, and disseminating enriched information, through digital platforms. Thus, digital literacy also involves the ability to understand, analyze, provide an assessment of various information received, and evaluate this information.

Dudeney, Nicky, and Mark (2013) imply digital literacy as the individual and social skills required to effectively interpret, manage, communicate, and create meaning within digital communication channel. Hockly (2012) elaborates digital literacy as the addition in education of skills which prepares students for future life in the 21st Century involved media, information and technology skills, which relate to the development of knowledge in using digital devices which was useful for creating, communicating, collaborating, searching and evaluating information in a digital society.

Eshet-Alkalai (2012) stated that: "Digital literacy involves more than the mere ability to use software or operate a digital device; it includes a large variety of complex cognitive, motor, sociological, and emotional skills, which users need to function effectively in digital environments." Regarding this, Iordache, (Iordache et al., 2017) defined digital literacy as the ability to find appropriate information and evaluate the validity of the information, communicate and create original content to express oneself in a manner consistent with one's personal or/and professional goals. Digital literacy is considered to be the same as digital

media literacy. Nevertheless, this definition is not entirely appropriate because it ignores the technical education of digital media, which is more complex than conventional media (Buckingham, 2015).Based on this description, it can be concluded that an important basis for understanding digital literacy is because digital literacy is one of the abilities to survive the demands of today's modern times.

Digital literacy is an individual's critical knowledge and abilities in accessing, managing, understanding, integrating, utilizing, and communicating information or content in digital media that involves critical, creative, and inspirational thinking skills (Jin, Reichert, Cagasan, et al., 2020; Reddy, Sharma, & Chaudhary, 2020). Referring to the definition, digital literacy is not limited to the ability to operate digital-based hardware and software but also the ability to search, assess, create, and communicate information that involves cognitive and technical abilities.

Digital literacy can be interpreted as the ability to use information and communication technology to search, assess, create, and communicate information that requires cognitive and technical skills (American Library Association, 2013). According to the Ministry of Education and Culture (2017) digital literacy is considered a life skill which is demonstrated through social skills, learning abilities, and critical, creative and inspirational thinking skills as digital competencies.

Based on some of these definitions of digital literacy, it can be concluded that digital literacy is one of the competencies that must be possessed by generations in the 21st century in using technology, interpreting and understanding, and assessing the credibility of information contained in digital content to support success in completing tasks effectively. effective & efficient both in career, academic life, and daily activities.

2.2. Digital Literacy Dimensions

Digital literacy refers to a variety of literacy related to the use of digital technology. Digital technology is part of electronic technology that includes hardware and software used by individuals for educational, social and/or entertainment purposes at school and at home, such as desktops, mobile devices, interactive whiteboards, data entry equipment, recording devices. digital services, Web 2.0 technologies and other resources on the internet which include various commercial software packages, trial for a certain period of time, or completely free and accessible from the Web (Ng, 2015).

In 2012, Ng Wang developed the concept of digital literacy into 3 intersecting dimensions, namely (i) technical (ii) cognitive and (iii) social-emotional dimensions of digital literacy (Ng, 2012). The relationship between the 3 dimensions of digital literacy is shown in Figure 1 below:
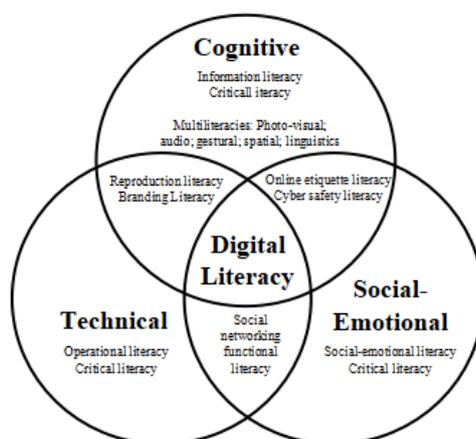

Figure 1. Digital Literacy Dimensions

Ng (2012) explained that individuals who are digitally competent are individuals who are able to operate technology adequately, for example through understanding file structures; managing data transfers which includes an understanding of file sizes and space required for

storage; find, download, install applications, and uninstall; use of infra-red and/or bluetooth; understand the data costs associated with downloading data; setting up and using communication tools and social networks; updating/changing user account information on the internet; send and retrieve attachments via email and/or dropbox; unzip it with a suitable application such as unzipping folders; know about the main features of the software program eg elements of the user interface; gestures that define interactivity (e.g. menus, sizes, dragging, scrolling, collapsible lists) and understand tabs and their relationship to content.

Ng (2012) explains that on the cognitive dimension individuals are expected to be able to evaluate and select appropriate software programs to study or to perform certain tasks. This dimension requires individuals to have knowledge of ethical, moral and legal issues related to online commerce and the reproduction of content that utilizes digital-based resources (eg copyright and plagiarism). Individuals should have an understanding of multiliteracy and be able to decode text-based information as well as information from images, sound bytes (eg podcasts), videos, maps and models. It involves multiliteracy skills, namely linguistic, visual, audio, spatial, gestural (as captured in video) and multimodal (as in multimedia sources).

The cognitive dimension in classroom teacher digital literacy is the teacher's ability to extract important data from a text, assess the validity of information, evaluate relevant information, organize data, and make conclusions (Cappuccio, Compagno, & Pedone, 2016). The social-emotional dimension of digital literacy and the intersecting fields between the socio-emotional and cognitive dimensions (as shown in Figure) involve the ability to use the internet responsibly to communicate, socialize and learn by (i) observing 'netiquette' through the application of rules the same as in face-to-face communication such as respecting and using appropriate language and words to avoid misinterpretation and misunderstanding (ii) protecting individual safety and privacy by keeping personal information as confidential as possible and not disclosing other personal information, and (iii) recognizing when there is a threat and know how to deal with it (Ng, 2012).

2.3. Instant Digital Competence Assessment (IDCA)

Calvani., et.al in 2008 developed a digital literacy measurement instrument called the Instant Digital Competence Assessment. The Instant Digital Competence Assessment was developed with the aim that there is a balance of digital literacy skills, so that digital competencies are expected to spread quickly in educational curricula around the world (Calvani, Cartelli, Fini, et al., 2008: 186). The Instant Digital Competence Assessment divides digital literacy competencies into 3 dimensions, namely the technological dimension, the cognitive dimension, and the ethical dimension.

The Instant Digital Competence Assessment (IDCA) was specifically developed to measure the level of digital literacy in education. This is motivated by Calvani, Cartelli, Fini, & Ranieri's awareness that digital competence stands as an important challenge for the 21st century education system. IDCA is a broad instrument for knowledge of linguistic and conceptual skills that can be measured by structured tests, measuring digital literacy levels using IDCA can be carried out by research institutions and individuals (Calvani, Cartelli, & Fini 2008:186). Based on the description above, the IDCA digital literacy framework was chosen as a guide in measuring digital literacy in this study.

3. Method

3.1. Research Design

Quantitative methods (e.g., surveys, experiments) are typically used within a postpositivist worldview in which some guiding determining theory is advanced at the beginning, and the study is delimited to certain variables that are empirically measured and observed. This study aims to describe classroom teachers' level of digital literacy, especially in the technological dimension of the instant digital competence assessment (IDCA). Therefore, this study uses a descriptive quantitative research design with survey method approach. Survey research is the most widely used quantitative design in the social sciences. Common uses of survey research

with which you are probably familiar include the census, polling on political issues or public opinions, and market research (Leavy, 2022). In social science, education, and health care research you are more likely to use a specialpurpose survey (Fowler, 2014). Surveys rely on asking people standardized questions that can be analyzed statistically. They allow researchers to collect a breadth of data from large samples and generalize to the larger population from which the

sample was drawn. The research procedure went through 4 stages, namely preliminary research, preparation of instruments, data collection, and report writing. Preliminary research includes observation and interview activities to select topics and determine research subjects. The instrument preparation stage is the activity of preparing open-ended questions because this research uses data collection techniques in the form of tests. The data collection stage contains test implementation activities followed by the six subjects. The report writing stage is the process of writing the result of the research based on the results obtained in the previous stages.

3.2. Participant

The subjects of this study were 6 classroom teachers in an elementary school. The 6 teachers are classroom teachers of grades one to six from one of the elementary schools in the Laweyan sub-district, Surakarta City. Each teacher is responsible for a different grade level. All subjects were selected using a purposive sampling technique. The choice of school is based on data from teachers who already have adequate teaching qualifications and experience. The classroom teachers were chosen because they have to teach most of the subjects in their classes, so they have more demands on learning resources and learning media to support learning. As a result, they have more opportunities to use digital technology and the internet than other kinds of teachers.

3.3. Data Collection

The instrument used in this study was a test instrument. The test was chosen because this study used the indicators of digital literacy in the technological dimension contained in the Instant Digital Competence Assessment (IDCA) which is an instrument for measuring basic cognitive knowledge of technology use. Each question in the test was developed based on digital literacy indicators in the IDCA technology dimension. Test questions made were then tested for validity using content validity to obtain test questions that are in line with the indicators used. The test questions given to the subject are in the form of short questions and descriptions. The test was carried out simultaneously by the six subjects using a written exam system.

3.4. Data Analysis

The results of the classroom teachers' digital literacy knowledge test were then presented in the form of a score description that was taken from the answers of each classroom teacher for each indicator. Then, an analysis of the completeness of each indicator was carried out. The value threshold used was 75 according to the threshold used by Calvani, Fini, & Ranieri (2009). The subject's final grade was calculated using the following formula:

$$\text{Value} = \frac{number\ of\ indicators\ fulfilled}{Number\ of\ indicators} \times 100$$

The results of class digital literacy levels were presented in the form of tables and graphs to make it easier for readers to understand and compare the level of digital literacy in each subject. The results of the research were valid, conclusions were then drawn to determine the category of classroom teachers' digital literacy levels. The categorization guidelines used in this study can be seen in Table 1 below:

Table 1. Guidelines for Categorizing Digital Literacy Levels

Category	Scores
Very High	81-100
High	61-80
Moderate	41-60

Low	21-40
Very Low	<21

(Source: Jacob, 2014)

4. Findings

The technological dimension in the classroom teachers' digital literacy level is considered as the ability to explore and deal with problems concerning technological contexts that have been adapted to their fields (Calvani, Cartelli, Fini, et al., 2008). In the IDCA, Calvani, Cartelli, Fini, et al. (2008) formulated 6 indicators of digital literacy in the technological dimension including 1) recognizing technological problems, 2) identifying interfaces, 3) selecting the most appropriate technological solutions, 4) handling logical operations, 5) mapping processes and 6) distinguishing reality in a virtual world.

The results of obtaining scores on each indicator are presented in Table 2 below:

Table 2. Technology Dimension Indicator Values

	S1	S2	S3	S4	S5	S6
Indicator 1	100	100	100	50	100	50
Indicator 2	68.75	90.63	84.38	84.38	84.38	68.75
Indicator 3	66.67	66.67	50	66.67	66.67	83.33
indicator 4	50	50	50	50	25	50
indicator 5	66.67	58.33	50	83.33	91.67	41.67
indicator 6	20	20	60	20	20	20

The results of the score obtained in Table 2 were then analyzed for completeness with a threshold value of 75. The completeness value of each subject is described in Figure 1 below:
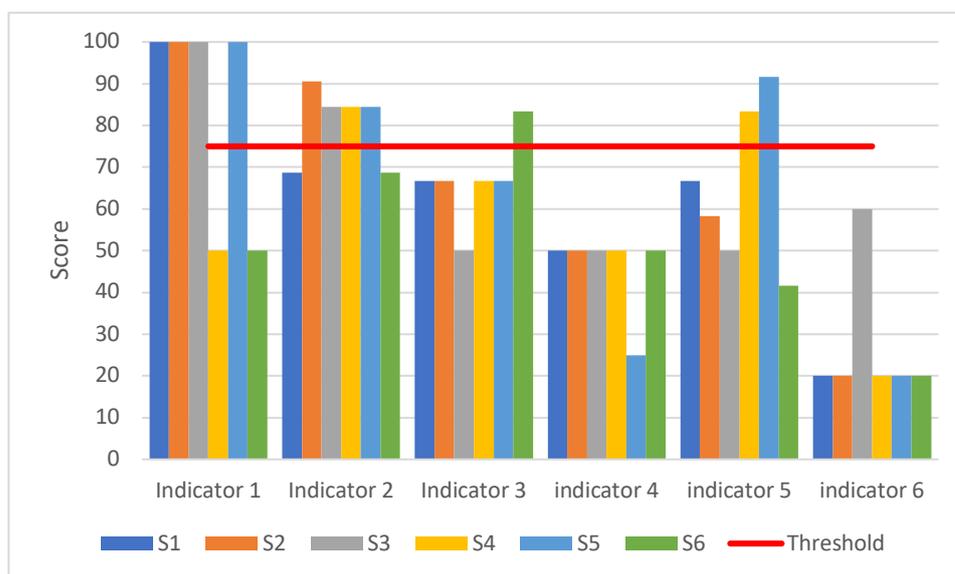

Figure 2. Technology Dimension Indicator Values

Figure 2 shows that there are 4 subjects in indicator (subjects 1, 2, 3, and subject 5) who have succeeded in obtaining scores above the threshold, and 2 subjects (subjects 4 and 6) obtaining scores below the threshold limits. These results indicate that subjects 1, 2, 3, and 5 have fulfilled the indicators of identifying problems, while subjects 4 and 6 have not met the indicators of identifying technological problems.

Based on the results that have been described, the number of indicators fulfilled and the scores of each subject can be seen in Table 3 below:

Table 3. The Research Subjects' Final Scores

Classroom teachers	Number of indicators	The fulfilled indicators	Scores	Category
Classroom teacher of grade 1	6	1	16,67	Very low
Classroom teacher of grade 2	6	2	33,33	low
Classroom teacher of grade 3	6	2	33,33	low
Classroom teacher of grade 4	6	2	33,33	low
Classroom teacher of grade 5	6	3	50	low
Classroom teacher of grade 6	6	1	16,67	Very low

Table 3 shows that the classroom teacher of grade 5 have moderate levels of digital literacy in the technology dimension, while the classroom teachers of grades 2, 3, and 4 have low levels of digital literacy in the technology dimension, and the classroom teachers of grades 1 and 6 have very low levels of digital literacy in the technology dimension.

5. Discussion

Indicator (1) recognizing technological problems in teacher digital literacy is intended as the teachers' ability to analyze and recognize the most common or simple technological problems (Calvani, Fini, & Ranieri, 2009). Recognizing technological problems is needed to assist teachers in determining actions or solutions to existing problems. This is in line with the opinion of (Yu, Fan, & Lin, 2014) who stated that analyzing and recognizing problems is necessary to help determine the most appropriate action or problem-solving solution. This is in line with Wolcott & Lynch's (1997) theory of thinking which explained that identifying or recognizing a problem is the first step before determining a problem-handling strategy in the critical thinking process. These results are in line with the theory of critical thinking put forward by Kneedler, known as Twelve Essential Critical Thinking Skills. Kneedler (in Surya 2013:179-180) divided the 12 components of critical thinking into 3 sub-discussions. Kneedler placed the ability to recognize problems as the basis for 2 other subs, namely assessing information and solving problems or drawing conclusions. This theory is consistent with the Gestalt theory formulated by Wertheimer (1910) and Kohler (1929). Gestalt theory views learning as a process of understanding or insight that can make a person understand the problems they face, so they can find solutions and solve them. Based on this theory, it can be understood that it is important to recognize the problems encountered to be able to find appropriate solutions or problem-solving.

These results indicate that subjects 2, 3, 4, and 5 have met the indicators, while subjects 1 and 6 have not met the indicators. Indicator (2) identifying interfaces in teacher digital literacy is intended as the teachers' ability to identify names and functions of icons, especially software in the world of technology (Calvani, Fini, & Ranieri, 2009). The ability to identify the interface can support teachers to make optimal use of the applications. Teachers can use devices or applications optimally if they understand the available features (Mullainathan, & Spiess, 2017). This is in line with the educational philosophy of pragmatism which states that everything proves itself to be true by looking at the consequences or results (Kaushik & Walsh, 2019). The connection with this indicator is that if the classroom teachers understand the various menus/icons on devices or applications, they can use these features/icons according to their function to support the delivery of material in the learning.

Indicator (3) choosing the most suitable technology for teacher digital literacy is the teachers' ability to choose solutions when facing problems in the technological environment (Calvani, Fini, & Ranieri, 2009). One of the problems with technology is the presence of viruses. Viruses that spread on computers can interfere with the performance of information technology (Fong et, al., 2020). Besides, viruses can cause problems on computers such as the loss of data on the

computer (Bowerman, 2017). Viruses on computers can be caused by dangerous websites. So, it is necessary to protect or block sites that cause viruses. The teachers' ability in this indicator can be a provision for the teacher to be aware of and protect against problems on the computer and can be a solution if the computer has been infected by viruses. This is in line with the S-R (stimulus-response) theory or connectionism theory. The S-R theory says that in the process of learning, the first time organisms (animals and people) learn by trial and error (Gershman, & Daw, 2017). If an organism is in a problematic situation, then the organism will issue a set of behaviors simultaneously from the set of behaviors that exist in it to solve the problem. Based on that experience, when experiencing a similar problem, the organism has already known which behavior to issue to solve the problem. This indicator implies that when the wrong solution to a technological problem is chosen, then the individual will choose other solutions to obtain the most appropriate solution. So that when encountering the same technological problems, individuals have already known which solution is most appropriate to implement. The above theory is in line with the learning principles in Gestalt theory formulated by Wertheimer (1910) and Kohler (1929) which stated that individuals tend to think about all the necessary aspects to solve problems cognitively. Based on the Gestalt theory, individuals also can view or review other problem-solving methods to find the best answer or solution. After the individual finds the most suitable solution, the individual will draw his understanding toward a conclusion. This indicator implies that when individuals encounter a problem, they will review it from various aspects and examine the existing settlement methods to find the most appropriate solution so that they can obtain the most appropriate solution to the problem he is facing.

Indicator (4) dealing with logical operations in teacher digital literacy is a simple logical ability commonly used in search operations (Calvani, Fini, & Ranieri, 2009). The basic search operations on google include: or (|): search for information that contains one of the two words; phrase (""): search for information containing the phrase you are looking for by using the " " sign; not (-): search results that contain the word that comes before, but not after (-); synonyms (~): search for words and their synonyms; an asterisk (*): word replacement character; and full stop (.): word replacement character (Brins & Page, 2011). The teachers' ability in this indicator can be a provision for teachers to search for information on Google so that the articles that appear are more relevant to the topic they are looking for. This is in line with Vygotsky's views in constructivism theory stating that intellectual development is influenced by sign systems that refer to symbols created to help people think, communicate, and solve problems. This indicator implies that the use of symbols can assist individuals in finding information on the internet.

Indicator (5) maps the process in teacher digital literacy, namely the ability to understand and use symbols and flowcharts as well as program instructions so that it can describe the data flow of a program (Calvani, Fini, & Ranieri, 2009). Flowcharts are the use of symbols to describe the steps of entities, processes, and data flow in a program (Chong, & Diamantopoulos, 2020; Aleriyani, 2016; Rosa & Wahju, 2020;). The teachers' understanding related to the symbols in the flow chart can be a provision for them in making and interpreting a flow chart either digitally or manually. This is in line with Vygotsky's views in constructivism theory stating that intellectual development is influenced by sign systems that refer to symbols created to help people think, communicate, and solve problems. This indicator implies the use of symbols that make up flowcharts can assist individuals in making a flow of thinking, communicating, and solving a problem.

Figure 1 shows that all subjects in indicator 6 obtained scores below the set threshold so all subjects were declared not to have met the indicators. Indicator (6) distinguishes reality from the virtual world in which teachers' digital literacy is interpreted as the ability to evaluate a clear understanding of the differences between the virtual world and reality (Calvani, Fini, & Ranieri, 2009). Communication in cyberspace enables the emergence of differences between individual personalities or characters in cyberspace and their personalities or characters in the real world (Naseh, 2016). The difference in character between individuals in the virtual world and the real world is due to anonymity and being invisible. Anonymity is a condition where an individual's identity cannot be identified (Kim, Lee, & Lee, 2019). While invisibility means that

individuals can communicate without physically showing themselves in virtual media interactions (Vavrova, 2014). Teachers' ability to understand this indicator is a provision that can be used to prevent students from committing violations in cyberspace or falling into negative things by using the principle of anonymity and invisibility in virtual media interactions. This statement is in line with the concept of transfer of training in connectionism theory. The theory explains that children tend to use what they have learned in the future on other occasions.

The low level of digital literacy can be influenced by various factors, such as age, education, employment, income, regional affiliation, availability of access, and socioeconomic (Rini, Suryadinata, & Efendi, 2022; Scherer & Siddiq, 2019; Urbacikova, Manakova, & Bielcheva, 2017). These results are supported by the theory of empiricism put forward by John Locke that all knowledge, skills, and attitudes of humans in their development are determined by real or empirical experience through their senses, both direct interaction with the world outside and through internal processing. (Joseph, 2006:98). In the theory of observational learning or sociocognitive learning, A. Bandura explains that human behavior is in the context of continuous reciprocal interactions among cognitive, behavioral, and environmental influences. A. Bandura also thinks that every child can still learn new things even if they don't do it directly as long as the child has seen other people do it before. The implication of the two aforementioned theories in the technological dimension is that technological developments give rise to new technology or knowledge that has never existed or has never been encountered before, so that it becomes something new that needs to be learned either independently or through teaching and the experience of seeing other people. Based on this, it is recommended for teachers to improve their competencies according to standards, especially those related to digital literacy (Agustini, Lian, & Sari, 2020).

The above theory is supported by the theory of reconstructionism. The theory of reconstructionism is a thought that seeks to overhaul the old setting by building a living arrangement of culture that refers to modernity according to the development of life and life as a consequence of the development of science, technology, and art. The implication of the theory of reconstructionism with the results of this study is that the emergence of technology has led to the expansion or transfer of various elements of education. Educational components that were originally conveyed conventionally were transferred to digital form to adapt to the changing times. These changes certainly require time to adapt.

6. Conclusion

Based on the presented results of the research, it can be concluded that there is no equality in the digital literacy abilities of classroom teachers in one of the Laweyan Surakarta sub-district schools. The classroom teachers of grades 1 and 6 have very low levels of digital literacy, The classroom teachers of grades 2, 3, and 4 have low levels of digital literacy, and the classroom teachers of grade 5 have moderate levels of digital literacy. Referring to these results, it is necessary to carry out training for teachers to develop their ability to use technology so that the program of integrating technology into the education sector can run effectively and can obtain the objectives.

Limitation

The limitation of this research lies in the research subject which is still limited. Researchers have limited time so they cannot conduct research in a broad scope.

Recommendation

Teachers in elementary schools need to be facilitated to receive training in order to have adequate digital literacy. Principals and departments need to develop programs to improve teacher professionalism so that the quality of learning is also better.

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Conflict of Interest

There are no conflicts of interest during this research and the article publication.

References

Adegboyega, L. O. (2020, April). Influence of Social Media on the Social Behavior of Students as Viewed by Primary School Teachers in Kwara State, Nigeria. In Elementary School Forum (Mimbar Sekolah Dasar) (Vol. 7, No. 1, pp. 43-53). Indonesia University of Education. Jl. Mayor Abdurachman No. 211, Sumedang, Jawa Barat, 45322, Indonesia. Web site: https://ejournal. upi. edu/index. php/mimbar/index.

Agustini, D., Lian, B., & Sari, A. P. (2020). School'S Strategy for Teacher'S Professionalism Through Digital Literacy in the Industrial Revolution 4.0. International Journal of Educational Review, 2(2), 160–173. https://doi.org/10.33369/ijer.v2i2.10967

Aleryani, A. Y. (2016). Comparative study between data flow diagram and use case diagram. International Journal of Scientific and Research Publications, 6(3), 124-126. https://www.ijsrp.org/research-paper-0316/ijsrp-p5122.pdf

Al Khateeb, A. abdulteeef M. (2017). Measuring Digital Competence and ICT Literacy: An Exploratory Study of In-Service English Language Teachers in the Context of Saudi Arabia. International Education Studies, 10(12), 38. https://doi.org/10.5539/ies.v10n12p38

Allsop, Y., & Jessel, J. (2015). Teachers' experience and reflections on game-based learning in the primary classroom: Views from England and Italy. International Journal of Game-Based Learning, 5(1), 1e17, DOI: 10.4018/ijgbl.2015010101

Apdillah, D., Salam, A., Tania, I., & Lubis, L. K. A. (2022). Optimizing Communication Ethics In The Digital Age. Journal Of Humanities, Social Sciences And Business (JHSSB), 1(3), 19-26. https://doi.org/10.55047/jhssb.v1i3.143

American Library Association (ALA). 2013. "State Summary Data." Public Library Funding & Technology Access Study 2011–2012. American Libraries (Digital Supplement Summer): 45–94. http://viewer.zmags.com/publication/4673a369

Bowerman, S. K. (2017). Cybersecurity Threats and Technology Applications in Homeland Security. In *Homeland Security Technologies for the 21st Century*. ABC-CLIO.

Bozan, M., & Anilan, H. (2022, April). Teaching Literacy in First-Grade of Primary School during COVID-19 Pandemic. In Elementary School Forum (Mimbar Sekolah Dasar) (Vol. 9, No. 1, pp. 24-42). Indonesia University of Education. Jl. Mayor Abdurachman No. 211, Sumedang, Jawa Barat, 45322, Indonesia. Web site: https://ejournal. upi. edu/index. php/mimbar/index.

Brin, S., & Page, L. (2012). Reprint of: The anatomy of a large-scale hypertextual web search engine. Computer networks, 56(18), 3825-3833.

https://doi.org/10.1016/j.comnet.2012.10.007

Buckingham, D., 2015. Defining digital literacy-What do young people need to know about digital media? Nordic Journal of Digital Literacy, 10 (Jubileumsnummer), pp. 21-35

Buckingham, D. (2016). Defining Digital Literacy. *Nordic Journal of Digital Literacy*, *4*, 59–71. https://doi.org/10.1007/978-3-531-92133-4_4

Caena, F. (2014). Teacher competence frameworks in Europe: Policy-as-discourse and policy-as-practice. European Journal of Education, 49(3), 311e331.

Calvani, A., Cartelli, A., Fini, A., & Ranieri, M. (2008). Models and Instruments for Assessing Digital Competence at School. *Journal of E-Learning and Knowledge Society*, *4*(3), 183–193. https://doi.org/10.20368/1971-8829/288

Calvani, A., Fini, A., & Ranieri, M. (2009). Assessing Digital Competence in Secondary Education - Issues, Models, and Instruments. In *Issues in Information and Media Literacy: Education, Practice, and Pedagogy* (pp. 153–172). Informing Science Press.

Cappuccio, G., Compagno, G., & Pedone, F. (2016). Digital Competence for the Improvement of Special Education Teaching. Journal of E-Learning and Knowledge Society, 12(4), 93–108. https://www.learntechlib.org/p/173669/

Chong, H. Y., & Diamantopoulos, A. (2020). Integrating advanced technologies to uphold security of payment: Data flow diagram. Automation in construction, 114, 103158. https://doi.org/10.1016/j.autcon.2020.103158

Dudeney, Gavin, Hockly Nicky, and Pegrum Mark. 2013. Digital Literacies: Research and Resources in Language Teaching. England: Pearson.

Eshet-Alkali, Y., & Amichai-Hamburger, Y. (2004). Experiments in digital literacy. Cyberpsychology and Behavior. https://doi.org/10.1089/cpb.2004.7.421

Fong, B., Fong, A. C. M., & Li, C. K. (2020). Telemedicine technologies: information technologies in medicine and digital health. John Wiley & Sons. https://doi.org/10.1002/9781119575788

Fowler, F. J., Jr. (2014). Survey research methods (5th ed.). Thousand Oaks, CA: SAGE

Gelmez Burakgazi, S., Karsantık, Y., Aktan, T., Ayaz, M. A., Büge, B. C., Karataş, F., Ödün, S., Varol Şanlı, Ş., Tarım, B., & Yavaşca, O. (2019). Equipped or Not? Investigating Pre-Service Teachers' 21st Century Skills. Asia Pacific Journal of Education, 39(4), 451–468. https://doi.org/10.1080/02188791.2019.1671803

Güneş, E., & Bahçivan, E. (2018). A mixed research-based model for pre-service science teachers' digital literacy: Responses to "which beliefs" and "how and why they interact" questions. Computers and Education, 118(November 2017), 96–106. https://doi.org/10.1016/j.compedu.2017.11.012

Hagel, P. (2015). Deakin University Library research and practice. dro.deakin.edu.au

Hakim, A. (2015). Contribution of competence teacher (pedagogical, personality, professional competence and social) on the performance of learning. The International Journal of Engineering and Science, 4(2), 1-12. https://www.theijes.com/papers/v4-i2/Version-3/A42301012.pdf

Hamidi, M and Indrastuti, S., (2012). Influence Analysis of Competence, Educational Background on Performance Polikteknik Bengkalis Lecturer of Leadership Perspective. Proceedings of the National Seminar on Industry and Technology. December 26, 2012. DOI:10.2991/sores-18.2019.83

Hockly, Nicky. 2012a. "Digital Literacies." ELT Journal 66(1):108–12. doi: 10.1093/elt/ccr077.

Hockly, Nicky. 2012b. "Digital Literacies." ELT Journal. doi: 10.1093/elt/ccr077.

Iordache, C., Mariën, I., & Baelden, D. (2017). Developing digital skills and competences: A quick-scan analysis of 13 digital literacy models. Italian Journal of Sociology of Education.

https://doi.org/10.14658/pupj-ijse-2017-1-2

Isrokatun, I., Pradita, A. A., Ummah, S. A., Amalia, D. Y., & Salsabila, N. S. Digital Literacy Competency of Elementary School Teacher Education Department Student as the Demands of 21st Century Learning. Mimbar Sekolah Dasar, 9(3). DOI: https://doi.org/10.53400/mimbar-sd.v9i3.44057

Jacob, H. H. (Ed.). (2014). Mastering digital literacy. Solution Tree Press.

Jin, K., Reichert, F., Cagasan, L. P., de la Torre, J., & Law, N. (2020). Measuring digital literacy across three age cohorts: Exploring test dimensionality and performance differences. *Computers & Education*, *157*(103968). https://doi.org/https://doi.org/10.1016/j.compedu.2020.103968

Johannesen, M., Øgrim, L., & Giæver, T. H. (2014). Notion in motion: Teachers' digital competence. Nordic Journal of Digital Literacy, 9, 300e312. https://doi.org/10.18261/ISSN1891-943X-2014-04-05

Julia, J., Iswara, P. D., Gunara, S., Yildiz, Y. M., & Agustian, E. (2020, December). Developing Elementary School Teacher Competence in Making Music Learning Media Using Scratch Application: An Action Research. In Elementary School Forum (Mimbar Sekolah Dasar) (Vol. 7, No. 3, pp. 362-385). https://doi.org/10.17509/mimbar-sd.v7i3.29100

Kainama, M. S., & Latuserimala, G. (2022). Antecedent and Consequence of ICT Utilization in Education : Voices from Private University Lectures In Indonesia. *Jurnal Pendidikan Progresif*, *12*(2), 425–434. https://doi.org/10.23960/jpp.v12.i2.202203

Kaushik, V., & Walsh, C. A. (2019). Pragmatism as a research paradigm and its implications for social work research. Social sciences, 8(9), 255. https://doi.org/10.3390/socsci8090255

Keengwe, J., Schnellert, G., & Jonas, D. (2014). Mobile phones in education: Challenges and opportunities for learning. Education and Information Technologies, 19, 441-450.

Kementerian Pendidikan dan kebudayaan. (2017). Materi Pendukung Literasi Digital [Digital Literacy Support Materials]. Jakarta: Ministry of Education and Culture of Republic of Indonesia. https://gln.kemdikbud.go.id/glnsite/wp-content/uploads/2017/10/literasiDIGITAL.pdf.

Kim, K. K., Lee, A. R., & Lee, U. K. (2019). Impact of anonymity on roles of personal and group identities in online communities. *Information and Management*, *56*(1), 109–121. https://doi.org/10.1016/j.im.2018.07.005

Koto, I. (2020, April). Teaching and Learning Science Using YouTube Videos and Discovery Learning in Primary School. In Elementary School Forum (Mimbar Sekolah Dasar) (Vol. 7, No. 1, pp. 106-118). Indonesia University of Education. Jl. Mayor Abdurachman No. 211, Sumedang, Jawa Barat, 45322, Indonesia. Web site: https://ejournal. upi. edu/index. php/mimbar/index.

Leavy, P. (2022). Research design: Quantitative, qualitative, mixed methods, arts-based, and community-based participatory research approaches. Guilford Publications.

Lee, D., Watson, S. L., & Watson, W. R. (2020). The relationships between self- efficacy, task value, and self-regulated learning strategies in massive open online courses. The International Review of Research in Open and Distributed Learning, 21(1), 23-39. Diperoleh 11 Februari 2022, dari https://doi.org/10.19173/irrodl.v20i5.4389

Madianou, M., & Miller, D. (2013). Polymedia: Towards a new theory of digital media in interpersonal communication. International journal of cultural studies, 16(2), 169-187.https://doi.org/10.1177/1367877912452486

Marsh, Jackie. (2016). "The Digital Literacy Skills and Competences of Children of Pre-School Age." Media Education. https://oaj.fupress.net/index.php/med/article/view/8759/8534

Mariaye, H. (2012). Understanding the professional images of pre service teachers. The metaphors we live and teach by. in EDULEARN12 Proceedings, 4140–4148.

https://www.researchgate.net/profile/Hyleen_Mariaye/publication/344443215_understa nding_the_professional_images_of_pre_service_teachers_the_metaphors_we_live_and_t each_by/links/5f75fb22a6fdcc00864d7d0b/understanding-the-professional-images- ofpre-service-teachers-the-metaphors-we-live-and-teach-by.pdf.

Miller, D. et al. (2016). How the World Changed Social Media. London: UCL Press. https://www.uclpress.co.uk/products/83038

Mullainathan, S., & Spiess, J. (2017). Machine learning: an applied econometric approach. Journal of Economic Perspectives, 31(2), 87-106. https://doi.org/10.1257/jep.31.2.87

Naseh, M. V. (2016). Person and personality in cyberspace: A legal analysis of virtual identity. *Masaryk UJL & Tech*, *10*(1). https://doi.org/10.5817/MUJLT2016-1-1

Ng, W. (2012). Can we teach digital natives digital literacy?. Computers & Education, 59 (3), 1065-1078. Diperoleh 25 November 2021. https://doi.org/10.1016/j.compedu.2012.04.016.

Nudiati, D., & Sudiapermana, E. (2020). Literasi Sebagai Kecakapan Hidup Abad 21 Pada Mahasiswa. Indonesian Journal of Learning Education and Counseling, 3(1), 34–40. https://doi.org/10.31960/ijolec.v3i1.561

Pozas, M., & Letzel, V. (2021). "Do You Think You Have What it Takes?" – Exploring Predictors of Pre-Service Teachers' Prospective ICT Use. Technology, Knowledge and Learning. https://doi.org/10.1007/s10758-021-09551-0

Rahman, M. H. (2014). Professional competence, pedagogical competence and the performance of junior high school of science teachers. Journal of education and practice, 5(9), 75-80.

Reddy, P., Sharma, B., & Chaudhary, K. (2020). Digital Literacy: A Review of Literature. *International Journal of Technoethics*, *11*(2), 65–94. https://doi.org/10.4018/IJT.20200701.oa1

Redecker, C. (2017). In Y. Punie (Ed.), European framework for the digital competence of educators: DigCompEdu. Luxembourg: Publications Office of the European Union.

Rini, R., Suryadinata, N., & Efendi, U. (2022). Digital Literacy Ability towards Curiosity Level and Student Self-Determination. *Jurnal Pendidikan Progresif*, *12*(3), 1311–1321. https://doi.org/10.23960/jpp.v12.i3.202224

Rosa, Y., & Wahju, M. B. (2020). Inventory and Sales Information System Design on Clothing Store (Case Study: X Fashion, Jakarta). *Jurnal Logistik Indonesia*, *4*(1), 39–48. https://doi.org/10.31334/logistik.v4i1.872

Roza, M., & Mufit, F. (2022). Science Teacher's Perception of Digital Technology-Based Learning in the 21st Century. *Jurnal Pendidikan Progresif*, *12*(1), 281–293. https://doi.org/10.23960/Jpp.V12.I1.202222

Santoso, F. W., Nurdyansyah, N., & Churrahman, T. (2020). The Effect of Teacher's Social Competence on Increasing Human Resources at SMP Muhammadiyah 9 Tanggulangin Boarding School. Proceedings of the ICECRS, 6.

Scherer, R., & Siddiq, F. (2019). The relation between students' socioeconomic status and ICT literacy: Findings from a meta-analysis. *Computers and Education*, *138*(0317), 13–32. https://doi.org/10.1016/j.compedu.2019.04.011

Shidiq, A. S., & Permanasari, A. (2020). Chemistry teacher's perception toward STEM learning. *International Conference on Education Development and Studies*, 40– 43.https://doi.org/10.1145/3392305.3396901

Suwarto, D. H., Setiawan, B., & Machmiyah, S. (2022). Developing digital literacy practices in Yogyakarta Elementary Schools. Electronic Journal of e-Learning, 20(2), pp101-111. https://doi.org/10.34190/ejel.20.2.2602

Syahid, A. A., & Nugraha, D. (2019). Development of a Training Curriculum Structure to Improve

ICT Competencies of Teachers in Primary Schools. *Mimbar Sekolah Dasar*, 6(1), 21–31. https://doi.org/10.17509/mimbar-sd.v6i1.13889

UNESCO. (2018). UNESCO ICT Competency Framework for Teachers. In Journal of Chemical Information and Modeling (Version 3, Vol. 53, Issue 9). United Nations Educational, Scientific and Cultural Organization. https://n9.cl/x1uf

Urbacikova, N., Manakova, N., & Bielcheva, G. (2017). Socio-Economic and Regional Factors of Digital Literacy Related to Prosperity. *Quality Innovation Prosperity*, *1745*, 124–141. https://doi.org/10.12776/QIP.V21I2.942

Vavrova, Y. (2014). Virtual Media Reality-Second and Third Life. In *Current Issues of Science and Research in the Global World* (p. 4). CRC Press.

Wolcott, S. K., & Lynch, C. L. (1997). Critical thinking in the accounting classroom: A reflective judgment developmental process perspective. *Accounting Education: A Journal of Theory, Practice, and Research*, *2*(1), 59–78. DOI:10.1016/S0748-5751(01)00029-X

Yu, K.-C., Fan, S.-C., & Lin, K.-Y. (2014). Enhancing Students' Problem-solving Skills through Project-based Learning. *International Journal of Science and Mathematics Education 2014*, *13*(6), 1377–1401. https://doi.org/10.54337/ojs.jpblhe.v10i1.6887

Zakharov, K., Komarova, A., Baranova, T., & Gulk, E. (2022). Information Literacy and Digital Competence of Teachers in the Age of Digital Transformation. Lecture Notes in Networks and Systems, 247, 857–868. https://doi.org/10.1007/978-3-030-80946-1_78

Zimmer, W. K., & Matthews, S. D. (2022). A virtual coaching model of professional development to increase teachers' digital learning competencies. Teaching and Teacher Education, 109, 103544. https://doi.org/10.1016/j.tate.2021.103544