

Literacy Analysis of Information and Communication Technology for Vocational High School Teachers in Using Augmented Reality Media

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Abstract: *Information and communication technology (ICT) literacy is a fundamental skill that every educator must possess in the 21st century. This study looks at the category of ICT literacy levels of accounting teachers in vocational high schools. This research is quantitative descriptive. The research sample consisted of 35 accounting teachers at a vocational high school in Surakarta. Five categories were used to categorize the level of ICT literacy, while the aspects measured in ICT literacy comprised six domains: access, manage, integrate, evaluate, create, and communicate. Data were collected using the methods of observation, interviews, and questionnaires. Data obtained through questionnaires were then analyzed using descriptive analysis techniques with percentages. The results showed that the six aspects measured in each category, on average, were in the relatively good category, the level was quite good (40%), the level was good (22%), and the level was very good (20%). It explains that ICT literacy in utilizing augmented reality media combines the ability to access, intellectually, interpret, communicate, and new skills to effectively use information and communication technology.*

Keywords: *ICT literacy, augmented reality, vocational high school teachers*

Abstrak: *Literasi Teknologi Informasi dan Komunikasi (TIK) merupakan suatu keterampilan dasar yang harus dimiliki oleh setiap pendidik di abad ke 21. Penelitian ini bertujuan untuk melihat kategori tingkat literasi TIK guru akuntansi di Sekolah Menengah Kejuruan. Penelitian ini merupakan penelitian deskriptif kuantitatif. Sampel penelitian terdiri dari 35 guru akuntansi di Sekolah menengah kejuruan di Kota Surakarta. Untuk pengkategorian tingkat literasi TIK menggunakan kategori lima kategori, sedangkan aspek yang diukur dalam literasi TIK yaitu 6 domain yaitu Acces, manage, integrate, evaluate, create, dan communicate. Pengumpulan data dilakukan dengan menggunakan metode observasi, wawancara, dan kuisioner. Data yang diperoleh melalui kuisioner dianalisis menggunakan teknik analisis deskriptif dengan persentase. Hasil penelitian menunjukkan bahwa enam aspek yang diukur pada tiap kategorinya, secara rata-rata berada pada kategori cukup baik level cukup baik (40%), level baik (22%) dan sangat baik (20%). Hal ini menjelaskan bahwa literasi TIK dalam memanfaatkan media augmented reality merupakan kombinasi dari kemampuan dalam mengakses, intelektual, menginterpretasikan, mengkomunikasikan dan keterampilan baru menggunakan teknologi informasi dan komunikasi secara efektif.*

Kata Kunci: *Literasi TIK, augmented reality, guru sekolah menengah kejuruan*

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INTRODUCTION

The development of science and technology, significantly information and communication technology (ICT), has transformed the way of learning in the 21st century. Information and communication technology currently affect human life, especially in education. ICT utilization in education is very much, for example, making learning and teaching activities better and more interesting. Technological advances that continue to develop rapidly then become a challenge for teachers to be literate in ICT or ICT literacy, hoping that integrating learning using ICT can create professional teachers (Ahmad et al., 2015).

According to a study on ICT literacy (Elmy & Jizat, 2019), teachers who function in improving the quality of education services and continuing professional development still showed a low level, so it is necessary to increase teacher competence in the ICT field. Competency development, in particular, of vocational high school teachers in the ICT sector, benefits teachers and students. Teachers who have good competence in ICT can use it to improve educational services for students in the learning process. As for students, apart from helping improve the efficiency and effectiveness of learning activities, it also provides opportunities for them to learn (Nugroho Yanuarta et al., 2021a).

Moreover, experts built the 21st-century information and communication technology literacy in the ICT field called the International ICT literacy panel. These experts in International ICT literacy argue that the assessment of ICT competence in the 21st century focuses on solving cognitive problems and thinking skills related to the use of technology to deal with difficulties in obtaining information (Afshari et al., 2009). This 21st century ICT literacy model contains seven domains that are essential skills to enable one to play an important role in society and science. The seven domains comprise defining, accessing, evaluating, managing, integrating, building, and communicating. All these skill domains can be combined and interact to form ICT competencies. In addition, Education Testing Services (ETS) issued a model that describes ICT literacy skills. It consists of *define* or the ability to identify information needs. *Access* is the ability to collect/retrieve information in a digital environment, including identifying the source of information from these sources. *Manage* is the ability to compile data/information according to the organizational format. *Integrate* is the ability to interpret digital information, including using ICT tools to summarize and compare the information. *Evaluate* is the ability to assess digital information's quality, relevance, bias, and accuracy. *Create* is the ability to generate data in an ICT environment.

The last, communicate, is the ability to communicate information according to the context (Educational Testing Service (ETS), 2002).

The benchmarks for ICT literacy can be categorized into the ability to define, access, manage, integrate, evaluate, create, and communicate. Besides, information and communication technology literacy is not just an understanding of technical skills but also includes cognitive things (Jo Shan Fu & Fu, 2013). Thus, ICT, integrated into learning, has a purpose, among others, to improve the competence of teachers in teaching and improve the quality of student learning. ICT has the innovative nature of improving what is being done now and what individuals have not done but will be able to do when they start using information and communication technology. Therefore, teachers should take advantage of all the capabilities and potential of technology to improve learning, significantly reforming to develop students' learning process.

ICT implementation in teaching and learning activities requires several conditions that support carrying out the ICT-based education process. According to research (Jimoyiannis & Komis, 2007), several conditions that can support the implementation of ICT in schools, especially those related to the internet, are 1) teachers and students must have easy access to technological devices, including

internet connections; 2) available digital content (teaching materials) that are easy for teachers and students to understand; 3) teachers must have knowledge and skills in using technology; 4) resources to help students achieve academic standards. Based on the research (Ahmad et al., 2015), the ICT literacy rate of 65% for the total high school teachers in Indonesia was in a good category. It indicates that the low ICT literacy of teachers also has many negative impacts, i.e., trust in the role of technology, teacher anxiety in teaching, and anxiety about lessons in various regions. In line with research findings (Junindra, 2021), teachers have difficulty teaching technology because they are accustomed to traditional learning. Teachers' low level of ICT literacy also impacts the low level of technological knowledge they have.

Problems that arise in the field also occur in vocational high school teachers, especially accounting subject teachers. From observations in the field, many accounting teachers still have not maximized the available technology in teaching in the classroom. Based on data in the field, 40% of accounting teachers in vocational high schools were over fifty. The age factor is one of the causes of low ICT literacy. In addition to the age factor, the facts on the ground also revealed that the lack of knowledge and awareness to improve teacher competence in the ICT field is also the cause of the low ICT literacy. Furthermore, it is known that there are still many schools that have not facilitated teaching activities with ICT equipment in the field. Since each school can establish an ICT vocational service center, teachers in Indonesia can develop ICT-based teaching activities. However, there are obstacles to teacher competence in achieving mastery of technology, such as their experience and knowledge of ICT facilities, websites, and the use of applications or learning media. In addition, five factors influence teacher literacy in mastering technology: (1) teacher skills in using ICT when teaching, (2) ICT resources, (3) teacher attitudes towards the use of ICT in education, (4) technical support and other needs, and (5) staff development in using ICT (Helaludin, 2019). Another opinion also explains that the lack of teaching literacy in using ICT integration in the classroom can cause students to distrust educators (Nugroho Yanuarto et al., 2021b). In this regard, implementation of the use of ICT depends on the ability of teachers to manage teaching from traditional learning to constructivism. According to a study (Sang et al., 2010), the problem of teacher confidence also affects the use of technology, where teacher beliefs affect the use of ICT tools, competence in classroom management, and knowledge in teaching implementation.

In today's technology era, there are many *portable software* and applications that can be used as learning media in schools, one of which is augmented reality (AR) media based on applications on Android. From the field observations on the accounting teachers in vocational high schools, 55% of teachers have never used AR applications in classroom teaching. So far, teachers have only used video media and power points for classroom teaching. Augmented reality (AR) is one of the computer content technology used in a real-world environment (Akçayir et al., 2016). AR technology also refers to the inclusion of virtual elements in the view of the actual physical environment to create mixed reality in real-time (Kohli et al., 2021). AR can be applied to different devices, such as smartphones, tablets, laptops, computers, or head-mounted monitors (Chen, 2019). In addition, AR provides overlay image, text, video, and audio components onto an existing image or space. AR technology has been able to bridge the gap and bring a more tangible learning approach. According to research (Vaičiūniene & Gedviliene, 2008), in addition to helping create learning conditions conducive to students' mentality, technology also acts as a medium or *tool* to simplify and accelerate the work of students and, of course, provide skills in using technology. From several opinions regarding the augmented reality, as already explained, the importance of using augmented reality in schools is to make it easier for students to understand abstract concepts so that the skills of teachers or students are needed to use augmented reality media.

From the study above, it can be said that ICT literacy has an essential role in education, especially in the use of learning media. However, ICT literacy for accounting learning in vocational high schools, especially in the use of augmented reality media, has not been fully disclosed. Therefore, this study focuses on analyzing the ICT literacy level of accounting teachers in vocational high schools, especially vocational high school teachers in the city of Surakarta.

RESEARCH METHODS

This research is quantitative research with a quantitative descriptive approach. This approach was chosen to get a picture or description of the literacy level of information and communication technology (ICT) in accounting teachers in vocational high schools using augmented reality media in Surakarta. Data collection methods used a survey method on 35 teachers of accounting subjects in Surakarta. Data collection techniques were through (1) observation, (2) interviews, and (3) information and communication technology literacy questionnaire. The questionnaire contained aspects or domains measured in ICT literacy, covering six domains according to the Educational Testing Service (2002). The six domains consisted of 1) ability to collect/retrieve information in a digital environment (access), 2) ability to organize data/information according to organizational format (manage), 3) ability to interpret digital information (integrate), 4) ability to assessing the quality, relevance, bias, and accuracy of digital information (evaluate), 5) the ability to produce information in an ICT environment (create), and 6) the ability to communicate information in context (communicate). This study employed an ICT literacy questionnaire consisting of 30 items in the form of a 5-point Likert scale. After the data were scored and the percentage value was calculated, they were then classified based on the data of assessment criteria according to Purwanto (2013). Then, the data were analyzed descriptively quantitatively.

Table 1. Categories of ICT Literacy Assessment

Percentage (%) ICT Literacy	Information
86-100	Very good
76-85	Good
60-75	Quite good
55-59	Poor
54	Very poor

RESULTS AND DISCUSSION

The ICT literacy of SMK accounting teachers studied in this study was divided into five aspects: access, manage, integrate, evaluate, create, and communicate. The ICT literacy level of vocational accounting teachers was measured based on the interpretation of the average score in Table 2. The interpretation of the average score was then divided into five categories: very good, good, enough, not enough and very less.

Table 2. Category of ICT Literacy Level for SMK Accounting Teachers

Category	Frequency	percentage
Very good	7	20.0
Good	8	22.9
Quite good	14	40.0
Poor	4	11.4

Very poor	2	5.7
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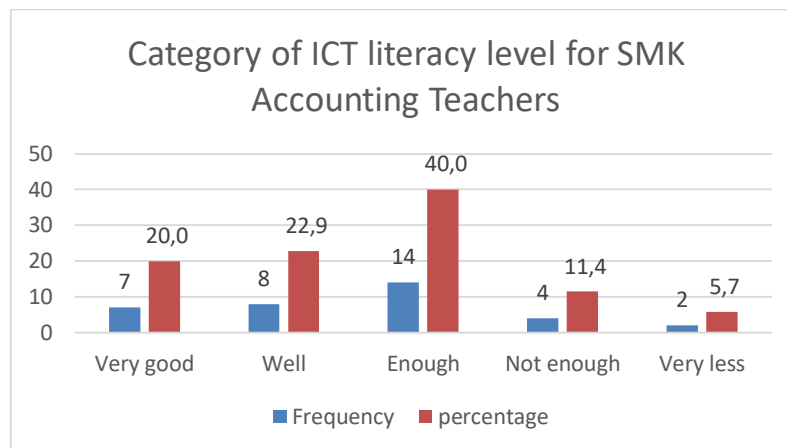


Figure 1. Category of ICT Literacy Level for SMK Accounting Teachers

In Figure 1, it was found that seven people or 20.0 % of SMK accounting teachers, had a very good category in the use of ICT literacy, especially in the use of augmented reality media; eight teachers or around 22.9% were in the good category in the use of ICT literacy; 14 people or 40% of the category were quite good; four people or 11.4% were in the poor category; remaining two people or about 5.7% were in the very poor category. Based on the table and figure data above, it can be concluded that overall, the level of ICT literacy in the use of augmented reality media is in enough category.

In this study, there were five domains of ICT literacy: access, manage, integrate, evaluate, create, and communicate. Domain access is the ability to collect/retrieve information in a digital environment. In Table 3, it can be seen the level of mastery in terms of access to retrieve information on augmented reality media.

Table 3. ICT Literacy in the Access Domain

Category	Frequency	Percentage
Very good	5	14.3
Good	6	17.1
Quite good	20	57.1
Poor	3	8.6
Very poor	1	2.9

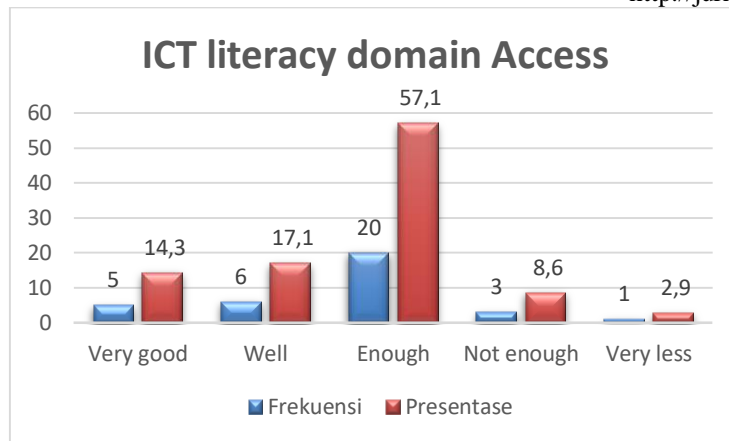


Figure 2. ICT Literacy in the Access Domain

In Figure 2, it was found that five or 14.3 % of vocational accounting teachers had a very good category in the use of ICT literacy, especially in the use of augmented reality media, six teachers or around 17.1% were in the good category in the use of ICT literacy, 20 people or 57.1% were in the quite good category, three people or 8.6% in the poor category, and the remaining one person or around 2.9% was in the very poor category. Based on the table and figure data above, it can be concluded that overall, the level of ICT literacy in the access domain in the use of augmented reality media was in enough category.

Then, the manage domain is the ability to organize data/information according to the organizational format. In Table 4, it can be seen the level of mastery in terms of managing about retrieving information on the use of augmented reality media.

Table 4. ICT Literacy in the Manage Domain

Category	Frequency	percentage
Very good	3	8.6
Good	16	45.7
Quite good	10	28.6
Poor	5	14.3
Very poor	1	2.9

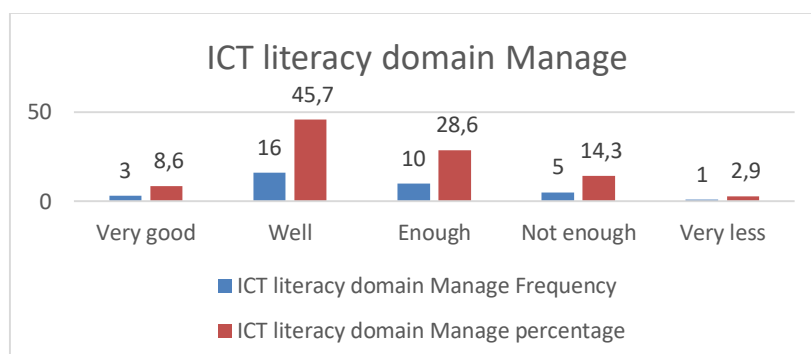


Figure 1. ICT Literacy in the Manage Domain

In Figure 3, it was found that three vocational school teachers or 8.6 % of vocational accounting teachers, had a very good category in the use of ICT literacy, especially in the use of augmented reality

media, 16 teachers or about 45.7% were in the good category in the use of ICT literacy in the manage domain, ten people or 28.6% were in the quite good category, five people or 14.3% were in the poor category, and the remaining one person or around 2.9% was in the very poor category. Based on the table and figure data above, it can be concluded that overall, the level of ICT literacy in the manage domain in augmented reality media was in a good category.

Next, the integrate domain is the ability to interpret digital information, such as using ICT tools to summarize and compare the information. In Table 5, it can be seen the level of mastery in terms of integrating domains about making summaries and comparing data on the use of augmented reality media.

Table 5. ICT Literacy in the Integrate Domain

Category	Frequency	percentage
Very good	1	2.9
Good	10	28.6
Quite good	9	25.7
Poor	15	42.9
Very poor	0	0

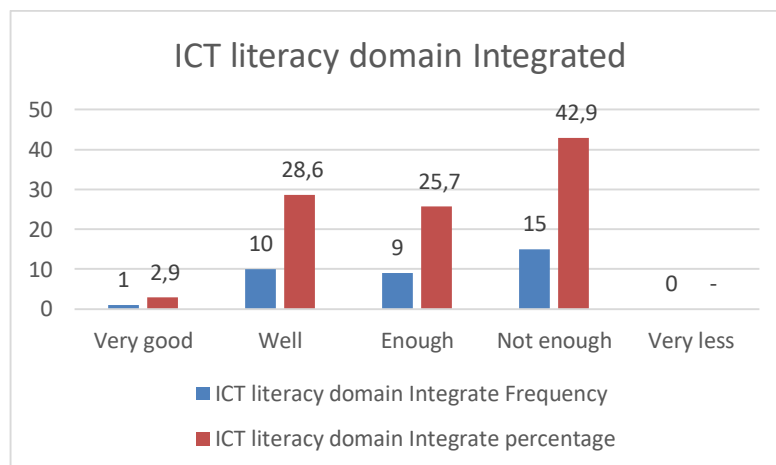


Figure 2. ICT Literacy in the Integrate Domain

In Figure 4, it was found that one vocational school teacher or 2.9 % of vocational accounting teachers had a very good category in the use of ICT literacy, especially in the use of augmented reality media, ten teachers or about 28.6% were in the good category in the use of ICT literacy in the domain of integrate, nine people or 25.7% were in the quite good category, 15 people or 42.9% were in the poor category, and 0% was in the very poor category. Based on the table and figure data above, it can be concluded that overall, the level of ICT literacy in the integrate domain in the use of augmented reality media was in the poor category.

The fourth domain, namely the evaluate domain, is the ability to assess the quality, relevance, bias, and accuracy of digital information. In Table 6, it can be seen the level of mastery in terms of the evaluation domain about assessing the accuracy of the information and assessing the relevance and the quality of using augmented reality media.

Table 6. ICT Literacy in the Evaluate Domain

Category	Frequency	percentage
Very good	1	2.9
Good	5	14.3
Quite good	11	31.4
Poor	16	45.7
Very poor	2	5.7

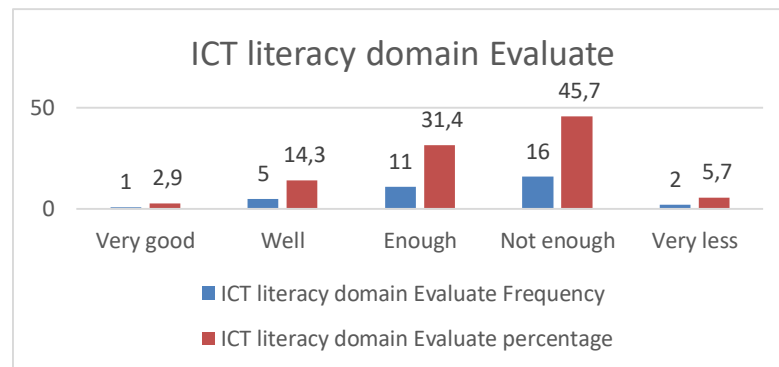


Figure 3. ICT Literacy in the Evaluate Domain

In Figure 5, it was found that one vocational school teacher or 2.9 % of vocational accounting teachers had a very good category in the use of ICT literacy, especially in the use of augmented reality media, five people (14.3%) were in the good category in the use of ICT literacy in the evaluate domain, 11 people or 31.4% were in the quite good category, 16 (45.7%) were in the poor category, and two people (5.7%) were in the very poor category. Based on the data in Table 6 and Figure 5 above, it can be concluded that overall, the level of ICT literacy in the evaluate domain in the use of augmented reality media was in the poor category.

The fifth domain in ICT literacy is the create domain, which is the ability to produce information in the ICT environment. In Table 7, the level of mastery in terms of domain create about creating or generating information from the use of augmented reality media can be seen.

Table 7. ICT Literacy of Create Domain

Category	Frequency	percentage
Very good	0	0
Good	10	28.6
Quite good	20	57.1
Poor	5	14.3
Very poor	0	0

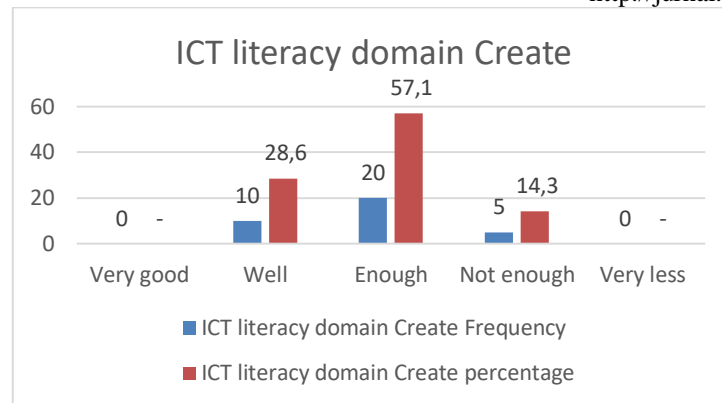


Figure 4. ICT Literacy of Create Domain

In Figure 6, it was found that 0% of SMK accounting teachers had a very good category in the use of ICT literacy, especially in the use of augmented reality media, as ten people (28.6%) were in the good category in the use of ICT literacy in the create domain, 20 people or 57.1% were in the quite good category, five people (14.3%) were in the poor category, and 0% was into the very poor category. Based on the data in Table 7 and figure 6 above, it can be concluded that overall, the level of ICT literacy in the create domain of using augmented reality media is in a relatively good category.

The sixth domain in ICT literacy is the communicate domain. This domain is the ability to communicate information according to the context. In Table 8, it can be seen the level of mastery in terms of the communicate domain about sharing information from the use of augmented reality media.

Table 8. ICT Literacy of Communicate Domain

Category	Frequency	percentage
Very good	5	14.3
Good	10	28.6
Quite good	14	40.0
Poor	5	14.3
Very poor	1	2.9

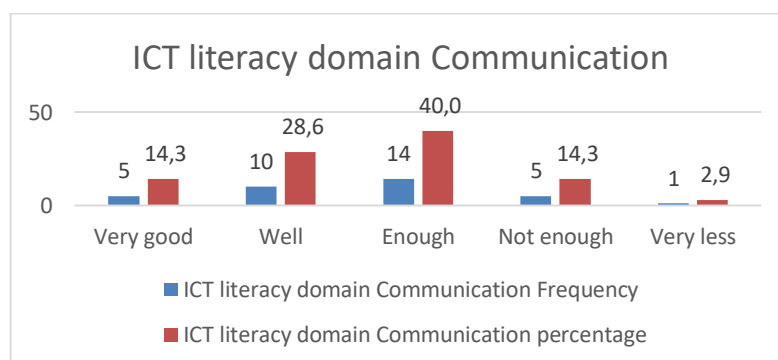


Figure 5. ICT Literacy of Communicate Domain

In Figure 7, it was found that five people (14.3%) of SMK accounting teachers had a very good category in the use of ICT literacy, especially in the use of augmented reality media; ten people (28.6%) were in a good category, 14 people or 40% were in a quite good category, five people (14.3%) were in the poor category, and one person or 2.9% was in the very poor category. Based on the data in Table 8

and Figure 7 above, it can be concluded that overall, the level of ICT literacy in the communicate domain using augmented reality media was in a relatively good category.

Among the six domains, vocational accounting teachers had the highest level of competence in the quite good category, namely the access domain, followed by the create, communicate, integrate, and evaluate domains. Although the overall level of ICT competence was at a good and quite good level, research data showed that there were still teachers in the category of poor and very poor in ICT literacy in utilizing augmented reality media. In this case, many factors affect a person's ICT literacy ability. According to a study (Jo Shan Fu & Fu, 2013), three factors play a role in a person's ICT literacy ability: anxiety, knowledge, and belief. However, these three factors can be improved through skills, training, and attitude change. It is in line with the opinion (Ghavifekr & Rosdy, 2015), stating that teachers' basic skills, motivation, and thinking patterns play an important role in teacher ICT literacy skills.

In the results of this study, it was stated that overall, from the domains studied, 40% of the literacy skills of accounting teachers in SMK were in the relatively good category, while 5.7% were in the very poor category. It is a note that when teachers have low basic skills, it can lead to low confidence in teaching, especially accounting subjects. Likewise, teachers who have traditional or ancient thinking patterns will use traditional teaching systems in their teaching as well (Nugroho Yanuarta et al., 2021a).

The research also showed that there were still teachers who were in the very poor category in the access domain (2.9%), manage (2.9%), evaluate (5.7%), and communicate (2.9%). It could be due to the low motivation of teachers in utilizing existing ICT media. In addition, based on interviews and observations of 35 teachers in vocational high schools, augmented reality media is still foreign to some teachers. It is due to the lack of teacher knowledge about ICT development in the 21st century. Conditions in schools also showed the lack of facilities provided by schools, especially ICT facilities in supporting learning activities in the classroom. According to a study (Jackson, 2017), subject matter knowledge, management knowledge, and integrity knowledge are the three main factors that affect ICT literacy. Thus, teachers need guidance from schools and governments to enhance the role of technology in accounting teaching. Coaching activities can also increase the ability to use and utilize technology for classroom teaching.

ICT literacy, especially the use of augmented reality media, can be a medium for teachers to increase technological activities in the classroom. It agrees with several studies, which state that the use of augmented reality in mobile applications can increase the learning motivation of health science of undergraduate students. Attention, satisfaction, and motivational belief factors increased, and these results were significant (Khan, Johnston, & Ophoff, 2019). The application of AR in mathematics learning resulted in better learning performance, motivation, and anxiety levels than the group without AR (Chen, 2019).

In addition, the workload of teachers and school facilities also affects the literacy ability of a teacher. Teachers who have a lot of high workloads in schools will find it challenging to improve innovative and quality teaching activities in the classroom. Besides, teachers who teach in schools that are not good in ICT facilities also have difficulty developing ICT literacy. It agrees with an opinion (Helaludin, 2019), stating that age, availability of school facilities, and teacher workload can be the main problems in increasing teacher ICT literacy and increasing teacher innovation in teaching in the classroom.

Furthermore, the utilization of learning media using augmented reality by accounting teachers in vocational high schools can take place well. According to a study (Rahmatina, Dharmono, & Kaspul,

2017), ICT skills involving interests, attitudes, knowledge, skills, and willingness to use and integrate ICT in the early stages of education are crucial in growing interest. It is also in line with the research results (Sang et al., 2010), which stated that using technology in learning, such as computer-based learning, the internet, tutorials, and other technologies, can improve learning achievement. Moreover, augmented reality-based learning is in accordance with developments in the 21st century so that students can well receive it. AR can be applied to different devices, such as smartphones, tablets, laptops, computers, or head-mounted monitors (Kohli et al., 2021). AR also provides opportunities based on this principle by combining printed text with virtual content (for example, integrating video into a textbook) or by physically multiplying objects with virtual text (for example, displaying informative text at the top of a screenshot of a historic building (Kanyilmaz et al., 2021). In addition, learning media with AR is very useful in improving the learning process and students' interest in learning because AR has entertainment aspects that can increase students' interest in learning, playing and projecting it in real terms and involving the interaction of all the students' five senses with this AR technology. It is also because AR has characteristics and functions that are almost the same as learning media, namely the function of conveying information between the recipient and the sender or educators with students, clarifying the delivery of the information supplied by educators and students in the learning process, and providing motivational stimulation and interest in learning. In the use of AR media, ICT literacy skills for an accounting teacher are needed so that the application of teaching in the classroom can take place well.

CONCLUSIONS AND RECOMMENDATIONS

The overall data analysis results showed that accounting teachers in vocational high schools were included in the relatively good category in the level of ICT literacy in the use of augmented reality media. It gives an overview of the quality of teaching activities on accounting subjects in vocational high schools. Teachers in vocational high schools are supported by the academic community in schools who understand the level of ICT literacy and realize how important it is to master ICT literacy and its contribution to improving competence. Overall, the accounting teacher's ICT literacy level category was in a relatively good category of the six domains measured in each category. It explains that ICT literacy in utilizing augmented reality media combines the ability to access, intellectually, interpret, communicate, and new skills to effectively use information and communication technology. It also provides an overview for vocational high school teachers to improve the quality of ICT literacy in the classroom teaching process.

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