Mapping the Use of Digital Learning Tools and Methods for Increasing Teachers' Digital Competence

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Journal info	Abstract.
	Teachers are required to be able to apply digital tools and media to every aspect of their professional duties. Teachers' digital competence become important for teachers to acquire. This research purpose is to mapping the use of digital technologies in teachers' practice. Data was obtained through a survey and analized with descriptive statistics analysis from 93 samples of elementary, middle school, high school, and vocational school teachers. The results show 56.99% teachers use smartphones for learning tools while other 43.01% use PC/laptop device. As many as 48.39% teachers conduct digital learning through message app, 19.35% through LMS, and the rest through online meeting, social media, or all of the type simultaneously. The type of the content dominated by video and image, obtained through web content providers that are searched through search engine. Teachers also use text to give guidance for students, and quiz for formative and summative assessment. A total of 22 teachers carried out asynchronous learning, 35 synchronous learning, and 33 hybrid learning. In conclusion, teachers more often use smartphones, messaging app, and learning media that contain text, with additional video or image content for the learning process, guidance, and quizzes in assessments provided through synchronous and hybrid learning.

A. INTRODUCTION

The influence of technology in people's lives is very widespread. The application and iteration of this technology have changed the way of life and people's views on various things, one of which is education. Education itself is a process that is believed to be able to place the standard of human life at a higher degree, to explore one is potential to optimize one's abilities, and then have a role in a dynamic society, therefore education process is always dynamic to keep up with the times.

Education is also a human need for knowledge and abilities both individually and as a society. The application of technology in education is the impact of the expansion of globalization which is the result of the integration of the economy, society through the connection of information, ideas, technology, resources both natural and human resources, and the economy in terms of capital markets, services, and finance (Kapur, 2018; Kumar & Parveen, 2013). Real learning is not limited to teacher-student interaction activities at school.

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Distance learning can also be carried out in certain conditions and environments so that there is still the essence of the interaction between teachers and students. Distance learning has differences that lie in the form of interaction between teacher and learner, learner characteristics, type of program, the role of human resources, management, technology, and so on (Munir, 2009).

The application of technology in education, especially in the learning process, also encourages the use of digital learning. Digital learning itself is a process of acquiring knowledge and learning competencies, regardless of the form of competence and knowledge, using digital technology which is accessed through devices such as smartphones or computers effectively (Aditya, 2021). The process of technology integration in education in the form of digital learning then encounters quite a crucial problem. This integration is slow because of the teacher's ability, especially in the use of technology, which can be seen from the results of the Teacher Competency Test in 2012 on technological ability which is still far from the passing grade limit of 47 out of 100 points from a passing grade of 70/100 (Abidin et al., 2017; Aditya, 2021). This technological competence illustrates how teachers' abilities can utilize Information and Communication Technology in the learning process creatively and innovatively to develop students' potential in literacy and numeracy skills as lifelong learners (Herliani & Wahyudin, 2019, p. 3).

Teachers realized that digital competence is an important thing to acquire, however, this has not been accompanied by the ability and the maturity of using digital technologies. Research by Astuti et al (2021, p. 2) shows that the maturity level of using digital technology for teachers in Indonesia is in low position. Other studies also show that teacher readiness in implementing digital learning and digital learning is quite high, especially during the Covid-19 pandemic which requires teachers to carry out digital learning (Aditya, 2021, p. 10). Ghomi and Redecker's research (2019, p. 8) shows that teachers who are accustomed to using many digital applications and tools correlate with the teacher's digital competency level. The influence of the subjects taught such as STEM or Computer related subjects can also support a teacher in the level of digital competence they have, but the significance of the correlation between subjects and digital competency levels does not have a high impact, so teachers of other subjects still can have high competence from other factors (Ghomi & Redecker, 2019). Krumsvik in Ottestad et al (2014) explains that digital competence is the teacher's ability to use Information and Communication Technology (ICT) which is applied in learning strategies and still has the value of pedagogical understanding so that it has an impact on what the learning process and the formation of education are like in student.

There are a lot of digital tools, and methods can be applied by the teachers in their teaching process. Those digital tools or method

also requires teachers to practice and learn the best way to apply it in their teaching. In order to do that, schools and education stakeholders that has the responsibility to train teachers must have data about what digital tools, methods, and media that teachers mainly used. Therefore, the main purpose of this research is:

1. Find out which device, digital tools, digital content, and digital content sources teachers use the most

2. Provides an overview of how teachers carry out guidance, assessment, and implementation method of learning to students using digital technology

B. RESEARCH METHOD

This research is intended to obtain information about digital technology used by teachers in the context of developing Digital Competence. This information is in the form of types of devices, digital tools, and how teachers practice integration in every aspect of digital competence. Quantitative data was taken using a survey method that contains self-assessment and analyzed using descriptive statistics. Descriptive statistics is a form of analysis that is used to describe or describe the research object from the sample simply, and as it is, so general conclusions apply (Sugiyono, 2017). Surveys are activities of investigating facts or phenomena from a subject quantitatively so that they can describe opinions and behavior or draw comprehensive conclusions about a matter (Ali, 2019, p. 47). Fowler in Ali (2019, p. 49) also describes the characteristics of survey data as follows:

1. The main purpose of survey data is to produce statistics or quantitative descriptions of various aspects of the study population

2. The main way of collecting information in this method is by asking questions or providing question instruments to samples in the study population which become data for analysis

3. This information-gathering activity was carried out by taking some samples from the study population, not all research subjects.

The research was conducted on a population of teachers, especially primary and secondary level teachers who are members of a teacher community in the city of Bandung. The population of this community member in 2022 is 165 members with quite a diverse composition, therefore the sampling technique used by researchers is Disproportioned Stratified Random Sampling. Disproportioned Stratified Random Sampling is one of the probability sampling techniques or sampling in a population by providing equal opportunities for all members to be selected as samples, and if the population of the research object has a stratified but disproportionate distribution (Sugiyono, 2007, p. 64).

Tabel 1 Sample composition

No	School Level	Sample
1	Elementary	52
2	Middle School	18
3	High School	9
4	Vocational School	14
	TOTAL SAMPLE	93

The instrument used is digital technology mapping which aims to determine preferences, types of digital technology, and general use of technology in learning. Mapping is carried out to provide information and recommendations regarding types of devices, digital tools, and how teachers practice integration and strategies for using digital technology in learning for more directed and structured training planning. carried out online through a personal web application and combined with the Google Form which was distributed to samples from the Teacher Community in the city of Bandung.

The mapping elements used include several digital technologies based on their type, how they are used, and the purpose of using these technologies. The table below describes digital technology mapping items and their mapping purposes.

Tabel 2 Digital Technology Use Mapping Instrument

No	Mapping Elements	Elements Descriptions	Mapping Item	Mapping Purpose
1	Devices	The hardware used by teachers in conducting learning, both online and offline learning	1. Smartphone Device 2. PC/Laptop Device	To know what hardware that the teacher uses in learning
2	Digital Learning Tools	Applications used by teachers in learning, both online and offline	1. Learning Management System (LMS) 2. Messaging Applications 3. Online Meeting 4. Social Media 5. All type simultaneously	to find out teacher preferences in applications used to access and carry out learning
3	Learning contents	The type of content used to be used as media in learning	1. Images/Photo 2. Video 3. Games 4. Audio	to find out teacher preferences in the type of content used as learning media
4	Learning content sources	The source of the content used by the teacher for learning media	1. Teachers' group/ community 2. Search engine 3. Collaborations/ examples	to find out how teachers get content for learning media
5	Digital platform for learning content resources	Platform/web/content source applications used by teachers in learning	1. Content Provider Websites 2. Digital Repository/ Digital Library 3. Social Media	to find out where teachers get content for learning media
6	Digital guidance method	Methods of providing guidance to students using digital technology	1. Online Meeting 2. Text based 3. Video 4. others (material module, task instructions, etc)	to find out how teachers carry out guidance methods for students in learning

7	Assessment Method	Types and assessment methods used by teachers in learning	1. Portfolios 2. Digital Quiz 3. Hybrid Quiz 4. Games 5. Text or Digital Essay Writing	to find out the types of assessment instruments used by teachers in formative and summative assessments
8	Learning Implementation Method	The method of implementing learning that involves students	1. Asynchronous 2. Synchronous 3. Hybrid 4. No Online Learning	to find out how teachers carry out learning with digital technology applications in it.
9	Digital Innovations	The application of new digital technologies to be applied in learning	1. Coding/ Computer programming 2. Artificial Intelligence 3. Virtual Reality 4. Augmented Reality 5. MakerSpace	to find out what technology the teacher wants to learn and apply in future learning

C. RESULTS AND DISCUSSION

1. Hardware Devices and Digital Learning Tools

Mapping the use of technology devices by teachers in the form of hardware and software is needed to find out tool preferences, types, and how digital technology is integrated into teacher activities in preparing, implementing, and evaluating classroom learning. Digital tools can be categorized into 2 types, namely tools in the form of hardware or known as hardware, and tools in the form of software known as software. In terms of hardware, the use of Personal Computers (PCs) or in the form of laptops is very common. However, the use of mobile devices, in this case, smartphones and tablets, is also increasing. Ahmad's research (2020) shows that in general, it is easier for students to access smartphone devices, although their use is not always for learning purposes. The use of a smartphone itself is felt to be more efficient because it is easier to carry, and it is easier to access the internet with a cellular network

directly embedded in the smartphone. The use of smartphones can also increase student motivation in their involvement in learning, and integration of smartphone use in learning is also recommended, of course with limitations that are adjusted by the teacher to students (Wali & Omaid, 2020).The results of mapping teacher preferences in using digital devices can be seen in the diagram below:
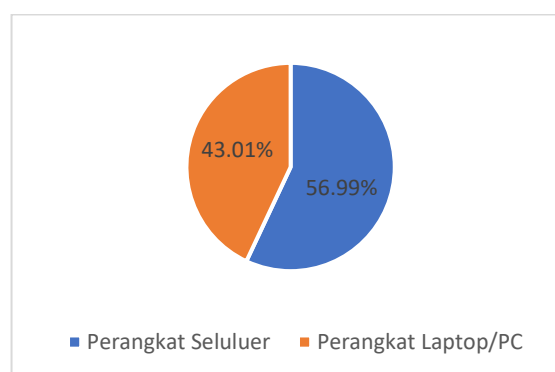

Figure 1 Hardware Devices Teachers Use in Digital Learning

In the diagram above, teachers who prefer using mobile devices such as smartphones or tablets are 56.99% of the total sample. While teachers who use laptop/PC devices are 43.01%. This shows that teachers

use mobile devices more in accessing the internet, and its relation to learning activities in class. The preference for using this tool will also affect the way they prepare teaching materials, use these teaching materials, and carry out learning evaluations. The use of digital applications/software in learning cannot be separated from the level of digital competence possessed by the teacher. Preferences for using digital tools can show how teachers interact in the digital world.
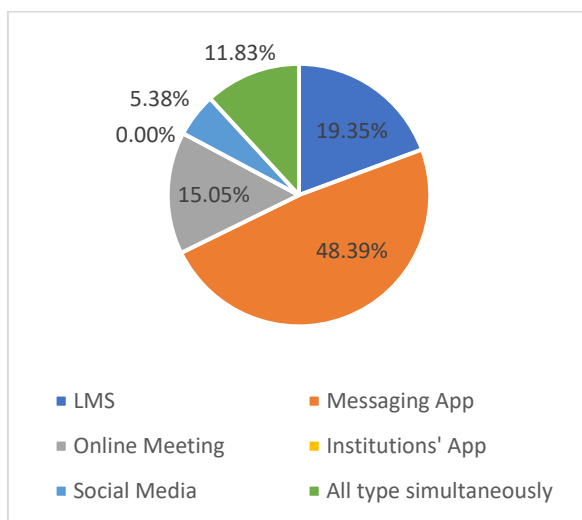

Figure 2 Digital Tools used by Teachers in Digital Learning

In Figure 2 above, around most teachers (48.39% of the sample) choose to use short message applications such as WhatsApp, Telegram, or other applications in interacting with students. The use of the Learning Management System (LMS) by teachers in interacting with students ranks second at 19.35%, followed by online meeting applications such as Zoom, Google Meet, and others at 15.05%. As for teachers who use almost all types of applications simultaneously 11.83%, and the use of social media by 5.38%. The preference for using applications by

teachers in collaborating and communicating shows a trend where teachers collaborate and communicate more with colleagues, parents, and students via short messages/text. The teachers consider the aspect of efficiency because they can directly communicate and discuss directly with the intended individuals. Meanwhile, the use of LMS and Online Meetings requires time and special techniques to use, even though more collaboration features can be used on these platforms.

2. Learning Contents

The forms of digital content used by teachers are quite diverse, from audio to games. The frequency of using digital content based on its type of learning can be seen in the diagram in Figure 3.
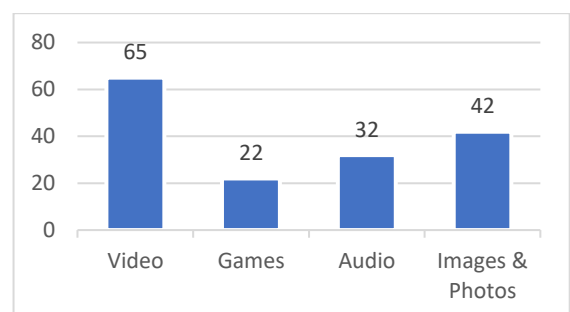

Figure 3 Digital Content Type used by Teachers in Digital Learning

Respondents chose 2-3 types of content that were most often used in their learning. The use of video content is the most widely used by teachers in learning being selected 65 times. This can be seen from the larger use portion of audio content that was selected 32 times, as well as images and photos that were selected 42 times.
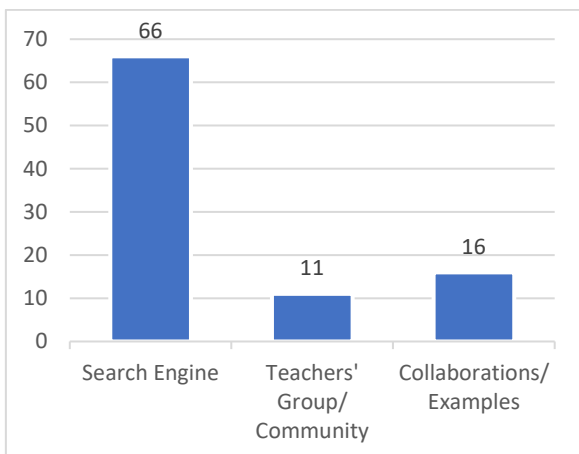
Figure 4 Digital Content Sources used by Teachers

Figure 5 Digital Platform for Learning Content Resource used by Teachers in Digital Learning

The use of web-based search tools is the main source for teachers in finding and obtaining digital content 66 times. Meanwhile, other sources that teachers use in finding and obtaining digital content are collaborations and examples provided by trainers (16 times) and through community/teacher groups (11 times). From this digital search tool, more detailed data is obtained about the platform the teacher is aiming for in obtaining digital learning content shown in Figure 5. A total of 75 times teachers has used web-type platforms that provide video, audio, and text content such as YouTube, blogs, and others. While other platforms are web types of repositories or digital libraries such as BSE, National Library, and others as well as social media such as Facebook, Twitter, and others.
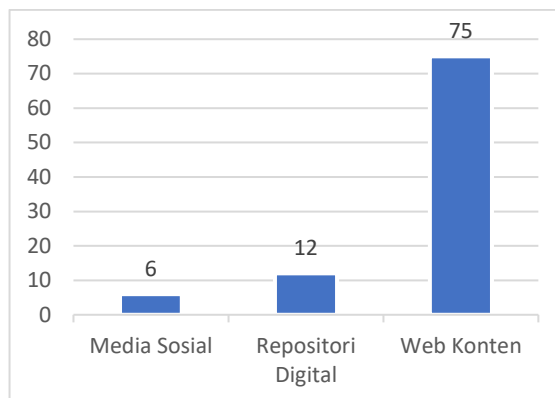
In managing digital content, teachers must also be able to manage and store data or content. The digital content storage base is divided into 2, namely online (cloud storage) such as Google Drive, Microsoft OneDrive, and others as well as offline or in-device storage. Ease of internet access determines the teacher's choice in choosing a storage base for learning content.

3. Digital Tools for Learning Guidance

In independent learning, the teacher should open access for students to ask questions and the teacher guides every learning process that is carried out by students. In this digital competency, guidance practices can be carried out in various ways, namely by making video tutorials or explaining material, and opening discussion rooms either text-based (chat) or video (online meetings). The results of the mapping of guidance practices that are most often carried out by teachers are shown in the diagram below:
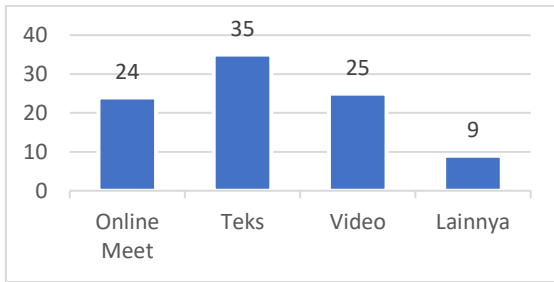
Figure 6 Digital Guidance Method used by Teachers in Digital Learning

As many as 35 out of 93 respondents chose to use the text-based guidance method in the form of chat and opened the comments column on the learning platform used. Teachers also provide guidance on assignments and material in class groups on short message applications such as WhatsApp. As many as 25 out of 93 teachers chose to make a video explaining a material. The video is made directly by the teacher, and or modified from sources obtained so that it contains an explanation of the tasks and materials needed by students. As many as 24 out of 93 teachers chose to use online meeting applications such as Zoom, Google Meet, and others to provide guidance. Teachers feel more effective because they can interact by opening discussions or asking questions directly with students. Meanwhile, 9 out of 93 teachers chose another method, namely by making guidebooks, assignment instructions, and material modules that students can download.

4. Digital Assessment Method

The assessment process carried out by the teacher can use digital technology, or what is commonly called e-assessment. The use of digital assessment has advantages such as time efficiency, and can also reduce paper use

(Asrial et al., 2022). Assessment methods that can be used are portfolios, quizzes, or exams that can be done both digitally and hybridity, collecting written assignments in digital format, or also in the form of games that are under the objectives of learning assessment. The teacher's ability to conduct digital assessments is also influenced by the teacher's preferences in choosing the type of platform or assessment method using digital technology in both formative assessment and summative assessment.
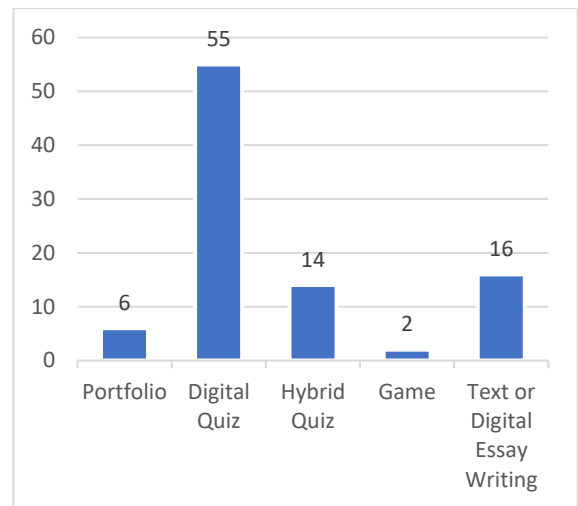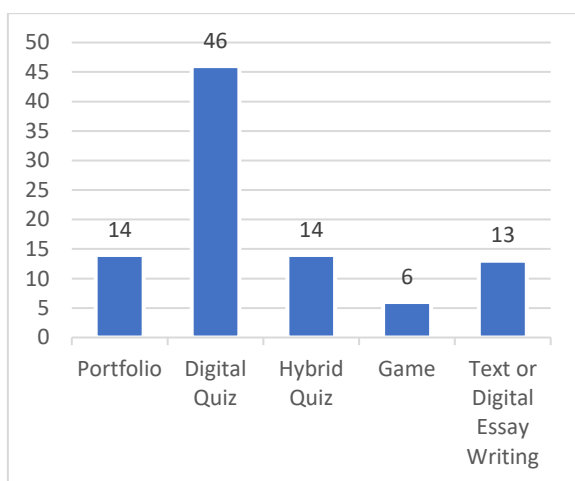

Figure 7 Digital Tools for Formative Assessment used by Teachers in Digital Learning

As many as 55 out of 93 teachers used the digital quiz method in conducting formative assessments. This is reinforced by the statements of 4 out of 5 interview respondents who use digital quiz platforms such as Google Forms, Kahoot, and others as digital tools in assessment. Teachers find it easier to create and use digital quiz platforms because the resulting data can be more organized and easier to process statistically. However, not a few teachers also use this type of assessment in the form of writing or essays

in digital form, as many as 16 teachers choose this method, and 14 others use quizzes in the form of a hybrid, namely using a digital platform in offline written assessment activities. The 6 teachers chose portfolios and 2 people chose games or digital games. At least the use of portfolio and game assessment methods is supported by statements of interview respondents who stated that analyzing student work cannot all be used in certain topics and/or subjects, therefore these methods are not widely adopted and are more specifically used by teachers on topics or subjects. certain lessons. While the game method is considered not very representative and difficult to relate to the goals of the assessment.

Figure 8 Digital Tools for Summative Assessment used by Teachers in Digital Learning

Not different from the method used by teachers in summative assessment, 46 teachers chose digital quizzes, 14 chose hybrid and portfolio quizzes, 13 chose digital writing, and the remaining 6 chose games. As stated in the explanation of the formative assessment above, the portfolio method has received an increase

in the summative assessment. This is caused by the topics and types of subjects that are more supportive of the assessment of project activities carried out by students.

5. Learning Implementation Method to Engage Students

To engage students, many digital types of technology are used by teachers in learning that is carried out both offline and online. To involve students more in learning, teachers must understand and could conduct learning with certain methods that can better support learning activities. The methods that teachers can use, especially in learning related to digital technology, are asynchronous, synchronous, and hybrid learning. Hybrid, synchronous and asynchronous learning are learning methods used for online learning, the difference is in the place of learning, the learning media used, and time synchronization (Fabriz et al., 2021). In synchronous learning, it is carried out at a predetermined or scheduled time so that the teacher can communicate directly through online meeting applications such as video calls, virtual meetings, or even just through a chat application so that the teacher can open direct discussions on learning activities and or use that time. to increase student involvement in learning. Whereas in asynchronous learning, learning is not timed, nor do they meet through digital portals, instead teachers require students to study independently with materials and assignments that have been made previously on the Learning Management System or other digital portals, so that students can access learning. freely both in terms of time and place

(van der Keylen et al., 2020). The hybrid method combines the two where the teacher will still meet with students and provide direct learning through virtual meetings but the teacher will also prepare additional materials, assignments, and or other guides on certain portals that students can access more freely.
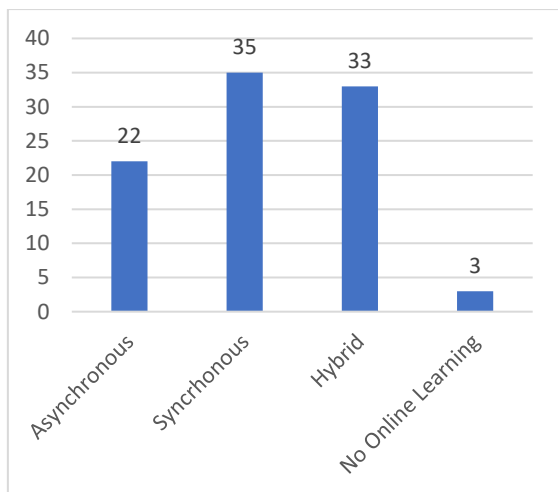

Figure 9 Digital Learning Method used by Teachers

In the diagram above, 22 teachers use asynchronous learning, 35 teachers use synchronous methods, 33 teachers use hybrid methods, and the remaining 3 people still do face-to-face learning (no online learning). This shows that teachers still prefer being able to interact with students even though only through virtual meetings, as evidenced by the large number of teachers who use synchronous and hybrid learning. Interaction with these students provides opportunities for teachers to be able to involve students in learning more by using interactive presentations, quiz applications, games, and others.

6.   Digital Innovation

The development of the learning process using digital technology cannot be separated from the application of technological innovation in education. The use of these technological innovations is also strongly influenced by the component skills and competence of teachers in adapting, operating, and applying these technologies according to the needs of learning, especially student learning goals. Papadakis' research shows that the use of programming language applications (coding) can improve students' computational thinking skills which are important to have as competencies needed in the future (Falloon et al., 2016; Papadakis, 2021). Another innovation in education today is Virtual Reality (VR) and Augmented Reality (AR) technology. VR and AR technologies in education are used to describe abstract concepts, simulate these concepts, and or increase student learning interactivity (Jumani et al., 2022, p. 196). The application of technology is also often related to STEM (Science, Technology, Engineering, and Mathematics) learning which requires students to be able to directly apply their learning results to projects. Project learning is carried out in Makerspace which is specifically designed and equipped with tools that support students in being creative in realizing the results of their projects (Blackley et al., 2017). Artificial Intelligence (AI) is currently being widely used to support the learning process, especially in personalizing individual learning, automating teacher routine tasks, and for more complex and impactful assessment processes (Seo et al., 2021). Technological concepts such as programming language (coding), Virtual Reality or Augmented Reality, and even

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Artificial Intelligence require teacher effort and competence in their application to the learning process.
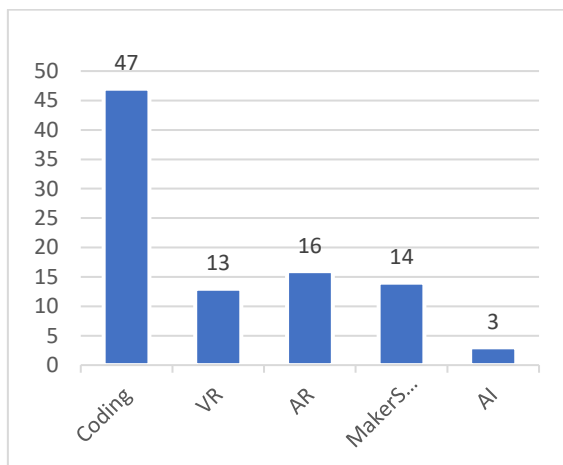

Figure 10 Digital Innovation Teachers Want to Learn

As many as 47 out of 93 teachers chose computer programming/coding which they wanted to try for teaching and learning innovation. As many as 16 out of 93 teachers chose Augmented Reality as the technology, they wanted to try in teaching development. This Augmented Reality can be especially useful in providing STEM learning. A total of 14 teachers chose to try MakerSpace as a teaching innovation. MakerSpace allows students to explore and be creative according to learning objectives, especially in solving problems that require the creation of tools or designs. Meanwhile, 13 teachers chose virtual reality as the technology they wanted to try in teaching innovation. virtual reality can increase student interaction with learning materials as well as Augmented Reality. While the other 3 teachers chose to try Artificial Intelligence (A.I.). Learning resources and teaching examples using A.I. there are still very few, so not many teachers choose this innovation,

especially since the positive impact of using A.I. in learning has not been studied empirically. The teachers who chose A.I. gave the opinion that the use of A.I. can help students expand references and knowledge input because A.I. can process massive data at once and learning materials can be customized according to the needs of each student quickly and easily.

D. CONCLUSION

The use of digital technology in learning can no longer be avoided. Teachers in their professional duties must be able to integrate digital technology in every aspect of their work, especially in the learning process. That way, digital competence is something that must be owned by teachers. The teacher's ability to use and integrate digital technology is also very dependent on the individual teacher. Digital tools can be accessed via a PC/Laptop or smartphone making flexibility in the use of applications and learning platforms even wider. Teachers in this case also have their preferences such as the use of text messaging applications which are considered more practical for communicating, which in the end are also used in the learning process for students. LMS platforms such as Google Scholar, Edmodo, and others have also been added to the list of digital tools that teachers can use.

The results of the research in general can be concluded as follows:

1. The use of digital technology devices teachers uses more mobile devices, as

much as 56.99% so that teachers can be more flexible in carrying out learning and can be accessed from anywhere. While the remaining 43% prefer to use PC/Laptop devices for better access to applications and computing capabilities.

2. With the preferences of teachers who use mobile devices more in learning, teachers also use short message applications more to interact, carry out the learning process, and even the evaluation process. The use of short messages is felt to be more effective for interacting with students both in the main and additional learning processes.

3. Teachers use more visual content such as pictures and photos, or videos in their learning. This visual content can attract more students' attention and can also facilitate students' understanding of learning.

4. Teachers also use digital content that already exists on digital content provider web pages or the teacher will search for it first through the search tool so that it can be adapted to the needs of learning content.

5. In conducting guidance on student learning, teachers do it more by using text, according to the preferences of teachers who use more short message/text applications to interact with students. As for the rest, the teacher also guides videos that have been prepared, and or interacts directly through online meetings

6. Teachers prefer to use digital quizzes to conduct assessments. This does not change much of the assessment method that is usually done by teachers in face-to-face learning.

7. Interaction with students is important for learning, so teachers prefer synchronous and hybrid methods in conducting online learning.

From the results of the research above, the authors also provide recommendations for training and developing teacher digital competencies as follows:

1. Can make more use of smartphone devices in teacher training for the application of learning. The flexibility and efficiency of smartphones can be used as practical learning tools for students and teachers to carry and use. By making more use of smartphones, it is hoped that students will be able to use their gadgets more positively and avoid negative things that arise from the flow of information on social media, and others.

2. Training to improve teachers' ability to design and produce their digital learning media, whether in the form of videos, images, or text. This ability also allows teachers to get protean career opportunities as content creators.

3. Increasing the variability of online learning methods. The use of text-based media, such as modules and others are indeed easier to implement because the teacher already has this ability. But synchronous learning through online

meetings requires special actions from the teacher so that students can maintain their concentration. With this exploration of online learning methods, it is hoped that teachers can find concepts for applying online learning methods in a more fun and impactful way.

4. Exploration of digital assessment methods more broadly. The use of quizzes or assessments with a type of written exam is very often used by teachers. However, assessment methods do not have to be text-based but can be explored through project or portfolio assessments, or learning-based digital games.

5. Increase exploration and experimentation to apply technological innovations in learning, such as AI, VR/AR, and Coding

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