

# Improvement Bases of Teachers' Technological Knowledge in the Implementation of Computer-Based Learning

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## ABSTRACT

Learning in times of covid-19 pandemic requires extra innovation and creativity of the teachers. Teachers must have fundamental mastery of technology, from the simplest technology to the more complex ones. The purpose of this research was to describe the fundamental improvement of technological knowledge through the implementation of Computer-Based Learning. This research was a qualitative-descriptive research, with questionnaires and interviews as substantive data collections. The locative data source of this research was several junior high schools in Gunungkidul Regency, Yogyakarta. The results of this research showed that technological knowledge can be legally conducted based on educational psychology, pedagogical competence, social competence, and creativity of teachers. The benefits of this research are to give perspective to teachers related to the importance of implementing Computer-Based Learning in their teaching.

**Keywords:** *Computer-based learning, digital technology, fundamental improvement technological knowledge*

## 1. INTRODUCTION

E-learning is not a new learning method in education. Online learning is a part of distance education. Learning process in the network involves information and communication technology. Utilizing technology for learning is the third generation in distance education (Anderson & Dron, 2011). Technology is used as a bridge between teachers and students in delivering subject matter. The use of communication and information technology is one of the working tools in learning in the XXI century (Griffin et al., 2012). XXI century learning is directed at the delivery of learning materials using communication and information technology.

The use of technology in learning is directed at helping students to develop technological skills as part of the competence of the XXI century (Haryono, 2017). The skills needed can be categorized into 4 groups, including 1) ways of thinking (creativity and innovation; critical thinking, problem solving, decision making; learning metacognition), 2) how to work (communication and collaboration), 3) tools for work (information literacy, ICT literacy); and 4) live in the world (life and career, personal and social

responsibility) (Griffin et al., 2012). These skills need to be acquired and developed by students. The use of technology in learning is expected to be able to help students develop the skills needed in the XXI century.

In the XXI century learning, teachers and students are required to be literate in digital technology (Syahputra, 2018). The adequate understanding of teachers and students about technology can facilitate the integration of technology in learning. Teachers must be able to utilize technology in learning and teaching, to increase the efficiency and effectiveness of students' learning (Peraturan Menteri Pendidikan dan Kebudayaan Nomor 22 Tahun 2016). In order to develop the efficiency and effectiveness of technology integration, it is now collaborating with the internet network.

Learning in networks (e-learning) refers to the use of computer network technology and the internet to communicate or convey information and instructions to individuals (Wang et al., 2010; Arkorful & Abaidoo, 2015). The learning model that integrates computer technology in learning is CBL (Computer Based Learning). CBL presents interactive learning, provides instruction, tests, and student feedback independently, with very little or no teacher involvement (Darmawan,

2011; Ruliah, Syahril, & Muchtar, 2019). CAI and CBI are forms of computer-based learning.

The use of computers in learning can be done by means of Computer Assisted Instruction (CAI) or Computer Based Instruction (CBI). CAI refers to a type of software program (software) for the benefit of the learning process (Voogt & Fisser, 2015). The application of CAI changes the way of delivering material, storing, and distributing material to students to become more practical. Integrating CAI in learning does not completely eliminate the role of the teacher; computers only act as a companion in delivering learning material.

CBI or Computer Based Instruction is a process in which the computer sends some subject matter to students (Aker & Hossain, 2013). Material delivery can refer to teaching and learning activities on computers that have been designed according to the subject matter. CBI is designed as an informative and interactive tool that keeps students actively involved in discovering new knowledge. One example of using CBI that can be applied is web-based learning, such as Google Classroom, Zenius.net, Edmodo, and others. The difference between CAI and CBI lies in the active involvement of students in the operation software.

According to the delivery of information and communication, e-learning has two types, namely synchronous and asynchronous. Synchronous uses technologies such as website conferencing, live streaming, including video conferencing that allows direct social interaction and feedback between students and teachers (Giesbers et al., 2014). Learning that uses synchronous means that students and teachers interact / communicate directly in a virtual place at the same time, whereas asynchronous communication is done at different times. Asynchronous communication does not demand a direct response from students. Examples of asynchronous use of websites, email, community forums, and so on.

Currently learning is being carried out online to avoid the massive spread of the Covid-19 virus. This learning policy began to be implemented on March 9, 2020 after the Minister of Education and Culture Nadiem Makarim issued Circular Numbers 2 and 3 of 2020 regarding online learning and working from home in order to prevent the spread of Covid-19. Following up on this circular, the local government issued a policy to implement learning from home. In line with this, the teacher turns face-to-face learning into online learning. Online learning requires extra creativity and innovation from the teacher. To maximize creativity and innovation in online learning, teachers need to master technology ranging from simple to complex. This will be an obstacle for teachers who have not got used to it using technology in the learning process.

Technological knowledge is part of the building blocks of TPACK (Technological Pedagogical Content Knowledge). Technological knowledge includes understanding how to use computer software and hardware, presentation tools such as presentation documents, and other technology and being able to overcome problems that arise in an educational context (Rosyid, 2016). Teachers need to understand how to operate technology so that if an error occurs in integration, the teacher is able to handle and solve the problem. Besides understanding device usage (laptop, computer, CPU, device, LCD, printer, viewer, etc.), teachers need to understand the workings of a software. Not only limited to understanding software and hardware, technological knowledge also includes the ability of teachers to adapt and learn new technology (Rosyid, 2016). The demands of teachers in the use of technology are stated in the Government Regulation of the Republic of Indonesia Number 74 of 2008 concerning Teachers Chapter II Competence and Certification, paragraph 4, which states that in pedagogical competence, a teacher at least utilizes learning technology. Apart from pedagogical competence, social competence also directs teachers to at least use communication and information technology functionally. Thus, a teacher is directed and should understand about technology.

Technological knowledge it can be interpreted as an understanding of the harmony of the integration between technology and human resources which can increase the knowledge of students. Teachers are not fixated on the use of technology only but also pay attention to human resources and effectiveness in increasing students' knowledge. Teachers need to select and determine the technology used in the teaching and learning process. Choosing and determining this technology that needs to be considered by teachers. This is because learning that integrates technology is more complex and must be faced by teachers.

Selection and determination of technology in learning is necessary pay attention psychology of the learners. Teachers need to understand the psychology of students in order to achieve learning goals. In the Government Regulation of the Republic of Indonesia No. 74/2008 concerning Teachers' Competence and Certification, states that the pedagogical competence of a teacher must understand students. Psychology is Greek which means science of the soul. Psychology in education is a sub-discipline of applied psychology. In principle, educational psychology is a sub-discipline of psychology that talks about human behavior in the teaching and learning process (Ichsan, 2016).

Understanding of the psychology of students can influence learning planning and technology choices. Teachers need to consider the stages of cognitive development of students. With regard to the selection

and determination of technology for the introduction of learning styles possessed by students, it is necessary. Knowing learning styles will help teachers to choose appropriate learning activities and make it easier for students to receive information (Cahyani, 2016). This is because the use of appropriate technology in learning will make it easier to achieve predetermined learning objectives. Use technology in learning is not limited to giving and tools for collect assignments.

It should be remembered that currently students live in the post-millennial era who prefer the use of digital tools and online forums that are integrated in learning (Lase, 2019). The post-millennial generation or generation Z is a generation born in the internet era. Learning in generation Z requires innovation and teacher creativity, especially the use of information technology. In utilization technology guru must make use of network applications to communicate (Sukono, 2018). This matter related in a way generation Z in obtaining information that is fast, effective, and practical.

Based on the description above, the formulation of the problem in this study is what is the basis for improving the technological knowledge of teachers in the application of Computer Based Learning. In line with the formulation of the problem, the purpose of this study is to describe the basis or reason for improving technological knowledge in order to apply Computer Based Learning. The benefit of this research is to give a perspective to teachers that teachers need to know that apart from the four basic competencies (pedagogical competence, professional competence, social competence, and personal competence); teachers need to understand technological knowledge.

## 2. METHODS

This research used qualitative-descriptive method. In the article, the researcher aims to describe the technological knowledge possessed by Indonesian language teachers in Gunungkidul Regency, Yogyakarta Province. The object of this research is to measure teachers' technology knowledge. The data also collected through a questionnaire and interviews with several Indonesian language teachers at junior high school. Locational data source of this study were several junior high schools in Gunungkidul Regency, Yogyakarta Province.

The data collection technique is done by using questionnaires, interviews, observing and taking notes. The questionnaire consists of three main aspects. The aspects used in the questionnaire consisted of the use of the Internet, facilities and infrastructure (16 questions); Use of Information Technology in Learning (10 questions); Teachers' Attitudes toward the Use of Information Technology in Learning (6 questions). For

interviews focused on the software or applications used by the teacher and the extent to which the teacher understood the software used. The observation and note technique were used to collect data related to the technological knowledge of the teacher. Data analysis in this study applies three main lines, namely, data reduction, data presentation, drawing conclusions (Miles & Huberman, 1992), which is then carried out by interpreting the data. Data reduction in this study is concerned with sorting data according to the statement. The aspects that are reduced in this study are 1) teachers' knowledge of hardware and software; and 2) the variety of applications / software used by teachers. After data reduction is done, data presentation is performed. Data is presented in tabular form which is further described. Based on the description of the data, the next step is to draw conclusions. The final step of data analysis in this study is to interpret the data.

## 3. FINDINGS AND DISCUSSION

Teachers at all levels of school must be ready and continue to develop competency in knowledge about technology. A teacher needs to fulfill four main competencies, namely pedagogic competence, professional competence, social competence, and personality competence (Government Regulation of the Republic of Indonesia Number 74 of 2008). Competency aspects related to the use of technology are pedagogical competence and social competence. In the Republic of Indonesia Government Regulation Number 74 of 2008 concerning Teachers Chapter II Competence and Certification of Article 3 paragraph 4, it is stated that in pedagogical competence, a teacher at least makes use of technology in learning. For social competence, it is stated in paragraph 6 which states that a teacher at least uses communication and information technology functionally. Using technology in learning can support the achievement of learning objectives. Given the development of the industrial era which has begun to enter the 4.0 era and the demands of learning in the XXI century which require teachers to take advantage of and be literate in information technology (Syahputra, 2018).

### 3.1. Teachers' Knowledge of Hardware and Software

The integration of technology in learning is directed at helping students develop technological skills as part of the competency needs of the XXI century (Haryono, 2017). To actualize these directions, teachers need to have knowledge of technology. The ability of technological knowledge in this study is limited to the teacher's knowledge of hardware, software, and the variety of applications / software used by the teacher. The technological knowledge aspect includes knowledge of hardware and software usage.

**Table 1.** Use of hardware and software

Knowledge	Aspect	%	Information
Technological knowledge	Use of hardware	90	Most teachers are able to use hardware such as printers, scanners, projectors, flash drives. There are still teachers who don't know OTG (On The Go).
	Use of software	88	Teachers are able to operate Google Classroom, Google Meet, Microsoft applications, Cloud Service, online learning websites, platforms to support the teaching and learning process. However, there are still teachers who have not maximized and provided variations in the use of software in learning.

Based on Table 1, the teacher's ability to use hardware is very good. This is because 90% of teachers are able to use or operate hardware. The hardware used by teachers is still limited to operating printers, scanners, projectors, flash drives and OTG. On The Go (OTG) is additional hardware to connect a device (smartphone) with a device that has a USB-A port. The use of OTG allows teachers to transfer files from flash disks without having to connect them to a Personal Computer (PC). This makes it easier for teachers to move files that will be shared with students. Hardware is a device that can be seen and touched. Ability to operate hardware can make it easier for teachers to integrate technology in learning. As previously described, technological knowledge includes understanding how to use computer software and hardware, presentation equipment such as presentation documents, and other technologies and can overcome problems that arise in the context of education (Rosyid, 2016).

The use of software in this study is limited to the operation of a web browser, Microsoft applications, Cloud Service, online learning websites, and platforms. Based on questionnaire results, 88% of teachers who are able to operate the software. This is confirmed by the results of interviews which state that there are still teachers who have not been able to carry out learning with communication technology and information. This inability can be caused by several factors such as the availability of infrastructure and knowledge about the use of technology. The teacher uses a web browser as a search engine for information related to learning materials. The browser is a program designed to retrieve information from a computer server on network internet (Nugroho & Purnama, 2012). By using a web browser, the teacher can search for material supporting information so that the material provided to students is more varied.

Teachers use Microsoft Office limited to Microsoft Word, Microsoft PowerPoint, and Microsoft Excel (as

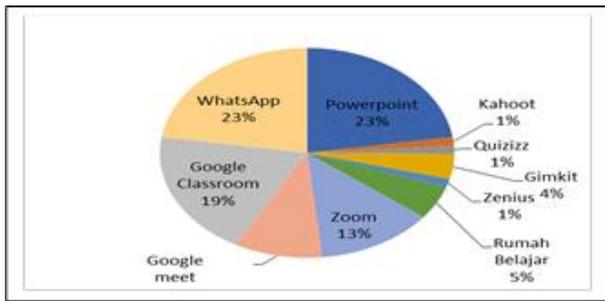
processing students' grades). Further, based on the questionnaire that has been filled in by teachers, it was found that the teacher did not use online learning websites and platforms in learning. In addition, 20% of teachers have not used online platforms for quizzes. Teachers need to provide variety and develop creativity in packaging learning materials into a software. This packaging needs to consider the psychology of the learner. Understanding of students is a demand for pedagogic competence listed in the Government Regulation of the Republic of Indonesia Number 74 of 2008 concerning Teachers Chapter II Competence and Certification paragraph 4. Conduct an understanding of peas well as students It is expected that teachers are able to educate according to the stage of development pas well as students (Dodi, 2016).

Learning online cannot be used as an excuse for teachers to only assign assignments to learners. Teachers need to create fun learning without neglecting the learning objectives to be achieved. Given the development stage of peas well as students is at a very rapid stage in all aspects. Development of cognitive aspects of peas well as students based on Piaget's theory is in the period of formal. At this stage, peas well as students able to think symbolically and understand something meaningfully (Samiudin, 2017). At this stage, learners can understand imaginative things without concrete objects and even visual objects. In addition to cognitive development, teachers need to pay attention to the learning styles of students. Recognizing student learning styles will make it easier for teachers to choose appropriate learning activities and make it easier for students to receive information (Cahyani, 2016). Learning styles of students today are not only limited to visual, auditory, and kinesthetic.

The use of technology in learning can support teacher confidence when delivering learning. As many as 92% of teachers agree that the use of technology can increase self-confidence. However, a teacher also needs elaboration in the delivery of teaching materials. In delivering teaching materials, teachers also use e-books, as many as 75% of teachers have used e-books. An e-book or electronic book is a publication consisting of text, images, video, and sound and is published in digital form that can be read on computers or other electronic devices (Ruddamayanti, 2019).

**3.2. The Variety of Applications / Software Used by Teachers**

Online learning requires extra creativity and innovation from the teacher. To maximize creativity and innovation in online learning, teachers need to master technology ranging from simple to complex. Figure 1 shows the software and applications used by teachers to support learning during the Covid pandemic.



**Figure 1** Software and applications used by teachers.

The use of software that is often used by teachers in learning such as 23% Powerpoint, 1% Kahoot, 1% Quizizz, 4% Gimkit, 1% Zenius, 5% Rumah Belajar, 13% Zoom, 10% Google Meet, 19% Google Classroom, and 23% WhatsApp. Many teachers use PowerPoint software and Whatsapp applications. Based on interviews, the use of these software and applications is because they are easy to operate by both teachers and students. However, it is necessary to pay attention to the effectiveness of using software and applications in delivering learning materials.

There are softwares that are rarely used by teachers in learning, such as Kahoot, Quizizz, Zenius, Gimkit, Zoom, Googlemeet, Google Classroom, and Rumah Belajar. The thing that becomes a consideration for using this software is the ability of teachers to operate, facilities, and infrastructure. Seeing this fact, it would be helpful if there are trainings on how to use the software and procurement of adequate facilities and infrastructure. The more software mastered by the teacher will provide new colors in the learning process. Given that teachers need to present learning that utilizes technology that leads to technological skills as part of the competence of the XXI century (Haryono, 2017).

Software used by teachers to support online learning is classified into 2 types, namely CAI and CBI. CAI refers to a type of software program for the benefit of the learning process (Voogt & Fisser, 2015) such as using Powerpoint, Whatsapp, Zoom, Kahoot, Gimkit, Google Meet. Teachers began to innovate the use of some software. The use of software should be directed to stimulate and train the way of thinking (creativity and innovation, critical thinking, problem solving, decision making, and learning metacognition) of students. This is related to the skills needs of the XXI century which include 1) ways of thinking, 2) to communicate, 3) tools to work, and 4) live in the world (Griffin et al., 2012). While Google Classroom, Rumah Belajar, and Zenius are CBI (Computer Based Instruction) which is a process in which the computer sends some subject matter to learners (Aker & Hossain, 2013). Students play an active role in finding new knowledge and teacher involvement is very little. Given that CBL learning presents interactive learning, provides instruction, tests, and student feedback independently,

with very little or no teacher involvement (Darmawan, 2011; Ruliah et al., 2019).

The things that need to be considered by the teacher are variety and creativity in usage software. This needs to be endeavored by the teacher even though learning using technology is more complex than learning without technology integration and must be done by the teacher. Given the rapid and rapid development of technology. Every teacher have their own considerations in choosing and determining the technology that is integrated in learning. The use of WhatsApp and Powerpoint applications still dominates the software used in learning. The selection and use of this software are based on practicality in use. The use of software is limited to tools for delivering materials and delivering assignments. Whereas to develop the ability of technological knowledge, a teacher needs to adapt and learn new technology (Rosyid, 2016). Adapt and learn new technology is important for teachers.

Based on the analysis above, it can be concluded that the technological knowledge of the teachers is good and needs to be improved in selecting variations in the use of software, creativity teachers in packaging technology-based materials, and teacher innovations in integrating technology in learning. Be side's government policy to learn from home, teachers need to improve their abilities in the field of technology. This is because education in the XXI century and the demands of education in the 4.0 revolution era that integrates technology. The selection and determination of the technology used must consider the abilities and psychology of students who are the central objects in education.

#### 4. CONCLUSION

The results of this study indicate that the knowledge of technological knowledge of Indonesian language teachers in SMP in Gunungkidul Regency is good. Based on research that has been done, things that need to be improved by the teacher are 1) paying attention to the level of cognitive development of students, 2) skills needed in the XXI century, learning strategies, 3) considering students' learning styles in setting technology, 4) creativity in packaging technology-based learning materials, and 5) innovation in integrating technology. Thus, the basis for increasing knowledge can be done legally based on educational psychology, pedagogical competence, social competence, and teacher creativity.

The use of appropriate technology in learning can support the achievement of the skills needed in the XXI century. Teachers need to create fun learning without neglecting the learning objectives achieved. This research is limited to examining the results of questionnaires and interviews with teachers, which can

be complemented by observing the lesson plan that has been compiled by the teacher. Apart from observing the lesson plans, it is necessary to observe their implementation in order to prove the lesson plans that have been prepared by the teacher.

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