SCIENTIAE EDUCATIA: JURNAL PENDIDIKAN SAINS

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Analysis of Students' Digital Accessibility in Terms of Use of Technology and Obstacles Faced in Learning Biology

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a r t i c l e i n f o	a b s t r a c t
	The need for labor in the future has more complex criteria than what is needed today. The increasing complexity of these criteria is due to technological advances which are increasingly shifting the position of humans at work. Technology has advantages and stability and can predict the results obtained. So it is essential for everyone to prepare for the increasingly fierce competition in the world of work. One of the efforts made is to familiarize students with technology at school. However, this needs to be supported by the availability of facilities and infrastructure as well as the ability of students to adapt. So this study aims to capture the digital accessibility of students in terms of the factors and obstacles they face in using technology. These data were obtained by applying the survey method to 41 students at SMA Bandung City. In this study, the data were analyzed quantitatively and represented in the form of diagrams. The results of data analysis show that students have adequate digital accessibility. This is indicated by their readiness and independence in learning technology as an additional learning resource. However, the biggest obstacle students face is the lack of stability in the internet network. So that it interferes with the learning process. 2022 Scientiae Educatia: Jurnal Pendidikan Sains

1. Introduction

Technological developments that are currently happening rapidly affect human life in various sectors (Barosz, Gołda, & Kampa, 2020; Davenport, Guha, Grewal, & Bressgott, 2020). The existence of machines has eased human work, such as robotic vacuum cleaners that can complete homework, silent speakers that can automatically dim the lights, and refrigerators that can order fresh food online. But at the same time, machines have also eliminated some human jobs. The ability of robots to perform routine tasks has changed the work system from what was previously done manually by human workers to be automated (Chui, Manyika, & Miremadi, 2016; Özkiziltan & Hassel, 2021). Prediction of results and quality can also be determined by machine. Humans today need to develop certain skills so that their jobs are not easily replaced by machines

The phenomenon of the erosion of human position caused by technological developments is called human vs machine (Powell, Noble, Noble, & Han, 2019). Machine automation is the focus of research development in the field of science and technology. Based on the data, machine automation can help human work as much as 45% compared to using human power (Chui et al.,

2016). Even today a machine can be operated by a robot so as to make production faster and more orderly when compared to humans acting as operators (Barosz et al., 2020).

In some studies, the rapid development of technology will make human labor less desirable. This is because machines can do dangerous work that cannot be done by humans, and work more efficiently, flexibly, more precisely, and on target as designed (Barosz et al., 2020; Özkiziltan & Hassel, 2021). However, not all jobs can be replaced by machines such as manual and cognitive non-routine tasks. This is difficult for machines to do because it requires adaptation, visual and language skills, and personal interaction. Meanwhile, non-cognitive routine tasks involve problem-solving skills, intuition, creativity, and persuasion that cannot be replaced by computers (Özkiziltan & Hassel, 2021). This condition results in a shift in the demand for the required workforce so as to encourage people to learn new skills to adapt to the needs and demands of the times.

The human qualities needed today are not oriented to their physical ability to work. Rather, they are those who can easily adapt to changes and contribute to the development of the systems in which they work. The Organization for Economic Co-operation and Development here in after abbreviated as OECD groups three types of skills needed by humans to be successful and productive in their work environment. The types of skills are a) cognitive and metacognitive skills including critical thinking, creative thinking, learning-to-learn, and self-regulation; b) social and emotional skills including empathy, self-efficacy, responsibility, and collaboration; c) practical and physical skills, which include using new information and communication technology tools (OECD, 2019).

Efforts to familiarize humans to have these skills are started at school. A flexible curriculum can be adapted to the needs of the workforce in the future. This starts with introducing students to challenges and ways to solve problems. Students will practice finding solutions to problems using various sources of information. If it is associated with technological developments, then they will seek information through digital media. These methods are taught through problem-based learning. This learning activity is much more effective if it involves the use of technology in delivering material (Siahaan, 2020; Sujadi, Kurniasih, & Subanti, 2017).

The integration of technology in education provides opportunities for students to access various information, communicate with experts and peers, and make scientific publications. The technology used massively provides an opportunity to expand learning time and increase student motivation (Wishnoebroto, 2010). This enables students to learn independently, think critically, solve problems, use information, communicate, innovate and collaborate (Moto, Ratanaolarn, Tuntiwongwanich, & Pimdee, 2018).

In addition, the use of technology as a learning medium will improve digital skills that need to be provided on an ongoing basis so that they are not outdated (OECD, 2019). This step is one form of preparing students to become competitive workers. However, when technology is implemented in learning, the teacher will have a different role than before. Teachers need to access the internet and get the information needed, use technology for learning activities, and provide appropriate learning resources in digital form (Hafifah & Sulistyo, 2020).

Therefore, to realize a society that is in accordance with the 21st-century framework, namely information and communication technology literacy, research is needed to measure the extent to which students' digital accessibility to the use of technology in learning activities is needed. To facilitate data analysis, the formulation of the problem in this study is

1. What are the factors that influence students' use of technology?
2. What are the obstacles faced by students in learning using technology?

The data are analyzed and presented in the form of a graph which is described in the next section

2. Method

This research was conducted by applying a descriptive survey research method. According to Fraenkel (2012), the survey method is a method used to obtain data from the population by distributing questionnaires to research participants. Researchers did not provide treatment as in experimental research. This research was conducted to obtain an overview of the level of digital accessibility of students and teachers. To support the quantitative findings, this research was also conducted by applying the interview method. This is done so that researchers obtain additional information in representing the numbers obtained through the survey method

The population in this study were students of class X SMA in Bandung, amounting to 41 people. This research is a preliminary study to carry out core research, namely building digital habits of mind of students through learning Biology by using Wikipedia. However, determining the number of samples in this study used a purposive sampling technique where the researcher determined the criteria for prospective research participants to have adequate digital accessibility. Therefore, the selection of research participants based on these criteria was carried out by applying the survey method, the results of which were described in this article.

The method of data collection in this study is by distributing questionnaires to students. The questionnaire used in this study is an attitude assessment with a range of values using 4 answer choices on a Likert scale. The Likert scale is a scale used to regulate attitudes, opinions, and perceptions of a person or group about social events or phenomena (Taherdoost, 2019). Research participants fill out a questionnaire by using a checkmark on the available answer choices. Table 1. Shows the instrument in this study.

Table 1. The instrument for gaining information about accessibility in technology

No	Aspects	Sub aspects
1	Basic Accessibility	Basic information
2	Digital Accessibility	Access to digital facility
		Teacher use and support for use of digital facilities
		Professional developments
3	ICT Accessibility	Use of mobile apps and communication
		Email information
		Use of computer and file management
		Use of Microsoft Office
		Use of email
		Use of web browser
		Using a platform for sharing content

The distribution of questionnaires to students and teachers is carried out online through the class LMS page. Surveys conducted online can be more efficient than in-person surveys. In general, the research conducted is illustrated in Figure 1.
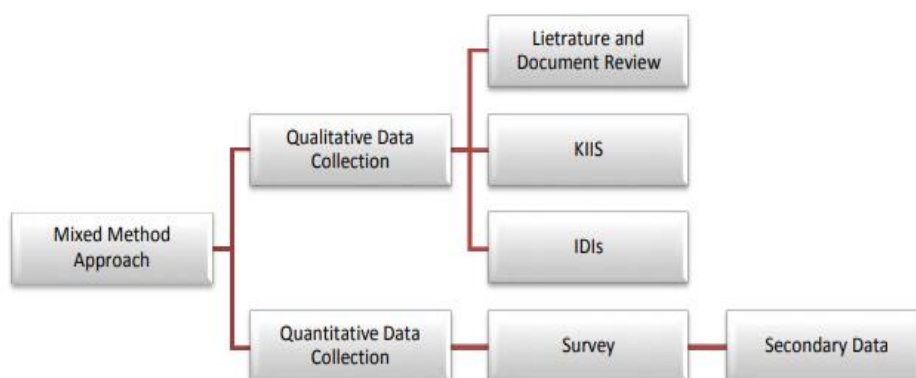
Figure 1. Research Flowchart

The data analyzed in this study is the data obtained based on the digital accessibility questionnaire of students in the third part. This is done because,- the amount of data obtained is quite large and does not have significant results. The diversity of data that is interesting to discuss is found in section 3. In the student accessibility questionnaire, section 3 collects data about things that affect the use of digital devices and the obstacles they face.

3. Result and Discussion

Technological developments make every aspect of life adapt in order to compete and increase the value of productivity. The efforts made are to follow and apply these technological developments in facilitating the work. Technology gives humans more time to do several things at the same time. In line with these developments, technology is now widely used in learning.

Research on technology in learning is mostly done to obtain effective methods, and learning tools, as well as a place for students and teachers to interact with each other (Ginola, 2016; Saputra, Suwiryo, & Artyana, 2018; Sujadi et al., 2017). However, to be able to use technological facilities, both students and teachers are currently required to have adequate digital accessibility (Kahar, Hanafi, & Alberth, 2016). As described in the previous section, the aim of the research is to analyze the digital accessibility of students.

Knowledge or access of students to technology is a basic thing that must be met before doing online learning. They not only have and know the use of technology but this ability is accompanied by their knowledge to find portals or websites that can help them in completing school assignments. This behavior reflects the students' information-seeking behavior.

The behavior of students in seeking information is an action that students take independently to state what information they need and seek that information (Singh, Kumar, & Khanchandani, 2015; Yamin, Ramayah, & Ishak, 2013). The information obtained is then evaluated and will ultimately satisfy the students' needs for that information (Hjorland, 2012; Morrison, 1997). The application of the information obtained is used by students to solve problems (Lloyd, 2017) Research conducted by Sulaiman (2020) suggests that there are several factors that are factors in students' information seeking behavior, namely group cooperation, students' anxiety about information and skills needs in using technology.

Skills in using technology are important skills for students to have in the 21st-century learning era. 21st-century learning is usually found in various forms, e-learning, online courses, electronic library, Computer Assisted Instruction (CAI), mobile learning (m-learning), and virtual reality-based learning (Lestari & Prasetyo, 2019). In addition, skills using technology can be taught through learning methods. Research by Eliana, Gymnastics, Wilujeng, & Jumadi, (2016) shows that Project Based Learning can improve students' skills in using technology. Because the project is elaborated with e-learning. In line with this, Thoriq (2018) chooses Moodle as the discovery learning method to improve students' skills in using technology. Because discovery learning can

lead students to obtain information using technology. So it can be said that technology has an important role in the learning carried out by students. The rapid development of technology not only helps students but can also be a distraction to learning. Therefore, in this section, we discuss specifically the factors that influence students to use technology and the obstacles they face.
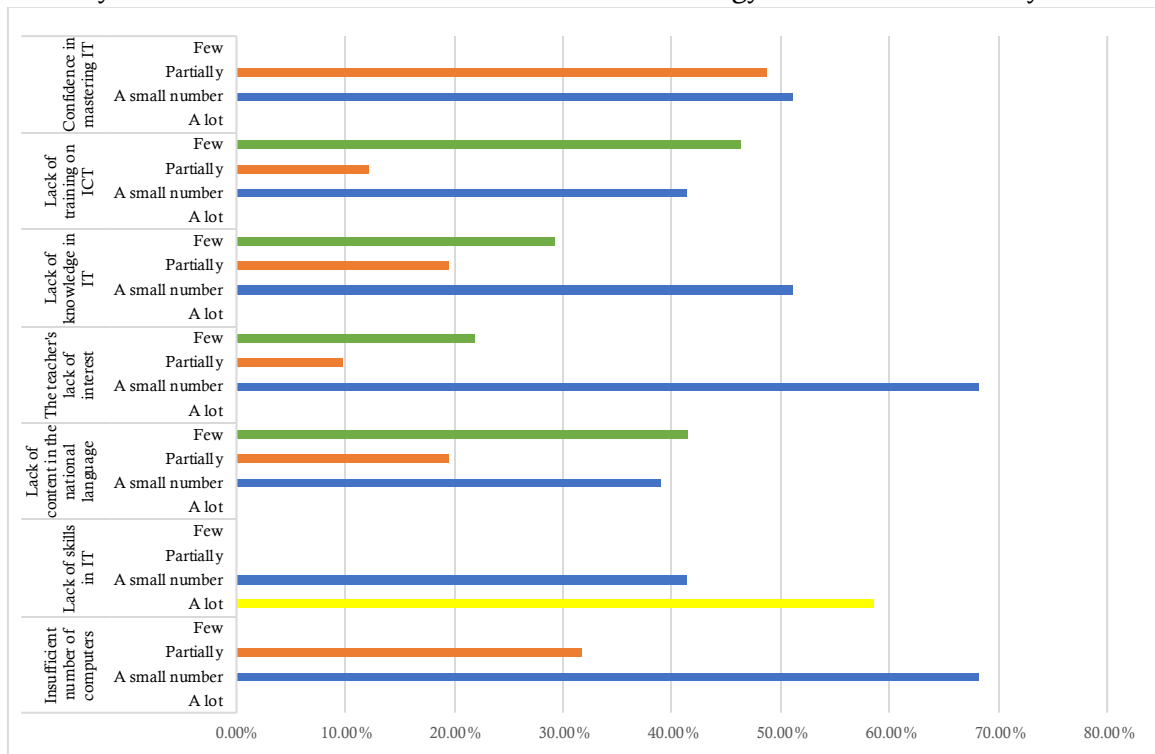

Figure 2. Factors of the student using technology

Figure 2 is the result of data analysis from the student's digital accessibility instrument part 3. This section provides information on the factors that influence students' IT use. There are seven aspects that the data capture, namely, (1) student confidence, (2) lack of IT training, (3) lack of IT knowledge, (4) lack of teacher interest, (5) lack of content in the national language, (6) lack of skills in IT and (7) The insufficient number of computers. The x-axis shows the percentage of students who choose the attitude scale based on the aspects on the y-axis. In general, Figure 2 shows that each aspect was chosen with a significant comparison, meaning that there is a large gap or difference, which is more than 15%, except for the first aspect. However, the differences in attitude scale differences are mostly on the partial and few scales.

Self-confidence is an important attitude for students as learners. High self-confidence is shown by an attitude that dares to express opinions and is more open and confident in the decisions taken (Aristiani, 2016). If it is associated with technology, students' self-confidence will tend to make them more adaptable to various types of technology, especially technology related to school lessons. This means that students' confidence in using IT is in the moderate category. Students' self-confidence can change depending on how teachers use learning methods. When teachers teach by involving technology, the confidence of students also increases (Laksmiwati, 2018). In addition, students' self-confidence also increases with the use of social media as a means for students to communicate (Lubis, Lubis, & Purba, 2020). Muhtia, Suparno, & Sumadi, (2018) found the use of the LMS also increased students' self-confidence, because the use of the LMS made students learn more independently with the materials included in the LMS. That way students will be more confident because they can control the methods they use in learning. This is

in line with the research of Cakir, (2012), which states that self-confidence will arise when students can do something and succeed, so they will be more motivated and tend to want to repeat it.

The second aspect is the lack of training in ICT. In this aspect, there are no students who choose the "many" attitude scale. This means that formally or informally, students have attended training using ICT. Based on the graph in Figure 2, about 46% of students who chose not all. So it can be concluded that the lack of ICT training is not the main factor for them to use technology. Even without training, they can use technology with the help of other sources, such as tutorials on the internet. The same is shown in the third aspect, namely the lack of IT knowledge. Figure 2 shows that none of the students chose the "many" scale. The choice of these students shows that they have adequate knowledge of technology. This indirectly confirms the findings in the second aspect. Because the second aspect shows the independence of students in finding out the use of technological devices which is supported by findings in the third aspect which shows their ability to adequate technology.

The next aspect is the student's assessment of the teacher. Students choose the attitude scale subjectively by looking at the daily life of the teacher teaching. The learning experiences they get on a daily basis are outlined in the fourth aspect of the assessment, namely the lack of teacher interest. If students feel that teachers often use technology in learning, they conclude that their teachers have a high interest in technology. Vice versa. The diagram in Figure 2 shows that students choose a scale other than the "many" scale. This shows that they think their teachers can and have a high interest in using technology. The findings in the fourth aspect relate to the next aspect, namely the lack of material with the national language. This is a problem faced by students in finding learning materials. The lack of available materials makes teachers use technology in learning.

The fifth aspect is the lack of skills in using IT. Figure 2 shows different results from some of the previous aspects. If previously the large scale was not selected, then in this aspect the "many" scale is filled with a percentage of 58%. This is in stark contrast to the previous aspect. If in the second aspect, students are confident in their technological abilities, then it should be linear with this aspect, namely skills in using IT. After analyzing the data, the researcher confirmed it with the students. The researcher randomly asked the students about the differences in their answers in the second and fifth aspects. Students revealed that they could indeed use technology but were not skilled. They consider that skill is an ability that can not only use but also solve problems related to technological devices. Students use technology devices available at school. They said that school computers can be used properly, but still use the services of technicians if problems occur. The findings in the fifth aspect relate to the sixth aspect, namely the insufficient number of computers. The data in Figure 2 shows that none of the students chose the "many" scale, so it can be concluded that the computer facilities at their school are quite capable. In addition, they also have a computer or laptop at home.

In general, the findings of these aspects indicate the lack of factors that prevent students from accessing technology. But that does not mean learning by using technology does not have obstacles. Data regarding the obstacles experienced by students are shown in Figure 3.
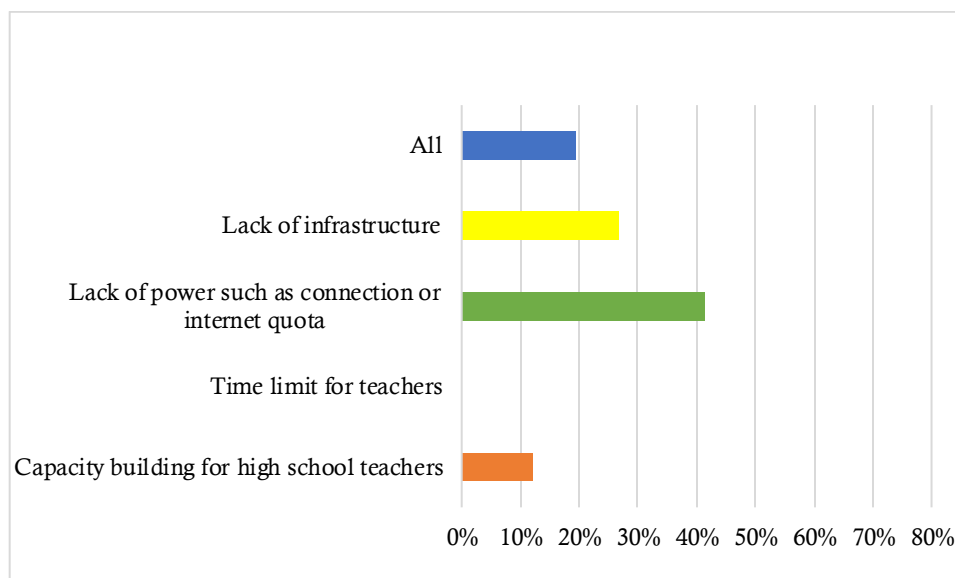
Figure 3. Obstacles faced by students when using technology

Researchers provide several options that become obstacles that students may experience, including: (1) teacher capacity, (2) time limits for teachers, (3) lack of internet access, (4) lack of infrastructure (5) all. The fifth option means that students are constrained in all the available options. These constraints are selected based on external factors that affect students' use of technology in learning. External factors were chosen to be taken into consideration for the school to improve the facilities and infrastructure of the school being fostered.

The first aspect that needs to be reviewed is the capacity of the teacher. As many as 12% of students chose to improve teacher capacity. However, the figures shown are still quite small when compared to other aspects. This means that the teachers who teach at the school have sufficient knowledge of technology. Adequate knowledge of technology helps teachers to combine pedagogical objectives and the type of technology to be used (Greener & Wakefield, 2015). In addition, knowledge of various kinds of technology will increase teacher confidence in teaching (Francom & Moon, 2018). Success in learning is seen when the teacher has self-confidence, so students are confident in the power and abilities of the teacher so that they will be more motivated in learning (Malureanu, Panisoara, & Lazar, 2021). Therefore, a training program on the use of technology in important learning is highly recommended (Erdermir, Bakirci, & Eyduran, 2009). However, not all teachers receive formal technology education in their respective teacher schools, and this is also a challenge faced by teachers today (Efriana, 2021; Titi & Sumarni, 2020). In addition, the age factor also affects teachers to use the internet. Older teachers think that there is no need to use technology in learning. They are more comfortable using the method they are used to (Surahman, Santaria, & Setiawan, 2020)

The relationship between teachers and technology has now become the focus of research and development in the world of education. Koehler & Mishra, (2006) added a teacher competency framework, namely Technological Knowledge (TK). In this case, Technological knowledge is a synthesis and integration between ICT in the learning process in the classroom. As technological knowledge in learning is described as a form of multi-integration and transformation (Holland & Piper, 2016). The boundaries of technological capability sometimes overlap. These limits classify forms of knowledge. For example, when discussing knowledge related to the use of online facilities for discussion and finding references in meeting material (Dalal, Archambault, & Shelton, 2017). The use of software such as Google Earth and SPSS can be classified as

Technological Knowledge if it is integrated with the pedagogical component. However, when the software is used for other general knowledge purposes that do not contain a pedagogical component, the software has not shown technology in learning.

Teacher skills development programs are currently in great demand, such as workshops, training, or in the form of seminars. In general, increasing trust about technology integration should be the main goal of a training program (Nelson, Voithofer, & Cheng, 2018). A more tangible integration between technology and pedagogy can be obtained in training programs (Brinkley-Etzkorn, 2018). Technological capabilities can be seen from the teacher's learning planning, from the planning it can be seen what touch of technology is used to represent the concept (Akyuz, 2018).

The next aspect is the constraint regarding limited internet access and lack of infrastructure. The obstacles faced make learning ineffective (Ariani, 2021). The aspect of internet limitations is the aspect that most students complain about, which is 41%. Constraints in this aspect have been increasingly felt since the COVID-19 pandemic hit. The needs of students for internet access are more than usual. The lack of internet access is felt not only by rural communities, but also by people living in urban areas. This is due to uneven geographical conditions (Rigianti, 2020). The results obtained in this study were confirmed by Abroto, Prastowo, & Anantama, (2021), about 41% of students also complained about an unstable internet network. So that the learning process will be disrupted and learning time is spent looking for a place to get better internet access. This aspect is related to the next aspect, namely the lack of infrastructure. The use of school computers whose functions are not optimal makes students feel that this sector needs to be improved.

4. Conclusion

Based on the results of data analysis, it can be concluded that the digital accessibility of students is sufficient if they do online learning. This can be seen from how independent they are in using technological devices. By getting used to following technological developments, you will indirectly prepare yourself to become a workforce with the skills needed in the future. However, the habituation of students using technology in schools has several obstacles. The aspect of internet network availability is the vehicle with the largest percentage faced by students. The results of this study are expected to be considered for updating the system or training process for teacher competency development. The school should try to provide adequate facilities to students. In addition, teacher-producing universities can include programs or courses related to the development of teacher technology skills (Technological Knowledge).

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