



VHS Teachers' ICT Literacy: Infrastructure and Motivation of Internet Access

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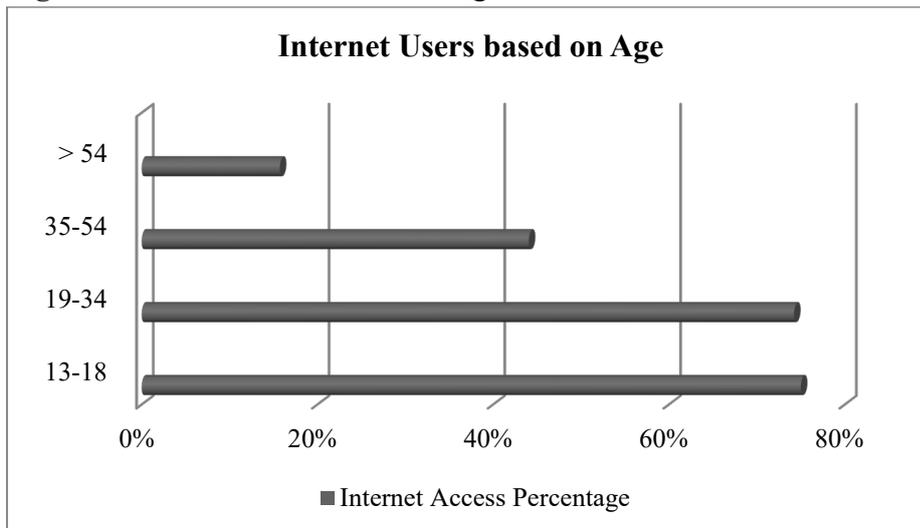
Disruption has been a common phenomenon that has impacted all sectors including education. The development of ICT has caused a shift in behavioural patterns, teaching patterns, performance patterns and changes in facilities so that are able to adjust. Being able to read, count, write and having basic knowledge is not enough, multi-literacy skills are needed to survive; one of which is ICT literacy. This study discusses the description of the availability of infrastructure and motivation possessed by Vocational High School teachers as a determinant factor for increasing ICT literacy. The availability of computers and internet access both at school and at home are identified. A survey with a quantitative approach was chosen as a research method. A total of 173 respondents filled out an online questionnaire provided by the researchers. Respondents were selected randomly. Less than 20% of respondents had limitations in infrastructure both at school and at home. Availability of internet access in certain areas in schools included, computers equipped with internet access for teachers, computer labs with internet access and personal computers special for home use are opportunities to optimize teacher literacy. The motivation that drives teachers to access the internet and content is accessed and discussed in this article.

Key words: *ICT literacy, infrastructure, motivation, vocational high school teacher.*

Introduction

Information and communication technology (ICT) literacy skills are required to be possessed by every individual who lives in the era of disruption like today (T. Kurniawan, 2018). The 2015 *World Economic Forum* established six basic literacy components to survive in the era of disruption namely, literacy, science, finance, culture, citizenship and ICT (WEF, 2015). ICT Literacy is defined as the ability to use digital technology, communication tools and networks in defining, accessing, managing, integrating, evaluating, creating and communicating the information well and legally in order to build a knowledgeable society (M. Skryabin., et.al,2015). As many as 143.26 million people in Indonesia or 54.68% of the total population of 262 million are internet users and an increase of 10.56 million from 2016 (APJII, 2018). The majority of internet users are still in the Java region that makes up to 58.08%, 19.09% are in the Sumatra region, 7.97% are in the Kalimantan region, 6 are 73% are in Sulawesi Island, 5.63% are in the Bali-Nusa region and 2.49% are in the Maluku-Papua region. Based on the age of the user, 75-50% are 13-18 years old, 74.23% are 19-34 years old, 44.06% are 35-54 years old and 15.72% are over 54 years old. The type of device commonly used to access the internet are personal tablet/smartphone, which is 44.16% and personal computers/laptops which are 4.49%. There are 39.38% of users who use both devices and 12.07% who use other devices. This data can be seen in Figure 1 below. Based on the data above, the development of ICT is an integral part of modern human life. The need for internet access seems to be included in Maslow's hierarchy of human needs, which is more fundamental in its position than the need for food, shelter and clothing (E. Fife and F. Pereira, 2008).

Figure 1. Internet Users based on Age



The development of ICT contributes to the education sector. Digital competence of students is an important educational goal in the 21st century (K. Kereluik, P. Mishra, C. Fahnoe and L. Terry, 2013). There are at least five shifts related to the learning process impacted by the



development of ICT, namely the shift from training to performance improvement, the shift from real classrooms to virtual classrooms that can take place anytime and anywhere, shifting from paper-based to online-based, the shift from physical facilities to networked facilities and the shift from cycle time to real time (P. Luik and H. Kukemelk, 2008). ICT literacy in learning can be implemented as learning media used by teachers or students (V. Dagiene, 2003).

In ICT literacy, the three dimensions contained are dimensions of knowledge, expertise and skills (J. Ainley, W. Schulz and J. Fraillon, 2016) (UNESCO-UIS, 2015). These five competencies will be optimal if supported by the availability of adequate infrastructure. The availability of computers, laptops, tabs and cellular phones is known by the public as ICT infrastructure (Indrawan, 2015). 25.72% of Indonesia's population already have a computer or laptop and 50.08% have a smartphone or tablet (APJII, 2018). Infrastructure support is an important factor in the implementation of education which serves to provide convenience for both students, teachers and educational staff.

This article discusses facilities and infrastructure in supporting the improvement of ICT literacy of vocational high school teachers seen from the availability of computer labs in schools, internet networks in residential areas and internet networks in schools. In addition, the motivation of teachers to access the internet and frequently accessed content are discussed.

Theoretical Framework

Facility and Infrastructure

The facility is anything that can be used as a tool in achieving the intent or purpose (S. Ghavifekr and W. A. W. Rosdy, 2016). Educational facilities are tools that are directly used and support the teaching and learning process, such as buildings, classrooms, desk chairs, as well as teaching tools and media (P. J. Fortier, 2013). Educational facilities are needed in teaching and learning processes, both movable and immovable, so that the achievement of educational goals can run smoothly, regularly, effectively and efficiently. From some of these definitions, it can be concluded that educational facilities are all facilities that directly support educational processes, especially the teaching and learning process, both movable and immovable so that the achievement of educational goals can run smoothly, regularly, effectively and efficiently.

Facilities and infrastructure are the main factors in the advancement of education, along with the development of science and technology, internet-supported activities are a major part (F. McCampbell, Atefeh S; Liedlich, 1996). Therefore, the technological factor is something that absolutely must be available and must meet the minimum standards required, both

related to equipment, infrastructure, operation and maintenance. Ideally in using the internet for learning in schools, there must be a number of computers that can access the internet for learning in schools, there must be a number of computers that can access the internet even better if the computers connected to the internet are placed in special areas such as computer laboratories or in other rooms that are considered strategic. This is intended to provide convenience for teachers and students in accessing the internet.

The most effective and efficient way to connect a number of computers to the internet is to build a local network, Local Area Network (LAN) (C. C. van den Blink, 2015). With the availability of a network, only one connection is needed to be used jointly by computers integrated into the network. One of the most important things from the network and connection to the internet for learning purposes is its reliability so it can be used at any time for 24 hours with a very minimal level of interference or failure.

- **Computer Laboratory**

The computer laboratory is a classroom equipped with computer facilities, internet network and *hotspot/wireless*, which are used for ICT learning for students and teachers and interested educational personnel. Computer laboratories are facilities designed to be an ideal learning environment. Computer laboratories show design features and instructional technology tools to improve the effectiveness of teaching and learning in students. Learning can be in the form of training in operating ICT, deepening the use of ICT and other uses. Thus, the motivation of students, teachers and educational staff to operate ICT and use them according to the demands of the tasks and the development of the era can be fulfilled.

Computer laboratories are usually provided by public libraries, by academic institutions for students attending the institution, (D. G. Hawkins, Brian; Oblinger , 2015) or by other institutions to the public or to people affiliated with the institution. Users have to follow the policies of certain users to maintain access to computers. This usually consists of users who are not involved in illegal activities or are trying to avoid security or content control software when using a computer. In public settings, computer lab users are often subject to deadlines, to give others the opportunity to use the lab, whereas, in other institutions, computer access usually requires valid personal login credentials, which also allows the agency to track user activity (D. G. Hawkins, Brian; Oblinger , 2015) . Computers in computer labs are usually equipped with internet access, while scanners and printers can add to lab settings. Computers in computer laboratories are usually arranged in rows, so that each work station has the same view at one end of the room to facilitate lectures or presentations, (C. Severance , 2015) or in groups, to facilitate small group works, (P. L. Dordal , 2019) to replace specialized computer laboratories, although

computer labs still have a place in applications that require special software or hardware that cannot be practically applied on personal computers

- **Internet Network**

Internet network is a system of networks that are connected in a general or global scopes aimed at facilitating communication of files or data services such as examples of file transfers, electronic mail, remote login, newsgroups and the World Wide Web (G. & B. Anderson, 2017). In the current era, the use of internet networks have enjoyed millions of people around the world with a variety of different interests. Even though in the past the use of the internet network was only limited to an academic and military institution it is now used generally. The definition of the internet network or connection is not only fixed on the general picture but a special understanding that a network of every computer in the world is connected to one another (D. Luthans, Fred Paul, Robert Baker, 1981). The benefits of the internet network is to make it easier to deliver information throughout the world freely and to facilitate data storage or files on other computers at a different location, for example, products and services from one region or country to (Unicef , 2017). *The current definition of internet network* is a system that benefits the peoples lives through certain devices and aims to improve the development of technology without restrictions.

The network that is commonly used is the client/server, network model. This model clearly separates which computers provide services (servers) and which computers receive services (clients). In order for servers and clients to communicate, a program/software server and program/software client are needed. There are three types of typologies that can be used to connect the server to the client; bus typology, ring typology and star or hub typologies. To develop, operate and maintain the infrastructure, four aspects of technological factors are considered, namely client (software and hardware), server (software and hardware), distribution mode and technical support.

Motivation to Access the Internet

Motivation refers to the concept used to explain the forces that exist and work within an organism or individual that becomes the driving force and guide of the individual's behavior to achieve a certain goal. With motivation, someone will be able to take action. If there is no motivation, an individual will not be able to reach his goal. The following are definitions of motivation from experts; motive is a state in self that arouses, activates, or moves (hereinafter referred to as motivation) and directs or guides a behavior to the goal (Permendiknas, 2008). Motivation is usually defined as a process that evokes and directs action. From these definitions, it can be said that the term "motivation" is used to indicate the following: power giver/generator of human behavior.

This concept refers to power in the individual (energy) that drives actions in certain ways; giving direction to human behavior. This concept refers to the orientation/direction of behavior towards a goal. Internet access has 4 sub-variables, namely motivational, material, skills and usage access. Motivational access is primarily shaped by attitudes towards technology. Attitudes must be considered as certain objects, while motivation is more a specific goal. Motivational factors are shaped by one's attitude towards internet technology (M. Almasi, H. Machumu and C. Zhu, 2017). Negative attitudes to technology such as computer anxiety have been shown to reduce access to the internet [23]. By increasing motivational access there is a possibility for increasing material access, skill access and usage access [23]. Material access requires the opportunity to access the internet and requires physical access or internet connection, whether at school, at home or elsewhere, costs for hardware, software and services. After adopting a favorable attitude towards the internet and obtaining a physical connection, skills to use the internet are required. The use of the internet is mostly defined in terms of frequency, duration of internet usage or types of activities carried out online.

Three motivations for children and adolescents to access the internet are to find information, connect with friends (old and new) and for entertainment. Information seeking is often driven by school assignments, while the use of social media and entertainment content is driven by personal needs (Abaidoo and N. Arkorful , 2014). Research has been conducted to assess facilities and infrastructure in supporting the increase of ICT literacy of vocational teachers. Completeness of facilities and infrastructure in schools, especially internet access, becomes motivation in increasing ICT literacy of vocational teachers.

- **Motivation to access the internet**

The large and growing number of Internet users has embodied the Internet culture. The internet also has a large influence on science and world views. By only relying on search engines like Google, users around the world have easy internet access to a variety of information. Compared to books and libraries, the internet represents extreme knowledge, information and data dissemination.

The development of the internet has also influenced the development of education. The use of computers and internet in education is not something new, in fact, it has long been used in developed countries like America and Europe since the 60s. Internet technology is present as multifunctional media. Communication via the internet can be done interpersonally (e.g. e-mail and chat) or massively, which is known as *one to many communication* (e.g. *mailing list*). The internet is also capable of being present in *real time audio-visual* as in conventional methods with the *teleconference* application.

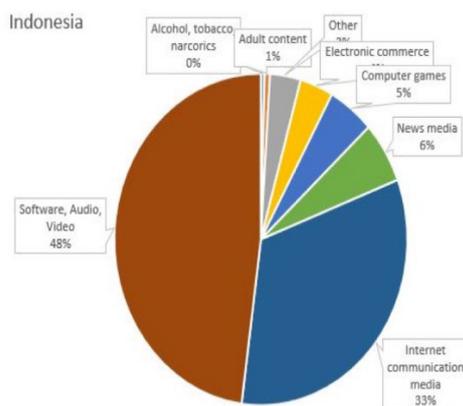
Based on the above information, the internet as an educational medium presents distinctive characteristics; as interpersonal and mass media, interactive in nature, enables synchronous and asynchronous communication. This characteristic allows students to communicate more broadly with knowledge resources when compared to just using conventional media. Internet technology supports students who experience limited space and time to still be able to enjoy education. Talk and chalk methods can be modified in the form of communication via e-mail, mailing lists and chat. Mailing lists can be analogous to "usrah", where experts discuss with members of the mailing list. This method is able to eliminate the distance between experts and students. A warm and informal atmosphere on the mailing list turned out to be an effective learning method. The internet is not a substitute for the education system. The presence of the internet is more supplementary and complementary as conventional methods are still needed. Talk and chalk methods are modified to be an online conference.

- **Frequently accessed content**

Statistical data shows that content that is sought after by children are software, audio and video respectively. Included in this category are music and video streaming services that are quite popular with children in Indonesia today. These content take up 50% of all content that children are interested in.

In the next position are communication media such as social media, messenger, forums and chat rooms with a percentage of 33%. In addition to communicating using social networks, children also use instant messaging applications such as WhatsApp. While news media and computer games occupy the next position with smaller portions of 6% and 5% respectively.

Figure 2. Internet Users based on Age



The statistical data in Figure 2 above shows the interest of children and adolescents

throughout the world today. This is why the use of internet products requires parental control, not only to block content that has bad potentials, but also to improve parent knowledge about children's interests.

Research Method

The research method used was a survey with a quantitative approach. The instrument research consists of two aspects. The first aspect was to explore the availability of infrastructure for ICT literacy which includes the availability of computer laboratories in schools, the availability of internet networks in schools and homes. The second aspect was to explore teachers' motivation in accessing the internet including the urge to access the internet and frequently accessed content. The primary data was collected from 173 respondents. 12 statements are presented in an online questionnaire as a tool for collecting data. Respondents in this study were selected by using *simple random sampling*

Result and Discussion

Availability of Computer Laboratory

The three pillars that are the main points of the strategic plan for the development of education are education equity, quality improvement and availability of access. Providing infrastructure adaptive to the challenges of technological development needs to be promoted to support the literacy improvement. At least, Vocational High Schools must have complete infrastructure that has been stipulated in the Minister of National Education Regulation No. 40 of 2008, one of which has a computer laboratory room. The computer laboratory is a very decisive component in an effort to optimize the use of ICT as a learning aid (K. Kereluik, et.al., 2013). Standard availability of computers in the laboratory is 1 computer unit per 1 student and 1 computer unit for the teacher. In addition, a Local Area Network (LAN) must be ensured to be properly connected to every available computer (Y. G. Sahin, S. Balta and T. Ercan, 2010). Results of the survey showed 92.49% of computer laboratories available at Vocational High Schools were equipped with internet access and 7.51% were still not equipped with internet access. As for the results of the computer availability survey specifically prepared for teachers accessing the internet, 82.66% of the computers have available facilities for teachers to access the internet and 17.34% are not yet available. In detail the results of the survey are both presented in Figure 3 and Figure 4.

The availability of internet access in a computer laboratory provides an opportunity for students to explore more information (S. Singh and J. Bala, 2014). Students tend to prefer the internet as a learning reference source because of the ease of obtaining information, up to date and relatively faster to get what is sought (ITU, 2017), (S. Hamid, J. Waycott, S. Kurnia and S. Chang, 2015). The availability of internet access can be utilized in a variety of

learning patterns; patterns of utilization in the laboratory, classroom, assignments and individual use (A. T. Hashem, et.al., 2015). To be able to utilize ICT as a form of improving the quality of learning, the main requirement that must be fulfilled is students and teachers must have access to digital and internet technology. The availability of computers for teachers and the sufficient laboratories in vocational high schools are expected to be able to be in line with the level of ICT literacy, at least the support facilities are available. This is shown in Figure 3 below:

Figure 3. Computer Facilities for Teachers to Access the Internet

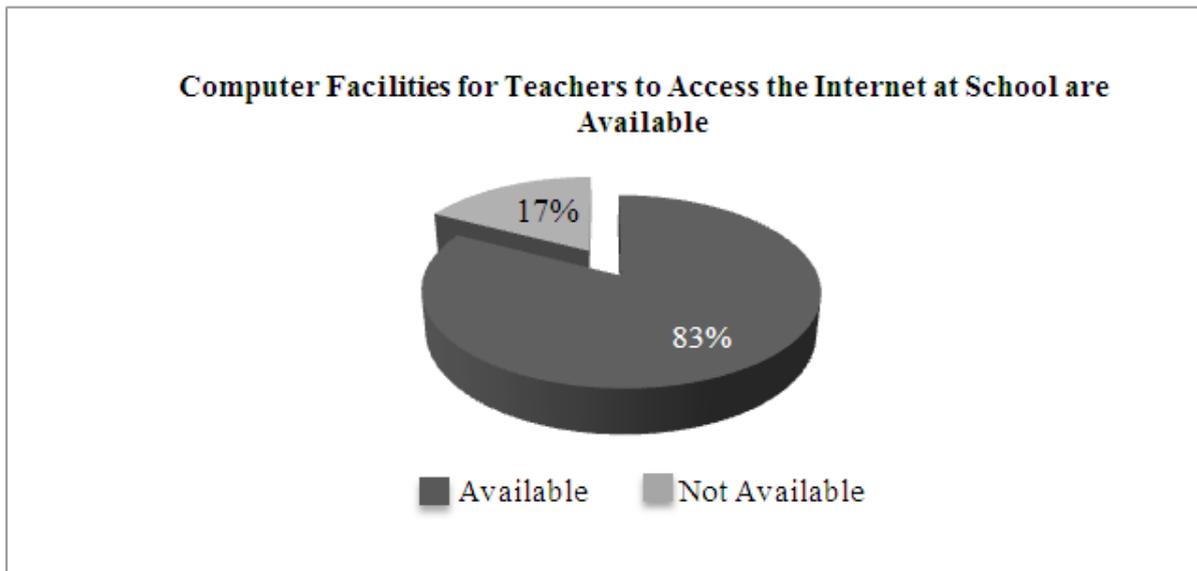
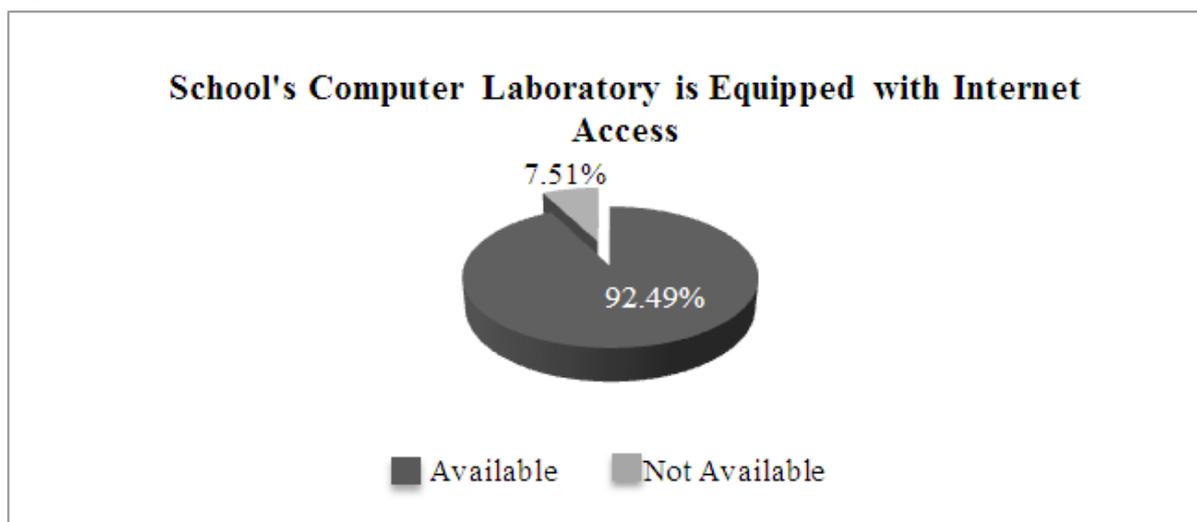


Figure 4. Computer Laboratory for Internet Access



Internet Network Access

In 2017, Indonesia was ranked 111th in the ICT Development Index (IDI) released by the International Telecommunication Union (ITU). IDI aims to compare the development of ICT between countries, with one assessment indicator is internet access (Gil-Flores, J. Rodríguez-Santero and J. J. Torres-Gordillo, 2017). Results of the survey showed 89.02% of schools had provided internet access in teacher rooms, parks, canteens, libraries and other strategic places. 10.98% of internet access is still not available at school. Availability of internet access in schools is a response to technological developments that are realized by the integration of ICT in learning. The ease of obtaining information and the transition of learning patterns from memorizing to understanding concepts is expected to emerge as the impact of the availability of infrastructure in the form of internet access. In addition, various online-based education services can easily be translated by schools, either students, teachers or other community members. In 2019, the Ministry of Communication and Information made a commitment that all schools in City Districts in Indonesia must have internet access with high internet connections in the equalization program. The availability of infrastructure in the form of internet access must be balanced with mature human resources so that the objectives of the integration and optimization of ICT literacy can be realized and have an impact on increasing professional competence, especially for teachers. In detail, the percentage of internet network access available in schools is presented in Figure 5 below:

Figure 5. Availability of Internet Spots in Schools

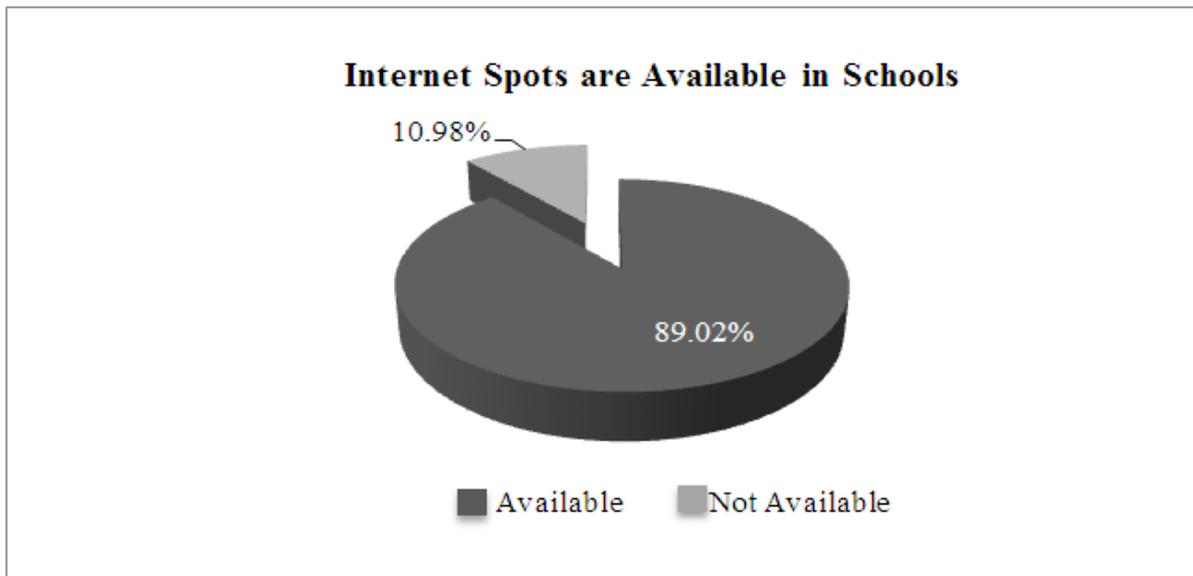
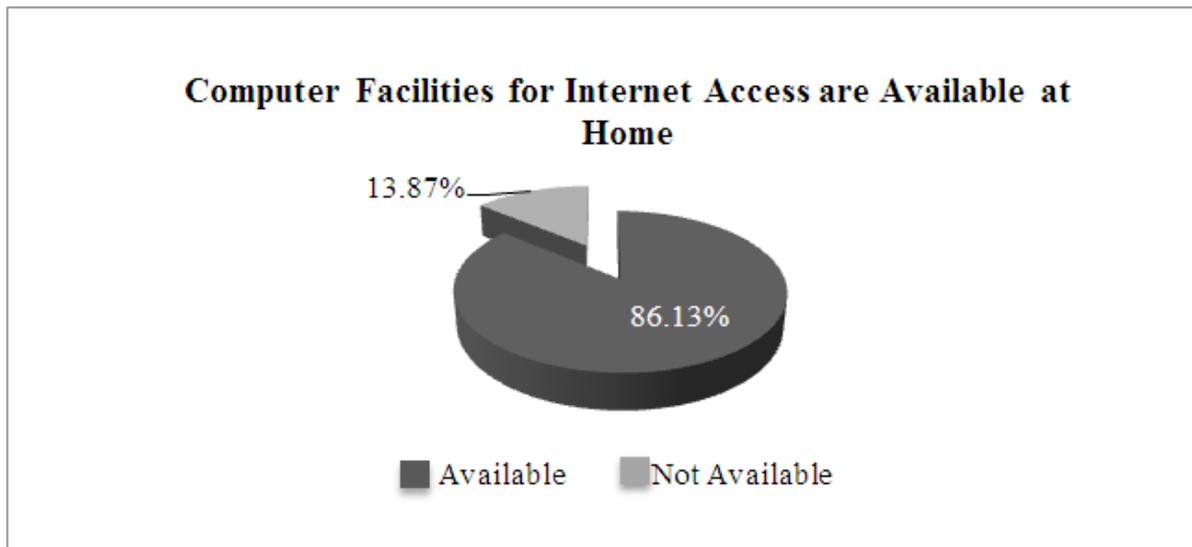


Figure 6. Availability of Computer Facilities for Internet Access at Home



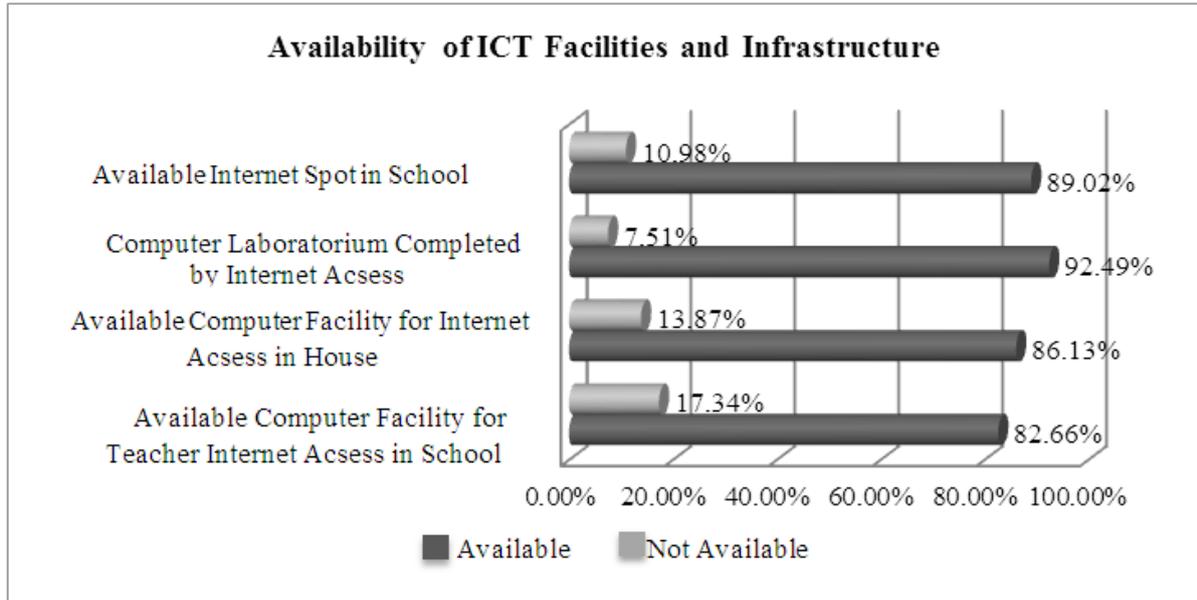
25.72% of Indonesia's population already has individual computer facilities. 4.49% of the devices commonly used to access the internet are personal computers, 44.16% use smartphones and 12.07% use other devices (APJII, 2018)

In figure 6, it can be seen that 86.13% of teachers already have computer facilities that can access the internet and 13.87% do not have computer facilities that can access the internet. The availability of internet networks at home is very beneficial for the development of the teaching profession when appropriate in its utilization. Teachers can increase knowledge, share resources with fellow classmates, collaborate with foreign teachers, the opportunity to publish information directly, organize communication directly and can participate in local or international forums (W. (Tony) Bates., 2016).

Many opportunities will be obtained if the availability of internet access can be optimized and used wisely. It is undeniable that more education and information services are now available online. The development of ICTs transformed society with the growth in the amount of information and the number of devices that continued to grow (P. Serdyukov, 2018). In this context, ICT access becomes a vital development tool and becomes one indicator of a country's progress [30]. The percentage of availability of computer facilities at home that can access the internet is shown in Figure 6. Overall, the description of the availability of infrastructure to support the ICT literacy of vocational high school teachers is presented in Figure 7. A positive percentage is seen in the survey results, that is, less than 20% of teachers have limited ICT infrastructure. However, the availability of adequate ICT infrastructure has not guaranteed a high level of ICT literacy because the behavior of using ICT in learning must be identified. Collaboration between the availability of infrastructure, adequate internet access, the existence of ICT training for teachers, perceptions of self-efficacy and the concept

of teaching also influence the use of ICT in the classroom (I. Büyükbaykal, 2015). Increasing ICT literacy must be made a common concern because it is a significant positive predictor for individual academic performance (M. Skryabin, et.al., 2015).

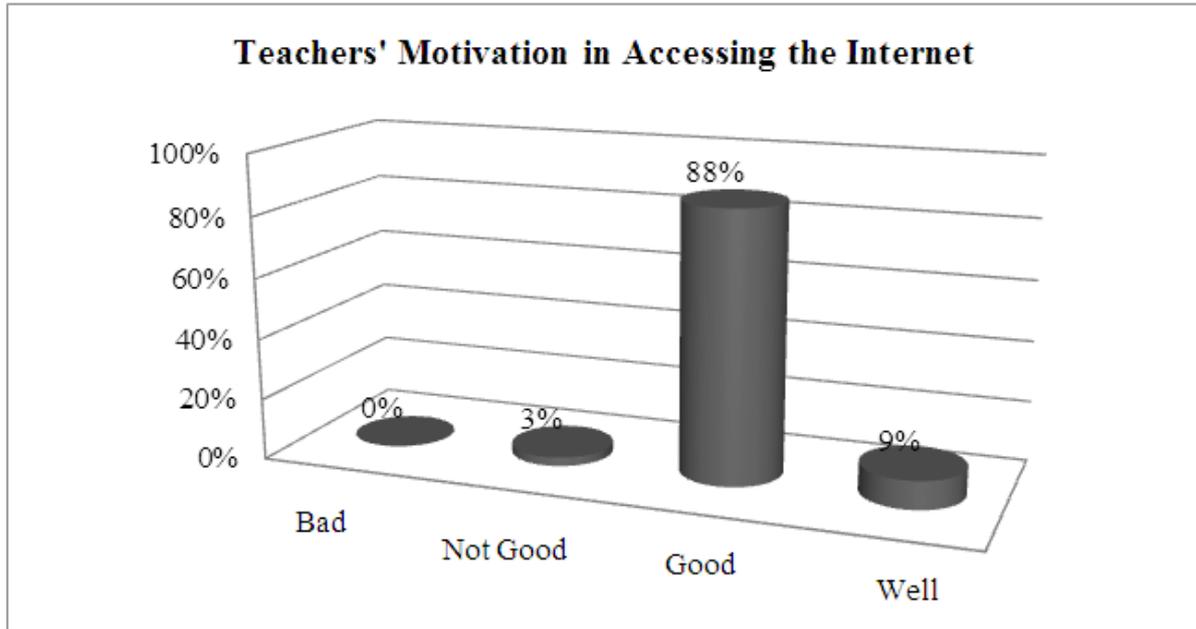
Figure 7. Availability of ICT Facilities and Infrastructure



Teachers' Motivation in Accessing the Internet

Technological developments and globalization have entered the social structure in society. The impact is that almost all aspects of life in the community have been digitalized, one of which is in the field of education. Technology ushered educational change in a fundamental structural framework that could be an integral part of achieving significant productivity improvements (T. Internet, T. I. Society, U. Nations, S. D. Goal, B. Commission and S. Development, 2017). Technology is used to support teaching and learning, technology to instill classrooms with digital learning environments, such as computers and mobile phones, supporting learning 24 hours a day, 7 days a week; build 21st-century skills; increase student involvement and motivation and accelerate the learning process. Technology also has the power to change teaching by delivering new models (T. Internet, T. I. Society, U. Nations, S. D. Goal, B. Commission and S. Development, 2017). This model connects teachers with students, resources and professional systems to help improve the learning process. Improved learning motivates teachers to access the internet in the learning process. This can be seen from the results of research on the motivation of teachers in accessing the internet in Figure 8 below:

Figure 8. Teachers' Motivation in Accessing the Internet



In general, the description of the availability of teachers' motivation in accessing the internet is in a good category. It is seen in the survey results, that most of the 88% of teachers access the internet, a small percentage of 9% of teachers are very good and 3% are poor in accessing the internet. Accessing the internet as a support in the learning process has a positive impact as teachers get updated information related to learning material and teachers can share with other teachers both nationally and internationally (A. W. (Tony) Bates, 2016). Internet is not a source of information, but over time it has shifted into a medium of communication. Communication can work in order to exchange information in the field of education (I. Büyükbaykal, 2015).

Access to the Internet is very important to achieve this vision in the future. This opens the door to a wealth of information, knowledge, educational resources and increasing opportunities to learn inside and outside the classroom. The teacher accesses the internet to prepare lessons and students to expand the range of their learning. Interactive teaching methods, supported by the Internet allows teachers to pay more attention to individual student needs and support shared learning (I. Büyükbaykal, 2015).

Conclusion

The massive development of ICT has an impact on the education sector. It is not enough if it is only balanced with a little literacy. Multi-literacy is needed to counter it. Vocational high school teachers have their own challenges because they play a role in preparing human resources who have global competitiveness in terms of employment. Optimizing the increase



in ICT literacy of vocational teachers must be balanced with the availability of infrastructure and motivation. The availability of infrastructure is the availability of computers and internet access either at school or at home. Less than 20% of teachers have limitations in infrastructure. In addition, the motivation possessed by teachers in accessing the internet is in a good category, which is 88%. The availability of infrastructure and motivation that teachers have to access the internet cannot yet be determined to contribute to the increase in ICT literacy. Further identification is needed to find the correlation between the two and the extent of usage and behavior of vocational high school teachers in implementing ICT literacy.

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REFERENCES

- A. T. Hashem, I. Yaqoob, N. B. Anuar, S. Mokhtar, A. Gani and S. Ullah Khan. (2015). “The rise of ‘big data’ on cloud computing: Review and open research issues,” *Inf. Syst.*, vol. 47, pp. 98–115,
- All, E. P. Nuñez Castellar and J. Van Looy.(2016). “Assessing the effectiveness of digital game-based learning: Best practices,” *Comput. Educ.*, vol. 92–93, pp. 90–103.
- APJII.(2018). “Penetrasi & Perilaku Pengguna Internet Indonesia Survey 2017,”.



- C. C. van den Blink. (2015). “Uses of Labs and Learning Spaces,” *Educ. Rev.*
- C. Severance. (2015). “Introduction to Networking Basics,” *Illus. Netw.*, pp. 1–2.
- D. G. Hawkins, Brian; Oblinger. (2015). “The Myth Review,” *Educ. Rev.*
- D. Luthans, Fred Paul, Robert Baker. (1981) “An experimental analysis of the impact of contingent reinforcement on salespersons’ performance behavior,” *J. Appl. Psychol.*, vol. 66, no. 3, pp. 314–323.
- E. Fife and F. Pereira.(2008). “Maslow ’ s Hierarchy of Needs and ICT : Challenges of end-user adoption of,” *J. Inst. Telecommun. Prof.*, vol. 2, no. 4, pp. 23–28.
- F. McCampbell, Atefeh S; Liedlich. (1996). “Ethics and the Student Computer Lab,” *J. Bus. Ethics*, vol. 15, no. 8, pp. 897–900.
- G. & B. Anderson.(2017). “Premature Deindustrialization and the Defeminization of Labor,” *J. Econ. Issues*, pp. 446–457.
- Gil-Flores, J. Rodríguez-Santero and J. J. Torres-Gordillo. (2017). “Factors that explain the use of ICT in secondary-education classrooms: The role of teacher characteristics and school infrastructure,” *Comput. Human Behav.*, vol. 68, pp. 441–449.
- I. Büyükbaykal.(2015). “Communication technologies and education in the information age,” *Procedia - Soc. Behav. Sci.*, vol. 174, pp. 636–640, 2015.
- I. Gershberg.(2014). “Educational Infrastructure, School Construction, & Decentralization in Developing Countries: Key Issues for an Understudied Area Alec Ian Gershberg,” *Int. Cent. fo Public Policy*, no. January.
- I. Marcus. (2017). “Science and Technology,” *A Companion to Gilded Age Progress. Era*, pp. 243–254.
- Indrawan. (2015). *Pengantar Manajemen Sarana dan Prasarana Sekolah*. Yogyakarta: Deepublish.
- ITU.(2019). “The ICT Development Index (IDI) Methodology,Indicators adn Definitions,” no. February, 2019.
- J. Ainley, W. Schulz and J. Fraillon.(2016). “A global measure of digital and ICT literacy skills,” *Aust. Coun. Educ. Res.*, p. 21.



- K. Kereluik, P. Mishra, C. Fahnoe and L. Terry.(2013). “What Knowledge Is of Most Worth: Teacher Knowledge for 21 st Century Learning,” *J. Digit. Learn. Teach. Educ.*, vol. 29, no. 4, pp. 127–140.
- M. Almasi, H. Machumu and C. Zhu. (2017). “Internet Use Among Secondary Schools Students and Its Effects on Their Learning,” *INTED2017 Proc.*, vol. 1, no. March, pp. 2379–2390.
- M. Skryabin, J. Zhang, L. Liu and D. Zhan.(2015).“How the ICT development level and usage influence student achievement in reading, mathematics and science,” *Comput. Educ.*, vol. 85, pp. 49–58.
- N. K. Dina Van Dijk. (2015). “Feedback Sign Effect on Motivation: Is it Moderated by Regulatory Focus?,” *Appl. Psychol.*, vol. 53, no. 1, pp. 113–135.
- P. J. Fortier. (2018). *Handbook of Local Area Network Software*. CRC Press.
- P. L. Dordal. (2019). “An Introduction to Computer Networks,”.
- P. Luik and H. Kukemelk.(2008). “Changes in learning process caused by the implementation of ICT in education in Estonian in-service and pre-service teachers perceptions,” *US-China Educ. Rev.*, vol. 5, no. 10, pp. 17–26.
- P. Serdyukov. (2018). “Innovation in education: what works, what doesn’t and what to do about it?,” *J. Res. Innov. Teach. Learn.*, vol. 10, no. 1, pp. 4–33.
- Permendiknas.(2008). “Standar Sarana dan Prasaran Sekolah Menengah Kejuruan/ Madrasah Aliyah Kejuruan (SMK/MAK),”.
- S. Ghavifekr and W. A. W. Rosdy. (2016). “Teaching and Learning with Technology: Effectiveness of ICT Integration in Schools,” *Int. J. Res. Educ. Sci.*, vol. 1, no. 2, p. 175.
- S. Hamid, J. Waycott, S. Kurnia and S. Chang.(2015). “Understanding students’ perceptions of the benefits of online social networking use for teaching and learning,” *Internet High. Educ.*, vol. 26, pp. 1–9.
- S. Singh and J. Bala. (2014). *Utilization Pattern of Internet among Secondary School Students*, vol. 2, no. 6. 2014, pp. 28–33.
- T. Internet, T. I. Society, U. Nations, S. D. Goal, B. Commission and S. Development. (2017). “Internet-Access-Education_2017120,”.



- T. Kurniawan. (2018). “The Urgency of Digital Literacy for Students in Disruption Era,” *Adv. Soc. Sci. Educ. Humanit. Res.*, vol. 285, pp. 154–158.
- UNESCO-UIS.(2015). “Information and Communication Technology (ICT) in Education in sub-Saharan Africa: A comparative analysis of basic e-readiness in schools,” *Inf. Commun. Technol. Educ. sub-Saharan Africa A Comp. Anal. basic e-readiness Sch. Inf. Pap. No. 25*, no. 25.
- Unicef. (2017). *The State of The World’s Children 2017 - Children in a Digital World*. New: United Nations Childrens Fund (UNICEF).
- V. Abaidoo and N. Arkorful. (2015). “The role of e-learning, advantages and disadvantages of its adoption in higher education,” *Int. J. Instr. Technol. Distance Learn.*, vol. 2, no. 12, p. 7.
- V. Dagiene. (2003). “Focus on the Pedagogical Dimension in ICT Literacy for Teachers,” *ICT Teach. Futur. - Sel. Pap. from Int. Fed. Inf. Process. Work. Groups 3.1 3.3 Work. Conf.*, vol. 23, no. May 2015, pp. 27–29.
- W. (Tony) Bates. (2016). “Teaching in a digital age,” *Teach. a Digit. age*, vol. 53, no. 2, pp. 1689–1699.
- WEF.(2015). “New Vision for Education Unlocking the Potential of Technology,” in *Industry Agenda*. pp. 1–32.
- Y. G. Sahin, S. Balta and T. Ercan.(2010). “The use of internet resources by university students during their course projects elicitation: A case study,” *Turkish Online J. Educ. Technol.*, vol. 9, no. 2, pp. 234–244.