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STRENGTHENING TECHNOLOGICAL LITERACY IN JUNIOR HIGH SCHOOL TEACHERS IN THE INDUSTRIAL REVOLUTION ERA 4.0

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Abstract. This study aims to find a model of strengthening technological literacy in junior high schools. This study used descriptive qualitative method. Data were collected through observation and interviews with teachers in junior high schools in the Bogor city area. This study found a model of strengthening technological literacy. This model includes elements of communication and collaboration in the form of active participation in learning and research activities. It consists of components of individual competence in the form of usage skills, critical understanding, and communicative abilities. This research contributes to the model of strengthening technological literacy for junior high school teachers in the Bogor City area.

Keywords: technology literacy; the industrial revolution 4.0

I. INTRODUCTION

The Industrial Revolution 4.0 is synonymous with disruption, disruptive because almost all areas of life are converted from manual to digital. If we are faced with this disorganization, then Indonesia's demographic bonus in 2045 must be prepared. Teachers must build children's literacy skills, both old literacy (reading, writing, arithmetic), and new literacy (data literacy, technology, and humanism). Teachers and educational institutions must strengthen in various aspects. Starting from curriculum, systems, management, models, strategies, and learning approaches by strengthening 21st century literacy skills. One of them is strengthening literacy skills for teachers and new literacy education institutions (data, technology, Human Resources/humanism). Indonesia is currently entering the era of the Industrial Revolution 4.0. The middle of this century (the digital revolution) is marked by the fusion of technology and blurring the lines of physical, digital, and biological spaces. In this era of the Industrial Revolution volume 4.0, there are fewer and fewer activities physically tied to geographic locations (Ake Wihadanto**[1]**). Because all human activities are converted from manual to digital. From the map of Indonesia's literacy ability, it is very paradoxical to the literacy ability of the Indonesian people. The proof, from the results of various researches and surveys, is the literacy ability of the community. Indonesia is still far from expectations. The lag will get worse when there is no preparation and strengthening of literacy in educational institutions. Research from Central Connecticut State University in 2016 stated that Indonesia ranks 60th out of 61 countries. The results show that reading skills, especially document texts, in Indonesian children aged 9-14 years are in the bottom ten. Literacy is not just reading, because it is a complex ability. In addition to the four language skills (listening or listening, reading, writing, and speaking), literacy is defined as all efforts in obtaining knowledge and information **[2]**. The aspect of computer literacy and counteracting fake and fake news (hoax) is included in it. From the explanation, in the Industrial Revolution 4.0 era, all teachers and educational institutions, especially basic education, must respond quickly so they are not left behind. Teachers must understand and master 21st century literacy which emphasizes data-based knowledge, technology, and humanism, not just the ability to read, write and count. Literacy skills lag far behind other countries, requiring basic education to strengthen literacy skills **[3]**.

The digital revolution and the era of technological disruption are other terms for Industry 4.0. Called the digital revolution because of the proliferation of computers and the automation of records in all fields. There are several challenges of industry 4.0 **[4]**. First, information technology security. Second, the reliability and stability of the production machine. Third, the lack of adequate skills. Fourth, the reluctance to change stakeholders. Fifth, the loss of a lot of work due to turning into automation **[5]** . The challenges of the Industrial Revolution 4.0 era are very complex. Not to mention in the world of education, everything has been converted in the digital world. In the past, manual, ancient, primitive systems were enough, nowadays everything has to be completely cyber. For example, e-library (digital library), e-learning (digital learning), e-book (online book), and others. The shift in teaching style shifts from teacher center to student center which can certainly increase students' interest in learning **[6]**. Utilization of information and communication technology in learning becomes a positive impact learning innovation. Not only in terms of interest in learning but also from learning outcomes. The use of various digital applications, interactive learning CDs, e-books, websites, and other digital learning styles is a paperless alternative **[7]**. Teachers do not need to print pages of test questions for their students. Students can

take evaluations with various online applications such as edmodoo and kahoot.17

From the explanation above, it can be concluded that the challenges of the Industrial Revolution 4.0 era are very complex **[2]**. First, information technology security that targets the world of education. Second, the reliability and stability of the production machine. Third, the lack of adequate skills. Fourth, the reluctance to change stakeholders. Fifth, the loss of a lot of work due to automation. Sixth, the stagnation of the use of technology, information, and communication. Seventh, uneven changes in curriculum, models, strategies, approaches and teachers in learning that strengthen new literacy. The development of the Industrial Revolution 4.0 era which was marked by the massive development of digital technology, artificial intelligence, big data, robotics, and others became a joint project of all educational institutions to answer it. Although it can't be done in all aspects, at least basic level educational institutions focus on strengthening new literacy.

There are six design principles of Industry 4.0, starting from interoperability, virtualization, decentralization, real time capability, service oriented and modular. The Industrial Revolution 4.0 can be interpreted as an industrial era, where all entities in it can communicate with each other in real time at any time based on the use of internet and CPS technology to achieve the goal of achieving new value creation or optimizing existing values from every process in the industry **[8]**. The development of information technology is part of the emergence of the digital revolution era in Indonesia. Its very rapid development is able to have a major influence and dominate all sectors of people's lives, including in the world of education. Academic demands at each level of education in Indonesia are different (Akbar & Dina **[9]**). Digital-age in education, especially in higher education, has consequences in the form of learning design by utilizing digital media as a means to increase student knowledge. Digital media can present learning materials contextually, audio and visually in an interesting and interactive way (Umam, Kaiful; Zaini **[10]**). Schools as part of higher education institutions should adapt themselves to carry out digital-based learning processes. The current advances in information technology and the internet have resulted in very abundant digital information resources (Kurnianingsih, Rosini, & Ismayati **[11]**). On the other hand, the development of information technology is likened to two sides of a coin that has positive and negative effects on society. Learning technology literacy is inevitable (Anggraini **[12]**). This demand then gave birth to a thought about the importance of technological literacy, including in the world of education.

The emergence of technological developments is a new challenge for the teaching model in schools. Educational institutions that have long implemented a textual education model by studying books with a textual model are now facing new challenges in the digital era. This condition requires educational institutions, especially junior high schools to adapt. The emergence of the digital era is also a challenge as well as an opportunity for teachers in schools to innovate in learning activities. Teachers in schools are required to have technological literacy skills.

To adapt to the era of industrial revolution 4.0, teachers are not enough to only have these 4 competencies, but must be added with five other competencies. (1) educating competence with internet-based learning; (2) competence for technological commercialization (having the competence to instill an entrepreneurial attitude with commercial technology. (3) having global competence by not stuttering towards culture, and being able to solve problems. (4) having the ability to predict things quickly because everything is at the moment this is very easy to change (5) has the competence to conduct consultations with students because in the future children's problems will no longer be in the material but are more related to psychology and increasingly complex pressures 4 The key to educational innovation is through development. Teachers will be very lame if they don't can align their competencies with technological advances. Teachers cannot access information via the internet, open e-books, and create learning media through technology. Teachers who are digitally blind will be left behind, teachers who can survive are teachers who master technology, technological literacy, and ICT. 5 Schools must respond quickly to p positive and adaptable to changes that occur. Schools need to prepare competent teachers according to the needs of the industrial revolution 4.0. Technological literacy is one of the competencies that is quite important in meeting the needs of the industrial revolution 4.0. Strengthening technological literacy is carried out to prepare professional teachers who are in accordance with educational needs in the era of the industrial revolution 4.0. The quality of teachers determines the quality of graduates. The teacher is a person who plays an important role in the implementation of education. Teachers face to face with students in class. Therefore, the quality of education cannot be separated from the quality of teachers.

Many skill models are useful for improving one's abilities and are sometimes referred to as multi-literacy (Mardina **[13]**). According to NCREL & Metiri Group literacy skills are skills that emphasize literacy skills that are connected to one another in the digital era, not only limited to the ability to read, listen, write and speak orally (Burkhardt **[14]**). Technological literacy, also known as computer literacy, is the ability to use computers, the internet, and other digital tools. Technological literacy is an effort to know, to search, to understand, to analyze, and to use digital technology. The seven elements of technological literacy include: (1) Information literacy is the ability to find, evaluate and use the information needed effectively (Hasugian **[15]**), (2) Digital scholarship is an element that includes the active participation of digital media users in academic activities to make information available. from the digital media as a data reference, for example in research practice or task completion (Stefani **[16]**), (3) Learning skills are learning effectively various technologies that have complete features for formal and informal learning activities, (4) ICT literacy or referred to as information and communication technology literacy which focuses on ways

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to adopt, adapt and use digital devices and ICT-based media both applications and services.

Based on the results of observations of teachers in Junior High Schools in the Bogor City area, it is known that learning activities are still dominant with textual models using printed books. The use of digital media in the learning process is still very limited. On the other hand, 21st century education requires educational institutions to be responsive to developments and changing times by mastering information technology or called digital-age literacy. The adjustment of schools in the use of digital media in the learning process is an urgent matter, including among junior high school teachers. There are several studies that have been carried out with a focus on technological literacy and the use of ICT (Information, Communication and Technology) in education, especially regarding the use of Technology for Literacy.

II. RESEARCH METHODS

This study uses a qualitative descriptive method to find a model of strengthening technological literacy carried out by junior high school teachers in the Bogor city area in the learning process. The data in this study were obtained through direct observation and in-depth interviews. Observations were carried out by making direct observations of teacher activities in learning material activities, preparing pre-test and post-test questions, as well as creating discussion forums and scoring student assignments through the website. Interviews were conducted with junior high school teachers in the Bogor city area. Interviews were conducted in-depth about the components of individual competence which consist of the use of skills, critical understanding, and communicative abilities. After conducting in-depth observations and interviews, researchers constructed messages obtained from informants and mapped the use of technology as a form of technological literacy, especially elements of communication and collaboration in the form of active participation in digital networks for learning activities. The data analysis technique was carried out based on the theory of Miles and Huberman, there were three stages of data analysis: (1) data reduction, (2) data display, and (3) data conclusion according to the researcher's interpretation (Tamin **[17]**). Reduction is done by summarizing, choosing the main things, and focusing on the things that are important. Presentation of data in the form of brief descriptions, charts, relationships between categories, flowcharts and the like. Conclusion drawing/verification is the third line in the data analysis technique after data reduction and presentation. The validity of the research data was carried out by triangulation **[18]**. Triangulation is a way to get really valid data by using multiple methods (Bachri, **[19]**). Data collection techniques that combine various techniques and existing data sources. Triangulation of data in this research is triangulation method which is done by combining observation and interview techniques, and combining data sources from several research subjects.

III. RESULTS AND DISCUSSION

This study found a model of strengthening technological literacy in the junior high school teacher environment in the city of Bogor. Communication and collaboration as one element of technological literacy in this research is in the form of developing learning content by utilizing communication and information technology applications. To determine the technological literacy abilities of junior high school teachers, they are divided into three categories, namely skills (use skills), critical understanding (critical understanding), and communicative abilities (communicative abilities). The individual abilities of junior high school teachers are presented in table 1.

Table 1. Individual Competence of Junior High School teachers

Category Individual Competence	Level	Indicator
Use Skill	medium	Teachers are able to use digital media, and are still in the process of adapting the use of technological literacy applications.
Critical Understanding	medium	Teachers are able to understand the content, function, and regulation of the use of digital media, but the willingness to cross-check information is lacking.
Communicative abilities	basic	Subjek penelitian belum mampu melakukan komunikasi dan partisipasi aktif dalam e-lerning karena baru pada tahap upload konten dan belum implementasi ke dalam proses pembelajaran bersama mahasiswa.

The data presented in table 1 is the level of competence which refers to the level of technological literacy ability of the European Commission Directorate General Information Society and Media (2009). There are three criteria in strengthening technological literacy skills through the use of technology applications in Bogor City Junior High Schools. E-learning is a learning system adapted from existing systems in conventional educational institutions into a digital system via the internet (Susanti & Sholeh **[20]**). E-learning in learning functions as a supplement that is optional, complementary, or substituted (Chandrawati **[21]**). The first technology literacy criterion is use skill. Use skills are skills in accessing and operating media activities. Use skills have three criteria, namely expertise in the use of media in a standard (low), expertise in actively using media, and high skills in using and utilizing media. Indicators of skills or use skills, especially on the use of computers and internet access, consist of ownership of computers/laptops; use of computers/laptops; ownership of social media and e-mail accounts; frequently visited sites; downloads and uploads. Researchers made direct observations by observing and observing the uploading of learning content to the e-learning portal by Bogor City Junior High School Teachers. The researcher observed the uploading of learning content which consisted of learning material, pre-test and post-test questions, and created a discussion forum through e-learning. Based on the results of initial observations before there was Technology Literacy, it was found that the research subjects, namely the teachers of

the Ba Bogor City Junior High School were able to use and utilize the media in the learning process. The forms of media utilization also vary, some use digital media using a laptop as a tool for presenting material to students, the internet as a source of information in extracting information related to subject matter (downloads), the use of social media in the form of Whatsapp groups as a means of discussion outside the classroom and e-mail. -mail for the collection of student assignments. There are also those who use Youtube as a medium to upload student assignments to be assessed. Some subjects still prefer to use the lecture method as a form of learning in class. Books are still the main reference in the preparation of learning materials. This is as stated by one of the research subjects. "On certain topics I deliver material using the lecture method, for example related to communication theory, lectures and the use of books as references are more appropriate, although on other topics, case studies, for example, can be used by utilizing other learning media." (subject 1, interview 17 July 2021).

That the importance of a concept and mechanism of information technology-based learning which is then known as e-learning. This has the effect of transforming conventional education into digital form. This transformation encourages an increase in digital capabilities and a shift in the textual learning model to contextual learning. Contextual learning is a learning concept that helps educators/teachers relate the material they teach to students' real-world situations and encourages students to make connections between their knowledge and its application in their lives as family and community members (Sulianto **[22]**). Universities are required to use a new paradigm in learning so that it can produce maximum output. This research is also in line with the research of Wijaya, Sudjimat, and Nyoto on the transformation of 21st century education (Wijaya **[23]**). There is a shift in the 21st century learning paradigm as shown in Figure 3. The second category of Individual Competence is Critical Understanding, which is the ability to analyze and evaluate media content extensively and completely. The criteria for this critical understanding include: the ability to understand the content and function of the media, have knowledge of the media and media rules or regulations, and the behavior of media users in utilizing the media. Criteria for critical understanding include the informant's trust in the mass media or the internet; able to distinguish the truth of news site content; ability to understand government regulations related to media; and check news sources.

Based on the results of the interviews, it is known that the research subjects have the ability to analyze and evaluate media content, especially those from digital media, although not comprehensively. The research subjects have been able to understand the content and function of the media and use it as a source of information in learning activities. “Besides printed books, Youtube is one of the media that I use in learning activities. Upload student assignments on certain topics and then they will be assessed when the assignments are already on Youtube.” (interview July 17, 2021). "In certain discussion topics I use Youtube as a source of information, for example in mass communication lessons, I take videos from Youtube about the future of communication to be discussed in class." (interview July 18, 2021. In addition, the research subjects also have knowledge about media, although not all of them understand media regulations, especially in Indonesia. The research subjects also do not always cross-check news sources. With the existence of e-learning as a digital learning media critical understanding skills will continue to increase. Bogor City Junior High School teachers are trained to create creative and innovative learning content that will be uploaded on the portal, not just "copy and paste" and utilize the work of others. Based on observations it is known that the critical understanding ability of the research subjects increases along with the application of technology in Bogor City Junior High School teachers.

The researcher found that the research subjects were able to take advantage of the Technology Literacy to prepare more creative and innovative materials. Uploaded content is more varied such as animations, images, and audio visuals. The third category of Individual Competence is Communicative Abilities or communication skills, namely the ability to communicate and participate through media channels. Communication skills are skills in building social relationships willing to participate in the environment through media channels. In addition, communication skills also include skills in compiling media content. The communicative abilities indicators consist of updating information on the internet and discussions through e-learning forums. Based on observations, it was found that before using and utilizing e-learning communicative abilities in the learning process had not been carried out. Communication skills on the internet are limited to status update activities on social media that have nothing to do with the learning process, criticize social media outside of learning materials, and also update news from the internet for the benefit of increasing information for themselves. With the existence of e-learning as a virtual learning medium, the ability of research subjects in the communicative abilities criteria will certainly increase. The increase in communicative abilities occurs because learning activities will always use and utilize the internet. This is in line with Adawi's research which states that with the application of distance education based on computers and networks (internet, fax, fax-internet, etc.), the dependence on distance and time required for the implementation of education can be overcome. because everything needed will be provided online so that it can be accessed at any time (Adawi **[24]**).

The reference used to determine the teacher's ability to use and utilize digital media is based on the criteria determined by the European Commission, Directorate General of Public Information and Media; The Media Literacy Unit was subsequently converted and adapted to social conditions in Indonesia. One of the most famous frameworks in the concept map is the Individual Competence Framework. Individual Competence or individual competence is the ability of individuals to media.

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These include the skills to use, to produce, to analyze, to communicate through the media. This individual competence consists of two categories, namely: (1) Personal competence, namely individual skills in using media and analyzing media content. (2) Social Competence, namely individual skills in communicating and building social relations through the media and being able to produce media content. Based on the results of the analysis, it was found a model of strengthening technological literacy which is presented in Figure 4. Figure 4 is a model of strengthening technological literacy in Bogor City Junior High School which is carried out through the learning process. Communicators consisting of basic subject teachers deliver messages (learning content) to communicants through e-learning media. The use of new media in the form of e-learning in the learning process is the implementation of communication and collaboration elements in technological literacy, in which there is an individual competence component consisting of use skills, critical understanding, and communicative abilities. Improving these three components through the use of e-learning will strengthen the literacy skills of communicators.

IV. CONCLUSION

This study found a model for strengthening technological literacy in Bogor City Junior High Schools. Strengthening technological literacy in Bogor City Junior High Schools implements elements of communication and collaboration which consist of three components of individual competence, namely use skills, critical understanding, and communicative abilities. Communication and collaboration is an element of technological literacy in the form of active participation in learning activities carried out by utilizing technological literacy applications. The use of technological literacy applications in learning activities at Bogor City Junior High Schools is one of the models for strengthening technological literacy. The existence of technological literacy makes junior high school teachers required to master new media so that they can indirectly improve their individual technological literacy skills. The contribution of this research is a model of strengthening technological literacy through the use of technological literacy in Bogor City Junior High Schools. Research on technological literacy in Bogor City Junior High Schools needs to be done to analyze the other six elements of technological literacy. Research recommendations are also intended for policy makers in Bogor City Junior High Schools to maximize the use of Technology Literacy Applications as an effort to strengthen technological literacy, especially in the communication and collaboration elements.

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