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Perception and Understanding of Chemistry Teachers toward Digital Literacy Based on Teachers' Competence in the Disruption Era

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Abstract: Digital literacy skills in the era of disruption are needed not only the ability to find, use and disseminate information in learning, but also the ability to make information, critical evaluation, accuracy of the application used and in-depth understanding of the content of the information so as not to cause errors. This study aims to describe the perception and understanding of digital literacy of chemistry teachers at the SMA/MA level in the era of disruption. The method used is descriptive method. The research sample was 23 high school/MA chemistry teachers in the Bogor area who were determined by cluster random sampling. The instruments used consisted of FGD instruments and questionnaires. The data obtained were analyzed descriptively quantitatively. Based on the data, it is known that the perception and understanding of high school/MA chemistry teachers on digital literacy in the era of disruption in the realm of educator competence is 86.40% (Very Good). The results of statistical tests state that there is no significant relationship between years of service, gender, school where they teach, and certification status with the digital literacy competence of chemistry teachers.

Keywords: digital literacy, teacher perception, chemistry teacher.

Abstrak: *Kemampuan literasi digital di era disrupsi diperlukan bukan hanya sekedar kemampuan mencari, menggunakan dan menyebarkan informasi dalam pembelajaran akan tetapi, diperlukan kemampuan membuat informasi, evaluasi kritis, ketepatan aplikasi yang digunakan dan pemahaman mendalam dari isi informasi sehingga tidak menimbulkan kesalahan. Penelitian bertujuan untuk menggambarkan persepsi dan pemahaman literasi digital guru kimia pada tingkat SMA/MA di era disrupsi. Metode penelitian yang digunakan adalah metode deskriptif. Sampel penelitian adalah 23 orang guru kimia SMA/MA di wilayah Bogor yang ditentukan secara cluster random sampling. Instrumen yang digunakan terdiri dari instrumen FGD dan kuesioner. Data yang diperoleh dianalisis secara deskriptif kuantitatif. Berdasarkan data diketahui bahwa persepsi dan pemahaman guru kimia SMA/MA terhadap literasi digital era disrupsi pada ranah kompetensi pendidik sebesar 86,40% (Sangat Baik). Hasil uji statistika menyatakan antara masa kerja, gender, sekolah tempat mengajar, dan status sertifikasi tidak terdapat hubungan yang signifikan dengan kompetensi literasi digital guru kimia.*

Kata kunci: *literasi digital, persepsi guru, guru kimia.*

▪ INTRODUCTION

The development of the word "disruption" has recently become increasingly popular along with the community's efforts to adapt to the pandemic situation. In the big Indonesian dictionary, the word disruption means things uprooted. The phenomenon of disruption is a situation where the movement of something is no longer linear. The era of disruption has several characteristics: 1) Volatility (V) namely changes that are massive, fast, with patterns that are difficult to predict; 2) Uncertainty (U) ie rapid changes cause uncertainty; 3) Complexity (C), namely the complexity of the relationship between the

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factors causing change; 4) Ambiguity (A), namely the lack of clarity in the direction of change that causes ambiguity (Poernomo, 2020).

The Era of Disruption has had a great impact on all systems in this world, where all work or activities are no longer done in real but virtual (online). Moreover, the impact of Covid-19 (Corona Virus Disease) has made all activities carried out from home. The world of education has not been spared the impact of this disruption and pandemic. The problems faced need to be responded to appropriately, namely by finding the right learning method with the current situation (Benyamin, et al, 2021). In this era, information technology has become the basis or basis in human life, including in the field of education in Indonesia. So there was a disruption of education.

Disruption in the world of education is a consequence of the emergence of the industrial revolution 4.0 era. The main characteristic of education in the industrial revolution 4.0 is the use of digital technology in the teaching and learning process (cyber system), so that the inheritance of knowledge and competence can take place continuously without having to meet face to face in class. In other words, teaching materials can reach students at any time, without being limited by space and time. There are several techniques for implementing Education 4.0, namely, (1) Preparing digital technology tools for the implementation of the Teaching and Learning Process (PBM), (2) Preparing a curriculum that is in accordance with the times, and (3) Ensuring educators have skills in utilizing IT for learning.

The era of learning disruption also brings students to various conveniences in learning. The learning mindset is no longer about the process of direct interaction between students and teachers. Rather, it has shifted to a single process of finding out from all sources. New styles and ways to learn in this digital era are the impact of the availability of science and technology products and emerging global trends. Students in this era, are self-taught users who rely heavily on technology in carrying out their daily learning activities (Komala, 2019).

The existence of internet access makes it easier for students to access information and entertainment content. They can find anything in cyberspace, according to their pleasure and desires. This fact creates an acute dependence on the internet. Not to mention the limitations of the current situation, which reduces their opportunities to engage in 'real' discussions with their peers. Ultimately, they tend to be easily skeptical and have an affinity for solitude. This situation has the potential to reduce the humanistic relationship between teachers and students. Because, its role has been replaced by technology. In addition, children's sensitivity and social skills are also threatened with degradation. Egocentricity will be very easy to grow if access to the environment is reduced or limited (Komang, 2020). This phenomenon of learning disruption appears and is lived by the students themselves. As a neo-millennial generation, they have individualistic tendencies, are free-spirited, able to multitask, and of course are very familiar with technology. With these conditions, students will automatically be easily dissolved in the vortex of disruption.

Education in general finally experienced a shift due to disruption of learning. After all, the internet and online media are only tools for learning. Internet content can make students know everything, but not enough to equip them with social and emotional intelligence. So, the challenge for teachers today is not only to be able to activate teaching innovation, but also to strengthen digital literacy in students' daily lives. The development

of information and communication technology that is increasingly pervasive at this time creates an integration between one media and another which forms the emergence of new, more complex media. The new integrated media are internet-based digital media, to achieve maximum results in the learning process, a person is not only required to be able to use digital devices well, but also must understand all things related to digital technology, known as digital literacy. (Hague & Payton, 2010). The emergence of the internet resulted in the connection of information from all corners of any hemisphere running so fast that it made it easier for humans to obtain and disseminate any information and anywhere, the ability of the internet is what ultimately led to the explosion of information. Along with the development of information and communication technology as well as the emergence of digital media such as the internet also led to the development of the concept of digital literacy (Pratiwi & Pritanova, 2017 p.12).

However, it is unfortunate that the Indonesian people do not fully understand the consequences of using digital media, and do not fully have digital literacy skills (Pratiwi & Pritanova, 2017 p.12). Research conducted by Radovan (2014) shows that digital literacy has a positive influence on academic performance. So that in the end digital literacy is needed by teachers so that the learning process becomes more interesting, fun, effective and efficient, as revealed by Rianto (2016) that digital literacy is considered absolute so that the media (internet) can bring benefits to its users.

Talking about the world of education, it will not be separated from the teaching profession where in the Law of the Republic of Indonesia number 14 of 2005 concerning the professionalism of teachers and lecturers. The teaching profession is further strengthened by the existence of a certification allowance for teachers who have passed the teacher competency exam. Legally, those who can be called teachers are someone who has obtained a decree (SK), both from the government and private parties assigned to teach (Suparlan, 2008). One of the competencies that must be possessed by professional teachers is the ability to use information and communication technology, but in reality these competencies are not fully owned by teachers in Indonesia. Teachers must also understand the pedagogical knowledge that supports the transfer of knowledge to students. In this case, teachers are required to have good competence regarding learning strategies using technology (Yunita & Bahriah, 2020)

Chemistry is the most important subject in science and contains a number of abstract concepts that require complex concepts that do not apply outside the classroom according to Stieff & Wilensky (2003) in Zhou, Hu, & Gao (2010). Chemistry is said to be abstract because one must have an intuitive feeling, understand the concept, and believe in the existence of the chemical so that it is easy to learn chemistry (Holme, Luxford, Brandriet, 2015). In addition, students also get a negative stigma from society that chemistry is a difficult subject. Therefore, teachers should break these negative views by creating an interesting learning atmosphere that can make students excited in the classroom (Yusuf, 2017). Not many teachers can provide fun learning in the classroom. Supposedly, the use of information and communication technology can be a solution for the use of learning resources. Unfortunately, not all teachers can operate information and communication technology so that the learning atmosphere is fun.

Teachers in big cities, especially in Bogor, should be able to operate information and communication technology because access to technology is very easy compared to remote areas where it is difficult to access technology. Teachers help students develop

the knowledge, abilities, skills and competencies needed for what information students have and what they need and then how students analyze and communicate (Alvarez & Gisbert, 2015) so as to acquire basic competencies in information processing, digital competencies for effective learning. very important in education. Therefore, digital literacy as competency and skill development is indispensable for the use of information and communication technology. This is interesting for researchers to examine how the perception and understanding of high school/MA chemistry teachers towards digital literacy in the era of disruption in the realm of educator competence in the Bogor area.

▪ METHOD

The research method used by researchers is descriptive. Descriptive research aims to describe an event accurately and systematically. The depiction of these events uses critical analysis (Sriundy, 2015: pp 90). This research was conducted in May – September 2021. The sample was taken using a cluster random sampling technique. According to Arikunto (2010:38), which states that "if the subject is less than 100, then it is better to take all so that the research is a population study and if the population is more than 100 then 10-15% or 20-25% or more are taken. The sample taken in this study consisted of 23 high school/MA chemistry teachers in Bogor.

The instruments used to determine the perception and understanding of high school/MA chemistry teachers on digital literacy in the disrupted era were FGD instruments and questionnaires. The questionnaire consists of 30 statement items arranged using a Likert scale. Questionnaires were given to respondents online via google form. The FGD instrument was a structured interview sheet which was used to collect information that was not obtained from the questionnaire. The FGD was conducted at SMAN 7 Bogor City through the chemistry teachers forum at Bogor City. The data obtained were then analyzed descriptively quantitatively using the SPSS 22 program. The questionnaire data were interpreted into the categories very good (81-100), good (61-80), adequate (41-60), poor (21-40), and very poor (0-20) (Arikunto, 2016).

▪ RESULT AND DISSCUSSION

High School Chemistry Teachers' Perception and Understanding of Digital Literacy in the Disruption Era

The development of information and communication technology, now the internet has become a popular source of information in all circles, including the world of education because it is able to offer access to information that is easy, fast, and in almost unlimited quantities (Association of Indonesian Internet Service Providers, 2015). Everyone can create, access, use and share or share information and knowledge, with the consequence that everyone must be able to deal with and master information properly (Sukaesih & Rohman, 2013). However, the ease of sharing and accessing digital information via the internet, has resulted in a lot of unaccountable information being widely circulated. To overcome these conditions, special skills are needed, known as digital literacy. Therefore, this research was conducted with the aim of knowing the perception and understanding of high school/MA chemistry teachers on digital literacy in the era of disruption in the realm of educator competence in the Bogor area. This is because qualified educators are not only professional educators, who have academic qualifications, competencies, educator certificates, are physically and mentally healthy, and have the ability to realize

national education goals (PP 74 of 2008 article 2) must also have Technological Pedagogical and Content Knowledge (TPACK) and good digital literacy.

The instrument used to determine the chemistry teacher's perception and understanding of digital literacy was adapted from research conducted by Garcia-Martin (2017), Zhou, Hu, & Gao, S (2010), and Ghavifekr, & Rosdy, (2015). Before being used, the questionnaire was tested on a limited basis in the Department of Chemistry Education Semester 6. Based on the validation results, it was found that from 45 statements only 30 items were valid, so 15 invalid statements were not used. The reliability of the instrument was obtained from Cronbach's Alpha which showed a score of 0.87 (High).

In the current era of disruption, the education system is experiencing drastic shifts and changes, where the learning process is no longer bound by space and time. In responding to all changes in the world of education, it takes educators who have competencies or skills that are relevant to the needs of the times, so that educators can still maintain their existence. The current of digitalization in the world of education flows very fast, therefore as an educator must have digital literacy skills in supporting the learning process and improving its performance. Digital literacy can simply be understood as a person's ability to use technology and information systematically. Atmazaki, et al (2019) define digital literacy as knowledge and skills to use digital media, communication tools, or networks in finding, evaluating, using, creating information, and utilizing it in a healthy, wise, intelligent, careful, precise, and obedient manner. law in order to foster communication and interaction in everyday life.

Given the importance for an educator to have digital literacy skills, the discussion of this research is about the perception of high school/MA chemistry teachers in the Bogor area which is measured consisting of 9 aspects, namely: 1) The ability to be confident in ICT; 2) Understanding of the use of ICT; 3) Expertise in using ICT; 4) Advantages in ICT; 5) Suitability of Teacher Practices with ICT; 6) Ease of use of ICT; 7) Observing the existence of ICT; 8) Cultural and Educational Perceptions of ICT; 9) Ability to use ICT. Based on the data from the questionnaire, it is known that in the first aspect, namely the aspect of the ability to be confident in ICT, an average of 88.9% (very good) was obtained. This shows that in general chemistry teachers are confident in the use of ICT in both learning and evaluation activities. Friedman (Afandi, Junanto, & Afriani, 2016) illustrates this change as “the world is flat” – which refers to a situation where the world is not limited to national boundaries and time zones due to technological developments. The development of information technology has created a "new space" that is artificial and virtual, called cyberspace (Piliang, 2012) so that educators and educational institutions should be able and confident in ICT.

In the second aspect, namely the aspect of understanding the use of ICT, it was obtained an average of 91.3% (very good). This shows that in general chemistry teachers have excellent competence in utilizing and using ICT in learning. According to Gilster, digital literacy is the ability to understand and use information in various formats that come from various digital sources displayed through computers (Belshaw, 2011). In the third aspect, namely the aspect of expertise in using ICT, an average of 88.0% (very good) was obtained. This shows that in general chemistry teachers have excellent competence in utilizing and using ICT in learning. The high level of understanding of up-to-date information for educators and students is one of the impacts of the need to keep abreast of the latest developments in their fields of interest because of the need to know how

problems develop in the field with a theoretical review that continues to be developed so that up-to-date and up-to-date information is needed. (Nurjanah, et al, 2017).

In the fourth aspect, namely the Profit aspect in ICT, an average of 82.6% (very good) was obtained. This shows that in general chemistry teachers have excellent competence in utilizing and using ICT in learning. This is in line with the opinion of Kurnianingsih, Rosini, & Ismayati (2017) which states that the advantages of advances in information technology and the internet today result in very abundant digital information resources. In the fifth aspect, namely the aspect of the Suitability of Teacher Practices towards ICT, an average of 81.9% (very good) was obtained. This shows that in general chemistry teachers have excellent competence in utilizing and using ICT in learning. In line with Husen and Postlethwaite (1985) in Bawden (2001) which states that skills and attitudes are one of the things needed to create an effective function in social roles that directly or indirectly involve computer media. In this case, attitude will determine how someone can use information properly and ethically, one of which can be shown through respect for copyright by including citations, bibliography, or sources of information used.

In the sixth aspect, namely the ease of use of ICT, an average of 84.2% (very good) was obtained. This shows that in general chemistry teachers have excellent competence in utilizing and using ICT in learning. In the seventh aspect, namely the aspect of observing the existence of ICT, an average of 89.1% (very good) was obtained. This shows that in general chemistry teachers have excellent competence in understanding the existence of ICT. In the eighth aspect, namely the aspect of Cultural Perception and Education on ICT, an average of 84.5% (very good) was obtained. This shows that in general chemistry teachers have very good cultural perceptions of ICT. In the ninth aspect, namely the ability to use ICT, an average of 87.2% (very good) was obtained. This shows that in general chemistry teachers have excellent competence in utilizing and using ICT in learning.

In general, the perception of chemistry teachers on digital literacy in the era of disruption in the realm of educator competence for the Bogor area was obtained by an average of 86.4% and was included in the very good category. Digital literacy basically involves not only technical abilities, but also involves skills and knowledge of more complex information, so someone who has a high level of digital literacy can be said to have been able to master the four main dimensions of digital literacy as expressed by Bawden, so that they are able to to search, evaluate, create and communicate information using digital technology effectively and efficiently. With these skills, a person will be able to assess and select e-resources based on the current, suitability, ownership of information sources (Nurjanah et al, 2017).

In addition to analyzing data on perceptions and understanding of teachers' digital literacy based on questionnaires, a Focus Group Discussion (FGD) was also conducted on September 15, 2021. Several important points resulting from this FGD were obtained, including: 1) The development of science and technology is very rapid, requiring chemistry teachers to develop competence on an ongoing basis. Innovation is the most important key in the Disruption era which requires chemistry teachers to form 21st century competence students who are able to think critically, creatively, collaboratively, and communicatively. Quality students are the output of a good school system. 2) In the current era of disruption, it can be done with several strategies. First, chemistry teachers

must be able to see the opportunities and potentials that exist by identifying problems in the learning process as the basis for developing a learning system. Second, chemistry teachers must be able to design and implement 21st century learning in accordance with the concept of a higher order thinking skills approach. The three chemistry teachers as drivers of 21st century education must be able to invite all educational stakeholders in schools, both colleagues, education staff, and parents to jointly create dynamic education in accordance with the development of industry 4.0. Fourth, chemistry teachers must provide enthusiastic support and appreciation to colleagues, education staff, and students who have achieved results for achievements, innovations, and other proud achievements. 3) The learning process in the Bogor area, chemistry teachers have utilized ICT to increase digital literacy skills, making it easier to complete their assignments and implement learning in schools. Digital literacy is a trigger for chemistry teachers to make changes in schools, in the form of school development and increasing the achievement of national education standards in schools, which are based on information and communication technology. 4) Implementation of digital literacy in the Bogor area, chemistry teachers have been given training containing technical uses of ICT such as operating office software and using the internet. At the time of the current pandemic, chemistry teachers already know various types of learning resources and understand how to find learning resources on the internet. There are two events to take advantage of various digital learning resources, namely online (on the network) and offline (out of the network). 5) Many chemistry teachers in the Bogor area are in the process of learning chemistry, video learning resources via Youtube or relevant learning applications.

Interrelationship of Working Period, Gender, Place of Teaching, and Certification Status on Digital Literacy Capabilities of Chemistry Teachers.

To further deepen the discussion, this research also examines how the relationship between tenure, gender, place of teaching, and certification status relates to digital literacy skills. Data on years of service, gender, place of teaching, and certification status can be seen in table 1 below.

Table 1. Data on tenure, gender, teaching place and status of chemistry teacher certification in Bogor

Aspect	Category	Amount	%
Working period	1 year	1 person	4.3
	5 years	8 people	34.8
	5 years	14 people	60.9
Gender	Male	6 people	26.1
	Female	17 people	73.9
Teaching place	SMAN	12 people	52.2
	SMAS	8 people	34.8
	MAS	2 people	8.7
	SMKS	1 person	4.3
Certification status	Already	11 people	47.8
	Not yet	12 people	52.2

Based on the questionnaire data it is known that there are 23 chemistry teachers in the Bogor area with three categories of tenure namely: 1) Less than 1 year as many as 1 person; 2) less than 5 years as many as 8 people; and 3) more than 5 years totaling 14 people. Nearly 50% of teachers who teach in the Bogor area are more than 5 years old. Based on the results of the statistical test calculation, digital literacy skills were obtained by looking at the working period of the chemistry teacher with p value = 0.264/2 = 0.132. so that p value 0.132 > 0.05 or Ho is accepted. Thus, there are no differences in the tenure of chemistry teachers for the chemistry teacher in the Bogor area in terms of understanding digital literacy skills in the realm of educators. So that there is no relationship between tenure and digital literacy skills for chemistry teachers who have a working period of less than one year, less than five years or more than five years.

Meanwhile, based on gender, chemistry teachers in the Bogor area are dominated by women with a percentage of 73.9% while men are only 26.1%. To see how gender is related to digital literacy skills, a statistical test is carried out. Based on the results of the statistical test calculation, the chemistry teacher's digital literacy ability was obtained by looking at gender with p value = 0.806/2 = 0.403. so that the p value is 0.403 > 0.05 or Ho is accepted. Thus, there is no difference between gender, male and female chemistry teachers in the Bogor Region in terms of understanding digital literacy skills in the realm of educators. So there is no relationship between gender and digital literacy skills.

The data in table 1 shows that there are 23 schools where chemistry teachers teach in the Bogor area, which can be categorized into six categories, namely: 1) teachers who teach at SMAN as many as 52.2%; 2) teachers who teach in SMAS are 34.8%; 3) teachers who teach at MAN 0%; 4) teachers who teach at MAS are 8.7%; 5) teachers who teach at SMKN are 0%; 6) teachers who teach in SMKS are 4.3%. Based on these data, teachers who teach at SMAN are more dominant in the Bogor area with a percentage of 52.2%, while there is no teaching chemistry teacher at MAN and SMKN schools. To see how much influence the place of teaching has with digital literacy skills, a statistical test is carried out. Based on the calculation results of the statistical test, the digital literacy ability of the chemistry teacher was obtained by looking at the origin of the teaching school with p value = 0.394/2 = 0.197. so that p value 0.197 > 0.05 or Ho is accepted. Thus, there are no differences in chemistry teachers in the Bogor Region from teaching schools, both from public and private high schools, public and private Madrasah Aliyah and Public and Private Vocational High Schools in terms of understanding digital literacy skills in the realm of educators. So there is no relationship between the origin of the teaching school and digital literacy skills.

Based on the certification of educators, 47.8% of alumni who teach in the Bogor area have been certified and 52.2% have not been certified. To see how the relationship between certification status and teachers' digital literacy skills, a statistical test was conducted. Based on the results of the statistical test calculation, the chemistry teacher's digital literacy ability was obtained by looking at the origin of the teaching school with p value = 0.354/2 = 0.177. so that p value 0.177 > 0.05 or Ho is accepted. Thus, there are no differences between chemistry teachers in the Bogor Region who have educator certification in understanding digital literacy skills in the realm of educators. Hence, there is no relationship between certified chemistry teachers and digital literacy skills. The teaching period, gender, place of teaching and teacher certification status do not have a significant influence on digital literacy skills in this era of disruption.

▪ CONCLUSION

Based on the results of data analysis and discussion of this research, it can be concluded that: 1) The perception and understanding of high school/MA chemistry teachers on digital literacy in the industrial revolution era in the realm of educator competence for the Bogor Region in general is in the very good category with an average percentage by 86.40%; 2) Based on statistical tests, there is no significant relationship between tenure, gender, school where you teach, and certification status with the digital literacy competence of SMA/MA chemistry teachers. This is evidenced by a significance value of 0.000 0.05 and is included in the strong category. This is because chemistry teachers are generally aware of the importance of digital literacy in today's era of disruption; 3) In this era of disruption, in general, the attitude of chemistry teachers towards digital literacy using information and communication technology is very good. This is evidenced by the ability to use and utilize technology both in the learning process and evaluation as well as a careful attitude in conveying information to students in particular.

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