Determining digital literacy among teacher from gender perspective through the Rasch model

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ABSTRACT

Advances in technology and the implementation of online learning require all parties in educational institutions, especially teachers, to be able to use technology. Digital literacy skills are needed to support the learning process. The purpose of this study was to measure the digital literacy skills of teachers through the Rasch model from a gender perspective during the coronavirus disease 2019 (COVID-19) pandemic at Senior High School/Madrasah Aliyah Negeri Palembang, Indonesia. A quantitative research method using Rasch analysis was applied. The results showed that the ability of teachers in digital literacy can be categorized as very high (three people), high (28 people), moderate (63 people), and low (two people) and showed that there are no question items that only favor one of the genders. The results showed that the male teachers in this study had a lower level of digital literacy skills than the female teachers.
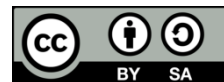
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1. INTRODUCTION

The digital literacy capabilities of teachers globally continue to grow rapidly. Digital literacy skills are important so that everyone is able to take advantage of the opportunities brought by technological developments. Digital literacy has basically become a much-needed skill because technology is developing rapidly and advances in information resources for learning, especially digital resources [1]. In education, technology skills provide opportunities to pave the way and introduce digital learning [2]. In the world of education, the use of digital literacy is an important concern for students, teachers, and policy makers [3]. A teacher is required to have good digital literacy skills in order to match the information needs of their students [4].

In line with that, during the coronavirus disease 2019 (COVID-19) pandemic the use of digital literacy is very much needed because the learning process is carried out remotely by utilizing digital. This happens because of the discontinuation of direct learning activities face-to-face. The circular letter of the Minister of Education and Culture of The Republic of Indonesia number 3 of 2020 contains information to prevent the spread of COVID-19 in Education Units, changing teaching and learning activities directly to online [5]. The learning and teaching process in the digital era is not only focused in the classroom, but also

by using digital media, online and teleconferencing. The teacher as the owner of the main role in the learning process must be more proficient than students in using technology [6]. Teachers as educators need to improve and innovate in the teaching process and adapt to technological advances [7]. Teachers must have sufficient digital literacy to meet the new needs of improving current and future innovative education. The level of digital literacy of teachers, career satisfaction, and professional roles have a very significant correlation to education [8]. Digital literacy not only emphasizes the skills to operate and use various information and communication technology devices, but also requires the individual's ability to "read" and "understand" the content of the information presented as well as the process of "writing" and "generating" new knowledge [9]. There are three levels of digital mastery, namely level I digital competence which includes skills, concepts, approaches, and attitudes. Level II digital use, covering professional disciplines/applications. Level III digital transformation, including innovation/creativity [10]. Research by Gebhardt *et al.* states that there are differences in digital mastery between male and female teachers [11]. The results of Gonzalez and Zarco's research provide information that women have a weaker ability to technology when compared to men [12]. Gender differences start from communication in the classroom to continue in teaching and learning activities [13].

This study aims to measure teachers' digital literacy skills through the Rasch model from a gender perspective during the COVID-19 pandemic. The Rasch model used in this study serves to provide an overview of respondents' answers. So that it can be seen the digital literacy ability of teachers at level I, II, or III during the implementation of learning. In addition, it is expected that there will be efforts to improve the digital literacy skills of teachers, both in mentoring and supporting infrastructure for digital learning.

The argument against this research is that teachers' digital literacy skills can be categorized as good. Where the ideal teacher's digital literacy ability has been facilitated by the school so that the increase in the teacher's digital literacy ability can affect the interests, motivation, and learning outcomes of students. Digital literacy skills can be influenced by the school environment, age level, years of service/length of work, and education. The measurement of teachers' digital literacy skills through the Rasch model is very good and in accordance with level I, II, or III. If schools and the government facilitate the improvement of digital literacy skills, the digital literacy skills of teachers in Indonesia will get better and increase.

2.   RESEARCH METHOD

This study employed a quantitative descriptive type to show the digital literacy skills of teachers in delivering learning materials during the COVID-19 pandemic. The sample in this study was determined based on purposive sampling (purposed sample). The sample used in this study were teachers who teach at Senior High School/State Aliyah Madrasah (MAN) Palembang, South Sumatra, Indonesia who participated in digital learning and filled out research instrument questionnaires distributed by researchers. So that the sample used in this study amounted to 96 people.

Data collection techniques used a questionnaire. The questionnaire used consisted of 39 questions. Level I (digital competence) include 15 questions, concepts, approaches, and attitudes towards digital. Level II (digital use) includes a professional/disciplined application of 13 questions. Level III (digital transformation) includes 11 questions for innovation/creativity. Questionnaires were distributed via Google Forms. The research data were analyzed using the Rasch model. The Rasch model is recommended for use in the analysis of test instruments [14]. Rasch is a test tool that is used to see the validity and reliability of the instrument in research. In addition, Rasch is also used to see the alignment between people and items [15]. The analysis was carried out using ministep software. The Rasch model is able to provide an evaluation of an item that is considered appropriate and provides identification results for an item that is considered biased [16].

3.   RESULTS AND DISCUSSION

The Rasch model is a test tool capable of classifying the results of item and person analysis. The Rasch model used in this study serves to analyze the description of respondents' answers to digital literacy skills. The results of Rasch's analysis of the digital literacy skills of MAN teachers in Palembang City are explained based on several statistical data.

3.1. Results

Summary statistics is a form of presenting data in a short and effective form which aims to make it easier to understand the contents of the data. Table 1 provides a summary of statistics that displays the results of the analysis of the instrument as a whole and provides information on the quality of person. Table 1 shows that the person measure value is 0.94. This value means that the teacher has a higher ability than the level of difficulty of the question and on average the teacher gives the correct answer to the question item. The size of

the person shows the average ability of the respondents to answer the instrument. The results of the average value of more than logit 0.0 show that respondents have relatively higher abilities compared to the level of difficulty of the test instrument, so teachers have a tendency to give correct answers to several items [15]. The Cronbach alpha value provides the results of measuring interactions between people and items as a whole [17]. The Cronbach alpha value from the analysis results is 0.90 which indicates that this value can be very good and consistent. The results of the reliability test above 0.80 show that there is a good interaction between people and item questions. These results show a congruent relationship between people and items used in the study [18], [19]. The results of this test provide information that the research instrument is able to provide an assessment of the teacher's digital literacy ability [20]. Based on Rasch's analysis of the difference in digital literacy abilities between men and women, it can be seen in Figure 1.

Table 1. Summary statistic

	Total score	Count	Measure	Model error	Infit		Outfit	
					MNSQ	ZSTD	MNSQ	ZSTD
Mean	117.8	29.0	1.75	0.37				
Standard deviation (SD)	9.9	0.0	1.41	0.22				
Maximum	145.0	29.0	7.96	1.84				
Minimum	93.0	29.0	-0.28	0.21	0.09	-4.3	0.07	-4.3

Real root mean square error (RMSE) 0.48; True SD 1.33; Separation 2.76; Person reliability 0.88
Model RMSE 0.43; True SD 1.33; Separation 3.14; Person reliability 0.91
S.E. of person mean=0.15
Person raw score-to-measure sorrelation=0.94
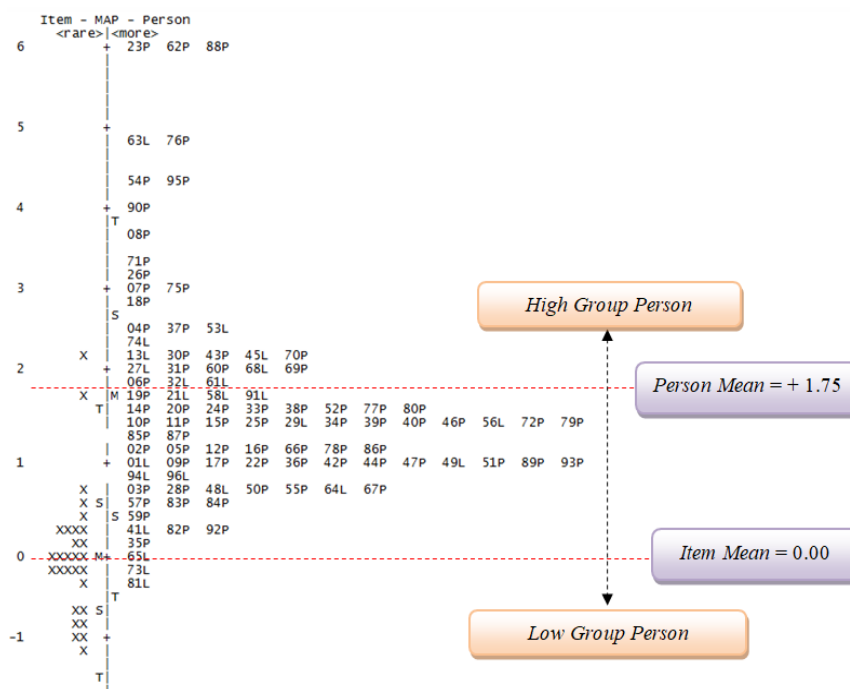Cronbach alpha (KR-20) person raw score "test" reliability=0.90

Figure 1. Person map

Groupings of people and items are shown based on their separation value. The greater the value of the separation indicates that the instrument has quality when viewed from all respondents involved and the items stated are getting better, because they are able to provide identification results for groups of respondents and items. With a person separation value of 2.76, H=[(4x2.76)+1]/3=4.01 rounded up to 4. Linacre, states that the isolation index value is good if it is greater than 2.0. Person groups based on the value of separation consist of very high, high, medium, and low groups. The probability of each person giving the correct answer to the item questions is related to the competencies possessed and the level of difficulty of the questions. The better a person's competence, the higher the probability of determining the correct answer on all items [21].

Person groups based on their ability to answer items consist of very high, high, medium, and low groups. The group of persons in the high category has full digital literacy skills at level I (digital competence), level II (digital use), and level III (innovation/creativity). Persons with high categories have a deficiency in one of the level indicators. Persons in the medium category have digital literacy skills at level I (digital competence) and level II (digital use). Persons categorized as low have several shortcomings in mastering digital literacy at levels I, II, and III.

The results of gender analysis based on Rasch show that men's digital literacy skills are lower than women. This can be seen from the number of women who are in the very high and high categories and there are only men who are included in the low category on the results of measuring digital literacy abilities. The results of this study indicate that women have a high desire to learn, are more diligent, and are willing to make changes. Whereas in digital mastery related to the implementation of learning, men tend to be less active in learning and think that the efforts made on digital mastery are sufficient to support the learning process.

3.2. Discussion

The results of the analysis of differences in teacher digital literacy in terms of gender perspective during the COVID-19 pandemic in Palembang City based on the results of the differential item functioning (DIF) analysis of gender/gender showed that there were no biased question items or no question items that only favored one gender. Meanwhile, based on the analysis of the person map, men have lower digital literacy skills than women. This result occurs because women have a high desire to learn, are more diligent, and are willing to make changes.

The results showed a contradiction with the research of Candrasari *et al.* which stated that women had lower technological abilities because they experienced more anxiety in using technology [22]. Poynton states that anxiety causes women to be lazy to master technology [23]. In addition, women show lower self-perceptions of technological capabilities than men [24]. The results of the study of Bunz, Curry and Voon stated that there was no gender difference in actual computer-email-web (CEW) fluency, but women felt that CEW fluency was lower than men [25].

Marini *et al.* research results show that women's interest in digital is lower than men. The digital literacy gap is caused by geographical factors, skills and education, government policies, as well as economic and cultural systems. The current situation has given a signal that it is necessary to empower Indonesian women in utilizing technology through digital literacy. Women are expected not only to be able to obtain information, but also to improve their quality of life. Efforts that can be made are to increase the capacity of Indonesian women through five competencies: access, analyze and evaluate, create, reflect, and act [9].

This study fills a gap from existing research where research results show that women have a higher level of digital mastery than men. Overall, teachers show great interest in the use of technology, but the digital literacy skills of state madrasah aliyah teachers in Palembang are at a moderate level so teachers need training to improve the quality of digital use. This is in accordance with Vidosavljevic and Vidosavljevic who stated that if the level of digital literacy of teachers is still low, then teachers need training in order to gain knowledge and skills regarding the use of technology [26]. Increasing digital literacy in the use of information technology is an important thing for teachers to do [27]. According to Viberg *et al.* there are seven factors that need to be prepared in the use of technology: i) The ability to use technology in digital-based teaching and learning processes; ii) The impact and support from the social environment; iii) Self-awareness of using technology; iv) The benefits of using technology and efficiency; v) Awareness of disability; vi) Pedagogical capacity; and vii) Awareness of technological assistance in life [28].

The results of this study can be used to determine policies on the digital literacy skills of teachers in schools so that learning runs effectively and efficiently. Some of the policies that can be carried out are the fulfillment of advice and infrastructure to support digital literacy, training and development of digital literacy skills for teachers, and communicating digital products that have been made to stakeholders [29]. Thijs *et al.* found that teachers also need strong support in developing digital literacy [30]. The factor that influences the development of digital literacy is the absence of digital devices that are able to provide access and support to resources. In addition, the lack of training and use of digital devices for teachers in the teaching and learning process and low awareness of the use of digital technology [31]. Spiers and Bartlett state that the intellectual processes associated with digital literacy include the competence to generate and utilize digital content, create digital content and communicate digital content [32].

The limitations of this study are that in-depth interviews have not been carried out with each teacher in mastering digital literacy. The provision of categories for teachers' digital literacy skills is only carried out in groups based on the results of Rasch's analysis. So, it is necessary to carry out further studies related to mastering digital technology for teachers in more detail in mastering digital literacy, especially in the manufacture of e-modules, e-books, e-learning, digital-based learning media, and the implementation of interesting digital learning.

4. CONCLUSION

The results of Rasch's analysis showed that the teacher has a higher ability than the level of difficulty of the questions. The value of person reliability from the measurement results is good. Person groups based on their ability to answer items consist of very high, high, medium, and low groups with digital literacy levels varying between level I (digital competence), level II (digital use), and level III (innovation/creativity). The results of the gender analysis showed that there are no items that are biased or that there are no items that only favor one gender. Meanwhile, the men in this study presented with a lower level of digital literacy skills than the women. Recommendations in future research should cover all senior high school/sekolah menengah atas/madrasah aliyah (SMA/MA) in Indonesia for broader data and information. In addition, future research should add more variables measuring digital literacy ability.

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