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Jurnal Elemen, 8(1), 263-275, January 2022 <https://doi.org/10.29408/jel.v8i1.4626> Students' perception of communication and collaboration effectiveness in online learning mathematics during the COVID-19 Sri Supiyati *, Muhammad Halqi, Ahmad Rasidi Mathematics Education Study Program, Universitas Hamzanwadi, West Nusa Tenggara, Indonesia * Correspondence: *sri.supiyati@hamzanwadi.ac.id © The Author(s) 2022 Abstract This study aims to determine student perceptions of the effectiveness of communication and collaboration in online learning mathematics during the COVID-19 pandemic. This study was an ex-post-facto with an exploratory, descriptive approach. The sample of this study was 26 students of the Mathematics Education Study Program at the Universitas Hamzanwadi. The respondents of this study were 26 students of Mathematics Education at Hamzanwadi University, five males and 21 females, which were obtained using the convenience sampling technique. This research was conducted in the even semester of the 2020/2021 academic year. The instrument used is a closed questionnaire with answers that are degraded according to the Likert scale and validated by experts. The research data were analyzed descriptively and inferential statistics. The results showed that (1) the perception of mathematics education students was > 58% of students giving a negative response to every question about the effectiveness of communication and collaboration in online learning; (2) ineffective communication and collaboration in online learning with an average student perception score of 2.16; (3) there is a positive and significant relationship between communication and collaboration in online learning during the COVID-19 pandemic with a significance value of 0.000 which is smaller than the alpha test value of 0.05 (<0.05); (4) the relationship of communication and correlation in online learning is strong or high with a correlation coefficient value of 0.677. Keywords: communication; collaboration; COVID-19; mathematics; online learning Received: 29

November 2021 | Revised : 3 December 2021 Accepted : 24 December 2021 | Published: 6 January 2022 Jurnal Elemen is licensed under a Creative Commons Attribution-ShareAlike 4.0 International License

1

. 263 Introduction The world pandemic of COVID-19 has not ended yet and has changed the world community lifestyle in all different aspects. (Surbakti & Pamungkas, 2021). In Indonesia, it is known as new-normal, where people carry out limited activities by adhering to a health protocol to avoid

COVID-19 spread. **On March 11, 2020, The World Health Organization declared COVID-19 a global pandemic** . Since then, **the**

7

world community has been active and collaborative in carrying out various preventive and curative activities in handling the COVID-19 pandemic (Kusumaningrum & Wijayanto, 2020), such as tracing and testing COVID-19, isolation and quarantine, social distancing, physical distancing, wearing a mask and hand washing, travel limitation and also taking care of positive Covid-19 (Gultom & Sitanggang, 2020; Kusumaningrum & Wijayanto, 2020; Sadikin & Hamidah, 2020). Muliadi, Mirawati, and Husnul (2021) elaborated that COVID-19 Spread is very fast in many countries; it forced every country to provide a fast response in each policy regarding health care and social care in individual, institution, community, local, national, and international. This ongoing pandemic has had a significant impact on changes in education in Indonesia, where the learning system must be carried out online to minimize outdoor community activities. Online learning is a new system in Indonesia. Iswari (2021), in general, learning is conducted offline. However, the policy of renewing the face-to-face learning system into online learning (Anhusadar, 2020; Firman & Rahayu, 2020), has been the best solution to ensure the learning activities are conducted COVID-19 pandemic (Muliadi, Mirawati & Jannah, 2021). Learning activities are the main component in education, ensuring that they can be carried out continuously and adequately (Maulah et al., 2020). Education in Indonesia has been conducted using the online system during the COVID-19 pandemic, even though there are still shortcomings that must be continuously evaluated (Muliadi et al., 2021). According to Muliadi et al. (2021), online learning is less effective due to limited interaction, communication, and collaboration between lecturers and students (Surbakti & Pamungkas, 2021). During the current COVID-19 pandemic, the online learning system uses computer technology as an intermediary for communication between lecturers and students (Anugrahana, 2020). Putri and Irwansyah (2021) create a distance that separates lecturers and students; there is no direct interaction and collaboration but is only mediated by digital platforms. Online learning tends to be dominated by communication through text, audio, or video, so there is a distance between educators and students during the learning process emotionally (Muliadi et al., 2021). Febrianto et al. (2020) emphasized that most students cannot ignore the importance of a lecturer in front of the class to build interaction, communication, and collaboration in

the learning process so that the learning communication process **is** more effective. Therefore, **the** success **of** the learning

22

process depends on the effectiveness of the communication process between educators and students (Toharudin, 2020). Online learning that utilizes digital platforms should not be an obstacle for students as the "z" generation is very close to digital technology. Buckingham (2013) explained that the current generation is a digital generation formed by new media technology. It suits the concept of Prensky (2009) that the young generation is famous as a digitally native generation, where they exist as the generation who has been adopting technology since they were born. However, as a digital generation, university students are not automatically able to adapt well in transforming conventional learning systems (face to face) to online systems. Therefore, lecturers and students must build an excellent relationship on learning interaction through communication and collaboration to achieve learning outcomes. Following Surbakti and Pamungkas (2021), online learning can be carried out properly if there is effective and maximum communication between lecturers and students. Sari et al. (n.d.) explained that learning communication is said to be good if students can understand the intent and purpose of the messages conveyed in learning to understand the material, generate interest in learning, and have good learning outcomes. Student-lecturer communication is the key element in deciding the learning quality (Toharudin, 2020). The success of the learning process as a process of transforming educational messages is very dependent on the effectiveness of communication and collaboration between lecturers and students in learning interactions. The same thing must also be owned in online learning that uses information technology as a communication intermediary between lecturers and students (Anugrahana, 2020). However, there is no direct learning interaction and is only mediated by digital platforms (Toharudin, 2020). Therefore, lecturers are required to build "real" communication and collaboration in learning interactions with online systems. It is because, in today's online learning, students still think of lecturers as "teachers" who are essential to be able to explain in detail and comprehensively each learning material, so that communication and collaboration are determinants of the effectiveness of online learning (Febrianto et al., 2020). Communication and collaboration have a significant role in online learning (Surbakti & Pamungkas, 2021). Suranto (2005) explains that communication is an act of contact between the sender and the receiver. Through the message, the sender and receiver share experiences that give meaning to the message sent, received, and interpreted by the recipient. In the learning process, the design of information and the delivery of information in learning interactions will determine the quality of communication built between lecturers and students (Surbakti & Pamungkas, 2021). Therefore, the effectiveness of online learning is largely determined by the quality of communication and collaboration built by lecturers and students through digital platforms. However, Putri and Irwansyah's (2021) research explains that computer-mediated communication cannot be implemented effectively due to internal, external, and contextual factors. Online learning in the mathematic education study program of Universitas Hamzanwadi has been conducted since

the Ministry of Education and Culture letter Number 3 of 2020 concerning Prevention of the Spread of **COVID-19 in Education Units**
. Online learning **in the**

3

COVID-19 pandemic, utilizing synchronous or asynchronous information technology (Muliadi et al., 2021). Muliadi et al. (2021) explained that the current digitalization era facilitates the implementation of online learning because of its fast advances in information and communication technology.

At the beginning of the COVID-19 pandemic, online learning was

13

an unfamiliar learning system, so lecturers were required to be adaptive by increasing creativity, skills, and professionalism (Maulah et al., 2020; Pangondian et al., 2019). Online learning is

not limited to time and place by using technology **in an open, flexible, and distributed learning environment (Putra et al., 2020). In**
online

2

learning, lecturers do not just transfer materials and assignments through digital platforms but must remain competency-oriented (Kusumaningrum & Wijayanto, 2020) and involve pedagogical, psychological, and didactic aspects (Mulyasa, 2013). Therefore, online learning is still through some steps, namely planning, implementation, assessment, and face-to-face learning. (Muliadi et al., 2021). The effectiveness of communication and collaboration in online learning in the Mathematics Education Study Program needs to be evaluated to determine the level of achievement of the learning objectives set. Rohmawati

(2015) explains that the effectiveness of online learning can be evaluated from learning interactions (communication and collaboration) and student mastery of learning materials. It is confirmed by Nugroho (2015)

that the effectiveness of online learning is not only measured by the achievement of learning

17

outcomes but also in terms of learning interactions and supporting facilities. Student responses or perceptions are essential indicators for effective communication and collaboration in online learning (Muliadi

et al., 2021 ; Nugroho, 2015). Perception is the process of interpreting the stimulus received through the five senses to be processed into an understanding

5

(Zhafira et al., 2020). Therefore, a study is needed

to determine the perceptions of students of the Mathematics Education Study Program about the effectiveness of

8

communication and collaboration in online learning during the COVID-19 pandemic. Methods This study was ex-post-facto research with an exploratory, descriptive approach (Muliadi et al., 2020; Muliadi et al., 2021). This study uses the ex-post-facto method to examine causal relationships that are not manipulated or treated by researchers, but researchers only record data from activities that have occurred. (Singarimbun, 2006). Descriptive exploratory studies are used to describe students' perceptions of the effectiveness of communication and collaboration activities in mathematics online learning during the COVID-19 pandemic (Muliadi et al., 2021). Applications used by lecturers of the Mathematics Education Study Program at Universitas Hamzanwadi in the even semester of the academic year 2020/2021 are WhatsApp and e-learning (LMS). The respondents of this study were 26 students (5 males and 21 females), which were obtained using the convenience sampling technique due to considering the accessibility of respondents in filling out online questionnaires during the COVID-19 pandemic (Fink, 2011). The research instrument used was a closed questionnaire with answers to students' degraded perceptions based on the Likert scale (Muliadi & Mirawati, 2020). This questionnaire was developed into several indicators regarding communication and collaboration in online learning systems. This research questionnaire is compiled in 8 statement points regarding the indicators developed by Adijaya and Santosa (2018) and has been validated by experts and declared valid. The indicators for the questionnaire developed are presented in Table 1 below. Table 1. Indicator research instrument Component Indicator Statement Value Communication Communication between students and lecturer Negatif 1 Communication between students Negatif 2 Expressing opinion and questions Positif 3 Elaborating concept/material Positif 4 Collaboration Interaction between students and lecturer Positif 5 Interaction between students Positif 6 Discussion and collaboration between students and lecture Negatif 7 Discussion and collaboration between students Negatif 8 The research data were analyzed using descriptive statistics and inferential statistics. The statistical analysis used was the relative percentage and central tendency in the mean (mean score). Descriptive statistics were used to describe the perception data of mathematics education students about the effectiveness of communication and collaboration activities in online learning systems during the COVID-19 pandemic. The average student perception score is converted into categories as presented in Table 2 below. Table 2. Interpretation of average score of students' preception Average score Interpretation 3,51 – 4,00 Very good 2,51 – 3,50 good 1,51 – 2,50 fair 1,00 – 1,50 Bad Inferential statistical analysis was used to determine the relationship between student perceptions of communication activities (X) and collaborative activities (Y) in online learning mathematics. The analytical technique used is the product-moment correlation test (r_{xy}) at a significance level of 5% ($\alpha = 0.05$), with the formulation of a statistical hypothesis, namely H_0 : There is no relationship between communication activities and collaborative activities in online learning mathematics) and H_1 : There is a relationship between communication activities and collaborative activities in online learning mathematics). If the results of the analysis are significant or the p-value of the correlation test is less than 0.05, then H_0 is rejected and H_1 is accepted or vice versa. To interpret the correlation index value between the variables X and Y, the conversion is used as presented in Table 3 below. Table 3. Correlation coefficient interpretation (Muliadi, 2020) Correlation Coefficient (r) Interpretation 0.00 – 0.199 Correlation very weak or very low 0.20 – 0.399 Correlation weak or low 0.40 – 0.599 Correlation fair or enough 0.60 – 0.799 Correlation strong or high 0.80 – 1.00 Correlation very strong or very high Results This study indicates that the description of students' perception data of communication and collaboration activities in online learning mathematics is presented in the form of percentages (see Table 4). There are four choices for each statement item,

namely Strongly Agree (SS), Agree (S), Disagree (KS), or Disagree (TS). Table 4. Description of

15

students' perception No Statement SS S Students' perception KS TS 1 Communication between lecturers and students is less effective in online learning mathematics 15% 54% 31% 0% 2 Communication between lecturers and students is less effective in online learning mathematics 8% 50% 42% 0% 3 Expressing opinions and questions is more convenient in online learning mathematics 4% 27% 54% 15% 4 Easier and faster elaboration of concepts/materials in online system mathematics learning 7% 8% 58% 27% 5 Interaction between lecturers and students is less effective in online learning mathematics 7% 31% 54% 8% 6 Interaction between lecturers and students is less effective in online learning mathematics 0% 23% 65% 12% 7 Discussion and Collaboration between between lecturers and students is less effective in online learning mathematics 8% 69% 23% 0% 8 Discussion and Collaboration between between lecturers and students is less effective in online learning mathematics 15% 69% 16% 0% Based on Table 4 above, it is known that most (69%) students gave a negative response to statement number 1; 58% of students gave a negative response to statement number 2; 69% of students gave a negative response to statement number 3; 62% of students gave a negative response to statement number 4; 79% of students gave a negative response to statement number 5; 77% of students gave a negative response to statement number 6; 84% of students gave a negative response to statement number 7; and 85% of students gave a negative response to statement number 8. The description of student perception data is emphasized in the form of a histogram in Figure 1 below. 80% 70% 60% 50% 40% 30% 20% 10% 0% 1 2 3 4 5 6 7 8 Sangat Setuju Setuju Kurang Setuju Tidak Setuju Figure 1. Percentage on students' perception on each question Data on students' perceptions of mathematics education about communication and collaboration activities in online mathematics learning

during the COVID-19 pandemic, were analyzed descriptively with a central tendency in the form of the

11

mean (average).

The results of the analysis are presented as presented in Table 5 below. Table 5

25

. Analysis result of central tendency Variance Value Number of students 26 Number of 8 Tquoetastliosnosre 450 Total average of 56.25 Deviation standard 0.612 Average score 2.16 Category Pretty good

Based on the results of data analysis in Table 5 above, it is known that the

9

average student perception score is still low. It is 2.16 with a pretty good category. The results of this study explain that mathematics education students justify ineffective communication and collaboration activities

in online mathematics learning during the COVID-19 pandemic. Students' perceptions of mathematics education regarding communication

23

and collaboration activities were analyzed using the product-moment correlation test to determine the relationship between the effectiveness of communication and collaboration activities

in online mathematics learning during the COVID-19 pandemic. The results of

12

the product- moment correlation test (r_{xy}) on the relationship between communication and collaboration activities in online learning mathematics are presented in Table 6 below. Table 6. Correlation test product-moment (r_{xy}) Variance Correlation Coefficient N Sig. (2-tailed) Communication – Collaboration 0.677 26 0.000

Based on Table 6 above, it is known that the correlation coefficient value of

24

0.677 with a significance value of 0.000 is smaller than the alpha test value

of 0.05 (< 0.05). So **H0 is rejected, and H1 is accepted**, which **means a positive and significant** relationship **between** communication activities **and**

6

collaborative activities in learning interactions

in online learning during the COVID-19 pandemic. The correlation coefficient value **is**

20

0.677, which means the relationship is strong or high. Discussion The results' elaboration of this study shows that communication and collaboration in online learning mathematics are not effective. It can be caused by many factors, such as the readiness of lecturers, students' facilities, and the learning environment to properly support online learning implementation (Sabrun et al., 2021). A good preparation stage is needed to provide learning media, online learning resources, support facilities, and a learning environment to achieve effective learning interactions (communication and collaboration). According to the opinion of Muliadi et al. (2021), online system learning requires maximum effort and support from all parties, including lecturers, families, and supporting facilities. The study results revealed that students recognized the importance of the learning environment in the effectiveness of online learning. Therefore, educators and families must

create an integrative learning environment and fulfill various essential components of learning, which are **discursive, adaptive, interactive, and reflective** (Oktavian & Aldya, 2020; Ulfah, 2020)

4

). Implementing

online learning during the COVID-19 pandemic requires sufficient time **so that** lecturers and students **can**

18

adapt comprehensively. Putri and Irwansyah (2021) explained that distance in online learning is a determining factor because the absence of lecturers and students in learning interactions in class results in the loss of non-verbal communication (body language) and collaboration, thus affecting students' understanding of learning materials and learning interactions are also changing. During the current COVID-19 pandemic, the online learning system uses computer technology as an intermediary for communication between lecturers and students (Anugrahana, 2020). Putri and Irwansyah (2021) create a distance between lecturer and students, with no interaction and direct collaboration, but through digital platform media. Online learning tends to dominate via text, audio, or video so that it builds a distance between lecturer and students emotionally during the learning process (Muliadi et al., 2021). Febrianto et al. (2020) emphasize that most students cannot replace the lecturer's presence in front of the classroom to build interaction, communication, and collaboration in the learning process to achieve more effective online learning. Therefore, the success of the learning process is very dependent on the effectiveness of the communication process between educators and learners (Toharudin, 2020). The percentage of students' negative responses thinks that online learning is ineffective because of limited interaction such as presenting opinions, discussion, collaboration, feedback, and response. It results in low mastery of learning materials due to limited communication and collaboration during online learning; even students admit that there is miscommunication

between lecturers and students or between **students. The** effectiveness of **online learning is**

19

measured by the achievement of student learning outcomes and the interactive process, and its supporting facilities (Nugroho, 2015). According to Sadikin and Hamidah (2020),

online learning has unique **challenges** because of **the location of students and lecturers**

16

who are far apart, so that lecturers cannot interact, guide, and directly supervise student activities during the learning process. (Szpunar et al., 2013) stated that students often have a wild imagination during online learning compared to face-to-face lectures. It is emphasized by the research result of (Sadikin &

Hamidah, 2020) that many students have difficulty understanding the lecture material given online. Students admit that independent materials and assignments are not enough because they need direct explanations from the lecturer (Swan, 2002). This research explained the relationship between communication and collaboration in learning interaction. Learning interactions are built from communication and collaboration between lecturers and students so that communication and collaboration activities become a unified process in learning interactions. There is certainly communication and collaboration in online learning because there is the interaction of lecturers and students through digital platforms. Communication will be successful if there is good collaboration between the sender of information (lecturers) and recipients (students) (Iswari, 2021). However, in online learning, lecturers have a little difficulty ensuring that students' information is following what the lecturer expects. According to Rakhmat (2005), the psychology of effective communication is characterized by an increase in collaboration and interaction between both sides. Communication and collaboration are integral processes in learning interactions, and they become important factors that determine the effectiveness of online learning. It follows the opinion of Toharudin (2020) that communication between lecturers and students is an essential factor determining the quality of online learning. The success of the learning process as a process of transforming educational messages is very dependent on the effectiveness of communication and collaboration between lecturers and students (Anugrahana, 2020). Lecturers are required to build "real" communication and collaboration in learning interactions via online systems. In today's online learning, students still regard lecturers as "teachers" who are essential to explain in detail and comprehensively each learning material so that communication and collaboration become determining factors for the effectiveness of online learning (Febrianto et al., 2020). Communication and Collaboration have an important role in online learning and daily life (Surbakti & Pamungkas, 2021). Communication and collaboration are two of seven skills of the 21st Century which hold a crucial role in life (Wagner, 2010). Therefore, the effectiveness of online learning is largely determined by the quality of communication and collaboration built by lecturers and students through digital platforms. Conclusion The perception of mathematics education students is > 58% giving a negative response to every question about the effectiveness of communication and collaboration in online learning. Communication and collaboration in ineffective online learning with an average student perception score is relatively low about 2.16.

There is a positive and significant relationship between communication **and** collaboration in online **learning** during **the**

14

COVID-19 pandemic with a

significance value of 0.000, which is smaller **than the** alpha test **value**

21

of 0.05 (<0.05). The relationship between communication and correlation in online learning is strong or high, with a correlation coefficient of 0.677. Conflicts of Interest The authors state that the publication of this work does not include any conflicts of interest. Furthermore, the writers have comprehensively addressed ethical issues such as plagiarism,

misconduct, data fabrication and/or falsification, multiple publishing and/or submission, and redundancy

10

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