Evaluation of online learning for mathematics education students

G M A Siregar$^{1,2}$, Hidayat$^{2,3}$, Sukmawarti$^{2,3}$ and M D Siagian$^4$

$^1$ Departemen Pendidikan Matematika, Universitas Pendidikan Indonesia, Jl. Dr. Setiabudhi No. 229 Bandung 40154 Jawa Barat, Indonesia
$^2$ Program Studi Pendidikan Matematika, Universitas Muslim Nusantara Al-Wasliyah, Jl. Garu II A, Harjosari I, Medan 20147 Sumatera Utara, Indonesia
$^3$ Program Studi Pendidikan Dasar, Universitas Negeri Medan, Jl. Willem Iskandar/ Pasar V, Medan 20221 Sumatera Utara, Indonesia
$^4$ Program Studi Pendidikan Matematika, Universitas Islam Sumatera Utara, Jl. Sisingamangaraja – Teladan, Medan 20217 Sumatera Utara, Indonesia

Email: ginda.mas@gmail.com

Abstract. The Covid-19 pandemic has affected most countries in the world, including universities in Medan, Indonesia. The spread of Covid-19 through social interaction requires the omission of face-to-face learning activities. Based on UNESCO data, 850 million students around the world, including Indonesia, study at home. For the mathematics education students in a private university in Medan, Indonesia, studying at home is a new phenomenon. Students and lecturers must change the learning method without preparation due to the sudden pressure. This article examined this phenomenon. The method used was descriptive qualitative to describe the process of implementing distance learning, the media, and evaluation used in e-learning during the Covid-19 pandemic for mathematics education students. Data collection was conducted by a questionnaire administered to 200 lecturers, interviews, and direct observation. The results show that Group Chat via WhatsApp was the most widely used online communication media, especially the Baby Boomers and Generation X, but millennials use online multimedia more frequently. The implementation has several shortcomings: the lack of interaction between instructors and students, students being asked to learn independently and do independent projects, teachers using more than one media not following the teaching-load hours or spending less time, and many experiencing technical obstacles.

1. Introduction
Each Indonesian government agency must carry out distance learning after the government establishing a vigilant status for the Covid-19 outbreak. Formal and written regulations, through the Ministry of Education and Culture No. 4 of 2020, emphasize that learning must be carried out from home for each student. Since February 2020, following the alert status of Covid-19 in Indonesia, schools and universities have implemented a study at home policy without any preparation.

Indonesian Ministry of Research, Technology and Higher Education (known as Ristekdikti) said that the implementation of e-learning in Indonesian universities is low, with only a small proportion of universities implement e-learning. Only nine universities have established e-learning and are ready to implement e-learning. Thus, many universities are unable to conduct distance learning by e-learning. However, the learning must be carried out despite the shortcomings, such as the lack of software and...
Online learning is a distance learning solution that can be done amid an outbreak. Besides its advantages, online learning has some disadvantages. A study by Binus University revealed the weaknesses of online learning, namely; 1) the tendency to ignore academic or social aspects, 2) the learning and teaching process tends towards training rather than educating, 3) the teacher’s role changes from mastering conventional learning techniques to requiring the learning techniques using ICT, 4) students with low learning motivation tend to fail, 5) Not all internet facilities are available (this may be related to the problem of the availability of electricity, telephone, or computer), 5) lack of computer literacy, 6) lack of student-teacher and student-student interactions.

Lifelong education for all, a commitment by UNESCO, describes the importance of education for adults through open and distance education [2]. This means that everyone has the right to continue their education regardless of distance and limitations. Thus, universities are required to carry out education by overcoming limitations through distance learning. One of the universities in Medan, Indonesia, carries out distance education. However, without experience and preparation, there will certainly be many shortcomings. Previous researchers have investigated the implementation of distance learning (online learning) based on the data obtained from the lecturers.

Studies conducted by Harrington and Reasons, evaluating online learning from distance education, discussed the application of an appropriate evaluation system in online learning [3]. Another study was also conducted to evaluate online learning implementation by applying seven good training principles in higher education [4]. Baldwin and Trespalacios evaluated online learning, especially the implementation performance, and discovered the aspects and issues in online learning, focusing on evaluating traditional online learning [5].

Studies related to the evaluation of the use of online learning media at private universities in Medan and other cities in Indonesia have been limited. This study examined the university's ability to carry out online learning in the Covid-19 period. It also evaluated the use of online learning media based on study programs, the appropriate material, and the lecturers' ability to master the online media they use.

This study is significant because it is intended to highlight the variety of online media for distance learning. Every online media has benefits and weaknesses; thus, it is important to evaluate to overcome future problems. Discovering the age of the lecturer is also crucial as every generation has different capabilities in using media, and this study showed its impact on teaching mathematics in the university.

2. Method
This research employed a qualitative approach to describe the phenomena. Data was collected from observations form, interviews, images, photographs, and footage of the incident. It determines and reports the way things are. Thus, it involves collecting data and testing hypotheses or answering research questions concerning the current status of the subject of the study [6]. The purpose of descriptive research is to observe, describe, and document aspects of a situation naturally. It sometimes serves as a starting point for hypothesis generation or theory development. In descriptive research, the events or conditions either already exist or have occurred, and the researcher merely selects the relevant variables to analyze their relationships.

According to [7], descriptive research is concerned with conditions or relationships that exist, such as determining the nature of prevailing conditions, practices, and attitudes; opinions held; on-going processes; or developing trends. In descriptive research, an accurate description of activities, objects, processes, and persons is the objective [8]. The population was all lecturers at one of the private universities in Medan, Indonesia. The research samples were lecturers who were willing to be evaluated when conducting online learning. Two-hundred lecturers were observed while carrying online learning. Data was collected by using a questionnaire designed by google form. Lecturers were observed when they were teaching in the virtual class, join in a chat group, and their online classroom management was also examined.
The sample selection used non-probability sampling, where the subjects were selected because of the ease of accessibility and proximity to the researchers [9]. Convenience sampling is useful because it allows the researchers to obtain basic data and trends regarding their study without the complication of using a randomized sample. It also benefits to document a particular quality of a substance or phenomenon within a given sample. The main disadvantage is that the units obtained may not represent the population.

The instrument used to examine the media the lecturers use to teach, and how they use it. Demography information was also sought to determine the age of lecturers and other information related to online learning. Human instruments are the researchers in qualitative research [10]. The results of observations made during the study were interpreted by researchers based on personal sensitivity.

3. Result and Discussion
The responses of 200 lecturers for the question "What media are used to online learning" are summarized in Table 1.

| Media                                      | Amount | Percentage |
|--------------------------------------------|--------|------------|
| Group Chat Application                     | 92     | 46.00%     |
| Classroom Management Web and Group Chat   | 54     | 27.00%     |
| Classroom Management Web                   | 39     | 19.50%     |
| Classroom Management Web and Virtual classroom | 4     | 2.00%      |
| Classroom Management Web, Online Media, and Chat | 0     | 0.00%      |
| Online Group Chat and Media                | 3      | 1.50%      |
| Classroom Management Web, Chat, and Online Media | 4      | 2.00%      |
| Virtual Classroom                          | 4      | 2.00%      |
|                                           | 200    |            |

Table 1 shows that Group Chat (through WhatsApp Application) has the highest number of users (46% or 92 lecturers). Group chat facilitated by WhatsApp Messenger is easy to use for direct communication within the community to create a virtual learning space without time and space restrictions [11]. Lecturers used this application in distance learning to deliver the subject matter and two-way communication.

Based on the observations, communication between lecturers and students run effectively and efficiently. This is in line with previous research [12] stated that the constant availability of facilitators and learning anytime and anywhere has made WhatsApp a new and convenient tool for teaching and learning activities. However, there was no significant difference between the gain of knowledge from WhatsApp or didactic lectures, advantages (technical, educational, or instructional) out pars the disadvantages. The lecturers-students interaction takes place actively and effectively, as seen in fqiure 1.

Fifty-four lecturers (27%) combined distance learning with group chat and web-based learning management (Google Classroom and Schoology). While 39 lecturers (19.5 %) only used web-based learning management. Based on interviews with the lecturers who used more than one online media communication, it was revealed that a combination of google classroom or Schoology with group chat helped them communicate, give instructions, as well as provide and collect assignments. The group chat was used when students have questions and can be responded to directly by the lecturers or their classmates. According to the lecturers, who only used web-based learning management, communication with google classroom or Schoology was effective, and no additional application was needed. They said that students directly received all notifications on the web through their smartphones, and discussions can be done on the web page provided.
The remaining 7.5% of learning was done using more than one media. Lecturers admitted that it is to build a good online learning environment, as every online media has advantages and disadvantages. For example, WhatsApp groups are good for communication (see Figure 1), but it cannot monitor student activities directly because it is not real-time. Thus, it is necessary to use virtual classes through zoom or google meet. Web-based management is good for gathering tasks timely, but not for communication. Of the two conditions, it is necessary to use more than one application in distance learning.

Figure 1. Group Chat Activities (a) Lecturers give problems, and students respond, (b) Lecturers provide guidance, (c) Students show the results they are working on, and lecturers give appreciation.
The use of online learning media is influenced by one's ability to use technology, especially information and communication networking media. Furthermore, someone's ICT expertise is influenced by his birth generation. Based on the times, surviving generations are grouped in Baby Boomers (1946-1964), Generation X (1965-1980), Millennials (1981-1994), and Generation Z (1995-2010) [13]. The samples of this study can be grouped by birth generation, as shown in figure 2.

Most lecturers belong to the millennial generation (59%), 14% are baby boomers, and 27% are Generation X. Table 2 and figure 3 present the use of online media types based on birth generation grouping.

**Table 2.** Online media used by each birth generation group.

| Online media for learning                              | Baby Boomers | X-Gen | Millennial | Z-Gen | Total |
|--------------------------------------------------------|--------------|-------|------------|-------|-------|
| Group Chat Application                                 | 21           | 30    | 41         | 0     | 92    |
| Classroom Management Web and Group Chat                | 5            | 12    | 37         | 0     | 54    |
| Classroom Management Web                               | 2            | 7     | 30         | 0     | 39    |
| Classroom Management Web and Virtual classroom         | 0            | 1     | 3          | 0     | 4     |
| Classroom Management Web, Online Media, and Chat       | 0            | 0     | 0          | 0     | 0     |
| Online Group Chat and Media                            | 0            | 0     | 3          | 0     | 3     |
| Classroom Management Web, Chat, and Online Media       | 0            | 2     | 2          | 0     | 4     |
| Virtual Classroom                                      | 1            | 1     | 2          | 0     | 4     |
| Total                                                  | 29           | 53    | 118        | 0     | 200   |
Online media types based on birth generation groups.

Figure 3 shows that the highest proportion of the users using more than one media in online learning is the Millennial generation. Millennials who are familiar with technology better utilize their abilities in online learning. In distance learning using one media, generally, the lecturers provide many assignments, and there is a lack of teacher-student interaction. Most students are asked to study independently and do independent projects. Lecturers who implement more than one learning media did not adhere to the actual teaching duration; they used a shorter time. In addition, lecturers experienced many technical obstacles.

4. Conclusion
Based on the study results, it can be concluded that Group Chat via Whatsapp is the most widely used online communication media, especially by Baby Boomers and X generations. On the other hand, millennials use more online multimedia. In addition, the interaction between teachers and students in online learning was limited. Students were mostly asked to study and do projects independently. Teachers who used more than one media spend a shorter teaching duration, less than the actual teaching load. Many lecturers also experience technical obstacles during online learning.

References
[1] Berliyanto and Santoso H B 2018 Indonesian perspective on massive open online courses: Opportunities and challenges J. Educ. Online 15 1
[2] UNESCO 2000 World Education Report 2000: The Right To Education Towards Education For All Throughout Life (France: UNESCO Publishing)
[3] Harrington C and Reasons S 2005 Online Student Evaluation of Teaching for Distance Education: A Perfect Match? J. Educ. Online 2 1–12
[4] Benigno V and Trentin G 2000 The evaluation of online courses J. Comput. Assist. Learn. 16 259–70
[5] Baldwin S J and Trespalacios J 2017 Evaluation instruments and good practices in online education Online Learn. J. 21 2
[6] Gay L R Mills G E and Airasian P 2012 Educational Research: Competencies for Analysis and Applications (United States of America: Pearson Education Inc)
[7] Best J W and Kahn J V 1998 Research in education (Boston: Allyn and Bacon)
[8] Amedahe F K 2002 Fundamentals of Educational Research Methods (Cape Coast: University of Cape Coast Press)
[9] Elfil M and Negida A 2017 Sampling methods in clinical research; an educational review Emergency 5 1–3
[10] Lincoln Y S and Guba E G 1985 *Naturalistic inquiry* (Beverly Hills, CA: Sage Publications, Inc)

[11] Jumiatmoko 2016 Whatsapp Messenger Dalam Tinjauan Manfaat Dan Adab *Wahana Akad.* 3 pp 51–6

[12] Gon S and Rawekar A 2017 Effectivity of E-Learning through Whatsapp as a Teaching Learning Tool *MVP J. Med. Sci.* 4 19–25

[13] Codrington G and Grant-Marshall S 2011 *Mind the gap: Own your past, know your generation, choose your future* (Parklands, South Africa: Penguin Books (SA) (Pty) Ltd)