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A Rubric-Based Evaluation of Video Conferencing Services for Educational Use

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Abstract: *The COVID-19 pandemic has brought about rapid changes in the educational process in all countries where extreme measures, such as lockdown, were applied. Almost all levels of education have turned to synchronous teaching, using various video conferencing services. This study will attempt to evaluate specific applications with the assistance of appropriate methodology based on rubrics and the SUS questionnaire for interactive systems. A comparative evaluation of 5 popular video conferencing tools (Big Blue Button, Google Meet, Skype for Business, WebEx, Zoom) was attempted based on a methodological approach with usability and functionality criteria. A rubric was generated to assist the authors in assessing the selected five video conferencing tools. The research took place in May 2020. The sample of the survey included 73 adults (teachers at all levels of education) that used those video conferencing services. The aim of this study is to highlight teachers' views and needs from tools supporting synchronous education in order to improve the online learning process at all levels of education.*

Keywords: *video conferencing tools; COVID-19; rubric; usability; SUS; synchronous education; distance learning*

1. INTRODUCTION

The pandemic of COVID-19 brought rapid changes in many aspects of everyday life. Especially in the field of education, there has been a shift towards completely online courses, thus radically changing the educational systems worldwide. The goal of using new technologies and methods at all levels of education is to enrich the online environments and lead to an increase in student engagement, retention, and student – teacher collaboration.

From the COVID-19 pandemic that forced schools to transition completely to online learning, it has become apparent that educational institutions must learn to adapt in order to provide students with the education they need to succeed. However, responses by higher education providers have been diverse worldwide, from having no response through to social isolation strategies on campus and rapid curriculum redevelopment for fully online offerings [1]. Several studies have begun to appear in international literature to highlight the transition to online education, e.g. [2] [3] [4].

It is said that in difficult situations there is always a benefit. The pandemic seems to confirm this saying in the field of education in the case of Greece. For their students to stop remaining inactive, teachers have surprisingly embraced distance education, both synchronous and asynchronous, mobilizing their students creatively - to the extent that distance education has allowed.

2. THE TRANSITION TO DISTANCE LEARNING

The field of education was perhaps one of the few areas that made a direct transition to its distance equivalent. The reason is that the tools and methods were already widely available. However, in the period before the COVID-19 pandemic, the purely online model was not preferred by many educational organizations, as face to face education (when feasible) has advantages that seem to prevail over the online version: interaction among students and a teacher, interaction between classmates, immediate feedback, increased reinforcement efficiency, etc. [5] [6] .

2.1. The Case of Greece

On March 10, 2020, the Greek government abruptly announced the closure of all educational units (private and public) at all levels, from nurseries to universities, for precautionary reasons for 14 days. On May 11, 2020, the schools reopened for the students of the 3rd level of Lyceum, while a week later (18/5/2020) all the children who attend secondary schools / high schools of the country (14+ years old) were able to return to the educational structures. On June 1, 2020, all educational structures reopened for all

students (of all levels). Of course, in each relaunched educational structure new safety rules are set (distances between trainees, separation of classes with a maximum of 15 students per class, different days and hours of attendance, cleaning protocols, etc.).

In the intervening period, software tools for distance education were gradually employed at every level, resulting in the consistent completion of the academic season. More specifically, higher education almost in its entirety (with the help of technological schools and IT departments) adapted directly within two weeks from the lockdown, continuing courses to large audiences with several tools for synchronous learning (where possible, e.g. at least in all theoretical courses). The video-conferencing services that were used by most of institutions are discussed and evaluated in the next sections of this paper. Besides, asynchronous teaching platforms (e.g. Moodle or similar software) were already widely used in almost all university courses in the country.

Concerning primary and secondary education, asynchronous teaching (which was not widely used until then at these levels) was immediately used, and later synchronous teaching methods and tools were gradually integrated, starting with secondary school students. Most primary school students used video conferencing services for synchronous teaching after the Orthodox Easter holidays, i.e. in May 2020, for a few hours a week (maximum 3 meetings of 1 hour per week). The frequency of online lessons, as well as the time of integration of each class in the process of synchronous learning was largely due to the readiness and familiarity of each teacher with modern technologies (beyond technical and educational reasons). The tool chosen for synchronous teaching in public primary and secondary education was Cisco WebEx.

By analogy, similar technologies were used during the same period in the country's private educational structures (private schools, secondary schools, foreign language centers, etc.). A great variety of software tools for synchronous and asynchronous learning were used in these structures, as well.

2.2. Massive and Rapid Adaptation

The way of the transition to the purely online model (even from the other end - the traditional model) [7] and adaptation of students and teachers at all levels are surprising. The transition to distance learning had two notable features: it was (a) *massive* (it took place at all levels of education in both the public and private sectors) and (b) *rapid* (the adaptation was immediate by the teachers, the students and their parents). What should be noted here is that before this unprecedented need, a negligible percentage of trainees (or parents in the case of underage students) did not have either the necessary technical knowledge or the will to support online education or (in many cases) necessary technical equipment.

2.3. Tools for Distance Learning

Distance learning can be (a) **asynchronous**, or (b) **synchronous**. Each of these forms uses different tools and methodologies.

Asynchronous learning describes forms of education, instruction, and learning that do not occur in the same place or at the same time. *Asynchronous online teaching* is where teaching materials are posted online, and learners work through them in their own time, communicating with each other and the teacher via discussion boards, forums, or email. Asynchronous learning is mostly supported by e-class platforms and learning management systems (LMS), such as Moodle (moodle.org). *Synchronous* learning is mostly supported by video conferencing tools, like the ones that are included in this study. Synchronous learning is discussed in the next section.

2.4. Challenges

No change is made without problems and challenges. In the case of Greece, there were several issues that need to be addressed in order to fully support online education. In addition to the lack of the necessary equipment from the various parties involved in the educational process, in some cases, two serious challenges arose from the transition: (a) the use of video camera for live streaming of the lesson from the school classroom, and (b) the examination process in higher education.

Regarding the live broadcast of the lesson that takes place in the classroom to the students who are absent (live streaming), there are many questions regarding the exposure (and / or recording) of students and teachers.

Regarding the university examination process, the main problem is the integrity of the process and there are challenges regarding the method used (oral exam, project elaboration, online quiz, or any combination), the identification of the students and supervision (also here issues concern privacy because of the need for camera and microphone use).

3. VIDEO CONFERENCING TOOLS FOR SYNCHRONOUS LEARNING

Synchronous teaching (and learning) requires the simultaneous participation of all students and instructors. The interaction between instructor and students takes place in real time, during which they can exchange opinions, as well as educational material. Simultaneous engagement can be achieved either by being in the same space (class, etc.) or by being interconnected via a network that allows audio and / or video conferencing.

An environment for synchronous education must be able to support the following:

- sending invitations to new students in order to attend classes through the virtual classroom
- monitoring of the working environment that the teacher has properly formed
- integration of texts, presentations and files
- attending discussions in the virtual classroom, and real-time conversation between students and the teacher.

There are several platforms available for synchronous communication of many users through video conferencing. Next, we will focus on the applications that were included in this research and were widely used for distance learning during the lockdown period in Greece.

3.1. Big Blue Button

Big Blue Button (bigbluebutton.org) is an open-source software that supports all forms of videoconferencing, screen sharing, desktop and file sharing, session recording etc., thus making it suitable for synchronous education and cooperative learning. It is an online application, with the current version being in HTML5 (while the previous one required flash support). This allows proper function on all computers, smart devices, tablets and mobile phones. It can also be installed as a plugin in learning management systems, such as Moodle, thus combining asynchronous and synchronous teaching.

3.2. Google Meet

Google Meet (meet.google.com) is a video-communication service developed by Google. It is one of two apps that constitute the new version of Google Hangouts, the other being Google Chat. It's essentially a useful and cost-effective platform for small businesses, as well as enterprise customers. It has a very light, fast interface that enables easy management of up to 250-person meetings.

The video-conferencing service serves about 100 million users every day, including G Suite enterprise and corporate clients, although Google has made Meet available to all Google account holders since April 2020, causing speculation about whether the consumer version of Google Meet would accelerate the deprecation of Google Hangouts.

3.3. Skype for Business

Skype for Business (skype.com) allows video conferencing between users in different geographical areas. The Skype for Business app will gradually be replaced by the Teams app, which is available in the same terms and similar environment, but with increased collaboration and multi-file sharing capabilities, as well as features of information management between teams within the same organization.

3.4. CISCO WebEx

CISCO WebEx (webex.com) is an online video conferencing service for up to 100 participants that offers users web conferencing capabilities with high quality video. The users of WebEx can fully collaborate remotely, increasing their productivity and reducing the cost of face-to-face meetings. It supports voice communication between users, as well as file sharing with partners without requiring complex settings and configuration.

3.5. Zoom

Zoom (zoom.us) is a commercial platform that allows multiple people to collaborate simultaneously, even creating webinars and conferences. The service has several features, e.g. user interface sharing, events creation via personal id and files and presentations sharing. The free version supports video conferencing of up to 100 users for up to 40 minutes. In the commercial "full" version, the creator of the events must own the purchased version of the tool, while the attendees can watch by installing the free version.

4. METHODOLOGY

4.1. The Neurocognitive approach

Teaching offered by University Institutions is not a simple or ordinary knowledge acquisition experience. Instructors develop reflective expertise in providing resources, descriptive metadata and explaining in depth collections of data that reside in huge local repositories, like libraries or research acquisitions.

Therefore, when the learning experience is transferred to the web sphere, the participants become aware of information that comes either from the learning resources or from observation of the complex rubric that biases the outcomes of the Interaction.

In other words, teaching with Zoom or similar paraphernalia is not a mere session for remotely working together, but for developing a culture of transgression in Academia.

As seen in Fig. 1, the goal of tele-education is to achieve high levels of Interaction. Indeed, highly proactive neurological therapeutic sessions, like Remote Fitting for Cochlear Implant users, or Play Audiometry sessions with young children, with or without hearing aids, and operative speech therapy over the Internet serve as road runners for the development of a culture for neurologically advanced training [8].

Figure 1. *Neurocognitively enhanced remote sessions of clinical operations with actual patients.*

This survey, even further postulates how e-Learning with such characteristics from small groups of interest may promulgate its characteristics to direct, on-line streaming services at national levels.

4.2. The Rubric

An approach for evaluating software is based on the use of Rubrics, that is, tables that contain characteristic criteria that are graded on a 3-level scale. The Rubric in this paper is based on 13 criteria in order to evaluate video conferencing technologies in a holistic high-level way and is based on the Rubrics designed in [9] and [10] for data visualization technologies and systems supporting data journalism. The criteria are divided into two categories with functional and usability features (as shown in detail in Table 1). The score ranges from 0 to 3 with 0 meaning poor, 1 modest, 2 good and 3 excellent.

The Rubric used in this research is a modified version of the one used in [10], specially adapted to the features of video conferencing tools. The differences between the rubric used in this paper and the rubric used in [10] are as follows (some features have remained the same):

- Features 1,2,3,5 and 13 have changes in the descriptions of the scores (some of them are minor, e.g. feature 5). The name of the feature is the same.
- Features 6,7,8,10,11 and 12 have been modified (in both feature names and score descriptions) to reflect video conferencing software capabilities.

Features 2,6,7,8,9,10,11 and 12 can be largely graded quite objectively, so the score is put by the writers, after reviewing the relative documentation of each tool. Most of these features concern the functionality of the tools. The score for features 1,3,4,5 and 13 results from the average scoring on a survey that was designed for the research. Note that these five features are *usability* features. The survey and the participants are presented in the next sections.

4.3. The Survey

For the purpose of this research, a questionnaire has been designed and distributed to the participants in the form of an online survey. The questionnaire is aimed at teachers who used a Video Conferencing tool (Big Blue Button, Google Meet, Skype for Business, WebEx or Zoom) for the purpose of synchronous teaching in their classes due to the dispersion of COVID-19. The questionnaire is anonymous, consisting of 20 questions that are divided into three parts: (a)

Table 1. *Modified evaluation criteria (Rubric)*

No	Category	Feature	Poor (0)	Medium (1)	Good (2)	Excellent (3)
1	**Usability**	**Ability to handle**	There is no control over communication.	Minor handling (control / modification of one or two elements).	Partial handling capability (modification of many items but with limitations).	Full control of all aspects / features of communication.
2	**Usability**	**Support materials**	There is no documentation.	Insufficient documentation with little information about key features.	Almost sufficient documentation. It leaves out some features.	Well documented. Available technical support (online chat, troubleshooting, videos, webinars, etc.).
3	**Usability**	**Ease of use**	Graphics are not labeled, and the available functions are not visible. Fonts are difficult to read, and navigation is poor. It is necessary for the user to have a cognitive background (i.e. the tool is not easily accessible to all users).	There are some available tags. The use of the tool's capabilities is not clear.	There are many available tags. The use of the tool's capabilities is clear, and navigation is simple.	The graphics are properly marked, the available functions are visible, and the fonts are legible. Using the application does not require extensive knowledge.
4	**Usability**	**Learning time**	It takes a long time (>5 hours).	It requires a moderate time (1 hour – 5 hours)	It takes less than 1 hour (from 10 minutes to 1 hour)	It requires a minimum of time (totally intuitive or less than 10 minutes)
5	**Usability**	**Making use of previous knowledge**	Previous experience with other software or previous versions required.	Previous experience with other software or previous versions is recommended. Quite intuitive.	It requires little experience with other video conferencing platforms or previous versions.	No previous experience is required. Totally intuitive.
6	**Functionality**	**File sharing**	It does not support file sharing.	It only accepts small files (e.g. <5 MB)	It can accept files of limited size.	It can upload/download files of any size for sharing.
7	**Functionality**	**Subscription requirements**	Subscription is required for all functions.	Subscription is required for most functions.	Subscription is required for some specialized functions, but access is possible for routine functions.	No subscription is required for full functions.
8	**Functionality**	**Support of large groups of students**	It can support 2-10 users.	It can support 11-50 users.	It can support 51-150 users.	It can support over 150 users.
9	**Functionality**	**Cost for "full" version**	High cost (over $ 100 / year)	Medium cost (between $ 100 - $ 20 / year)	Low cost (below $20 / year)	Totally free
10	**Usability**	**Screen sharing**	No screen sharing supported.	Only one option available (e.g. full screen).	Many functions available	Complete range of available screen sharing options.
11	**Functionality**	**Scheduling**	No scheduling options supported.	Supported only with the use of outside scheduling or calendar software	The ability to schedule meetings comes only in-app.	The ability to schedule meetings comes both in-app and with the use of outside scheduling or calendar software
12	**Functionality**	**Supported devices and software**	It supports only one type of device, browser and / or operating system.	It supports limited specific types of devices, browsers and / or operating systems.	It supports most types of devices, browsers and / or operating systems.	It supports all types of devices, browsers and / or operating systems.
13	**Usability**	**Aesthetics**	Minimalist style, few options, limited color palette, limited fonts...	Minimalist style, but some flexibility, more screen layout types or style options.	Various style options and screen layout types.	Many style options available, such as color, font, screen layout type, etc. Impressive interface elements.

demographics, (b) rubric questions, (c) SUS questions.

The first part of the questionnaire is presented in the next section to outline the participants' profile in respect to the use of video conferencing services as teachers.

The second part of the questionnaire contains five questions concerning usability features, namely the criteria 1,3,4,5 and 13 of Table I (as mentioned in the previous section). The participants were asked to rate these certain criteria by choosing the most suitable answer according to their experience with the video-conferencing tool they used. Replies were afterwards matched to a rating on a Likert scale from 0 to 3, according to the meaning presented in Table I.

The third (and last) part of the questionnaire contains the ten questions of the System Usability Scale (SUS) questionnaire. SUS is considered one of the most effective questionnaires in terms of *validity* and *reliability* of the results produced [11] [12]. In recent years, through extensive testing and validation, there has been a growing popularity of the SUS questionnaire for the following reasons:

- It' s free of charge
- Its validity has been established in a series of studies in both conventional software and websites, as well as other devices such as mobile phones, etc.
- It produces the same or more reliable results compared to other questionnaires even with a small number of participants [11].

4.4. The Participants

The sample included 73 adults. All of them used at least one of the video conferencing services presented above to teach their classes due to the dispersion of Covid-19. Only teachers of several educational levels participated in the research and evaluated the tools they have used (not students). The participants were of several age groups: 15 of them (20.6%) were 22-34 years old, 33 of them (45.2%) were 35-50 years old, while the rest 25 of them (34.2%) were over 50 years old.

Most of the participants (67.1%) were teachers in higher education and used the tools for the needs of their university courses. Moreover, 11% of the participants were primary school teachers and 4.1% of them were teachers in the secondary education. Finally, a significant portion of the sample (17.8%) were foreign languages (FL) teachers.

Taking into account the distribution of the education levels of the participants, the size of their classes (that used the video conferencing tools for distance learning) was as expected: 14 teachers (19.2%) had very small groups (3-9 students), 21 teachers (28.8%) had small groups (10-29 students), 28 teachers (38.4%) had relatively big groups (30-79 students), 8 teachers (11%) had big groups (80-139 students), and 2 of them (2.7%) had very big groups (>140 students). It should be noted here that classes with over 30 students are observed only in tertiary education and constitute 52% of the sample. Also, very small groups (<9 students) are observed only in FL classes and (in three cases) in primary school classes.

5. RESULTS AND DISCUSSION

Fig. 2 shows the percentage of use for each video conferencing service by the participants for synchronous teaching due to the dispersion of COVID-19.

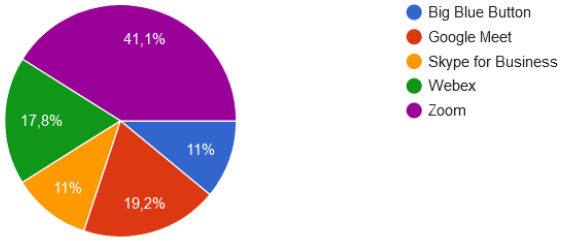

Figure 2. *Video conferencing tools used for synchronous teaching due to the dispersion of COVID-19.*

Certain abbreviations will be used for the results presentation and the rest of the discussion. For the tools, the following abbreviations will be used: *BBB, GM* and *SfB* to reference Big Blue Button, Google Meet and Skype[12 for Business respectively. WebEx and Zoom will be used as is.

There cannot be a direct linking between tools (Fig. 2) and grades of education, although there are some preferences. For example, GM, Zoom and BBB were widely used in universities and FL schools. Also, Webex was the main choice for teaching in primary and secondary public education. However, the general preference (41.1%) towards Zoom by the participants comes in agreement to our general sense of use "superiority" for the tool (from quality research, discussions etc.).

Only 7 out of the 73 participants had used this certain tool for distance learning in the past: 4 teachers had used Zoom before, 2 teachers had used SfB, while 1 teacher had used BBB (Fig. 3). Also, only 20 out of the 73 participants (27.4% of the sample) had experience with any video conferencing tool before the spread of Covid-19 (Fig. 4). Interestingly, although more than 70% of the sample had never used video conferencing tools before, they did respond quickly to distance education's requirements and even rated the tools quite high.

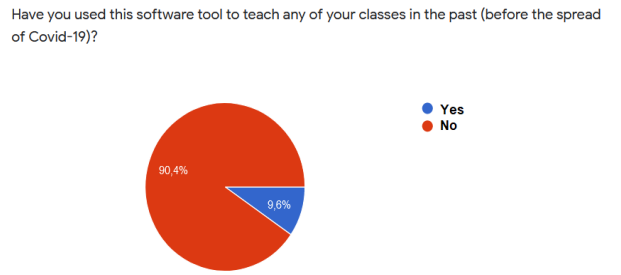

Figure 3. *Experience with the same video conferencing tool before the dispersion of COVID-19.*

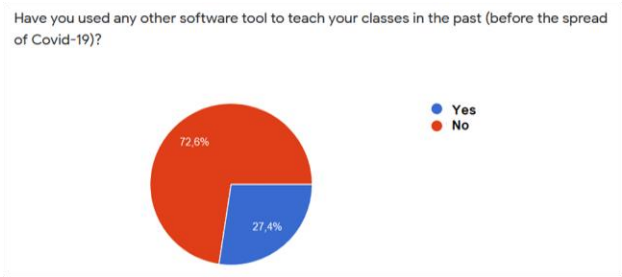

Figure 4. *Experience with any video conferencing tool before the dispersion of COVID-19.*

Summary Table 2 shows the average ratings of the participants' replies at the questions of the second part of the survey (they only concern usability evaluation criteria of the rubric). The rest of the comparative evaluation of the tools with the corresponding score that resulted after the authors' evaluation (according to info gathered from relevant research on the tools) is presented in Table 3.

Table 2. Average usability criteria

No	Feature	BBB	GM	SfB	WEBEX	ZOOM
1	*Ability to handle*	1,88	2,14	1,63	1,85	2,47
3	*Ease of use*	2,25	2,64	1,75	1,54	2,33
4	*Learning time*	1,88	2,50	1,88	1,31	2,07
5	*Making use of previous knowledge*	2,50	1,64	1,88	1,38	2,23
13	*Aesthetics*	1,00	1,86	1,25	1,38	2,00

Table 3. Rest of the evaluation criteria

No	Feature	BBB	GM	SfB	WEBEX	ZOOM
2	*Support materials*	2,50	2,50	3,00	3,00	2,50
6	*File sharing*	0,00	3,00	2,00	2,50	2,00
7	*Subscription requirements*	3,00	2,00	0,50	2,00	2,00
8	*Support of large groups of students*	1,50	3,00	3,00	2,50	3,00
9	*Cost for "full" version*	3,00	0,00	1,00	0,00	0,00
10	*Screen sharing*	3,00	2,00	2,50	3,00	3,00
11	*Scheduling*	1,00	2,50	1,50	2,50	3,00
12	*Supported devices and software*	2,00	2,00	3,00	2,50	3,00

Concerning our ratings in Table 3, there are some rankings that are mapped in between the explanations of the rubric (e.g. 1.50, 2.50, etc.). This was due to two reasons: (a) in some cases our experience was not totally accurate with the higher ranking, but it was higher than the lower ranking, or (b) sources were not clear or were controversial.

Fig. 5 shows the sum of all rubric's criteria for the 5 video conferencing tools, while the graph in Fig. 6 breaks down this sum in its two components: usability and functionality.

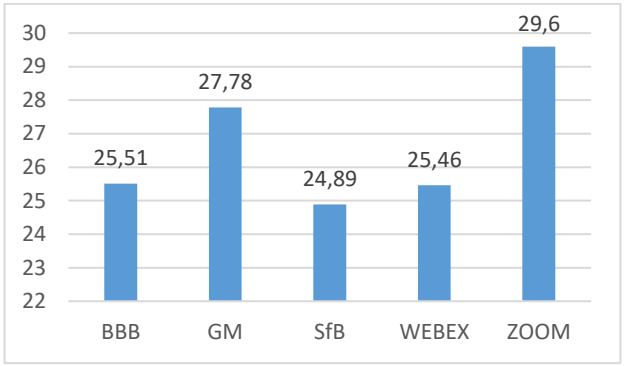

Figure 5. *Sum of all rubric's criteria for each video conferencing tool.*

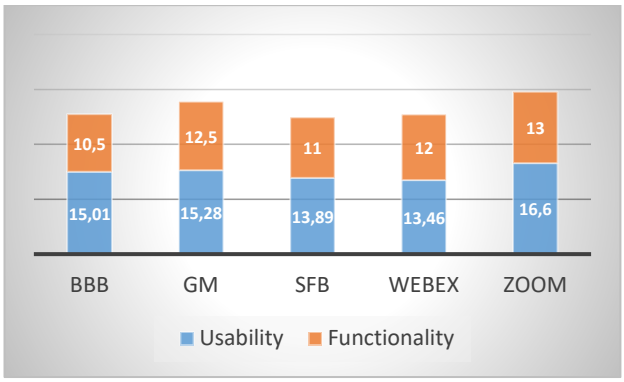

Figure 6. *Breakdown of the rubric's rankings in usability and functionality categories.*

It is obvious from the two graphs that Zoom has scored better than the other tools both in the total rubric as a whole and in its two component categories. Google Meet has the second highest ranking in total, which is also reflected in our functionality and usability rankings. The following graph shows the sum of the usability criteria only rated by the survey's participants (that is criteria no 1,3,4,5 and 13). As it can be seen in Figure 7, the participants' opinions on the second part of the questionnaire agree with the general usability rankings in Figure 6 (this is natural as the participants' ratings affect this ranking to a very large extent).

Table 4 shows the average ratings of the participants' replies at the questions of the third part of the survey. The reader can refer to relevant literature (e.g. [12]) for the complete list of the questions and the structure of the SUS questionnaire. In the results summary of SUS questionnaire for the five services under review is presented the average of normalized values (Ni =

X - 1 for questions 1,3,5,7,9 and N_i = 5-X for questions 2,4,6,8,10). As shown in Table 4, the average scores for all ten SUS questions for Zoom are ≥ 3 (≥75%)!

The result (final score) of each participant is calculated as follows:

$$FS(\%) = 2.5 * \sum_{i=1}^{10} N_i$$

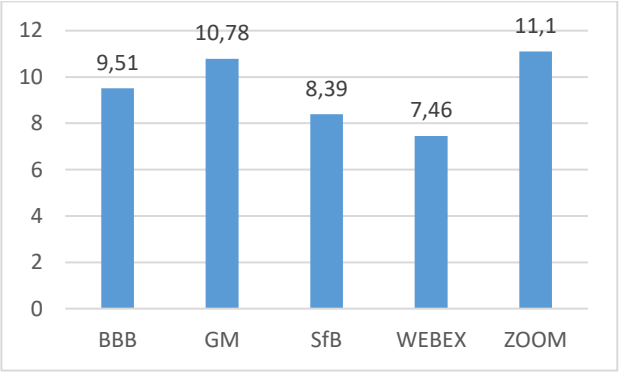

Figure 7. *Sum of usability criteria as evaluated by the participants.*

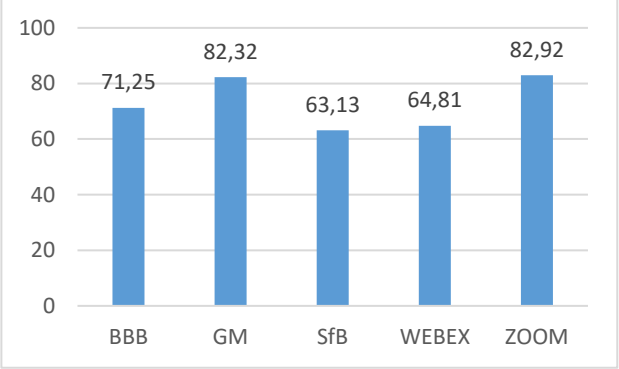

Figure 8. *Average scores in the SUS questionnaire for each video conferencing tool.*

Table 4. Summary of the SUS questionnaire

Question No	BBB	GM	SfB	WEBEX	ZOOM
1	2,25	2,93	1,63	2,00	3,17
2	3,38	3,64	2,75	2,92	3,47
3	2,75	3,71	2,88	2,54	3,10
4	1,88	3,29	3,00	2,85	3,37
5	2,50	2,57	2,63	2,46	3,20
6	3,00	3,50	2,13	3,00	3,53
7	3,13	3,50	3,00	2,46	3,17
8	3,50	3,64	2,38	2,77	3,53
9	3,00	2,93	2,25	2,00	3,00
10	3,13	3,21	2,63	2,92	3,63

The graph in Fig. 8 shows the average of the final score (percentage) from of the normalized user responses for each tool. Since the SUS questionnaire provides usability measurements, a comparison to the rubric's results (especially in usability criteria) is necessary. By comparing the rankings in Figures 6, 7 and 8, we can conclude that usability views on the tools are largely in agreement in both parts of the questionnaire. Only the ranking between Skype for Business and WebEx changes slightly. However, it is very interesting that the ranking order of the tools using the SUS questionnaire (Fig. 8) and the Rubric (Fig. 5) is the same!

Several statistical tests (in SPSS v.26) were conducted to reveal possible statistically significant findings. More particularly, ANalysis Of Variance – ANOVA [13] and (independent) t-tests were conducted between several variables. First, the role of the age group was examined in terms of the sample's ratings. Although it seems that for each age group the average response to the SUS questionnaire is relatively different (as seen in Fig. 9 older age groups gave a higher degree of usability to the tools they used), ANOVA analysis shows that there is no statistically significant finding at 0.05 level. The same is true for the Rubric usability criteria, which means that age does not affect how participants responded to the survey.

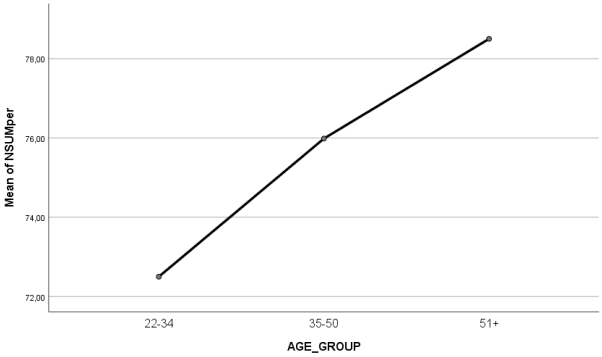

Figure 9. *Plot of mean SUS ratings in different age groups.*

An ANOVA test revealed a semantically significant finding concerning the education level to which each participant teaches (Table 5). Depending on the level of education, there were differences in how teachers perceived usability of videoconferencing tools. Combining descriptive and Post Hoc analysis statistics, we observe that **primary school teachers have rated the usability of the video conferencing tools that they have used statistically significantly lower (with 0.05 level of significance) than both teachers of higher education (p-value = 0 <0.05 and p-value = 0.001 <0.05 in the Rubric criteria and in the SUS questionnaire respectively) and the foreign languages (FL) teachers (p-value = 0 <0.022 and p-value = 0.049 <0.05 in the Rubric criteria and in the SUS questionnaire respectively).**

Similarly, another ANOVA test (Table 6) for comparing means of usability between teachers with different group size showed that: **teachers with large student groups (80-139 students) have rated the usability of the video**

conferencing tools that they have used statistically significantly higher in Rubric criteria (with 0.05 level of significance) as compared to teachers with very small classes (3-9 students) (p-value = 0.035 <0.05) and teachers with small classes (10-29 students) (p-value = 0.038 <0.05).

Table 5. ANOVA Post Hoc Tests (Comparing means of usability between education level groups)

Dependent Variable		(I) GRADE	(J) GRADE	Mean Difference (I-J)	Std. Error	Sig.
NSUMper	Bonferroni	Primary	Secondary	-12,81250	9,96650	1,000
			Higher	-22,65944*	5,61366	,001
			FL	-18,00481*	6,61523	,049
RUB_USER_SUM	Bonferroni	Primary	Secondary	-,91667	1,55308	1,000
			Higher	-4,12755*	,87478	,000
			FL	-3,09615*	1,03085	,022

Table 6. ANOVA Post Hoc Tests (Comparing means of Rubric usability criteria between group sizes)

Dependent Variable		(I) _GROUPS	(J) _GROUPS	Mean Difference (I-J)	Std. Error	Sig.
RUB_USER_SUM	Bonferroni	Big (80-139 persons)	Very small (3-9 students)	3,21429*	1,06620	,036
			Small (10-29 students)	3,00000*	,99950	,038
			Relatively Big (30-79 students)	1,10714	,96442	1,000
			Very big (Over 140 persons)	-,50000	1,90186	1,000

Concerning the experience of the participants with video conferencing services before the spread of COVID-19, independent t-tests showed that:

(i) there is no statistically significant difference (with 0.05 significance level) in the mean value of usability scores between participants who had used the same video conferencing tool in the past and those who used it for the first time because of quarantine.

(ii) there is no statistically significant difference (with 0.05 significance level) in the mean value of usability scores between participants who had used any video conferencing tool in the past and those who used a tool for the first time because of quarantine.

It should be noted, however, that the second observation is *marginally true* for the responses in the SUS questionnaire, since p-value is 0.056 (Table 7). Participants with experience in video-conferencing tools gave higher SUS ratings in the tools they used (mean=80.75%) than those with no experience in video-conferencing tools at all (mean=74.39%).

Table 7. Independent Samples t-Tests (Comparing means of SUS usability between experienced and inexperienced users)

Independent Samples Test		Levene's Test for Equality of Variances		t-test for Equality of Means		
		F	Sig.	t	df	Sig. (2-tailed)
NSUMper	Equal variances assumed	8,957	,004	1,521	71	,133
	Equal variances not assumed			1,949	60,913	,056

6. CONCLUSION

Although the purpose of this study was not to have a "winner", it is obvious from the results that two of the popular video-conferencing services in our research (Zoom and Google Meet) were rated higher than the others. In fact, according to [14], a score of SUS greater than 81.2 implies ranking in the top 10% of the systems in the category under consideration. Interestingly, the participants rated these two services with such a high score (specifically Zoom with 82.92 and Google Meet with 82.32)! Big Blue Button followed both in Rubric's and SUS responses, which is interesting in terms of usability, as it is an open-source software.

In the context of the sample's ratings, it was found that there is a strong correlation (r = 0.682) between the answers given to Rubric's usability criteria and the answers given to the SUS questionnaire. The correlation is statistically significant at a significance level of 0.01, since p-value = 0. This observation methodologically enhances the reliability of the sample responses to the designed Rubric usability criteria.

Although Zoom was very popular and there was a common impression (mostly in informal discussions and posts) that it outperformed all other relevant services, this survey shows that Google Meet's move to provide its services to everyone for free (due to the spread of COVID-19) was a very effective strategic move to challenge on an equal footing its main competitor, Zoom. In fact, Google was also keen to push the security of Google Meet, following widespread criticism of Zoom's platform [15].

Some very important findings have been made in the present study. In principle, the age of users is not a factor in assessing the usability of video conferencing tools for teaching. In contrast, it seems that primary school teachers found the tools less easy to use than higher education teachers and foreign language teachers. This may be partially due to the inexperience of primary school teachers with innovative technological tools. Of course, the hypothesis of correlating experience with any video conferencing services before COVID-19 to their usability ratings is rejected. It is worth noting, however, that all primary school teachers in the sample used WebEx. Finally, video conferencing services proved to be a very good alternative for the most difficult teaching situations, i.e. large classes (> 80 students), where participants seemed to appreciate the high level of the tools' usability.

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