

Article

Primary and Secondary Students' Usage of Digital Platforms for Mathematics Learning during the COVID-19 Outbreak: The Case of the Gaza Strip

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Abstract: During the outbreak of the COVID-19 pandemic, digital learning has reshaped mathematics education in different ways. In particular, different social media platforms have acquired an unforeseen prominence as a way to enhance mathematics learning and to model somehow the face-to-face classroom interactions abruptly interrupted. How primary and secondary students have reacted or responded to these changes in the initial learning conditions is the main aim of this study. With this purpose in mind data was collected from 3179 students from the Gaza Strip by means of a validated rating scale and then a cluster analysis approach was applied that revealed the existence of three clusters. K-means cluster analysis was applied to analyze data as an exploratory approach to identify structures within the data. Also, chi-square was applied to identify differences between the clusters with regard to demographic characteristics. Regarding the grouping of participants in clusters the analysis performed lead to the identification of three clusters: Cluster 1, 2 and 3 had 2001, 824 and 354 cases, respectively. These clusters were grouped depending on employ social media platforms used by the students to reinforcement their mathematics learning. Participants in Cluster 3 exhibited the highest proficiency in the usage of social media for mathematics learning as compared to those in Cluster 1 and Cluster 2. This means that students in cluster 1 are more likely to exhibit negative attitudes and low levels in the skills related to using digital technology and the employment of social media in mathematics learning. The results showed that there were no significant differences between cluster-groups with regard to gender, age, and type of school. In contrast, significant differences were found among the three clusters with regards to the educational level of parents and the economic status of the family. However, the overall results show that digital learning is considered a positive response to the school closure in the time of the COVID-19 outbreak.

Keywords: COVID-19; digital learning; social media platforms; mathematics learning; Gaza Strip; Palestine



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1. Introduction

The rapid outbreak of coronavirus diseases (COVID-19) has affected educational systems at the globe, leading to the widespread closure of educational bodies including the schools in the affected countries. It was reported that many countries have implemented nationwide closure, influencing 90% of the world's student population [1]. School closure does not only influence households, students, educators, and lecturers, but has economic, psychological, and social consequences [2–4].

School closures during the COVID-19 outbreak have highlighted on various sensitive issues such as digital learning [5–7], student debt [8], food insecurity [9], homelessness [10],

housing [11], and disability services [12] as well as health care [13–16]. School closures influence death rates during the COVID-19 outbreak either positively, through minimizing transmission and the number of cases to a low level [17], or negatively, through decreasing in the healthcare workforce [18].

The number of patients with coronavirus has extensively increased throughout the world. The confirmed global cases detected currently stand at 7,039,918, with 404,396 deaths, as of 9 June 2020 [19]. The exponential spread of COVID-19 enforced significant efforts to the practice of social distancing, leading to the widespread closures of educational institutions including schools and universities.

In Palestine, the beginning of the outbreak of the COVID-19 pandemic was confirmed on 5 March 2020 in West Bank. As of 9 June 2020, the number of confirmed patients was 481 with 404 cases have recovered in the West Bank the Gaza Strip [20]. To help contain the spread of COVID-19 and prevent a possible large-scale outbreak among students, the Ministry of Education and Higher Education has decided to close all educational institutions temporarily from 6 March 2020, until further notice [3]. This procedure was done as a preventive measure to combat and contain the spread of COVID-19, as well as to protect students, teachers and lecturers. The parents were instructed to keep their children at home and prevent them to go to public places or crowds. During the school closures, the teachers were continued to tutored using social media platforms to maintain the educating of students during this crisis.

In many countries, the outbreak of the COVID-19 pandemic has resulted in a shift from a dominant paradigm into a modern paradigm in terms of learning worldwide. Most institutions around the world are shifting from traditional education face-to-face to digital learning [21–24]. The majority of the students at the globe are shifting their mode of learning from the physical classroom to digital learning education [17,25–28].

1.1. Disciplinary Differences in Adopting Digital Learning during Covid-19 Pandemic

During these days as a result of the rapid outbreak of COVID-19, many studies have been carried out in the educational field, particularly medical student education, with respect to COVID-19. These studies have focused on the use of modern technology in medical education, in the time of COVID-19 [26,29–39]. Furthermore, special attention was paid on the employing information technology and digital platforms to fight and manage the COVID-19 outbreak [21,40–53]. During the current crisis, there are global attention and extensive work with regard to telemedicine in the era of COVID-19 [54–59].

In addition, various studies have highlighted the required knowledge for the employing of digital technology during the COVID-19 pandemic. For example, Iwai [60], carried out a study related to online learning during the outbreak of the COVID-19 Pandemic and discussed the pros and cons of virtual classes for students. In the study of Bao [61] they highlighted on employing distance education and digital technologies in the era of COVID-19. Utilizing technology may help to bridge the educational gap for students during this unprecedented circumstance. The study presented some principles for effective online education such as high relevance between student learning and online instructional design as well as the support provided by educators to students.

Also, Adnan and Anwar [62], they reported that the logic of going “digital” is not simple. In the study of Zhao and Xu [63], they studied the impact of social media on the attention and knowledge of the individuals towards the COVID-19 epidemic. They showed that social media platforms can be used to disseminate information and measure individuals’ attention towards public health emergencies. Different platforms of social media can be used to communicate urgently to individuals with regard to increasing their awareness and adhering to the health guidelines. In the studies of Sun et al. [64] and Mondol and Mohiuddin [65], they reported that in spite that COVID-19 has had a significant influence on the educational system, universities should take this unexpected opportunity to the adoption of online education through digital technology. Furthermore, Suryaman et al. [66] presented important tips that help students learn from home during

the quarantine period. In one of the tips, he recommended teachers to download some teleconferencing tools (e.g., Skype, Zoom, Lifesize . . .) to facilitate presenting lessons remotely.

Baytiyeh [67] stated that continuous communication and maintaining the learning of students during the closure of the schools is very important. Burke [68] reported that there are key procedures that need to be implemented during the closure of the schools such as ongoing communication with principals, teachers, students, parents, and other staff members through phone calls, social med, and e-mails, maintaining free access to supporting materials related to the curriculum such as Google Apps (e.g., dropbox, Google drive, cloud . . .), Moodle Cloud, Edmodo, or social media tools (e.g., WhatsApp, Twitter, YouTube, Facebook, Instagram, Yahoo . . .) and maintaining access to information via cloud computing for servers and making backup copies in a place other than the school [68].

More recently, Mulenga and Marbán [5] carried out a study aimed to respond to the question of whether COVID-19 is the gateway for digital-learning in mathematics education. They found that some prospective teachers exhibit low skill levels in the employ of digital technology in mathematics learning and education during the COVID-19 outbreak. In another study [7], the authors investigated the online learning mathematics activities of the prospective teachers in the time of the outbreak of the COVID-19 pandemic in Zambia. They found out that online learning mathematics activities were statistically significant differences between prospective teachers. The attitudes of prospective teachers towards the employ of technology in learning mathematics were found to vary. Moreover, they carried out a study to identify the social media usage in learning and teaching of mathematics by pre-service teachers. They showed that social media has positively affected mathematics education. Social media platforms have different benefits to mathematics education such as sharing data and information, as well as cost-saving. Also, the results showed that pre-service teachers have a positive attitude towards the employing of social media in learning and teaching of mathematics [7].

However, the results of recent studies indicate that the adoption of appropriate technology in mathematics education enhances and improves learning of students [69]. During this crisis, the type of digital technological tool was not exactly determined, where the students use various types of technological tools depending on the ease and flexibility of the tool from the student's point of view.

As of 7 May 2020, at the time of writing the present article, the number of patients with coronavirus throughout the world currently stands at 1,353,631, with 72,235 deaths [19]. The infected cases are likely to rapidly increase after this paper is published. In Palestine, as of 7 May 2020, the number of confirmed patients was 263, where a total of 44 cases have recovered, 36 in the West Bank and eight in the Gaza Strip [20]. As a result of this rapid outbreak, the preventive measures have imposed on thousands of individuals to restrict the movement, self-isolation, stay home, as well as closures of all educational bodies including schools, universities, institutions, and colleges. The reason behind the rapid closure of the educational institutions is to avoid the gathering of students in these crowded places, therefore prevent the spread of infection and the ability to contain the rapid outbreak of COVID-19. The outbreak of the COVID-19 has disrupted the education of millions of students around the world. Therefore, digital learning is considered an important tool to overcome this unexpected closure. Many countries, some for the first time, have employed digital learning as a quick response to this crisis.

During the COVID-19 crisis, the responses in different parts of the world towards adopting digital platforms in learning were obviously dissimilar. It was expected that high-income countries may be easy to transfer their students from traditional learning to e-learning and provide them with the required electronic services. Also, the student did not shift suddenly to digital platforms to complete their learning, particularly practical courses. The situation is completely different in moderate and low-income countries as well as refugees who live in deteriorated camps. The Gaza Strip in Palestine is one of these cities that still faces significant obstacles during this crisis and it is striving hard to ensure

that students will not be interrupted from studying in the time of the deterioration of the living conditions from bad to worse.

1.2. COVID-19 and Digital Learning Platforms in Palestine

Before the COVID-19 pandemic, higher educational institutions, like universities and colleges have increasingly shifted toward the adopted of e-learning as a supplement to traditional learning. Almost all Palestinian higher educational institutions have employed the e-learning for some courses [70,71]. On the other hand, a few numbers of primary and secondary schools incorporated and adopted e-learning in the education process with the help of some national and international agencies, which supported the employing of e-learning in Palestine. For primary and secondary schools, information technology (IT) and e-learning curricula are conceived within the framework of the current Education Development Strategic Plan 2008–2012, which aimed to enhance the quality of learning by adopting a paradigm shift from education to learning [72]. The Ministry of Education is still in the process of incorporating for e-learning in the schools with collaborations with the Ministry of Telecommunications and Information Technology, and international organizations to improve the employment of information technology and digital tools in the education system and produced electronic curricula, materials, and exams. However, this plan was not completed due to complex political and economic circumstances and limited financial support from donor parties. Although most schools in the Gaza Strip is still suffering from the shortage of financial support, some initiatives have been launched to adopted e-learning and incorporate it with traditional learning.

The employment of e-learning and various digital platforms was restricted only within the walls of the school and for some courses (i.e., religion, technology, language, etc.), where a group of students could use the computer device and log in to the required site and carry out the educational tasks based on the supervision of educator. Students were unable to employ technology and digital platforms outside the school due to the weakness of infrastructures, absence of Wi-Fi network, continued cuts of electricity, and the students does not have computer device or mobile phone. This situation is also applied for teachers. The dominant way to teach and learn of mathematics is the traditional method, interacting face to face between educators and students. The use of digital platforms today during the COVID-19 pandemic made mathematics e-learning a urgent necessary method, so the students suddenly shifted from tradition method to e-learning method through digital platforms.

The sudden closure of all educational institutions in Palestine was an immediate response by the responsible authorities as a preventive measure to protect the students and educators from risks of COVID-19 infection because the educational environments are considered an appropriate place to the transmission of COVID-19, where a lot of students interact, meet, contact each other as well as frequently touch different things such as chairs, books, desks, and boards. Furthermore, students use communal toilets and taps for drinking water. This environment can participate in the rapid outbreak of COVID-19 among the students and then society as a whole.

More recently, it was reported that schools are considered breeding grounds and dangerous places for the outbreak of COVID-19 [73]. As a result of this crisis, the students and educators have temporarily suspended school and stayed home. Despite this unfortunate situation, students are expected to learn using different internet tools [29,74,75]. Modern communication devices, including computers, laptops, phones, and tablets, have become accessible to many students due to the low cost, but we must not forget that there are a number of students unable to purchase such devices or access the internet because of the difficult living conditions experienced by their families. Policymakers and responsible educators are expected to change the direction of learning in Palestine during the COVID-19 pandemic. It was reported that the educational systems will witness a paradigm shift due to the presence of modern technology devices [17,69,76].

During the quarantine and the restriction movement period imposed by the Palestinian Ministry of Health, the most percentage of vital institutions, including educational institutions, have shifted from the traditional paradigm to the modern paradigm, i.e., digital learning.

All educational staff, principals, teachers and students were informed on Friday night, March 6 about school closure until further notice. In order to maintain the continuity of the learning of students during the time of emergency, the Palestinian Ministry of Education announced the implementation of an emergency plan to face the unexpected closure of the schools [3]. Most schools published statements to inform students and educators on the adoption of technologies for digital learning. A team of specialists from the Ministry of Education and UNRWA have started to prepare, record, and broadcast the lessons on the Voice of Education, live audio, 102.7 FM) and through live broadcasts on social media like WhatsApp and Facebook [3]. Also, teachers have uploaded supporting materials, educational worksheets, and additional files on Rawafed website (Figure 1) to help students in their learning. During temporarily closing schools, all teachers continued their educational duties as well as stayed in contact with the students to ensure from their health and help them to continue with their educational assignments. Teachers were guided to provide the educational material for them to enhance teaching using social media platforms. Similarly, students were also requested to stay in contact with their teachers through digital platforms to avoid missing out on learning. These procedures are an urgent response to ensure that learning continues in the comfort of their homes.



Figure 1. Rawafed website: an online platform established by the Ministry of Education and Higher Education, Gaza Strip, Palestine (<http://rawafed.edu.ps/portal/elearning/>).

Most of the Palestinian universities such as the Islamic University of Gaza, Al-Aqsa University, Al-Azhar University, . . . have also transformed to digital learning platforms to help students on learning and stay connect with during the first and second semesters. This is not strange, where teachers and students in many countries have been forced to learn distance learning methods and strategies and provide students with suitable materials. The outbreak of the COVID-19 pandemic is considered a catalyst factor in employing digital devices, social media platforms, online resources, and many e-learning activities. The recent studies confirm that no shift can be successfully projected without teachers as the main part of this shifting. In the current days, there is pressure on teachers and lecturers to employ the affordances of modern technology to bridge gaps in the learning process [17,69,77,78].

In the Gaza Strip, digital learning is not well established and not many lessons and lectures are presented digitally especially applied materials like mathematics. Before the

COVID-19 crisis, there is a very few Palestinian school, college, or university that presents mathematics-related courses online. But now, many educational institutions are offering mathematics lessons online. The present study aims to give a rapid response to how Palestinian students engage in mathematics learning activities through various digital platforms. Therefore, digital learning as an urgently educational response to COVID-19 pandemic stimulate some interesting issues:

- Does adopting digital learning in mathematics learning differs among Palestinian students with respect to gender, age groups, type of school, parental education level, and the economic level of the family?
- Do all students (clusters) exhibit an acceptable level of proficiency in the usage of social media and in terms of the variety of digital resources used for mathematics learning?

2. Materials and Methods

2.1. Sample and Procedure

Through a cross-sectional study design 3179 primary and secondary school students from Gaza volunteered to participate in this research by answering to a Likert-like scale. Participants were selected by means of a grab sampling method (also known as convenience sampling method) among students from private, public, and UNRWA schools. All Palestinian students are studying in private schools, public schools, or UNRWA schools. Private schools and public schools are supervised by the Palestinian Ministry of Education whereas schools UNRWA schools are supervised by the UNRWA [53].

The instrument used to collect data from participants was the adaptation to the context of this study of the one used in [5] which was itself an adaptation of the validated scale by Moll and Nielsen [79]. It exhibits good psychometric properties with a Cronbach's value equal to 0.986. Such scale is designed to capture social media usage in mathematics courses and social media usage in mathematics learning and respondents are asked to evaluate their level of agreement with each statement in the scale according to a 5-point rating. Participants are also requested to answer sentences relating to social media activities they engage in for learning mathematics by reporting how frequently digital learning platforms were utilized. Finally, participants are required for responding to some open-ended questions.

At the time of conducting this study, there were confirmed cases of COVID-19 in Palestine, therefore schools were closed and health intervention measures had been imposed to restrict movements of individuals to contain the outbreak of the COVID-19 pandemic. Because it was not possible to conduct a community-based sample survey during the movement restriction period, we decided to collect the required data online. To this end, a poster was posted on the groups on Facebook and WhatsApp as well as on school. This poster contains an overview of the study, aims, declarations of anonymity and confidentiality, voluntary of participation, and a direct link of the questionnaire. Students aged 12 years or more were instructed to answer the questionnaire on their own, whereas students aged 11 years or less were instructed to response the question with the aid of their guardians.

2.2. Statistical Analysis

Data were statistically analyzed with SPSS Version 22.0 for Windows (Statistical Package for Social Sciences Inc, Chicago, IL, USA). An analysis of descriptive statistics was applied to show the demographic characteristics of the participants. K-means cluster analysis was applied to analyze data as an exploratory approach to identify structures within the data. In the present study, we categorized data into clusters, where a high intra-cluster similarity, low inter-cluster similarity and find natural groupings among students on how they employ social media platforms in mathematics learning. Therefore, we first wanted to determine how many groups the data will cluster into and which groups of students need urgent attention in the using of digital platforms. Second, we wanted to determine the number of students who would participate in online mathematics virtual

classrooms during the COVID-19 pandemic. Chi-square was used to ascertain whether age, gender, type of school, educational level of parents, and economical level of the family had a significant main effect on social media platforms used. Also, chi-square was applied to identify differences between the clusters with regard to demographic characteristics.

2.3. Ethical Considerations

All students voluntarily confirm their informed consent to participate in the study after being informed about the objective of the study. The Ethics Committee of Ministry of Education and Higher Education approved our study protocol and procedures before the formal survey. The procedures of the current study complied with the Declaration of Helsinki respecting research on Human participants.

3. Results and Discussion

Three thousand, one hundred seventy-nine (N = 3179) students successfully completed the questionnaire giving a response rate of 92%. Demographic information from the participants is summarized in Table 1. As clearly shown from the table, the age of the most participants ranged from 6–9 years, where this group of students was continuing their learning with the help and support of their parents.

Table 1. The demographic characteristics of the study participants (N = 3179)

| Variable | Description | Frequency | Percentage (%) |
|---|----------------|-----------|----------------|
| Gender | Female | 1754 | 55.2 |
| | Male | 1425 | 44.8 |
| Age (years) | 6–9 | 1846 | 58.1 |
| | 10–14 | 561 | 17.6 |
| | 15–18 | 772 | 24.3 |
| School | Private school | 561 | 17.6 |
| | Public school | 1829 | 57.5 |
| | UNRWA school | 789 | 24.9 |
| Parents' educational level | Primary | 23 | 0.8 |
| | Secondary | 1028 | 32.3 |
| | Graduate | 2025 | 63.7 |
| Economical level of family ¹ | Post-graduate | 103 | 3.2 |
| | Low | 2986 | 94.0 |
| | Moderate | 95 | 2.9 |
| Device used to connect to social media | High | 98 | 3.1 |
| | Smart phone | 1710 | 53.8 |
| | Laptop | 682 | 21.5 |
| | Home PC | 133 | 4.1 |
| | iPad/Tab | 654 | 20.6 |

¹ Economical level of family calculated based on PCBS criteria for households in the Gaza Strip.

For the type of school, the majority of the students (57.5%) reported that they are studying in public schools, while 24.9% are recording in UNRWA schools, and the rest percentage (17.6%) are studying in private schools.

The analysis of parental educational level showed that 63.7% of the parent students had a university degree, 32.3% had finished secondary school and 3.2% had finished master's or Ph.D. degrees, and only 0.8% had a preparatory or primary school. The results illustrate that the education level of the households is generally good, which will help in enhancing the level of awareness towards the related issues with employing digital platforms in learning. Such results are expected in Palestinian society as a whole since the majority of the Palestinians are educated due to the political, economic, and social pressure that prevailed in the last years [80,81].

In addition, the vast majority (94.0%) reported that the economic status of their family is low. The rest were either moderate or high. This result was normally expected, where the majority of the Palestinian households in the Gaza Strip are considered to be living in

poverty and others in deep poverty [82] due to political circumstances and Israeli blockade imposed on the Gaza Strip since 2007.

When asked which device frequently used to access social media, 53.8% marked the option corresponding to smartphones, 21.5% pointed to the use of laptops, 20.6% said that they used iPad/Tab, and the rest was found to use home PC. The highest percentage of students stated that they use smartphones during learning because it is easy to use these phones and transfer it anywhere, availability, and low cost.

Survey participants were asked to state the frequency at which they used social media platforms to continue their mathematics learning during the COVID-19 outbreak. It was found out that the students used a variety of social media platforms, with Social networking (e.g., Facebook), Document managing and editing tools (e.g., Google documents, Dropbox), and Video sharing (e.g., YouTube) being the three most popular platforms among the students (Figure 2).

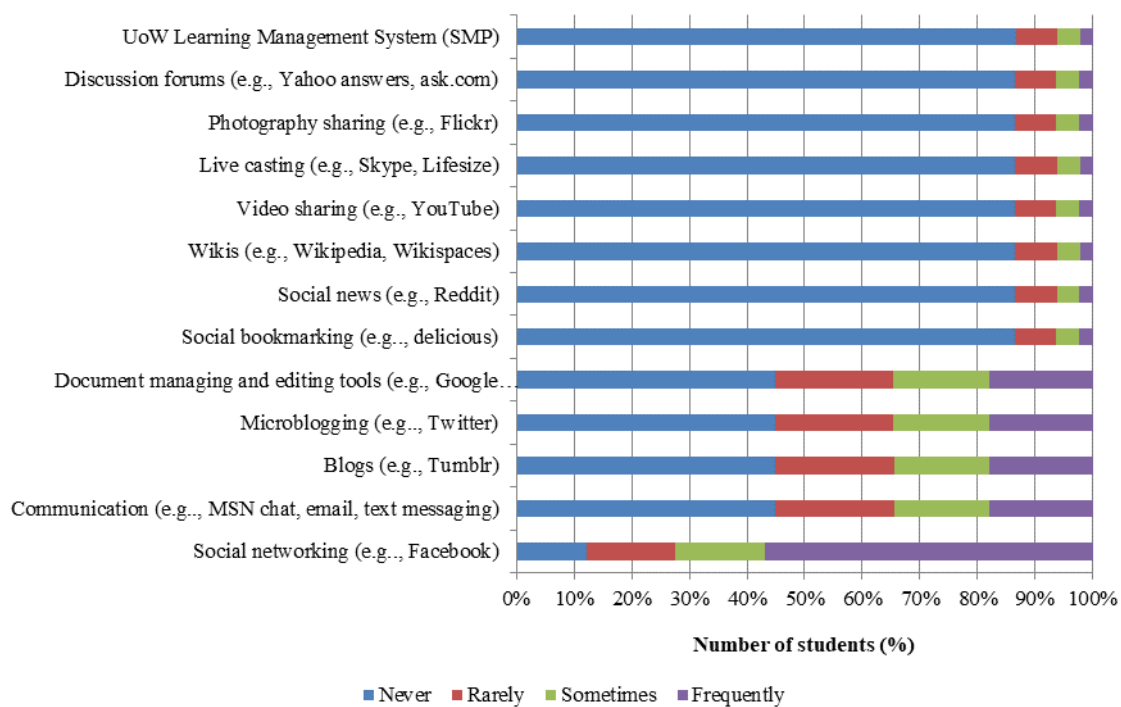


Figure 2. Overview of number of students (%) frequency of students using social media platforms during mathematics learning.

Moreover, other social media that were rarely or never used by respondents were Social bookmarking (e.g., delicious), Blogs (e.g., Tumblr), and Social news (e.g., Reddit). Only three respondents said they use the Learning Management System (LMS). Frequencies of social media platforms found in the present study generally agreed with those reported by Moran et al. [83], they reported that as a high level of awareness of social media among the general population, higher education faculty members, and therefore the students, are employed social media platforms during the education or learning especially Facebook and YouTube. In the study of Sobaih et al. [84], they found out that teaching assistants and professors use social media platforms for academic-related purposes (e.g., teaching) and Facebook was found the highest used and then WhatsApp was the second-highest used site by teaching assistants and professors, therefore, the students will frequently use these platforms during the study.

The results which are presented in Table 2 summarizes the social media tools deployed by students (males and females). When searching for differences between male and female social media use, we found out that distribution is the same across males and females. In fact, the results showed that there are no significant differences between males and females

in their deploying social media platforms during mathematics learning. During school closure and imposed quarantine, both females and males used social media platforms effectively to complete their duties and continue their mathematics learning. In normal conditions, before the COVID-19 outbreak, males were generally less than females in employing digital platforms in learning for economic reasons, where males work to help their families. During the COVID-19 outbreak and due to imposed quarantine, males stayed home for a long time and this helps them to employ social media platforms for economic, social, entertainment, and educational purposes (e.g., learning and education). The same trend was also found when categorized students by age (Table 3), and type of school (Table 4).

The following tables (Tables 5 and 6) show how the amount of social media used varies by the economic status of the family and the educational level of parents. The table compares those students based on the economic and education status of their parents with respect to the frequency of their use of the selected social media platform. It can be seen that the chi-square test results for the educational level of parents is found to be significant (see p -values). Hence the results showed that the educational level of parents and the use of social media platforms are dependent to one another. In other words, the use of social media apps for mathematical learning is dependent upon the educational level of parents.

Regarding the grouping of participants in clusters the analysis performed lead to the identification of three clusters as a result of multiple iterations: Cluster 1 had 2001 cases, Cluster 2 had 824 cases and Cluster 3 had 354 cases, respectively and the minimum and maximum scores across the clusters of all the test factors were 1 and 4 respectively. For instance, the minimum social networking (e.g., Facebook) score was 1 (Cluster 1, 2 and 3) while the maximum social networking (e.g., Facebook) score was 4 (Cluster 1, 2 and 3). These clusters were grouped depending on employ social media platforms used by the students to reinforcement their mathematics learning. The figure also shows that students with similar characteristics (homogeneous within) in Cluster 3 had the highest mean score values, but very different (heterogeneous across) with the two clusters. Based on the input variables; the observation of the response of any student in Cluster 1 differs from any student in Cluster 2 and Cluster 3 respectively.

The results showed that there were no significant differences between cluster-groups with regard to gender, age, and type of school (Tables 2–4). In contrast, significant differences were found among the three clusters with regards to the educational level of parents and the economic status of the family ($p < 0.001$).

According to the features that characterize each cluster (see Figure 3) we observed that:

- The participants in Cluster 3 got the highest mean score values when compared to other clusters. They exhibit high proficiency in the usage of social media for mathematics learning being this understood not only in terms of high frequency of use but also in terms of a high variety of such resources used. The level of social networking proficiency for students in cluster 3 is higher than the students in both cluster 1 and 2.
- Cluster 1 comprises cases relating a behavior similar to those in Cluster 3 regarding just some of the digital platforms under consideration and similar to those in Cluster 1 regarding the rest. Those participants exhibit moderate proficiency in the usage of social media for mathematics learning and a moderate variety of resources used.
- The participants in Cluster 2 got lowest mean score values among all clusters. They show low proficiency in the employ of social media for mathematics learning and a low variety of platforms used. The level of social networking proficiency for students in cluster 3 is lower than the students in both cluster 1.

Table 2. Comparison of the use of social media platforms among students and gender based on Chi-square test results (N = 3179).

| Item | Gender (N = 3179) | | | | | | | | <i>p</i> ¹ |
|---|-------------------|------|------|------|-------------------|------|------|------|-----------------------|
| | Male (N = 1425) | | | | Female (N = 1754) | | | | |
| | N(%) | R(%) | S(%) | O(%) | N(%) | R(%) | S(%) | O(%) | |
| Social networking (e.g., Facebook) | 5.0 | 7.2 | 7.1 | 25.6 | 7.1 | 8.3 | 8.4 | 31.1 | 0.437 |
| Communication (e.g., MSN chat, email, text messaging) | 20.3 | 9.5 | 7.0 | 8.1 | 24.7 | 11.0 | 9.7 | 9.8 | 0.424 |
| Blogs (e.g., Tumblr) | 20.3 | 9.5 | 7.0 | 8.1 | 24.7 | 11.0 | 9.7 | 9.8 | 0.441 |
| Microblogging (e.g., Twitter) | 20.3 | 9.5 | 7.0 | 8.1 | 24.7 | 11.0 | 9.7 | 9.8 | 0.431 |
| Document managing and editing tools (e.g., Google documents, Dropbox) | 20.3 | 9.5 | 7.0 | 8.1 | 24.7 | 11.0 | 9.7 | 9.8 | 0.468 |
| Social bookmarking (e.g., delicious) | 38.4 | 3.6 | 1.6 | 1.1 | 48.1 | 3.5 | 2.3 | 1.3 | 0.232 |
| Social news (e.g., Reddit) | 38.4 | 3.6 | 1.6 | 1.1 | 48.1 | 3.5 | 2.3 | 1.3 | 0.287 |
| Wikis (e.g., Wikipedia, Wikispaces) | 38.5 | 3.6 | 1.7 | 1.0 | 48.1 | 3.6 | 2.3 | 1.2 | 0.287 |
| Video sharing (e.g., YouTube) | 38.4 | 3.6 | 1.6 | 1.1 | 48.1 | 3.5 | 2.3 | 1.3 | 0.232 |
| Live casting (e.g., Skype, Lifesize) | 38.5 | 3.6 | 1.7 | 1.0 | 48.1 | 3.6 | 2.3 | 1.2 | 0.287 |
| Photography sharing (e.g., Flickr) | 38.4 | 3.7 | 1.7 | 1.0 | 48.1 | 3.5 | 2.4 | 1.2 | 0.218 |
| Discussion forums (e.g., Yahoo answers, ask.com) | 38.4 | 3.7 | 1.6 | 1.0 | 48.1 | 3.5 | 2.3 | 1.3 | 0.193 |
| Learning Management System (LMS) | 38.6 | 3.6 | 1.6 | 1.0 | 48.1 | 3.5 | 2.3 | 1.3 | 0.246 |

¹ Calculated by Chi square test (χ^2), *p* value significant at ≤ 0.05 . Abbreviation: N = Never, R = Rarely, S = Sometimes, O = Often.

Table 3. Comparison of the use of social media platforms among students and age based on Chi-square test results (N = 3179).

| Item | Age (N = 3179) | | | | | | | | | | | | p ¹ |
|---|----------------------|------|------|------|-----------------------|------|------|------|-----------------------|------|------|------|----------------|
| | 6–9 Years (N = 1846) | | | | 10–14 Years (N = 561) | | | | 15–18 Years (N = 772) | | | | |
| | N(%) | R(%) | S(%) | O(%) | N(%) | R(%) | S(%) | O(%) | N(%) | R(%) | S(%) | O(%) | |
| Social networking (e.g., Facebook) | 7.2 | 9.1 | 9.0 | 32.8 | 2.1 | 2.4 | 3.1 | 10.0 | 2.8 | 4.0 | 3.4 | 14.1 | 0.584 |
| Communication (e.g., MSN chat, email, text messaging) | 25.5 | 12.1 | 10.0 | 10.4 | 8.1 | 3.3 | 2.8 | 3.5 | 11.3 | 5.2 | 3.9 | 3.9 | 0.491 |
| Blogs (e.g., Tumblr) | 25.5 | 12.1 | 10.0 | 10.4 | 8.1 | 3.3 | 2.8 | 3.5 | 11.3 | 5.2 | 3.9 | 3.9 | 0.501 |
| Microblogging (e.g., Twitter) | 25.5 | 12.1 | 10.0 | 10.5 | 8.1 | 3.3 | 2.8 | 3.5 | 11.3 | 5.2 | 3.9 | 3.9 | 0.493 |
| Document managing and editing tools (e.g., Google documents, Dropbox) | 25.5 | 12.1 | 10.0 | 10.4 | 8.1 | 3.3 | 2.8 | 3.5 | 11.3 | 5.2 | 3.9 | 3.9 | 0.487 |
| Social bookmarking (e.g., delicious) | 49.8 | 4.2 | 2.4 | 1.6 | 15.0 | 1.6 | 0.7 | 0.3 | 21.7 | 1.4 | 0.9 | 0.4 | 0.103 |
| Social news (e.g., Reddit) | 49.9 | 4.2 | 2.4 | 1.5 | 15.0 | 1.6 | 0.7 | 0.3 | 21.7 | 1.4 | 0.9 | 0.4 | 0.145 |
| Wikis (e.g., Wikipedia, Wikispaces) | 49.9 | 4.2 | 2.4 | 1.5 | 15.0 | 1.6 | 0.7 | 0.3 | 21.7 | 1.4 | 0.9 | 0.4 | 0.153 |
| Video sharing (e.g., YouTube) | 49.8 | 4.2 | 2.4 | 1.6 | 15.0 | 1.6 | 0.7 | 0.3 | 21.7 | 1.4 | 0.9 | 0.4 | 0.103 |
| Live casting (e.g., Skype, Lifesize) | 49.9 | 4.3 | 2.4 | 1.5 | 15.0 | 1.6 | 0.7 | 0.3 | 21.7 | 1.4 | 0.9 | 0.4 | 0.153 |
| Photography sharing (e.g., Flickr) | 49.8 | 4.3 | 2.5 | 1.5 | 15.0 | 1.6 | 0.7 | 0.3 | 21.7 | 1.4 | 0.9 | 0.4 | 0.134 |
| Discussion forums (e.g., Yahoo answers, ask.com) | 49.8 | 4.3 | 2.5 | 1.5 | 15.0 | 1.6 | 0.7 | 0.3 | 21.7 | 1.4 | 0.9 | 0.4 | 0.127 |
| Learning Management System (LMS) | 50.0 | 4.2 | 2.4 | 1.5 | 15.0 | 1.6 | 0.7 | 0.3 | 21.7 | 1.4 | 0.9 | 0.4 | 0.177 |

¹ Calculated by Chi square test (χ^2), p value significant at ≤ 0.05 . Abbreviation: N = Never, R = Rarely, S = Sometimes, O = Often.

Table 4. Comparison of the use of social media platforms among students and type of school based on Chi-square test results (N = 3179).

| Item | Type of School (N = 3179) | | | | | | | | | | | | <i>p</i> ¹ |
|---|---------------------------|------|------|------|--------------------------|------|------|------|--------------------------|------|------|------|-----------------------|
| | Public School (N = 1829) | | | | UNRWA'S School (N = 789) | | | | Private School (N = 561) | | | | |
| | N(%) | R(%) | S(%) | O(%) | N(%) | R(%) | S(%) | O(%) | N(%) | R(%) | S(%) | O(%) | |
| Social networking (e.g., Facebook) | 7.2 | 9.1 | 9.0 | 32.2 | 2.8 | 4.0 | 3.5 | 14.5 | 2.1 | 2.4 | 3.0 | 10.1 | 0.594 |
| Communication (e.g., MSN chat, email, text messaging) | 25.4 | 12.1 | 9.6 | 10.4 | 11.2 | 5.2 | 4.4 | 4.1 | 8.4 | 3.3 | 2.6 | 3.4 | 0.478 |
| Blogs (e.g., Tumblr) | 25.4 | 12.1 | 9.6 | 10.4 | 11.3 | 5.1 | 4.4 | 4.1 | 8.4 | 3.3 | 2.6 | 3.4 | 0.487 |
| Microblogging (e.g., Twitter) | 25.4 | 12.1 | 9.6 | 10.4 | 11.2 | 5.2 | 4.4 | 4.1 | 8.4 | 3.3 | 2.6 | 3.4 | 0.500 |
| Document managing and editing tools (e.g., Google documents, Dropbox) | 25.4 | 12.1 | 9.6 | 10.4 | 11.2 | 5.2 | 4.4 | 4.1 | 8.4 | 3.3 | 2.6 | 3.4 | 0.464 |
| Social bookmarking (e.g., delicious) | 49.3 | 4.2 | 2.4 | 1.6 | 22.2 | 1.4 | 0.9 | 0.4 | 15.0 | 1.6 | 0.7 | 0.3 | 0.065 |
| Social news (e.g., Reddit) | 49.4 | 4.2 | 2.4 | 1.5 | 22.2 | 1.4 | 0.9 | 0.4 | 15.0 | 1.6 | 0.7 | 0.3 | 0.094 |
| Wikis (e.g., Wikipedia, Wikispaces) | 49.3 | 4.3 | 2.4 | 1.5 | 22.2 | 1.4 | 0.9 | 0.4 | 15.0 | 1.6 | 0.7 | 0.3 | 0.099 |
| Video sharing (e.g., YouTube) | 49.3 | 4.2 | 2.5 | 1.5 | 22.2 | 1.4 | 0.9 | 0.4 | 15.0 | 1.6 | 0.7 | 0.3 | 0.065 |
| Live casting (e.g., Skype, Lifesize) | 49.3 | 4.2 | 2.5 | 1.5 | 22.2 | 1.4 | 0.9 | 0.4 | 15.0 | 1.6 | 0.7 | 0.3 | 0.099 |
| Photography sharing (e.g., Flickr) | 49.3 | 4.2 | 2.5 | 1.5 | 22.2 | 1.4 | 0.9 | 0.4 | 15.0 | 1.6 | 0.7 | 0.3 | 0.085 |
| Discussion forums (e.g., Yahoo answers, ask.com) | 49.1 | 4.3 | 2.5 | 1.6 | 22.2 | 1.4 | 0.9 | 0.4 | 15.0 | 1.6 | 0.7 | 0.3 | 0.080 |
| Learning Management System (LMS) | 49.2 | 4.2 | 2.5 | 1.6 | 22.2 | 1.4 | 0.9 | 0.4 | 15.0 | 1.6 | 0.7 | 0.3 | 0.117 |

¹ Calculated by Chi square test (χ^2), *p* value significant at ≤ 0.05 . Abbreviation: N = Never, R = Rarely, S = Sometimes, O = Often.

Table 5. Comparison of the use of social media platforms among students and the educational level of their parents based on Chi-square test results (N = 3179).

| Item | Educational Level of Parents (N = 3179) | | | | | | | | | | | | | | | | p ¹ |
|---|---|------|------|------|----------------------|------|------|------|---------------------|------|------|------|-------------------------|------|------|------|----------------|
| | Primary (N = 23) | | | | Secondary (N = 1028) | | | | Graduate (N = 2025) | | | | Post-Graduate (N = 103) | | | | |
| | N(%) | R(%) | S(%) | O(%) | N(%) | R(%) | S(%) | O(%) | N(%) | R(%) | S(%) | O(%) | N(%) | R(%) | S(%) | O(%) | |
| Social networking (e.g., Facebook) | 0.0 | 0.4 | 0.0 | 0.3 | 2.5 | 2.8 | 3.3 | 23.7 | 9.1 | 11.6 | 11.6 | 31.4 | 0.5 | 0.6 | 0.6 | 1.6 | <0.001 |
| Communication (e.g., MSN chat, email, text messaging) | 0.3 | 0.4 | 0.0 | 0.0 | 12.5 | 7.6 | 6.7 | 5.5 | 30.6 | 11.9 | 9.5 | 11.7 | 1.5 | 0.7 | 0.5 | 0.6 | <0.001 |
| Blogs (e.g., Tumblr) | 0.3 | 0.4 | 0.0 | 0.0 | 12.5 | 7.6 | 6.7 | 5.5 | 30.6 | 11.9 | 9.5 | 11.7 | 1.5 | 0.7 | 0.5 | 0.6 | <0.001 |
| Microblogging (e.g., Twitter) | 0.3 | 0.4 | 0.0 | 0.0 | 12.5 | 7.6 | 6.7 | 5.5 | 30.6 | 11.9 | 9.5 | 11.6 | 1.6 | 0.7 | 0.5 | 0.6 | <0.001 |
| Document managing and editing tools (e.g., Google documents, Dropbox) | 0.6 | 0.0 | 0.0 | 0.1 | 31.0 | 0.7 | 0.3 | 0.3 | 51.8 | 6.5 | 3.6 | 1.8 | 3.1 | 0.0 | 0.0 | 0.1 | <0.001 |
| Social bookmarking (e.g., delicious) | 0.7 | 0.0 | 0.0 | 0.0 | 31.0 | 0.7 | 0.3 | 0.3 | 51.8 | 6.5 | 3.6 | 1.8 | 3.1 | 0.0 | 0.0 | 0.1 | <0.001 |
| Social news (e.g., Reddit) | 0.6 | 0.1 | 0.0 | 0.0 | 31.0 | 0.7 | 0.3 | 0.3 | 51.8 | 6.5 | 3.6 | 1.8 | 3.1 | 0.0 | 0.0 | 0.1 | <0.001 |
| Wikis (e.g., Wikipedia, Wikispaces) | 0.7 | 0.0 | 0.0 | 0.0 | 31.0 | 0.7 | 0.3 | 0.3 | 51.8 | 6.5 | 3.6 | 1.8 | 3.1 | 0.0 | 0.0 | 0.1 | <0.001 |
| Video sharing (e.g., YouTube) | 0.6 | 0.1 | 0.0 | 0.0 | 31.0 | 0.7 | 0.3 | 0.3 | 51.8 | 6.5 | 3.6 | 1.8 | 3.1 | 0.0 | 0.0 | 0.1 | <0.001 |
| Live casting (e.g., Skype, Lifesize) | 0.6 | 0.1 | 0.0 | 0.0 | 31.0 | 0.8 | 0.2 | 0.3 | 51.8 | 6.5 | 3.6 | 1.8 | 3.1 | 0.0 | 0.0 | 0.1 | <0.001 |
| Photography sharing (e.g., Flickr) | 0.7 | 0.0 | 0.0 | 0.0 | 31.0 | 0.7 | 0.3 | 0.3 | 51.8 | 6.5 | 3.6 | 1.8 | 3.1 | 0.0 | 0.0 | 0.1 | <0.001 |
| Discussion forums (e.g., Yahoo answers, ask.com) | 0.7 | 0.0 | 0.0 | 0.0 | 31.0 | 0.7 | 0.3 | 0.3 | 51.8 | 6.5 | 3.6 | 1.8 | 3.1 | 0.0 | 0.0 | 0.1 | <0.001 |
| Learning Management System (LMS) | 0.7 | 0.0 | 0.0 | 0.0 | 31.0 | 0.7 | 0.3 | 0.3 | 51.8 | 6.5 | 3.6 | 1.8 | 3.1 | 0.0 | 0.0 | 0.1 | <0.001 |

¹ Calculated by Chi square test (χ^2), p value significant at ≤ 0.05 . Abbreviation: N = Never, R = Rarely, S = Sometimes, O = Often.

Table 6. Comparison of the use of social media platforms among students and the economical level of their family based on Chi-square test results (N = 3179).

| Item | Economical Level of Family (N = 3179) | | | | | | | | | | | | <i>p</i> ¹ |
|---|---------------------------------------|------|------|------|-------------------|------|------|------|---------------|------|------|------|-----------------------|
| | Low (N = 2986) | | | | Moderate (N = 95) | | | | High (N = 98) | | | | |
| | N(%) | R(%) | S(%) | O(%) | N(%) | R(%) | S(%) | O(%) | N(%) | R(%) | S(%) | O(%) | |
| Social networking (e.g., Facebook) | 12.1 | 15.1 | 15.4 | 51.4 | 0.0 | 0.0 | 0.0 | 3.0 | 0.0 | 0.1 | 0.4 | 2.5 | <0.001 |
| Communication (e.g., MSN chat, email, text messaging) | 42.9 | 18.7 | 15.3 | 17.0 | 1.0 | 0.8 | 0.7 | 0.5 | 1.0 | 1.2 | 0.6 | 0.3 | <0.001 |
| Blogs (e.g., Tumblr) | 43.0 | 18.6 | 15.3 | 17.0 | 1.0 | 0.8 | 0.7 | 0.5 | 1.0 | 1.2 | 0.6 | 0.3 | <0.001 |
| Microblogging (e.g., Twitter) | 42.9 | 18.7 | 15.3 | 17.0 | 1.0 | 0.8 | 0.7 | 0.5 | 1.0 | 1.2 | 0.6 | 0.3 | <0.001 |
| Document managing and editing tools (e.g., Google documents, Dropbox) | 43.0 | 18.6 | 15.3 | 17.0 | 1.0 | 0.8 | 0.7 | 0.5 | 1.0 | 1.2 | 0.6 | 0.3 | <0.001 |
| Social bookmarking (e.g., delicious) | 80.6 | 2.2 | 4.0 | 7.2 | 3.0 | 3.0 | 0.0 | 0.0 | 2.9 | 0.0 | 0.0 | 0.2 | <0.001 |
| Social news (e.g., Reddit) | 80.6 | 2.2 | 4.0 | 7.2 | 3.0 | 3.0 | 0.0 | 0.0 | 2.9 | 0.0 | 0.0 | 0.2 | <0.001 |
| Wikis (e.g., Wikipedia, Wikispaces) | 80.6 | 2.2 | 4.0 | 7.2 | 3.0 | 3.0 | 0.0 | 0.0 | 2.9 | 0.0 | 0.0 | 0.2 | <0.001 |
| Video sharing (e.g., YouTube) | 80.6 | 2.2 | 4.0 | 7.2 | 3.0 | 3.0 | 0.0 | 0.0 | 2.9 | 0.0 | 0.0 | 0.2 | <0.001 |
| Live casting (e.g., Skype, Lifesize) | 80.6 | 2.2 | 4.0 | 7.2 | 3.0 | 3.0 | 0.0 | 0.0 | 2.9 | 0.0 | 0.0 | 0.2 | <0.001 |
| Photography sharing (e.g., Flickr) | 80.6 | 2.2 | 4.0 | 7.2 | 3.0 | 3.0 | 0.0 | 0.0 | 2.9 | 0.0 | 0.0 | 0.2 | <0.001 |
| Discussion forums (e.g., Yahoo answers, ask.com) | 80.6 | 2.2 | 4.0 | 7.2 | 3.0 | 3.0 | 0.0 | 0.0 | 2.9 | 0.0 | 0.0 | 0.2 | <0.001 |
| Learning Management System (LMS) | 80.6 | 2.2 | 4.0 | 7.2 | 3.0 | 3.0 | 0.0 | 0.0 | 2.9 | 0.0 | 0.0 | 0.2 | <0.001 |

¹ Calculated by Chi square test (χ^2), *p* value significant at ≤ 0.05 . Abbreviation: N = Never, R = Rarely, S = Sometimes, O = Often.

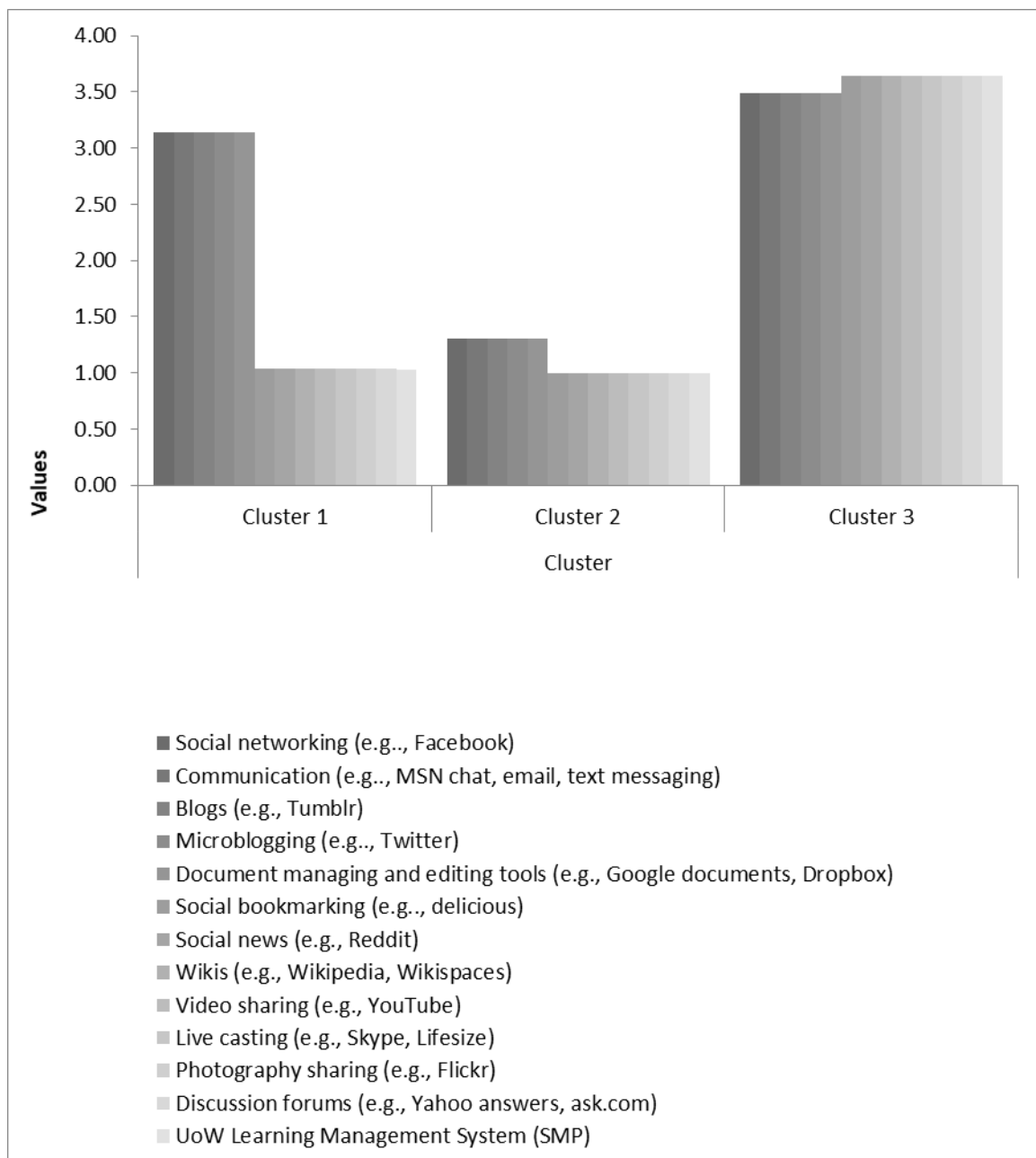


Figure 3. Homogeneous within, Heterogeneous across based on social media platforms used.

Thus, we might label clusters as *Moderate*, *Low* and *Proficiency*, respectively, being these terms understood in the sense explained above. This, in particular, means that almost 1 out of each 4 students participating in this study are more likely to exhibit low levels in the skills related to using digital technology and the employment of social media in mathematics learning. Also, they are also likely to exhibit negative attitudes towards the employ of various social media platforms in mathematics learning. Moreover, this considers a major challenge for students to engage in e-learning during school closures due to the COVID-19 pandemic. Therefore, most students may miss out on digital learning particularly when the required digital platforms are uncommon and hard to use. These gaps in knowledge of ease of use of social media technologies are a negative factor that affects integrating social media technologies into the learning of mathematics. It is worth mentioning at this stage that we must consider also that students' intention to use social

media platforms based on each cluster could be influenced by different factors such as accessibility of digital platforms, electricity crisis (e.g., Gaza electricity crisis), unreliable internet connections, and internet costs.

Anyway, the latter claims need further attention so that the authors, going a little bit beyond the scope of this study, present the excerpts from the qualitative content analysis of the answers the participants gave to the open questions posed at the end of the rating scale they were required to complete, an analysis aimed to better understand how participants have employed social media platforms in their mathematics digital learning which maybe give us an overview of some of the figures illustrated in Table 2. However, as it has been already saying, content analysis of the students' answers from the three clusters is far beyond the coverage of this paper. Students provided different general responses to using social media platforms in mathematics learning. In the following part of this paper, the responses of students are presented verbatim as follow:

A. Social Networking (e.g., Facebook)

Students mentioned different reasons for using social networking sites (e.g., Facebook) to support their mathematics digital learning. First, a high percentage of students recognized the features of the Facebook application. Students fell into three categories: (1) Slightly above three-quarters (78.2%) of students use Facebook for communication, (2) Approximately 19.3% use it for sharing information and (3) the rest use it for collaboration. One student said:

"I have posted some mathematics questions that are difficult for me to answer and send them to my Facebook educators and friends to get the right and concise answers from those who know".

Another student mentioned:

"During the closure of schools as a result of the COVID-19 outbreak, I and my friends in Tawjihi 2020 (mathematics exam for Tawjihi start on June 10, 2020) continue our mathematics learning through mathematical Facebook pages, where our educators are still presenting online mathematics lessons".

B. Video Sharing (e.g., YouTube)

When students answered on question: if they had social media applications that they irreplaceable when they studying mathematics, about 12.3% of students confirmed that they usually use YouTube for more understanding mathematics tutorial. Some students verbatim said:

"On YouTube, I post and download videos related to certain lessons in mathematics and I often use YouTube to learn more about any lesson in our mathematics curriculum. Furthermore, many times, I could not employ social media Apps due to some technical problems including electricity crisis and internet connections issues".

C. Live Casting (e.g., Skype, Life size)

Based on the responses of students to the open-ended questions, a small percentage of students are using live casting (e.g., Skype, Lifesize) in their mathematics learning. The frequent uses of live casting (e.g., Skype, Lifesize, webinars) by the students include: chatting and subscribing different lessons and information with friends. These telecommunication facilities will be strongly taken into consideration during the COVID19 outbreak due to the students needing to have live streaming videos for learning.

D. Communication (e.g., Email, MSN Chat, Text Messaging)

Most students use various social media platforms for communication such as MSN chat, text messaging. Some of these platforms were not used or rarely employed in digital learning such as email. A student stated:

"Sometimes, I send and receive emails from websites that are related to mathematics topics, I receive notes, solutions, and books via emails from my educators".

Another group of 3 students said:

"I rarely email educators and classmates, I just send questions/solutions to my educators when they order from me".

Six other students from secondary school (Tawjihi 2020) said the following details:

"Some educators use emails to send lesson notes to students. It is very important because we receive notes and comments as well as we send solutions at a better time and anywhere".

Another student stated:

"The use of WhatsApp is regular for our educators to give us lesson notes and feedback for topics taught in this semester so that we have enough time to study and understand the required lessons, in particular the difficult topics in mathematics".

In addition, other students stated:

"Educators have been employing social media platforms to give online exams. Such this procedure is considered very important due to enabling students to become familiar with the "use of technology for educational purposes. In addition, sometimes, I could not use social media platforms due to some problems such as electricity cutting for a long period of time and not available internet connections".

Finally, many students acknowledged that educators frequently employ social media platforms to send handouts, assignments or any educational content, this is beneficial, because usually *"I may not have money to photocopy the required educational content, so it's better I have them on softcopy"*.

In general, some students have the skill required to employ various digital platforms for learning mathematics. However, it is up to them to contact with their teachers during the school closure as a result of the COVID-19 pandemic and proceed with digital learning from their homes.

E. Learning Management System

None of the students reported anything with regards to employing this platform in mathematical learning during the COVID-19 outbreak.

4. Conclusions and Recommendations

The current health crisis has caused an unprecedented disruption in the mathematics education of school students in the Gaza Strip, Palestine. In order to maintain the continuity of the education of students during the time of emergency, the whole mathematics education system has shifted for the first time to an online mode of education using different digital platforms. The results of the present study seem to suggest that students believe that digital learning will enable them to shift to an entertaining and interesting paradigm rather than a traditional and rigorous paradigm. During the school closures period, use of digital learning in mathematics learning appears to be a quick positive response during the COVID-19 outbreak. Using digital learning in mathematics gives students a significant opportunity to study and complete their learning from their homes in times of crisis. The results showed that there are no significant differences in deploying social media platforms during mathematics learning based on gender, age groups and type of school. The uses of social media apps for mathematical learning is dependent upon the educational level of parents and the economical level of the family. The authors concluded that students were very unfamiliar with the employing technological networking platform in their learning during the closure of the school as a result of the COVID-19 outbreak. This may be due to a lack of adopting or employing such learning systems by their educators before this crisis. Before the COVID-19 pandemic, most teachers have never incorporated the Learning Management System (LMS) into the teaching process. Therefore, teachers have never created online virtual classrooms for presenting the learning content for sharing, downloading, and viewing by their students. The schools that have not to employ digital learning (e.g., LMS) before the COVID-19 crisis must appreciate the value of digital platforms and

make it a permanent feature of their learning process to avoid the negative impacts of any forthcoming crisis whether health, social, economic, or political. In our country, the employing of digital learning and its incorporation into the learning process faces several problems, most notably the lack of financial support, the scarcity of main resources, the continuous interruption of electricity, and poor internet services, all of which make the employment of digital learning difficult.

The best method for remote mathematics education in the time of COVID-19 is continuing to follow their existing mathematics curriculum as planned, focus on the depth of content, implementing it at a slower pace and with reduced content. Beside the mathematics curriculum book, the self-learning materials should be design and then upload it on the official website of the Ministry of Education, where it is available to all students. The self-learning materials are considered a urgent positive response in order to maintain the continuity of mathematics learning of students during the closure of schools. Self-learning materials are a set of supporting materials that accompany the curriculum book. The content of these materials focuses on the basic concepts and skills in mathematics, so that the concept or skill is presented with some specific and illustrative self-evaluation examples. The materials also include a set of instructions related to learning the skill and links to supportive digital content (an educational video, an audio clip, an educational game, etc.). This method is the best and most appropriate, as it is compatible with the conditions that Palestinian students live in. We recommend the educational responsible authorities to enhance and develop of digital learning in mathematics education during and post-COVID-19 era and re-evaluate digital learning and its importance in teaching and learning of mathematics across all grades during and after COVID-19 pandemic.

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