www.ijte.net

Pupils' Profiles of Social Media Usage in Mathematics with a Special Look at Facebook

José M. Marbán
University of Valladolid, Spain

Eddie M. Mulenga
University of Valladolid, Spain

To cite this article:

Marbán, J. M. & Mulenga, E. M. (2022). Pupils' profiles of social media usage in mathematics with a special look at Facebook. *International Journal of Technology in Education (IJTE), 5*(1), 132-153. https://doi.org/10.46328/ijte.209

IJTE
International Journal of Technology in Education
2022, Vol. 5, No. 1, 132-153 https://doi.org/10.46328/ijte.209

Pupils' Profiles of Social Media Usage in Mathematics with a Special Look at Facebook

José M. Marbán, Eddie M. Mulenga

Article Info

Article History

Received:
09 August 2021
Accepted:
28 December 2021

Keywords

Facebook
Mathematics
Secondary school
Social media
Students

Abstract

The presence of social media platforms in secondary students' daily life is growing on but it may appear difficult to know which ones are more convenient for academia, particularly among secondary school pupils who are commonly substantial internet-based life clients. This study seeks to understand Zambian pupils' profiles of social media usage, in particular, in mathematics learning environments, mainly focusing on Facebook. Primary data sources were collected using a validated questionnaire from 288 participants at Wusakile Secondary School in Kitwe comprising of Grade 11 and Grade 12 pupils. Results revealed that Facebook was the most widely used application and that there was no statistically significant difference in pupils' mathematics Facebook usage based on gender while there was when considering grade level. Results also indicated that Grade 11 pupils' mean scores for social media usage were higher than those from Grade 12 pupils. Finally, results show that in the absence of mathematics classroom instructions, some pupils are also having mathematics discussions outside the classroom by means of social media, particularly on Facebook, although this academic use is still far from being relevant.

Introduction

Social media platforms are tools which may help to transform the educational sector in Zambia as they have come in handy for continuous dissemination of information in real time around the globe and allow people to be connected and cooperating despite of geographical conditions. However, social media platforms can also either build or destroy the values, morals, traditions and customs of the Zambian society. Bulut (2018) strongly agrees that it is a known fact that these social media platforms have both -positive and negative- effects on school pupils' physical, social, cognitive, emotional, and language development. In particular, the 2018 National Survey on access and usage of ICTs by households and individuals conducted by the Zambia Information and Communication Technology Authority (ZICTA, 2018) states that "the proportion of households indicated that they used tools or strategies to mitigate exposure to illicit content was very low accounting for 14.5 percent of the total number of households that reported that they have access to the internet at home" (p. 8). For this reason, among others, the government of Zambia is deeply concerned about the abuse and misuse of social media platforms.

Lau (2017) highlighted that both university lecturers and students have increasingly welcomed a few social media platforms like Twitter, Facebook, WhatsApp among others to support instructional method both inside and outside the classroom. Facebook (2017) reports that in the ongoing past, social media usage has been increasing worldwide with Facebook reaching out to 2 billion users and approximately one billion of every day users since July 2017. As indicated by Facebook (2015), the world's biggest social media stage, it has more than 1.31 billion mobile users and 1.49 billion monthly users. The Global Social Media Research Summary elaborated by Chaffey (2016) reported that Facebook is the most famous online social media platform on the planet with approximately 80% of web users worldwide owning a Facebook account in 2014. Statistics further revealed that 40% of Internet users were Facebook users or signing into the Facebook account once every month in 2014. In April, 2016, Facebook continued its dominance with 1.59 billion active Facebook users globally. Lau, Lui, and Chu (2016), posited that social media platforms may expand students' ability to generate and stimulate their interests in academic subjects and communicate with professionals easily. Cox and McLeod (2014) posited that online networks advance correspondence with instructors, students, guardians and help encourage proficient learning networks.

Some of the key takeaways from the Global Digital Report includes approximately 4 billion of internet users worldwide, 3 billion social media users worldwide and 5 billion mobile phone users. Furthermore, recent statistics depict that Facebook use dominates the social landscape. Facebook's predominance is genuinely phenomenal. In addition to the fact that Facebook takes the top recognition, its other claimed social media platforms (Facebook messenger and Instagram) take second and third as reported by the Global Digital Report of 2018 conducted by Chaffey.

Ho and McLeod (2008) mirrored the contrast that people find it easier to chat online than face-to-face. This is consistent with research from other authors (Kaplan & Haenlein, 2010; Lee & Chun, 2016; Sung & Lee, 2015) who found that individuals can easily participate in an online interaction and share their views with others through typing comments below other people's original posts, liking and sharing of posts than on an eye-to-eye correspondence.

Web 2.0 tools allow users to have direct and user-driven networks (e.g. see Cheung, Chiu, & Lee, 2011) to exchange information with each other. This shows a critical link with the findings of other researchers such as Chun and Lee (2016) and Lee and Chun (2016) that users usually share news online and exchange ideas. Chaffey (2016), in his Global Social Media Research Summary of 2016, shows that in 2009, Facebook became the top most used application in the world by passing Myspace and has not renounced its position since then. Statistics further suggests that in 2014, Twitter being the second most used social media platform had around 50% of all web users worldwide with registered accounts. However, just 20% of the number is active on Twitter. The report by Hutchinson (2016) vividly captured that Twitter had likewise attracted an exceptional rapid increase in both engaged users and site visits since its launch in March, 2006 and the Global Social Media Research Summary of 2016 (Chaffey, 2016) further closes with empirical evidence that in April 2016, Twitter had nearly 320 million registered users globally and on comparison with Facebook, it's a small fraction of Facebook active users.

DeLegge and Wangler (2017) provide a quantitative analysis of results highlighting that although Google+ and YouTube have a higher number with 60% of all web-based users worldwide in 2014, both platforms have less engaged users than Twitter. This is partly because users are automatically signed on other accounts when they login in on Gmail, which is the most popular personal email server for Google. According to the most recent research which was done in the University of Florida (USA), Chun and Lee (2017) disclosed that social media platforms such as, Facebook, Instagram, YouTube, Twitter, etc., can be utilized by institutions to communicate with their intended audience for academic purposes.

Regarding students' mathematics academic performance, research conducted by Lau (2017) indicated that academic performance was unfavourably influenced when social networking sites were utilized to satisfy social needs only. He further proposed that in order to encourage the participation of the undergraduate students with their fulfilment and performance in a mathematics course, staff must adopt Facebook as an instructional platform by creating a Facebook group exclusively for deliberating mathematical content courses outside the classroom walls. There are several studies (e.g. see Arteaga Sánchez, Cortijo, & Javed, 2014; Aydin, 2012; Kaban, 2021a; Mulenga & Marbán, 2020; Susilo, 2014; Biton & Segal, 2021) showing that Facebook is among the social media tools which contribute positively to the educational environment.

According to Hilary (2017) in a revised social media policy at St John's College, it is documented that the social media policy is intended to alleviate the dangers related to the utilization of social media among students, academic and non-academic members of the college's staff. Furthermore, the college will maintain guidelines outlining the standards it expects students, academic and non-academic staff to observe when utilizing social media or taking part in any type of online communication, while directly or indirectly associated with the college. Therefore, it is argued that non-academic Internet use, including the use of web 2.0 tools, among secondary school pupils was negatively linked with classroom performance. Social media platforms have brought about a new age for information trading and free articulation of opinion. The connection between social media and social change is noteworthy in the sense that social media has not only brought about extraordinary changes in the field of popular opinion yet in addition play a fundamental role to cultivate social change (Dong, Liang, & He, 2017).

Unfortunately, the uncontrolled use of social media platforms may lead to online life enslavement, which includes not being able to control one's Internet use and utilizing it to such a degree, that it meddles with other life errands (Ryan, Chester, Reece, & Xenos, 2014). Extant literature reveals that troublesome usage of social media (also termed "disorder" or "addiction") prove to be a source of mental problem especially among teenagers (e.g. Van den Eijnden, Lemmens, & Valkenburg, 2016). In spite of an increasing data world wide of relevant literature on the utilization of web-based social networking sites, there is lack of studies in Zambia on how social media usage -especially in the case of Facebook- in the learning of mathematics affects the social life of secondary school pupils. Hence, researchers around the world have started examining what motivates school pupils to join Facebook. Well, as could be expected, the following are some of the motivations for using Facebook. Firstly, Krishina, loh and Khol (2018) highlighted that Facebook offers another learning atmosphere, and is utilized for online scholarly discourses between distance students. In any case, students are not

encouraged to utilize it for academic purposes because of its famous social use. Secondly, Smock, Ellison, Lampe, and Wohn (2011) contend that Facebook is a toolbox of various uses ranging from inactively browsing what different users post to sharing various sorts of posts such as videos, pictures, trailers etc. Thirdly, in accordance with Nadkarni and Hofmann (2012) Facebook is additionally utilized for self-marketing.

Peluchette and Karl (2010), disclosed that a number of students share unbefitting and contemptible (revolting) materials on Facebook in order to get the attention of their friends. The utilization of Facebook by the instructors is perceived to impact positively many students and thus debated to increase students' motivation for learning (Mazer, Murphy, & Simonds, 2007). Finally, Ferrucci and Tandoc (2015) concluded that the phenomenology of Facebook usage can be isolated into three sections: overseeing intentions, encountering the results of activities, and feeling a range of emotions. The two researchers revealed that many people go on Facebook without even a specific reason. In fact, once users are logged on Facebook, they get glued onto their laptops or phones in the middle of classes, jobs or travelling making it almost impossible to log out.

Therefore, many scholars have now noted that Facebook is the most interesting topic of research in academia. Its use cuts across age, gender, race, religion and geographical location. It provides the fastest ways of communication and news sharing as opposed to traditional media. Facebook's popularity goes beyond geographical boundaries, traditions, cultures and decades (e.g. Glynn, Huge, & Hoffman, 2012; Lee & Ma, 2012). Several studies have tried to investigate what really motivates users to go on Facebook (e.g. Baek, Holton, Harp, & Yaschur, 2011; Peluchette & Karl, 2010; Quan-Haase & Young, 2010; Raacke & Bonds-Raacke, 2008; Ross et al., 2009; Smock et al., 2011).

Ferrucci and Tandoc (2015) noted that Facebook users take part in a wide range of activities just to satisfy their curiosity. For instance, others join Facebook just to share information for social communications (Smock et al., 2011). However, some of the studies reviewed above neglected to handle the crucial inquiry of whether Facebook can be utilized for legitimate academic purposes or not. Hence, in this examination, we analyse the profiles of secondary school pupils' utilization of social media -especially Facebook- and its effect on mathematics engagement.

Regardless of the developing collection of research papers confirming a rapid increase in the number of studies done on the utilization of social networks among university undergraduates, there is a lack of research in Zambia on how secondary school pupils use Facebook to enhance their learning of mathematics. It is on these premises that this research was based establishing as its main aim that of examining the Zambian secondary school pupils' profiles of social media usage in Mathematics and, especially, the use of Facebook in the learning of mathematics at Wusakile secondary school. Being more specific, this research was concerned with whether there is a significant difference in Zambian mathematics pupils' Facebook usage based on gender and grade level or more broadly, if there is a significant difference in Zambian mathematics pupils' scores on the usage of social media sub-factors based on gender and grade level and -hence or otherwise- if pupils' use of Facebook could predict their online mathematics learning engagement.

Method

As per Zhou (2004), quantitative research should grasp both the rationale of statistical induction and contextual investigation with analytic induction. Thus, it was vital for the authors of this paper to carefully select the items for inclusion in the study during the analysis. According to Kaplan and Haenlein (2010), social media technology is a gathering of Internet-based applications that work with respect to the ideological and innovative establishments of Web 2.0 tools and that permit the creation and exchange of ideas between users. Based on the definition above and on the main aim stated in the previous section, authors of this paper examined the role that social media play -especially Facebook- in secondary school settings and on internet public activities. The study employed the survey model. Essential data sources were collected quantitatively through the use of a questionnaire adapted from Kaya and Bicen (2016). The questionnaire consisted of 51 items on the attitudes towards Facebook use.

Respondents evaluated their degree of agreement with each item on a 5-point Likert scale (1 = Strongly Disagree, 2 = Disagree, 3 = Undecided, 4 = Agree, 5 = Strongly Agree). This study dissects and analyses the process of 51 items. The consequences of this investigation demonstrated that the reactions to the survey questionnaire used had a reliability coefficient $\alpha = 0.77$ for the whole scale, that was sufficiently high for our purpose. In addition, Cronbach's alpha tests were also conducted in SPSS for each of the items of the questionnaire to test for their internal consistency. Thus, all the alpha values which were computed for each item of the questionnaire in SPSS also showed acceptable levels of Cronbach's alpha suggesting a proper reliability of our adjusted scale.

Participants

Convenience sampling technique was utilized in this study. A questionnaire was administered to 288 pupils who were in Grade 11 and 12 classes respectively from Wusakile secondary school in Kitwe (Zambia), ranging from 14 to 28 years old (mean age = 17.8 and *SD* = 1.8). A total of 127 (44.1%) participants and 161 (55.9%) were in Grade 11 and Grade 12 respectively. Of the 288 participants, 51.7% were females, 48.3% males, 238 participants (82.6%) had Smartphones while the rest had no phones at all, 71.5% had Internet package on their gadgets while the remaining 28.5% did not have.

Regarding Facebook usage between the Grades, 12 participants from Grade 11 classes and 25 participants from Grade 12 classes declared that they had no Facebook accounts and were excluded from analyses while 115 Grade 11s and 136 Grade 12s owned a Facebook account. Thus, 123 participants were female Facebook users while 128 were male Facebook users. 104 owned Facebook messenger accounts while 184 did not.

Concerning the use of other social media platforms, 65 participants owned a YouTube account, followed by 129 WhatsApp, 32 Instagram, 5 Viber, 56 Twitter, 10 Snapchat, 125 Google+, 1 Ask.fm, 1 Tango, 34 Gmail, 26 Yahoo mail and 4 owned a LinkedIn account respectively. Signed permission was obtained from the School Head teacher. All the data coming from the self-report questionnaires was gathered during a regular normal

working school day in classrooms with the assistance of the Deputy Head Teacher. All the 288 participants were studying ordinary mathematics as a compulsory subject.

Data Analysis

Descriptive statistics was used to explore the profiles of secondary school pupils' social media usage, one-way ANOVA was used to break down if there were any significant differences in Zambian mathematics pupils' Facebook usage based on gender and grade level and, finally, the independent samples t-test was employed to understand better the significant differences in Zambian mathematics pupils' scores on the use of social media sub-factors based on gender and grade level.

Results

In this section, we examine the results acquired from the survey by breaking down the answers of all the 288 respondents. Descriptive statistics, results of the ANOVA table and the independent samples t-test are presented and interpreted. The section contains 6 tables of which Table 1 below gives a summary of the descriptive statistics of the participants concerning the types of operating systems used.

Table 1. Operating Systems used by Participants

Operating System	Frequency	Percent	Valid Percent	Cumulative Percent
Android	130	45.1	45.1	45.1
iOP	11	3.8	3.8	49.0
Windows	39	13.5	13.5	62.5
None	108	37.5	37.5	100.0
Total	288	100.0	100.0	

From Table 1, we see that 130 participants use Android Operating System, 39 use Windows, 11 use iPhone OP and 108 pupils neither use Android, iOP nor Windows operating system. This clearly suggests that 37.5% never owned any Smartphones. Thus, this study has disclosed that the major tool used by the pupils to access social media, in particular Facebook is a Smartphone (as 62.5% agree). It is therefore argued that learners at secondary school are not tool exposed to digital devices and this limits them to the most affordable and accessible too, a phone. Although, previous studies (e.g. see Singh & Gill, 2015; Stanciu, Mihai, & Aleca, Stanciu, 2012), revealed that the major tools that students used to access social media were reported to be laptops followed by desktops and mobile phones.

The first relevant point of the investigation was to look at the popular profiles of pupils' social media utilization. From Table 2, it is evident that 100% of participants use social networking sites. The most popular social networks used by the pupils was Facebook (87.2%), followed by WhatsApp (44.8%), Google+ (43.4%), Facebook messenger (36.1%), YouTube (22.6%), Twitter (19.4%), Gmail (11.8%), Instagram (11.1%), Yahoo mail (9.0%) and Snapchat (3.5%). Other social media sub-factors used include Viber (1.7%), LinkedIn (1.4%),

Ask.fm (0.3%) and Tango (0.3%). It is contended that high score of Facebook use (251) is attributed to the Facebook application being user friendly. Contrary to our obtained results, other studies (e.g. see Chukwuere & Bonga, 2018; Çetinkaya, 2019; Kaban, 2021a) reported that majority of the respondents used WhatsApp more than any other social media platform presenting the view that the use of WhatsApp is more beneficial. Researchers have again noticed that since its creation in 2004, Facebook has more than 600 million users (Facebook, 2012; Pingdom, 2012).

Table 2. Types of Social Media Popularly Utilized by Pupils

Social media	Number (N)	Percentage (%)
Facebook	251	87.2
WhatsApp	129	44.8
Google+	125	43.4
Facebook Messenger	104	36.1
YouTube	65.0	22.6
Twitter	56.0	19.4
Gmail	34.0	11.8
Instagram	32.0	11.1
Yahoo mail	26.0	9.00
SnapChat	10.0	3.50
Viber	5.00	1.70
LinkedIn	4.00	1.40
ask.fm	1.00	0.30
Tango	1.00	0.30

Several studies have explored the utilizations and motivations that inspire individuals to use Facebook, and the many reasons have given rise to a wide range of various motivations (Ferrucci & Tandoc, 2015). For example, based on the features of the Facebook application, authors of this paper contend that school pupils may communicate with friends, loved ones, family and meet new individuals, set status updates, share photos, videos and their favourite memories. Facebook also helps them to follow the latest news and current events around the world.

Additionally, pupils may also wish to subscribe to their favourite pages, such as academic groups, watch live streaming videos of interest. This is consistent with Kelley (2021) who argued that "digital instructional videos on a multitude of mathematical topics have become increasingly accessible to both teachers and students..." Facebook and YouTube videos have made their way into the 'mathematics classroom' in the form of live mathematical instruction or online classes. Interestingly, school pupils are also posting on their timelines, browsing for people and play games among many other things. WhatsApp, Facebook messenger, YouTube, Google+, Twitter and Gmail were also among the most popular used social media networks. Our results appear to agree with the results of Chukwuere and Bonga (2018) who revealed that several undergraduate students used social media platforms too much. But low use of LinkedIn (4) is not shocking as school pupils may not be very

familiar with this social media platform since it is considered a business and professional driven service centred on building one's professional network. Tango and Ask.fm are also not common social media platforms used by secondary school pupils.

However, the use of these social networks suggests that once pupils become very familiar with all of them, they can be used for further studies in future. It is advised that mathematics teachers should have social interactions with their pupils through schools' social media platforms. These platforms would encourage both pupils and teachers the habit of having mathematics intellectual discourses on and off the classroom to better prepare them for their exams. Consistent with Biton and Segal (2021), whose study suggested that Facebook as an online "social network" can be used to help motivate secondary school pupils to become well prepared for their final mathematics examinations.

Table 3. Pupils' Facebook Use based on 'Grade Level' and 'Gender'

					Std.	95% Confidence Interval for Mean	
		N	Mean	Std. D	Error	Lower Bound	Upper Bound
Grade	Grade 11	37	1.68	.475	.078	1.52	1.83
	Grade 12	251	1.44	.499	.032	1.38	1.50
	Total	288	1.56	.497	.029	1.50	1.62
Gender	Male	37	1.57	.502	.083	1.40	1.74
	Female	251	1.46	.501	.032	1.35	1.57
	Total	288	1.52	.501	.029	1.46	1.58

Table 3 shows that there is a statistically significant difference based on grade level in the Zambian mathematics secondary school pupils' usage of Facebook for Grade 11s and 12s. These findings indicate that at the significance level of 0.05%, grade level has an impact on pupils' use of Facebook and Grade 11 pupils have higher mean values for Facebook use than Grade 12 pupils. The differences in the use of Facebook could be attributed by grade level. The findings also unearthed that there are no statistically significant differences based on gender in the mean scores of pupils across the grades. These results suggest that gender does not have an effect on Zambian mathematics pupils' use of Facebook.

When Table 4 is analysed, we see the pupils' mean scores taken from the sub-factors of social media usage differ significantly based on grade level with respect to Facebook [Grade 11s, $\mu = 0.91$ and Grade 12s, $\mu = 0.84$], Instagram [Grade 11s, $\mu = 0.09$ and Grade 12s, $\mu = 0.12$], Twitter [Grade 11s, $\mu = 0.23$ & Grade 12s, $\mu = 0.17$], Google+ [Grade 11s, $\mu = 0.49$ & Grade 12s, $\mu = 0.39$], Gmail [Grade 11s, $\mu = 0.09$ & Grade 12s, $\mu = 0.14$] and Yahoo mail [Grade 11s, $\mu = 0.12$ & Grade 12s, $\mu = 0.07$]. These results suggest that Grade 11 pupils' mean scores for Facebook, Twitter, Google+ and Yahoo mail are more positive than Grade 12 pupils' scores and vice versa for Instagram and Gmail. The results show no significant differences in the pupils' social

media scores taken from YouTube, WhatsApp, Viber, Snapchat, Ask.fm, Tango and LinkedIn sub-factors in relation to grade level.

Table 4. Results of the Independent Samples t-test of Pupils' Social Media Use Sub-factors based on Grade Level

Social media Sub-factors	Grade level	N	Mean	Std. Deviation	Std. Error Mean
Facebook	Grade 11	127	.91	.294	.026
	Grade 12	161	.84	.363	.029
FB Messenger	Grade 11	127	.38	.487	.043
	Grade 12	161	.35	.478	.038
YouTube	Grade 11	127	.24	.426	.038
	Grade 12	161	.22	.414	.033
WhatsApp	Grade 11	127	.44	.498	.044
	Grade 12	161	.45	.499	.039
Instagram	Grade 11	127	.09	.294	.026
	Grade 12	161	.12	.331	.026
Viber	Grade 11	127	.02	.152	.014
	Grade 12	161	.01	.111	.009
Twitter	Grade 11	127	.23	.421	.037
	Grade 12	161	.17	.375	.030
Snapchat	Grade 11	127	.03	.175	.016
	Grade 12	161	.04	.190	.015
Google+	Grade 11	127	.49	.502	.045
	Grade 12	161	.39	.490	.039
Ask.fm	Grade 11	127	.00	.000	.000
	Grade 12	161	.01	.079	.006
Tango	Grade 11	127	.00	.000	.000
	Grade 12	161	.01	.079	.006
Gmail	Grade 11	127	.09	.294	.026
	Grade 12	161	.14	.345	.027
Yahoo mail	Grade 11	127	.12	.324	.029
	Grade 12	161	.07	.253	.020
LinkedIn	Grade 11	127	.02	.152	.014
	Grade 12	161	.01	.079	.006

Table 5 shows significant difference scores of pupils' social media sub-factors based on gender in relation to FB-messenger, YouTube, Twitter, Gmail and Yahoo mail. These findings suggest that male pupils' mean scores of FB-messenger [$\mu = 0.88$], YouTube [$\mu = 0.27$], Twitter [$\mu = 0.23$], Gmail [$\mu = 0.20$] and Yahoo mail [$\mu = 0.11$] are more positive than the female pupils' mean scores of FB-messenger [$\mu = 0.86$], YouTube [$\mu = 0.18$], Twitter [$\mu = 0.16$], Gmail [$\mu = 0.04$] and Yahoo mail [$\mu = 0.07$] respectively. This indicates that

there is a strong correlation among the named social media sub-factors based on gender. Again, results have likewise uncovered that there is no significant difference between male and female school pupils' social media sub-factors of Facebook, WhatsApp, Instagram, Viber, Snapchat, Google+, Ask.fm, Tango, and LinkedIn.

Table 5. Results of the Independent Samples t-test of Pupils' Social Media Use Sub-factors based on Gender

Social media Sub-factors	Gender	N	Mean	Std. Deviation	Std. Error Mean
Facebook	Male	139	.88	.320	.027
	Female	149	.86	.349	.029
FB Messenger	Male	139	.40	.492	.042
	Female	149	.32	.469	.038
YouTube	Male	139	.27	.447	.038
	Female	149	.18	.386	.032
WhatsApp	Male	139	.49	.502	.043
	Female	149	.41	.493	.040
Instagram	Male	139	.12	.320	.027
	Female	149	.11	.311	.025
Viber	Male	139	.02	.146	.012
	Female	149	.01	.115	.009
Twitter	Male	139	.23	.422	.036
	Female	149	.16	.369	.030
Snapchat	Male	139	.05	.219	.019
	Female	149	.02	.141	.012
Google+	Male	139	.43	.497	.042
	Female	149	.44	.498	.041
Ask.fm	Male	139	.00	.000	.000
	Female	149	.01	.082	.007
Tango	Male	139	.00	.000	.000
	Female	149	.01	.082	.007
Gmail	Male	139	.20	.403	.034
	Female	149	.04	.197	.016
Yahoo mail	Male	139	.11	.311	.026
	Female	149	.07	.262	.021
LinkedIn	Male	139	.02	.146	.012
	Female	149	.01	.082	.007

Reasons for which Secondary School Pupils used Facebook

As regards pupils' activities when logged on Facebook, the second and third aims of our study were to find out the purposes for which pupils used Facebook generally and further explore how they used Facebook for academic purposes. Therefore, results show the synthesis of the 51 items (see Table 6).

Table 6. Pupils' Reasons for using Facebook

No.	When using Facebook…	Mean (μ)	STD
1.	I communicate by Facebook	3.60	1.40
2.	I share pictures on Facebook	3.43	1.44
3.	I use Facebook in order to meet with new people	3.37	1.50
4.	Nice picture comments increase my confidence.	3.32	1.47
5.	I belong to an academic group on Facebook.	3.30	1.54
6.	I check Facebook and I like or comment on posts related to Mathematics.	3.28	1.46
7.	I follow Mathematics pages on Facebook.	3.26	1.42
8.	I follow news on Facebook.	3.25	1.44
9.	My profile picture is up to date.	3.23	1.43
10.	I share news on Facebook.	3.21	1.49
11.	My profile picture is alone.	3.18	1.54
12.	I share mathematics problems with friends on Facebook.	3.17	1.45
13.	I follow specific friends on Facebook.	3.13	1.47
14.	I generate new ideas by Facebook.	3.12	1.49
15	My details are up to date.	2.85	1.40
16.	I use Facebook in order to check mutual friends.	2.79	1.47
17.	My Facebook use increases my confidence.	2.79	1.43
18.	I change my profile picture regularly.	2.74	1.39
19.	I use Facebook just for fun.	2.70	1.44
20.	I check my previous partners' Facebook profile.	2.66	2.19
21.	Negative picture comments depress me.	2.61	1.54
22.	I accept friend request according to the gender.	2.61	1.52
23.	My other social network accounts are connected with Facebook.	2.60	1.42
24.	I use Facebook in order to find out popular places.	2.55	1.43
25.	I change my privacy according to closeness.	2.54	1.33
26.	I check in places regularly on Facebook.	2.52	1.37
27.	I start up new debates by Facebook.	2.52	1.38
28.	I become upset if I do not receive any likes or comments on my status/pictures\ or content that I had share.	2.50	1.54
29.	I feel isolated when I cannot login to Facebook.	2.44	1.43
30.	I follow specific brands/products on Facebook.	2.41	1.29
31.	Content I share changes according to my mood	2.38	1.39
32.	I change my profile picture in order to get attention.	2.34	1.34
33.	I share songs on Facebook.	2.31	1.43
34.	My profile picture is a famous person.	2.28	1.45
35.	I follow famous people on Facebook.	2.26	1.37
36.	I share trailers on Facebook.	2.25	1.28
37.	I use Facebook in order to get attention.	2.22	1.36

No.	When using Facebook…	Mean (μ)	STD
38.	I accept every friend request.	2.22	1.34
39.	I play games on Facebook.	2.22	1.38
40.	My privacy settings are public in order to get more likes.	2.18	1.40
41.	I update my relationship status instantly in order to get attention.	2.05	1.24
42.	I can buy followers on Twitter.	2.01	1.18
43.	I can buy Likes on Facebook.	2.01	1.16
44.	I fool/deceive people on Facebook.	2.00	1.27
45.	I can buy Retweets on Twitter.	1.99	1.13
46.	I share videos on Facebook.	1.93	1.13
47.	I share my own videos on Facebook.	1.90	2.16
48.	I use my friends' Facebook account.	1.89	1.23
49.	I share my Facebook password with my friends.	1.80	1.22
50.	I use Facebook for Politics.	1.72	1.04
51.	I use Facebook in order to gossip.	1.67	1.06

Source: Field data (2017).

The data from Table 6 based on 251 Facebook users on variables with highly positive scores showed that participants mainly communicate by Facebook ($\mu = 3.60$), share pictures on Facebook ($\mu = 3.43$), use Facebook to meet with new people ($\mu = 3.37$), belong to an academic group on Facebook ($\mu = 3.30$), check Facebook and like or comment on posts related to Mathematics ($\mu = 3.28$), follow Mathematics pages, news and specific friends on Facebook [all $\mu \geq 3$], share mathematics problems with friends on Facebook ($\mu = 3.17$), generate new ideas ($\mu = 3.12$) and share news on Facebook ($\mu = 3.21$). Whereas participants in average seem also to use Facebook in order to check mutual friends ($\mu = 2.79$), Facebook use increases their confidence ($\mu = 2.79$) and use it to confirm if their details are up to date ($\mu = 2.85$). After the in-depth analysis of the above items, this study finds that pupils can use Facebook to learn mathematics from their mathematics teachers and friends inside and outside the classroom. This is only possible if mathematics teachers strongly welcome technology and constantly engage with their students. To support this claim, Marpa (2021), found that the attitudes of the mathematics teachers toward using technology in terms of behavioural engagement and confidence with technology were positive while strongly positive in terms of affective engagement.

Consistent with Park, Song, and Hong (2018), whose study investigated how Facebook use influences student commitment in the classroom hall, results from their examination disclosed that students with very active Facebook use accomplished fundamentally higher scores on student commitment than those with less active Facebook use. It is argued from recent literature (e.g. Batmang, Sultan, Azis, & Gunawan, 2021; Çetinkaya, 2019; Kaban, 2021a; Makarova, Ldokova, & Egorova, 2021; Marpa, 2021; Shukla, & Mcinnis, 2021) that using mobile-based applications such as Facebook as assistive technology in a problem-based school learning process increases students' success, quality of learning and is effective in developing positive attitudes and thereby resulting in a digitalization of the educational environment.

Based on the obtained results, it can be deduced that pupils who follow, comment or like posts related to mathematics have an undeniable opportunity to express their views on any related mathematics topic they failed to express in class due to shyness. By subscribing to mathematics pages, they see posts related to mathematics on news feed and express their opinions on their timelines so that their specific friends and mathematicians they follow could see and criticise. Our findings seem to agree with Mahmud, Ramachandiran and Ismail (2018), whose results disclosed that students communicate well via web-based networking media since they can present their views freely and without being shy.

However, in the absence of internet bundles or reliable internet connections, pupils feel isolated when they can't login to Facebook ($\mu = 2.44$). Furthermore, pupils bring up new discussions by utilizing Facebook ($\mu = 2.52$). In any case, they become disturbed on the off chance that they don't get any likes or comments on their Facebook updates, posts they share or pictures they upload ($\mu = 2.50$). A perceptible strategy to decide reactions to one's posts is the number of "likes" or "comments" they get. Likes and comments have become like some sort of a currency on Facebook that could mean ubiquity, endorsement, or even popularity (Ferrucci & Tandoc, 2015). This is discouraging as pupils are too expectant to learn from their Facebook peers, family and friends. Unfortunately, this same expectation of how others might react also demoralises school pupils from posting anything.

Authors of this paper argue that pupils view acknowledgement as something important. If they update a status on Facebook and get likes or comments from it, it's obviously a good thing because they know that people care about what they are posting. Results also disclosed that pupils feel depressed if they receive negative picture comments ($\mu = 2.61$) and due to this, the content they share changes according to their mood swings ($\mu = 2.38$). This study found out that even if pupils had mathematics content to share on Facebook, a lot become very de-motivated as Facebook users would pay less or no attention at all to issues related to mathematics while online.

Consistent with Ferrucci and Tandoc (2015), who highlighted that Facebook posts that are not funny get derided, subsequently, even friends and loved ones once in a while laugh at posts that are excessively long and passionate. As such, pupils would rather use Facebook just for fun ($\mu = 2.70$) instead of academics. Due to the negative attitudes of Facebook users concerning usage of Facebook for mathematics purposes, pupils have also linked their other 'social media' accounts with Facebook ($\mu = 2.60$) so as to easily navigate between them and interact with their specific friends on common mathematics problems affecting them. Although some participants use to follow famous people on Facebook ($\mu = 2.26$), it is possible that pupils could be following some renowned mathematicians on Facebook, some famous mathematics teachers in their district and extraordinary mathematics pupils on Facebook.

Among many other uses of Facebook recorded, our findings suggest that pupils rarely share trailers on Facebook ($\mu = 2.25$), use Facebook to get attention ($\mu = 2.22$), accept every friend request ($\mu = 2.22$), play games on Facebook ($\mu = 2.22$), update their relationship status immediately in order to get attention ($\mu = 2.05$), purchase likes on Facebook ($\mu = 2.01$) and trick/decieve individuals on Facebook ($\mu = 2.00$).

Unfortunately, our field findings also recoded lower scores in the use of Facebook from item 45 to item 51 (see Table 6).

Discussion

The discussion below is a combination of statistical analyses results obtained and relevant literature that supports or contradicts our results. The research results presented on Table 3 show that there is a statistically significant difference based on grade level in the Zambian mathematics pupils' use of Facebook. Grade 11 pupils with (M = 1.68, Std.D= 0.475 and Std error = 0.078) have higher mean values for Facebook use than Grade 12 pupils with (M = 1.44, St.D=0.499 and Std error = 0.032).

It could be argued that Grade 11 pupils were very active Facebook users as they frequently followed mathematics pages and groups on Facebook so as to consult from their peers on any maths related problems. It is also likely that they create Facebook conversation groups for discussing mathematics related homework, assignments and projects. With this approach, pupils are able to communicate mathematics with fellow pupils and their teachers and eventually use Facebook as a learning platform. As a matter of fact, one of the most important events of the 21st century is the "birth" of modern technologies, in particular the development of electronic digital platforms such as Facebook to facilitate mathematics instructions (Marpa, 2021). This is consistent with Lau (2017), who posited that students have strongly embraced Facebook to support instructional method both inside and outside the classroom. Furthermore, the reason why Grade 11 students' scores are more positive than the Grade 12 students in this School is that Grade 12 students were busy studying and preparing for their final examinations resulting in them having little or no time to explore the Facebook package for academic purposes. Among many other barriers, some Grade 12 students did not even have smart phones. The Grade 11 students on the other hand were very excited and had more time on their disposal to explore the digital platforms for mathematics engagement. However, our results are limited to this sample and as such we acknowledge our limitation in making any generalisations from these results. Therefore, it is debatable whether this fact is likely to be reproduced at a higher scale or wider context.

According to Table 2, the study also found that majority of the participants (87.2%) use Facebook more than any other application. This, however, is contrary to the findings of Chukwuere and Bonga (2018) who proposed that Facebook is the second social media platform that students use the most. In terms of WhatsApp use, the results obtained agree with Chukwuere and Chukwuere (2017) who also contend that WhatsApp is the second social media platform mostly used among students. Arguably, Facebook and/or WhatsApp, one of the modern communications and socialization channels have become indispensable tools of education. Thus, it can be deduced that the use of social media technologies in mathematics teaching and learning bears relevance and significance to the mathematics teachers and students because they develop positive attitudes toward it (Kaban, 2021b; Marpa, 2021).

Thus, it will suffice to highlight that high WhatsApp (44.8%) use is not surprising as WhatsApp messenger is a free messaging application for Android and other Smartphones. Therefore, due to its good feature, school pupils

are using WhatsApp for making free online calls both local and international to discuss maths related problems at length. Besides calls, pupils may wish to send and receive photos related to mathematics, share maths videos, mathematics documents, voice messages, and eventually create a WhatsApp group so that they can easily stay in touch with their classmates. This is consistent with Kaban (2021a) and Lampropoulos, Siakas, Makkonen, and Siakas (2021) whose common result indicated that the use of these social media tools (e.g. WhatsApp) in the education and training process has a positive effect on student success.

Secondly, there was no statistically significant difference based on gender in the mean scores of secondary school pupils. Nonetheless, existing literature informs us that females are more actively involved than males in utilizing social media platforms (Hargittai, 2007; McAndrew & Leong, 2012), however, when males do utilize Facebook, they as often as possible disclose more personal information as opposed to females (Special & LiBarber, 2012). In relation to gender, a study by Marpa (2021) appears to give a contradictory result. This is probably because our study sampled secondary school pupils while the study by Marpa (2021) sampled teachers of mathematics. In his study, results revealed that male and female teachers differed significantly in their attitudes toward using technology in mathematics teaching. Males exhibited stronger or more positive attitudes than females.

When social media sub-factors are analysed, results of the independent samples t-test of pupils' social media use sub-factors based on grade level differed significantly in relation to Facebook, Twitter, Google+ and Yahoo mail (see Table 4). Again, these results suggest that Grade 11 pupils' mean scores for Facebook, Twitter, Google+ and Yahoo mail are more positive than Grade 12 pupils' scores and vice versa for Instagram and Gmail. These results indicate a significant positive correlation between grade level and the mentioned social media sub-factors whereas the results also show no significant differences in the secondary school pupils' social media scores taken from YouTube, WhatsApp, Viber, Snapchat, Ask.fm, Tango and LinkedIn sub-factors in relation to grade level.

Arguably, on one hand, social media platforms have created negative effects on our general public and Zambian cultural values. On the other hand, Facebook and other social media platforms are popularly used among secondary school pupils but there is a high probability that these social media platforms can be utilized for communication and mathematics learning provided they are monitored and regulated by the school management. Several studies (e.g. see Kabani, 2021a; Lampropoulos et al., 2021; Olagbaju & Popoola, 2020; Onat Kocabiyik, 2021) have shown that using social media in a creative and student-centered manner in educational settings can motivate students. In addition, the studies mentioned above have revealed that social media can also be used as a way of helping students create virtual platforms where they will be able to exchange ideas, opinions and knowledge in both academic and extra-curricular environments, mature and flourish.

According to Table 5, significant difference scores of pupils' social media use sub-factors between males and females in relation to FB-messenger, YouTube, Twitter, Gmail and Yahoo mail are recorded. These differences could be partly because pupils are motivated differently with regards to using social media platforms. Others are using social media for personal purposes while others for academic use only. As a matter of fact, existing

literature already informs us that females are more active than males in the usage of social media platforms (Hargittai, 2007; McAndrew & Leong, 2012), when males use Facebook, they as often as possible use it to disclose more personal information as opposed to females (Special & LiBarber, 2012). On the other hand, there was no significant difference between male and female school pupils' social media sub-factors of Facebook, WhatsApp, Instagram, Viber, Snapchat, Google+, Ask.fm, Tango and LinkedIn. This is probably because these digital platforms are user friendly to both males and females (Mulenga & Marbán, 2020).

Authors of this paper wanted to find out if pupils' usage of Facebook could predict their online mathematics learning involvement. Participants were further asked to rate how they used Facebook based on their social lives by indicating their degree of agreement with each of the fifty-one (51) items on a Likert scale. Based on Table 6, our analysis revealed that pupils at Wusakile secondary school use Facebook for communication ($\mu = 3.60$). Facebook is the most used application (μ =3.60). This is consistent with the report from Facebook, (2017). This is also consistent with Newham (2012) who argued that many people spend a lot of time communicating on Facebook. Newham (2012), eventually discovered that for most individuals, Facebook has replaced face-to-face communication.

Participants were further asked to rate how they used Facebook for academic purposes. Results show that more than 3 pupils on average "belong to an academic group on Facebook", "share mathematics problems with friends on Facebook" and also "generate new ideas on Facebook". Thus, it is probable that in the absence of mathematics classroom instructions, pupils are also having mathematics discussions outside the classroom, particularly on Facebook. Our research results agree with the findings of Mahmud et al (2018), who posited that outside-the-classrooms or after school programs are completed, Facebook or any other social media platforms are needed to act as a median for lecturers to advise or teach their students remotely. Taken together, all these findings seem to give a clear picture of other Facebook uses outside-the-classroom where teachers can act as peers or ultimate consultants on Facebook whenever pupils need immediate clarifications on mathematics problems wherever they may be.

Participants were also using Facebook for non-academic reasons such as: checking in places regularly, finding popular places, checking their former partners' Facebook profiles, following specific brands, sharing songs, trailers, news and videos. Surprisingly, others were using Facebook just to get the attention from people, playing games, gossiping, and to deceive people. This is similarly in agreement with the study by Hamat et al (2012) who found that Facebook is not only utilized for formal educational purposes but largely includes the social lives of users. As a matter of fact, Facebook has made negative impacts on our general public and social customs. In some cases, it even tends to thrive on fantasies by promoting beauty that does not exist.

Conclusions

Results suggest that Facebook use can constitute, to a larger extent a learning environment for mathematics were intellectual discourses can be discussed with different people. In light of the above discussion, our research aims have been met. This study has revealed the impact of social media on pupils' mathematics engagement with

Facebook as the contextual study. It has been shown that there is no statistically significant difference in pupils' use of Facebook based on gender but grade level does have. The difference could be partly because pupils are motivated differently with regards to using Facebook. Regarding social media sub-factors, the results also show no significant differences in pupils' social media scores taken from YouTube, WhatsApp, Viber, Snapchat, Ask.fm, Tango and LinkedIn sub-factors in relation to grade level.

In a nutshell, the reviewed literature (e.g. Biton, & Segal, 2021; Kaban, 2021a; Kaban, 2021b; Kelley, 2021; Lampropoulos, Siakas, et al., 2021; Mulenga & Marbán, 2020) have highlighted the facets that drive students to the use of social media, with a special look at the use of Facebook and provide an important addition to the existing knowledge. The present results are preliminary findings of the larger ongoing project. The results in this study suggests that the Ministry of General Education should consider undertaking programs to enhance pupils' and mathematics teachers' competencies and attitudes in using social media technologies especially Facebook, considering the new modality of learning overwhelmed by the effects of the pandemic. One uptake of this ongoing study is to enhance pupils' comprehension of social media use, in particular -Facebook- and its use as an educational tool to create interactive learning environments for pupils of mathematics.

This study only focused on the use of social media platforms – with a special emphasis on Facebook – among secondary school pupils but we recommend that a similar study should be carried out with university students and as such; some limitations must be highlighted. First, our results are limited to this sample and as such we acknowledge our limitation in making any generalisations from these results. The use of data from a self-report scale could be influenced by individual response biasness. Quantitative methods are not enough to explore and describe the depth and breadth of the observations concerning Facebook use among secondary school pupils. Without these constraints, after-effects of this investigation have suitable potential ramifications for incorporating social media sub-factors especially Facebook into the teaching and learning of secondary school mathematics.

Acknowledgements

The authors of this paper wish to acknowledge the overwhelming support received from Wusakile Secondary School administration. In particular, we wish to recognize the efforts of the Deputy Head Teacher who tirelessly helped in the data collection process. In addition, we must acknowledge our immense gratitude to all the Grade 11 and 12 participants who have made this research possible. More than 300 pupils gave their time and energy to these ground-breaking results reported in this paper. As authors, we owe them a great debt. Finally, we would like to acknowledge the support of our families and friends who have always been kind and had us in their minds for comfort.

References

Arteaga Sánchez, R., Cortijo, V., & Javed, U. (2014). Students' perceptions of Facebook for academic purposes. *Computers & Education, 70*, 138-144. http://dx.doi.org/10.1016/j.compedu.2013.08.012

Aydin, S. (2012). A review of research on Facebook as an educational environment. *Educational Technology Research and Development, 60(6),* 1093–1106. https://doi.org/10.1007/s11423-012-9260-7

Baek, K., Holton, A., Harp, D., & Yaschur, C. (2011). The links that bind: Uncovering novel motivations for linking on Facebook. *Computers in Human Behaviour 27*(6), 2243-2248. https://psycnet.apa.org/doi/10.1016/j.chb.2011.07.003

Batmang, B., Sultan, M., Azis, A., & Gunawan, F. (2021). Perceptions of pre-service teachers on online learning during the COVID-19 pandemic. International Journal of Education in Mathematics, Science, and Technology (IJEMST), 9(3), 449-461. https://doi.org/10.46328/ijemst.1595

Biton, Y., & Segal, R. (2021). *Learning and Teaching Mathematics with Online Social Networks: The Case of Facebook [Online First]*, IntechOpen, DOI: 10.5772/intechopen.95998. Available from: https://www.intechopen.com/online-first/75118

Bulut, A. (2018). Okul öncesi öğrencilerinin teknoloji kullanımlarına ilişkin alışkanlıklarının gelişim özellikleri üzerindeki etkileri [The effects of pre-school students' technological habits on their development characteristics]. Eğitimde Yeni Yaklaşımlar Dergisi, 1(1), 52-69. Retrieved from https://dergipark.org.tr/en/pub/eyyad/issue/47266/595606

Çetinkaya, L. (2019). Mobil uygulamalar aracılığıyla probleme dayalı matematik öğretiminin başarıya etkisi [The effects of problem based mathematics teaching through mobile applications on success]. *Eğitim ve Bilim,* 44(197), 64-84. doi:http://dx.doi.org/10.15390/EB.2019.8119

Chaffey, D., (2016). *Global Social Media Research Summary, Smart Insights.* Retrieved from http://www.smartinsights.com/social-media-marketing/social-media-strategy/new-global-social-media-research/, 2016 (accessed 22.02.19).

Chaffey, D., (2018). *Global Social Media Research Summary, Smart Insights*. Retrieved from http://www.smartinsights.com/social-media-marketing/ social-media-strategy/new-global-social-media-research/, 2018 (Global Digital Report 2018, accessed 22.02.19).

Cheung, C. M., Chiu, P. Y., & Lee, M. K. (2011). Online social networks: Why do students use Facebook?. *Computers in Human Behaviour 27*(4), 1337-1343. http://dx.doi.org/10.1016/j.chb.2010.07.028

Chukwuere, J., & Bonga, S. O. Y. (2018). An exploration in the influence of social media on university students' relationships. In N. Callaos, B. Sáncjez, & M.Savoie (Eds.), *Proceedings of the 22nd World Multi-Conference on Systemics, Cybernetics and Informatics: WMSCI 2018* (Vol. 1, pp. 113-118). Orlando, Florida: USA.

Chukwuere, J. E., & Chukwuere, P. C. (2017). Cyber bullying of female students: an exploration of literature study. *Gender and Behaviour 15*(4):9983-9995. 2017. https://www.ajol.info/index.php/gab/article/view/165798

Chun, J. W., & Lee, M. J. (2016). Increasing individuals' involvement and WOM intention on social networking Sites: Content matters! *Computers in Human Behaviour*, 60:223-232. https://doi.org/10.1016/j.chb.2016.02.069

Chun, W. J., & Lee, M. J. (2017). When does individuals' willingness to speak out increase on social media? Perceived social support and perceived power/control. *Computers in Human Behaviour, 74* (2017):120-129. https://doi.org/10.1016/j.chb.2017.04.010

Cox, D., & McLeod, S. (2014). Social media strategies for school principals. *NASSP Bulletin 98*(1):5-25. https://doi.org/10.1177/0192636513510596

DeLegge, A., & Wangler, H. (2017). Is this the end for Facebook? A mathematical analysis. *Applied Mathematics and Computation, 305*, 364-380. https://doi.org/10.1016/j.amc.2017.02.014

Dong, T., Liang, C., & He, X. (2017). Social media and internet public events. *Telematics and Informatics, 34*(2017): 726–739. https://doi.org/10.1016/j.tele.2016.05.024

Facebook. (2012). *Fact Sheet.* Retrieved February 29, 2012, from http://newsroom.fb.com/content/default.aspx?NewsAreaId=22.

Facebook. (2015). *Stats*. Retrieved from http://newsroom.fb.com/company-info/. (Accesses on 21.08.15).

Facebook. (2017). *Facebook Newsroom:* Company Info. Retrieved from https://newsroom.fb.com/company-info/ (accessed 4th March, 2019).

Ferrucci, P. & Tandoc, E. (2015). The Facebook Experience: A phenomenology of Facebook use. *Online Journal of Communication and Media Technologies,* 5. 176-197. http://dx.doi.org/10.29333/ojcmt/2523

Glynn, C. J., Huge, M. E., & Hoffman, L. H. (2012). All the news that's fit to post: A profile of news use on social networking sites. *Computers in Human Behaviour, 28*(1):113-119. https://doi.org/10.1016/j.chb.2011.08.017

Hamat, A., Embi., M. A., & Hassan, H. A. (2012). The use of social networking sites among Malaysian university students. *International Education Studies, 5*(3):56. https://doi.org/10.5539/ies.v5n3p56

Hargittai, E. (2007). Whose space? Differences among users and non-users of social network sites. *Journal of Computer-Mediated Communication, 13*(1):276-297. https://doi.org/10.1111/j.1083-6101.2007.00396.x

Hilary. (2017). Social Media Policy. *St John's College:* Oxford. Available at: https://www.sjc.edu/

Ho, S. S., & McLeod, D. M. (2008). Social-Psychological Influences on Opinion Expression in Face-to-Face and Computer-Mediated Communication. *Communication Research, 35*(2), 190–207. https://doi.org/10.1177/0093650207313159

Hutchinson, A. (2016). *Twitter Showcases Key Milestones and Data on 10th Birthday [Infographic]*. Social Media Today. https://www.socialmediatoday.com/social-networks/twitter-showcases-key-milestones-and-data-10th-birthday-infographic

Kaban, A. (2021a). Views on the usage of social media tools in school-family communication. *International Journal of Technology in Education (IJTE),* 4(3), 314-330. https://doi.org/10.46328/ijte.118

Kaban, A. (2021b). Metaphoric perceptions of teachers, students, and parents towards social media. International Journal on Social and Education Sciences (IJonSES), 3(3), 489-503. https://doi.org/10.46328/ijonses.192

Kaplan, A. M., & Haenlein, M. (2010). Users of the world, unite! The challenges and opportunities of Social Media. *Business Horizons, 53*(1):59-68. https://doi.org/10.1016/j.bushor.2009.09.003

Kaya, T., & Bicen, H. (2016). The effects of social media on students' behaviors; Facebook as a case study. *Computers in Human Behaviour*, 59. 374-379. https://doi.org/10.1016/j.chb.2016.02.036

Krishina, M. M., Loh, C. T., & Khor, M. W. (2018). Is Facebook useful for learning? A study in private universities in Malaysia. *Computers & Education, 130*. Pages 94-104 https://doi.org/10.1016/j.compedu.2018.12.002

Lampropoulos, G., Siakas, K., Makkonen, P., & Siakas, E. (2021). A 10-year longitudinal study of social media use in education. International Journal of Technology in Education (IJTE), 4(3), 373-398. https://doi.org/10.46328/ijte.123

Lau, W. W. F., Lui, V., & Chu, S. K. W. (2016). The use of wikis in a science inquiry based project in a primary school. *Educational Technology Research and Development*, 65: 533–553. http://dx.doi.org/10.1007/s11423-016-9479-9 (Advance online publication).

Lau, W. (2017). Effects of social media usage and social media multitasking on the academic performance of university students. *Computers in Human Behavior*, *68*, 286–291. https://doi.org/10.1016/j.chb.2016.11.043

Lee, M. J., & Chun, J. W. (2016). Reading others' comments and public opinion poll results on social media: Social judgment and spiral of empowerment. *Computers in Human Behaviour, 65*:479-487. https://doi.org/10.1016/j.chb.2016.09.007

Mahmud M.M., Ramachandiran C.R., Ismail O. (2018) Social Media Dependency: The Implications of Technological Communication Use Among University Students. In: Tang S., Cheah S. (eds) Redesigning Learning for Greater Social Impact. Springer, Singapore. https://doi.org/10.1007/978-981-10-4223-2_7

Makarova, O., Ldokova, G., & Egorova, R. (2021). Analysis of students' views of the quality of pedagogical education in Russia. International Journal of Education in Mathematics, Science, and Technology (IJEMST), 9(3), 462-481. https://doi.org/10.46328/ijemst.1624

Marpa, E. P. (2021). Technology in the teaching of mathematics: An analysis of teachers' attitudes during the COVID-19 pandemic. International Journal on Studies in Education (IJonSE), 3(2), 92-102. https://doi.org/10.46328/ijonse.36

Mazer, J. P., Murphy, R. E., & Simonds, C. J. (2007). I'll see you on Facebook: the effects of computer-mediated teacher self-disclosure on student motivation, affective learning and classroom climate. *Communication Education, 56*:1-17. https://doi.org/10.1080/03634520601009710

McAndrew, F. T., & Jeong, H. S. (2012). Who does what on Facebook? Age, sex, and relationship status as predictors of Facebook use. *Computers in Human Behaviour, 28*(6):2359-2365. https://doi.org/10.1016/j.chb.2012.07.007

Mulenga, E. M., & Marbán, J. M. (2020). Social media usage among pre-service secondary mathematics teachers in Zambia. *JRAMathEdu (Journal of Research and Advances in Mathematics Education), 5(2),* 130147. https://doi.org/10.23917/jramathedu.v5i2.9920

Nadkarni, A., & Hofmann, S. G. (2012). Why do people use Facebook? Personality and Individual Differences, 52(3):243-249. http://dx.doi.org/10.1016/ j.paid.2011.11.007.

Newham, M. (2012). *Is social networking affecting social interactions between users?* [Unpublished bachelors dissertation]. DBS School of Arts, Dublin.

Olagbaju, O.O. & Popoola, A.G. (2020). Effects of audio-visual social media resources-supported instruction on learning outcomes in reading. International Journal of Technology in Education (IJTE), 3(2), 92-104. https://doi.org/10.46328/ijte.v3i2.26

Onat Kocabiyik, O. (2021). Social media usage experiences of young adults during the COVID-19 pandemic. International Journal of Technology in Education and Science (IJTES), 5(3), 447-462. https://doi.org/10.46328/ijtes.226

Park, E., Song, H.-D., & Hong, A. J. (2018). The use of social networking services for classroom engagement? The effects of Facebook usage and the moderating role of user motivation. Active Learning in Higher Education. https://doi.org/10.1177/1469787418809227

Peluchette, J. V., & Karl, K. (2010). Examining students' intended image on Facebook: "What were they thinking?!". *Journal of Education for Business, 85*(1):30-37. http://dx.doi.org/10.1080/08832320903217606

Pingdom. (2012). *Internet 2011 in numbers.* Retrieved from https://www.pingdom.com/blog/internet-2011-in-numbers/

Quan-Haase, A., & Young, A. L. (2010). Uses and gratifications of social media: A comparison of Facebook and instant messaging. *Bulletin of Science, Technology & Society, 30*(5):350-361. https://doi.org/10.1177/0270467610380009

Raacke, J., & Bonds-Raacke, J. (2008). MySpace and Facebook: Applying the uses and gratifications theory to exploring friend-networking sites. *CyberPsychology & Behaviour, 11*(2):169-174. https://doi.org/10.1089/cpb.2007.0056

Ross, C., Orr, E. S., Sisic, M., Arseneault, J. M., Simmering, M. G., & Orr, R. R. (2009). Personality and motivations associated with Facebook use. *Computers in Human Behaviour, 25*(2):578-586. https://psycnet.apa.org/doi/10.1016/j.chb.2008.12.024

Ryan, T., Chester, A., Reece, J., & Xenos, S. (2014). The uses and abuses of Facebook: A review of Facebook addiction. *Journal of Behavioural Addictions, 3*(3):133–148. http://dx. doi.org/10.1556/JBA.3.2014.016

Shukla, N. J., & Mcinnis, E. (2021). Flipped classroom: Success with first year mathematics students. International Journal on Social and Education Sciences (IJonSES), 3(1), 32-47. https://doi.org/10.46328/ijonses.56

Sian, L. C., & Long, M. (2012). News sharing in social media: The effect of gratifications and prior experience. *Computers in Human Behaviour, 28*:331-339. 10.1016/j.chb.2011.10.002.

Singh, K. P., & Gill, M. S. (2015). Role and users' approach to social networking sites (SNSs): a study of universities of North India. *The Electronic Library, Vol. 33 No. 1,* pp. 19-34. https://doi.org/10.1108/EL-12-2012-0165

Smock, A. D., Ellison, N. B., Lampe, C., & Wohn, D. Y. (2011). Facebook as a toolkit: A uses and gratification approach to unbundling feature use. *Computers in Human Behaviour, 27*(6):2322-2329. https://doi.org/10.1016/j.chb.2011.07.011

Special, W. P., & Li-Barber, K. T. (2012). Self-disclosure and student satisfaction with Facebook. *Computers in Human Behaviour, 28*(2):624-630. https://doi.org/10.1016/j.chb.2011.11.008

Stanciu, A., Mihai, F., & Aleca, O. (2012). Social networking as an alternative environment for education. *Accounting and Management Information Systems, Vol. 11 No. 1,* pp. 56-75. http://online-cig.ase.ro/RePEc/ami/articles/11_1_4.pdf (application/pdf)

Sung, K. H., & Lee, M. J. (2015). Do online comments influence the public's attitudes toward an organization? Effects of online comments based on individuals' prior

attitudes. *The Journal of Psychology, 149*(4):325-338. https://doi.org/10.1080/00223980.2013.879847

Susilo, A. (2014). Exploring Facebook and WhatsApp as supporting social network applications for English learning in higher education. *Widyatama International Seminar (75),* (pp. 10-24). http://repository.ut.ac.id/id/eprint/4930

Van den Eijnden, R. J.J. M., Lemmens, J. S., & Valkenburg, P. M. (2016). The Social Media Disorder Scale: Validity and psychometric properties. *Computers in Human Behaviour, 61*:478-487. https://doi.org/10.1016/j.chb.2016.03.038

Zambia Information and Communications Technology Authority (ZICTA) in collaboration with the Central Statistical Office (CSO), Republic of Zambia Ministry of Transport and Communications (2018). *National Survey on Access and Usage of Information and Communication Technologies by Households and Individuals*. 2018 Survey Preliminary Report.

Zhou, H.T., (2004). Case Study Research: Design and Methods (in Chinese). *Chongqing University Press*. 41 p.

Author Information

José María Marbán

https://orcid.org/0000-0002-6561-6784

University of Valladolid

Department of Didactics of Experimental Sciences, Social Sciences and Mathematics.

Faculty of Education and Social Work

Campus Miguel Delibes - Paseo de Belén 1,

47011 Valladolid (España)

Spain

Contact e-mail: *josemaria.marban@uva.es*

Eddie Mumba Mulenga

https://orcid.org/0000-0002-4720-5009

University of Valladolid

Department of Didactics of Experimental Sciences, Social Sciences and Mathematics.

Faculty of Education and Social Work

Campus Miguel Delibes - Paseo de Belén 1,

47011 Valladolid (España)

Spain