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Abstract

The study was aimed to determine the impact of social media used on mathematics/statistics through online distance learning (ODL) among pre-diploma and diploma business management students enrolling for Intensive Mathematics (MAT037), Business Mathematics (MAT112), Mathematics with Business Applications (MAT111) and Introduction to Statistics (QMT181) courses of academic session November 2020 – January 2021 in a public university in Malaysia. The quantitative research design was employed in which samples were selected using cluster sampling method. From 53 academic groups of students taking MAT037, MAT111, MAT112, and QMT181, 21 groups were selected randomly. All students from 21 groups selected were chosen as samples. An online survey was conducted in January 2021 during the Recovery Movement Control Order (RMCO) Phase 3 period (1st January 2021 – 31st March 2021). During this period of time, Malaysian public universities were still conducting teaching and learning activities via ODL. A total of 539 pre-diploma and diploma business management students of ages between 18 years to 23 years old participated in the study. Findings of the study revealed that WhatsApp was the most favourite used social media platform among the students, followed by Instagram, YouTube, Telegram, Twitter, Facebook, Pinterest, TikTok, Facebook Messenger, and Snapchat. Male students were found to favour Facebook while female students favoured Twitter, Pinterest, and Telegram more than males. Older (20 – 23 years old) and senior (Part 2 and higher) students preferred to use Twitter while Instagram and Pinterest users were higher among younger (18 – 19 years old) and junior (Pre-diploma/Part 1) students. Twitter users were also higher among students residing in urban areas, enrolling in insurance discipline of study, and taking statistics course. Combination of YouTube, Telegram, and/or WhatsApp used with lecturers' supervision, guidance, and collaboration during ODL had significantly affected mathematics/statistics performance while there was no significant effect between the combination of YouTube, Telegram, and/or WhatsApp when social media were used without lecturers' supervision, guidance, and collaboration. Results of the study also revealed that mathematics/statistics performance for groups who frequently used YouTube and groups who frequently used Telegram were significantly higher than groups who frequently used WhatsApp.

Thus, it is concluded that YouTube, Telegram, and WhatsApp can be beneficial and effective as educational tools in supporting mathematics/statistics learning with lecturers' supervision, guidance, and collaboration. According to the results, Instagram was students' second-most-used social media, so lectures and students should use Instagram to support and supplement mathematics/statistics learning.

Keywords: Academic Usage, Social Media, Online Distance Learning, Mathematics/Statistics Performance

Background of the Study

In this millennial or digital era, social media has rapidly grown its importance in humans' daily activities. Individuals from different generations and different age groups are fascinated to use social media. It is an undeniable fact that social media has transformed the lifestyles of individuals. Social media makes the world more open, and allows people the power to share, interact, and stay connected with each other. To use social media, one must own a device. The most popular device owned is a smartphone. Findings from Internet Users Survey 2020 by Malaysian Communications and Multimedia Commission (MCMC) (MCMC, 2020) concluded that the use of smartphones in Malaysia to access internet had increased from 93.1% in 2018 to 98.7% in 2020 and users visiting social network platforms had also increased from 85.6% in 2018 to 93.3% in 2020. The significant increase was due to the outbreak of Covid-19 pandemic in which large number of activities had shifted to online such as online shopping, online banking, online learning, online meeting, webinar, and many others. These online activities are mainly done from home using internet as people are advised to stay safe at home to curb the spread of Covid-19 in the community.

In Malaysia, the percentage of Facebook users had declined from 97.3% in 2018 to 91.7% in 2020. Meanwhile, YouTube users had climbed significantly from 48.3% in 2018 to 80.6% in 2020, Instagram users had increased from 57% in 2018 to 63.1% in 2020 and Twitter users had also risen from 23.8% in 2018 to 37.1% in 2020 (MCMC, 2020). For ages between 18 years to 24 years old, Instagram has become the most popular social media used as reported by *napoleonCat.Stats*, 2021. For this age group, Instagram is popularly used among females compared to males. *NapoleonCat.Stats* (2021) reported that as of May 2021, 14.7% females used Instagram compared to 14% males. Facebook is popular among males of ages between 18 years to 24 years old for with 11.4%, compared to only 10% females (*NapoleonCat.Stats*, 2021).

With proper, appropriate and guided usage, social media can be a very useful and valuable tool for academic purposes in enhancing the learning process of students through a better process of communication, interaction and collaboration on the social network. There were massive relevant previous studies suggested on the effectiveness of social media like Facebook, Instagram, WhatsApp, YouTube, Twitter, or Telegram on students' learning in higher education. However, literature of social media on mathematics/statistics learning and the impact of it on mathematics/statistics performance were limited. Therefore, this study aims to fill the gaps, exploring the public university students on the impact of utilization of YouTube, Telegram, or WhatsApp or any combination of the social media in mathematics/statistics online distance learning and to investigate the impact of the social media usage with and without lecturers' supervision, guidance, and collaboration on mathematics/statistics performance. The participants consisted of pre-diploma and diploma

business management students enrolling for Intensive mathematics (MAT037), Business Mathematics (MAT112), Mathematics with Business Applications (MAT111) and Introduction to Statistics (QMT181) courses of academic session November 2020 – January 2021 in a public university in Malaysia. The quantitative research design was employed in which samples were selected using cluster sampling method. From 53 academic groups of students taking MAT037, MAT111, MAT112, and QMT181, 21 groups were selected randomly. All students from 21 groups selected were chosen as samples.

Statement of Problem

With the rapid growth in communication technology, most of young people especially students have smartphones to communicate, interact, and share ideas with families, friends, or other people in the same or different communities via various social media platforms. The problem is do students use the social media wisely not merely for personal and social uses but also for their learning purposes. Therefore, it is important to study students' responses towards social media for academic usage to enhance learning.

Purpose of the Study

This study is aimed to investigate what are the favourites social media used among pre-diploma and diploma business management students of ages between 18 years to 23 years old, their perceptions towards social media for academic purposes, and lastly the impact of some social media used in mathematics/statistics online distance learning (ODL) on mathematics/statistics performance.

Research Questions

The study aimed to answer the following research questions:

1. What are the favourite social media used among pre-diploma and diploma business management students of ages between 18 years to 23 years?
2. How do favourite social media and daily time spent on social media differ respectively across demographic characteristics?
3. How do students who use their favourite social media sites differ from those who don't, and do these differences affect mathematics/statistics performance?
4. How does mathematics/statistics performance differ respectively when social media used with and without lecturers' supervision, guidance, and collaboration?
5. What is the impact of most frequent social media used in online distance learning and mathematics/statistics courses on mathematics/statistics performance?

Significance of the Study

An understanding of the usage of social media and how it influenced students' learning would be of great importance and relevance to students as well as educators. The study investigates favourite social media used by pre-diploma and diploma students of ages between 18 years to 23 years old. As social media is very attached to students' life, it is very important and relevant to study students' perceptions on the social media used for academic purposes and to study the impact of social media used in mathematics/statistics online distance learning on mathematics/statistics performance.

Literature Review

Social Media

Websites and applications which focus on communication, community-based input, interaction, content-sharing and collaboration are collectively known as social media. In simple words, social media is a tool or platform used to stay in touch, communicate, interact, and share ideas with families, friends, or other individuals in the same and different communities. Siddiqui and Singh (2016) defined social media as computer tools that allowed people to share or exchange information, ideas, images, videos and even more with each other through a particular network. All these social media have special features that make modern people especially students attracted to using the social media for personal, social, or academic purposes. Some popular social media used by young people are WhatsApp, Instagram, YouTube, Telegram, Twitter, Facebook, Pinterest, TikTok, Facebook Messenger, and Snapchat.

Firstly, WhatsApp was launched in 2009. With just a Wi-Fi connection, WhatsApp is a free, multiplatform messaging app that lets allows users to make video and voice calls, send text messages, and above all, it is popular due to its simple and straightforward features (Goodwi, 2021). Secondly, Instagram was launched in 2010 and is a social networking app for sharing photos and videos from a smartphone. The popularity of Instagram had exploded especially among younger generation and anyone obsessed with mobile photography (Moreau, 2022). Next, YouTube is popular as a video sharing service where users can watch, share, like, comment, and upload their own videos (McGarrigle, 2021). Fourthly, Telegram is a popular cross-platform messaging app that is widely used because it offers some enhanced privacy and encryption features as well as support for large group chat features (Johnson, 2021). Next, Twitter is established in 2006 and it is a 'microblogging' system. Its microblogging feature allows users to publish their ideas and opinions in "real-time messaging" format by writing tweets limited to certain number of characters (initially 140 but now, up to 280) (Malik et al., 2019). Created in 2004, Facebook is a social networking website where users can post comments, share photographs, and post links to news or other interesting content on the web, chat live, and watch short-form video (Nations, 2021). Another popular social network, Pinterest, focuses on collecting and sharing things users find online (GCFGlobal.org., 2021). Next, TikTok is a short-form, video-sharing app that allows users to create and share 15-second videos, on any topic (Geyser, 2021). Next, Facebook Messenger is a free mobile messaging app used for instant messaging, sharing photos, videos, audio recordings and for group chats. The app is free to download and can be used to communicate with friends on Facebook and with phone contacts (McGarrigle, 2018). Lastly, Snapchat is a social networking and multimedia mobile application that allows users to share photos, videos, and messages (called snaps) that disappear within a short period of time (Freyn, 2017).

Social Media Usage in Higher Education Students' Learning

Social media has taken over contemporary society in this fourth industrial revolution. There are many previous studies that have proven the usefulness and effectiveness of social media when integrated into teaching and learning processes. Amry (2014) studied an experimental group using WhatsApp in classroom and a control group by using only face-to-face learning without using WhatsApp. She concluded that WhatsApp had helped students to create a learning community by creating positive attitudes towards WhatsApp usage in classroom, to easily construct knowledge, and share it with other members of a WhatsApp group through

instant messaging. The role of teachers was to collaborate with students to enhance teaching and learning process and to avoid the abuse of social media. According to Ujakpa et al (2018), lecturers and students should use WhatsApp to communicate while using course-related humor to keep slow-moving students engaged. Tang and Hew (2017) reported that WhatsApp had been used in different academic disciplines to support students' learning. Gasaymeh (2017) reported that the use of WhatsApp among students for academic purposes was limited but rather students used WhatsApp for personal and social purposes on a daily basis. However, students had positive feelings and intentions about using WhatsApp in their formal learning if it was introduced and it would be easy, fun, and useful if WhatsApp is integrated into the education.

The increase in the use of social media in this digital era is due to its ubiquity, convenience, flexibility and functionalities (Al-Rahimi et al., 2013). Like many other modern people, students too are very attached to smartphones, internet, and social media. Al-Rahmi et al. (2014) reported that in modernizing the process of students' learning, interaction, collaboration and sharing, social media has become highly beneficial for students in higher education. Apart from allowing students to communicate and collaborate with their peers, enabling them to concentrate more on their reading and writing skills, Issa et al (2021) concluded that the use of social networking as a learning and teaching tool in the Middle East higher education sector would also encourage sustainable practices. In academic life, Boateng and Amankwaa (2016) found that students use social media to communicate with their teachers as a group outside the class, use social media as a platform of discussions for assignments and course work, get updates on class schedules, class venues, receives and sends information among peers, and explore issues related to their course work. However, social media is also a source of distraction that may divert students' attention from their learning (Ali et al., 2017; Means, 2019). When left to their own devices, students can easily become distracted by something more interesting to them but irrelevant to their learning material, resulting in time waste. Therefore, it is very important for students to be self-disciplined in managing their time wisely when using social media.

Eid & Al-Jabri (2016) concluded that there was a significant positive relationship between both chatting and online discussion, file sharing and knowledge sharing, and entertainment and enjoyment with students' learning. Alghizzawi et al (2019) further showed knowledge sharing, social media features, and motivation to use social media systems using Facebook, YouTube and Twitter, had positive effect on the perceived usefulness and perceived ease-of-use of e-learning platforms which led to increased e-learning platform acceptance among students. Time spent and specific types of social networking sites were shown to mediate the relationship between social networking sites usage and academic performance as concluded by (Salvation and Adzharuddin, 2014). Ali et al (2017) confirmed that students believe social networking will assist them to complete their study tasks more quickly, communicate and collaborate with their peers, and improve their reading and writing skills. A study by Al-Rahmi et al (2015) showed a significant effect of social media on the students' academic performance with collaborative learning as the mediating variable. The study concluded that without good collaborative learning, an education institution cannot take advantage of social media for improving academic performance. Osharive (2015) recommended the use of social media for academic purposes as a large number of students were addicted to social media by expanding social networking sites and creating new pages to enhance academic activities and

avoiding setbacks in students' academic performance. Students should not be left alone to use the social media, but should be monitored by teachers and parents as such to create a balance between social media and academic activities of students to avoid setbacks in the academic performance of the students. Linking course content with practical peer interaction was superior among students using social media during learning as revealed by Al-rahmi et al (2015) and consequently supported their learning in class.

Bardakçı (2019) suggested that students had intention to use YouTube in their learning to improve their academic performance. He found that performance expectancy and social influence are the significant predictors of behavioral intention to use YouTube and behavioral intention is the significant predictor of actual usage of YouTube. According to Buddayya and LG (2019), students were aware that YouTube videos could be beneficial in their learning process. YouTube videos can also be used for deriving educational, cultural and behavioural benefits.

Pujiati and Tamela (2019) stated that features in Instagram had allowed users to upload and share photos, pictures, and videos for public or private use had attracted students' interest in using the platform to support learning. Instagram can be a channel for supporting education in which modules and class information can be shared on Instagram as reported by (Kaya and Bicen, 2016). Pujiati and Tamela's (2019) use of Instagram to build students' motivation and improve their English knowledge and skills in syntax, vocabulary, and composition was successful in getting students to learn English and improve their English skills. A study by Gaya et al (2020) revealed that Facebook, WhatsApp and Instagram platforms have effects on the academic performance among mathematics education students in Nigeria. Twitter could also be incorporated in higher education learning as reported by Szapkiw and Szapkiw (2011) by engaging students with course content interactions through discussion, polling, question and answer sessions, and other collaborative interactions in a higher education classroom. Htay et al (2020) revealed that Twitter was mainly used for social communication among postgraduate students. However, most students could see the benefits of using Twitter for their learning if they received adequate guidance on how to use the platform which means that lecturers must collaborate with students for a more convincing outcome and to avoid students abusing social media. Malik et al (2019) reviewed literature on potential of Twitter as a technology-enabled learning instrument in classroom and found that Twitter has been deemed as a supportive tool within the classroom in improving students' learning, motivation, engagement, communication and teaching, all of which leads towards creating a more resourceful classroom environment.

In their studies, Al Momani (2020); Alahmad (2020) had shown evidence in improving students' reading skills through the effectiveness of Telegram application due to its ease of access, ease of exchanging personal ideas, peer input, and input from the teacher to individual students. Moreover, students can enjoy the comfort of using Telegram which could be catered to their own needs and to a capability of Telegram to provide them with a feeling of security. Al-Dheleai and Tasir (2017) studied students' perceptions towards the use of Facebook for course-related online interaction and its effects on academic performance and found students had positive views towards the use of Facebook for online interaction with peers. Al-Dheleai and Tasir (2017) also revealed that there was a relationship between students perceived online interaction using Facebook and academic performance. The

impacts of Facebook on the curriculum was studied by Means (2019) and reported that students can use Facebook for academic purposes, including collaboration, discussion and to obtain extra help by forming groups on Facebook and post questions to obtain feedback from peers, sharing links, such as videos on the wall of the group page and in personal messages while teachers can access the Facebook group to send reminders to their students about assignments and tests. However, Thompson (2017) argued that the frequent use of Facebook could interrupt students' learning. Findings by Toker and Baturay (2019) indicated that students with high GPA and autonomy need, used Facebook for studying and socialization for which students who dislike to delay or postpone action on academic works may be highly motivated to use Facebook for academic purposes.

Pinterest is a unique platform for inspiration which allows users, mostly young adults, to create and share a visual pinboard of pictures, charts, and articles about various brands and products (Jorgensen, 2016). Pearce and Learmonth (2013) found that Pinterest was a popular and useful tool for developing curated multimedia resources to support students' learning in anthropology class. Yang (2020) studied the use of TikTok in English as a Foreign Language (EFL) classroom and suggested that TikTok could be utilized as supplementary video aids to complement tradition in-class English teaching, enrich classroom activities, enhance their learning motivation and improve their basic English skills. In addition, out of class, TikTok could be used as an English learning strategy to expand students' English knowledge, get access to plentiful authentic learning materials and cultivate their English learning interests. Smutny and Schreiberova (2020) examined educational chatbots for Facebook Messenger to support students' learning. Freyn (2017) studied about Snapchat in an EFL classroom by engaging students to use this social media technology to practice English outside the classroom.

Social Media usage in Higher Education Mathematics Learning

The idea of incorporating social media into teaching, studying, and learning of mathematics is very important in these days of digital era. Naidoo and Kopung (2016) studied the intervention of WhatsApp instant messaging in assisting students in learning mathematics. They suggested to use WhatsApp instant messaging as a tool to foster a social constructivist environment for mathematical learning which also supported students in improving students' performance in mathematics. In another study conducted by Khoza (2020), mentioned that to understand students' habits of using WhatsApp in the learning of mathematics and found that social habits drove the learning although there were elements of discipline and personal habits. In order to address societal, individual, and the mathematics education needs, Khoza (2020) also recommended students using WhatsApp to integrate social, discipline, and personal actions as taxonomies of education habits.

Many mathematical contents are provided in social media such as YouTube, Facebook, and Instagram. Hidayatullah and Suprpti (2020) reported that mathematical content provided by social media became the main choice for teachers as it could support audio visuals to facilitate the teaching and learning processes. Students were easily and understood mathematics better through audio visual content contained in YouTube, or in Instagram. According to Thompson (2017), learning patterns using social media, would allow students to absorb and produce mathematical information through new literacy style. Daraei (2015) showed that Facebook brought positive change in students' satisfaction, helped students to

do many activities with online classes, and helped students to improve their exam's grades when Facebook was used for academic purposes in learning mathematics. Iksan and Saufian (2017) reported the benefits of Telegram in learning are by allowing students to gain new experience, be more creative, generate spontaneous ideas, provide authentic ideas without the risk of being humiliated and encourage excitement as well as passionate with their learning. Suryati and Adnyana (2020) showed that mathematics learning outcomes with telegram-assisted blended learning strategies were better than conventional mathematics learning outcomes.

Methodology

Research Design

Quantitative research was employed in this current study. The study used structured online questionnaires for students and open-ended questionnaires for lecturers via WhatsApp.

Population of the Study

The target population of the study was pre-diploma and diploma business management students of ages between 18 years to 23 years old enrolling in Pre-Commerce (BA002), Business Studies (BA111), Insurance (BA115), Office Management (BA118), and Banking Studies (BA119) in a public university in Malaysia.

Sample and Sampling Procedure

The pre-diploma and diploma business management students were divided into 53 academic groups of which 21 academic groups (40% of groups) were randomly selected. The study used cluster sampling technique in selecting the participants. All participants in 21 groups selected were taken as samples of the study. The sample of the 21 groups comprised of students from five different business management programs that included, Pre-Commerce (BA002), Business Studies (BA111), Insurance (BA115), Office Management (BA118), and Banking Studies (BA119). A total of 539 respondents participated in the study. These students enrolled for mathematics/statistics courses at pre-diploma and diploma levels; Intensive Mathematics (MAT037), Mathematics with Business Application (MAT111), Business Mathematics (MAT112), and Business Statistics (QMT181) in the university.

Data Collection Procedure

Data collection was conducted primarily in three stages. The first stage was the online survey via Google Docs Form. The second stage was mathematics/statistics performance by the final grade points scores in mathematics/statistics courses. The third stage was open-ended questionnaires to lecturers via WhatsApp. An online survey was conducted in January 2021 during the Recovery Movement Control Order (RMCO) Phase 3 period (1st January 2021 – 31st March 2021). During this period of time, Malaysian public universities were still conducting teaching and learning via online distance learning (ODL). Most of them were staying at home with their families.

Data Analysis

To answer the postulated research questions, both descriptive and inferential statistical tests were used. For this current study, data were analyzed using Statistical Package for Social Science version 26.0 (SPSS v26.0). Statistical tests used to answer the research questions

were Chi-square independent test, independent samples t-test, one-way analysis of variance (ANOVA), and two-way ANOVA.

Results and Findings

Demographic Characteristics

Primary data was gathered using online survey via Google Docs Form. 539 pre-diploma and diploma business management students were surveyed from a public university in Malaysia. Out of the 539 participants, 79% were females and 21% were males. Majority of students (73.7%) were of ages below 20 years (18 – 19 years) and 26.3% students were 20 years and above (20 – 23 years). Majority of the students (61.6%) resided in urban areas while 38.4% stayed in rural areas. Most of the students (72.9%) came from family of B40 income group (income of less or equal to RM4360), 19.5% from M40 income group (income of RM4361 or equal to RM8300), and only 7.6% students came from T20 family income group (income of RM8301 or above). Most students (78.1%) are pursuing study at diploma level while 21.9% students enrolled for pre-diploma in the university. Exactly 75.5% students enrolled for pre-diploma and Part 1 (junior) while 24.5% students were in Part 2 and higher (senior). Majority (33.4%) of students enrolled in office management discipline of study, 23.7% in business studies, 21.9% in pre-commerce, 13.7% in insurance, and 7.2% in banking studies. More than three quarter of students (78.8%) took mathematics while 21.2% students took statistics. Table 1 summarized the demographic characteristics of 539 participants.

Table 1

The Frequency distribution of participants' demographic characteristics

Demographic characteristics	Category	Frequency	Percentage
Gender	Male	113	21.0
	Female	426	79.0
Age	Below 20 years (18 – 19 years)	397	73.7
	20 years and above (20 – 23 years)	142	26.3
Location of stay	Rural	207	38.4
	Urban	332	61.6
Family income	Less or equal to RM4360 (B40)	393	72.9
	RM4361 or equal to RM8300 (M40)	105	19.5
	RM8301 or above (T20)	41	7.6
Study level	Pre-diploma	118	21.9
	Diploma	421	78.1
Students' status	Junior (Pre-diploma and Part 1)	407	75.5
	Senior (Part 2 and higher)	132	24.5
Discipline of study	Pre-commerce (BA002/003)	118	21.9
	Business studies (BA111)	128	23.7
	Insurance (BA115)	74	13.7
	Office management (BA118)	180	33.4
	Banking studies (BA119)	39	7.2
Mathematics/statistics courses taken	Intensive Mathematics (MAT037)	118	21.9
	Mathematics with Business Application (MAT111)	180	33.4
	Business Mathematics (MAT112)	127	23.6
	Business Statistics (QMT181)	114	21.2

Favourite Social Media Used

Research Question 1: What are the favourite social media used among pre-diploma and diploma business management students of ages between 18 years to 23 years?

The findings first revealed that all participants used at least one social media in a day. The number of social media used varied from 1 to 9 social media. From 539 participants, most of them (31.2%) used three social media, 25.4% used four social media, 16.7% used five to nine social media, 15.6% used two social media, and 11.1% used only one social media in their daily activities. The findings were in line with Internet Users Survey 2020 by MCMC (2020) that concluded 93.3% of the population of Malaysia visited social networking platforms in 2020 compared to 85.6% in 2018. Out of 539 participants, all have smartphones with 523 (97%) students used smartphones for their social networking activities. Majority of them (51.8%) owned Android and 48.2% owned iPhone. The present study concluded that all 539 participants visited the social networking platforms with 88.9% students used two or more social media in a day and 11.1% used only one social media for their daily social networking activities.

Students of ages between 18 to 23 years were born between the year of 1998 to 2003, are grouped as generation Z (or simply Gen Z), also known as zoomers (Robinson, 2021). According to PrakashYadav and Rai (2017), Gen Z has undergone the web revolution throughout the 1990s and the first to have internet technology so readily available and they have been exposed to an unprecedented amount of technology in their upbringing. PrakashYadav and Rai (2017) also described the characteristics of Gen Z as technology innate, communicate with images, creators and collaborators, future focused, realistic, want to work for success, self-reliant, and persistent. Table 2 demonstrates ten most favourite social media used among pre-diploma and diploma business management students of ages between 18 years to 23 years.

Table 2

Favourite social media used among pre-diploma and diploma business management students of ages between 18 years to 23 years

Social media	Frequency	Percent
WhatsApp	536	99.4
Instagram	481	89.2
YouTube	427	79.2
Telegram	370	68.6
Twitter	301	55.8
Facebook	130	24.1
Pinterest	93	17.3
Tik Tok	55	10.2
Facebook Messenger	22	4.1
Snapchat	14	2.6

This study found WhatsApp ranked the first with almost all students (99.4%) used it. The result agreed with the study by Badrol and Wok (2020); Devi and Tevera (2014); Ahad and Lim (2014) that WhatsApp was the most popular used social media among higher education students. The heavy usage of WhatsApp was due to its ease of use, speed, real-time

messaging, and low cost (Ahad and Lim, 2014). The study next found Instagram ranked the second with 89.2% usage while YouTube ranked the third in popularity with 79.2% usage. Telegram ranked the fourth with 68.6% usage, 55.8% used Twitter which ranked the fifth, 24.1% used Facebook ranked the sixth, 17.3% used Pinterest ranked the seventh, 10.2% used TikTok ranked the eighth, 4.1% used Facebook Messenger ranked the ninth, and 2.6% used Snapchat ranked the tenth in popularity. There were also other social media such as Discord (1.3%), iMessage (1.1%), WeChat (0.7%), LinkedIn (0.4%), Wattpad (0.4%), Line (0.4%), and Twitch (0.2%) used but not very popular among this group of students.

Association between Demographic Characteristics and Social Media Used

Research Question 2: Are the favourite social media used and daily time spent on social media respectively differ significantly across demographic characteristics?

Chi-square test for independence was used to answer the first part of research question 2 while independent-samples t test, and one-way analysis of variance (one-way ANOVA) were used to answer the second part of research question 2. Results revealed that Facebook usage among students of ages between 18 to 23 years was significantly associated with gender (Chi-square = 17.156, $p < 0.001$) and it was popular among males compared to females. Twitter (Chi-square = 5.599, $p < 0.05$), Pinterest (Chi-square = 18.835, $p < 0.001$), and Telegram (Chi-square = 8.219, $p < 0.01$) usage were also significantly associated with gender. It was found that female proportions using Twitter, Pinterest, and Telegram were significantly higher than male proportions. There were no significant associations between Instagram, YouTube, TikTok, WhatsApp, Facebook Messenger, and Snapchat usage and gender. This means both males and females equally favour Instagram, YouTube, Tik Tok, Facebook Messenger, and Snapchat. Results also concluded that there were significant associations between Twitter (Chi-square = 6.255, $p < 0.05$), and Pinterest (Chi-square = 8.858, $p < 0.01$) and age group. It was found that older students (20 years old and above) have significantly higher proportion than younger students (below 20 years old) in Twitter usage while Pinterest usage was significantly higher proportion among younger students compared to older students. Both younger and older students equally favoured Facebook, Instagram, YouTube, TikTok, WhatsApp, Facebook Messenger, Telegram, and Snapchat.

It was found that Twitter was favoured among students staying in urban areas (Chi-square = 4.278, $p < 0.05$), students enrolled in insurance discipline of study (Chi-square = 11.541, $p < 0.05$), and took statistics course (Chi-square = 11.474, $p < 0.001$). Twitter was also preferred by senior students (Chi-square = 8.303, $p < 0.01$) while Pinterest was favoured by junior students (Chi-square = 4.249, $p < 0.05$). There was no significant association between any social media used and family income group. The result concluded that the social media usage for the three family income groups was equal. The result implied that the impact of social media usage was socio-economically equal even among less rich families. Result also showed no significant association between social media used and students' study levels.

On average, students spent 5.53 hours on social media usage per day and 4.51 hours per day was allocated for academic purposes. Most students spent 5.18 hours on social media usage per day and 3.78 hours per day on social media for academic purposes. The study revealed that female students spent significantly ($t = -3.688$, $p < 0.001$) more time (mean = 5.77 hours, SD = 2.886 hours) compared to males (mean = 4.65 hours, SD = 2.743 hours) on social media

usage per day. Females also spent significantly ($t = -5.382, p < 0.001$) more time (mean = 4.76 hours, SD = 2.030 hours) than males (mean = 3.60 hours, SD = 2.016 hours) on social media for academic purposes. The result revealed that daily time spent on social media and daily time spent on social media for academic purposes only differ between male and female students but not for other demographic characteristics studied. Result obviously showed that students have turned to using social media in daily activities as they can easily communicate and interact with families, friends, and acquaintances from wherever they are without any difficulty.

Students' Perceptions on Social Media Usage for Academic Purposes

Research question 3: What are the differences in students' perceptions towards social media usage for academic purposes between users and non-users of the favourite social media used and do these perceptions correlated to mathematics/statistics performance?

The current research also studied students' perceptions on social media usage for academic purposes. The present study used 10 positive statements of students' perceptions on social media usage for academic purposes and was measured using 5-point Likert scale: 1 – strongly disagree, 2 – disagree, 3 – moderately agree, 4 – agree, 5 – strongly agree. The internal consistency reliability for the scale showed the Cronbach's Alpha value of 0.901 which surpassed the acceptable value of 0.70 (Pallant, 2011). Independent-samples t test was conducted to test for any significant difference between users and non-users of the favourite social media used. The findings revealed that Instagram ($t = -2.601, p < 0.01$) and YouTube ($t = -2.395, p < 0.05$) users perceived the frequent use of the social media was not a problem to them as it improved their academic performances. Students felt easy communicating with their classmates regarding academic matters when using Instagram ($t = -2.130, p < 0.05$) and Telegram ($t = -2.042, p < 0.05$). They also felt easy when communicating with other friends regarding academic matters when they used Instagram ($t = -2.499, p < 0.05$) and Telegram ($t = -1.984, p < 0.05$). Instagram ($t = -2.163, p < 0.05$) users also felt easy to engage in academic discussion when using the social media. Instagram ($t = -3.123, p < 0.01$) users perceived that their academic performance had improved via academic discussion on the social media. Users of Instagram ($t = -2.660, p < 0.01$) also used the social media to disseminate knowledge to their classmates. Among Instagram users perceived that it is valuable ($t = -2.556, p < 0.05$) and useful ($t = -3.480, p < 0.001$), and it is a positive influence to use the social media for academic purposes ($t = -2.143, p < 0.05$). Students who used Instagram also reported that they did revision with their friends ($t = -2.184, p < 0.05$) via the platform.

From these findings, it is concluded that only students who used Instagram, YouTube, and Telegram significantly perceived these social media can be incorporated for academic purposes. Even though students perceived that the use of the social media would be useful, valuable, and had positive influence if the social media are used in education, nevertheless, results showed that the social media users did not show any significant difference in mathematics/statistics performance compared to the non-users. The possible explanation would be, most of students used the social media mainly for personal and social usage but not for academic purposes. They got distracted and abused the social media for other unrelated academic matters that were more satisfying. Lecturers must promote, encourage, and guide the students to use the social media such as to communicate with classmates about matters related to courses requirements, communicate with lecturers about matters related

to courses requirements, publish courses announcements, discuss ideas about courses with classmates, discuss ideas related to courses with lecturers, post links to topics and resources related to courses, form student groups for academic purposes, discuss assignments and projects required by the lecturers, and organize the time to study (Gasaymeh, 2017).

Table 3

Pearson coefficient correlation (r) of perception statement of social media for academic purposes with mathematics/statistics performance

Statement	Pearson coefficient correlation (r)	Sig
Improve academic performance even with frequent use of social media.	0.127**	0.003
Use social media to communicate with classmates regarding academic matters.	0.087*	0.044
Use social media to communicate with other friends regarding academic matters.	0.089*	0.038
Engage in academic discussions on social media.	0.060	0.163
Academic discussions on social media had improved academic performance.	0.054	0.214
Use social media to disseminate knowledge to classmates.	0.126**	0.003
It is valuable to use social media as educational tool.	0.064	0.140
It is useful to use social media as educational tool.	0.063	0.147
It is a positive influence to use social media as educational tool.	0.080	0.063
Use social media to do revision with friends.	0.108*	0.012

* Significant at 0.05 level

** Significant at 0.01 level

Table 3 showed the Pearson coefficient correlation (r) of perception statement of social media for academic purposes with mathematics/statistics performance. Mathematics/statistics performance was measured by grade points achieved by students in Final Examination Semester November 2020 – January 2021. Results revealed that there were weak but significant positive correlations between improve academic performance even with frequent use of social media ($r = 0.127$, $p < 0.01$), usage of social media to communicate with classmates regarding academic matters ($r = 0.087$, $p < 0.05$), usage of social media to communicate with other friends regarding academic matters ($r = 0.089$, $p < 0.05$), usage of social media to disseminate knowledge to classmates ($r = 0.126$, $p < 0.01$), and usage of social media to do revision with friends ($r = 0.108$, $p < 0.05$). Result indicated that students also used social media to enhance their learning. The result was consistent with studies confirmed by (Bardakci, 2019; Gaya et al., 2020; Al-Dheleai & Tasir, 2017).

Social media usage in online distance learning (ODL) and mathematics/statistics performance

Research question 4: How does mathematics/statistics performance differ respectively when social media used with and without lecturers' supervision, guidance, and collaboration?

All 539 students participated in the study were divided into 21 academic groups enrolling for three different mathematics courses (MAT037, MAT111, MAT112) and one statistics course (QMT181). For the current study, out of ten favourite social media used among pre-diploma and diploma business management students, only three social media were used to support and complement the ODL by the lecturers. For the current study, the social media used in ODL were YouTube, WhatsApp, and Telegram. From 21 academic groups, 4 groups used Telegram, 3 groups used g YouTube, 4 groups used WhatsApp and Telegram, 4 groups used YouTube and Telegram, and 6 used using WhatsApp, YouTube, and Telegram to complement the ODL. In other words, 7 groups used only one social media, 8 groups used two social media, and 6 groups used three social media during ODL as shown in Table 4.

Table 4

Number of academic groups using combination of social media used during ODL by mathematics/statistics courses

Combination of social media used during ODL	Mathematics/statistics courses				Number of academic groups
	MAT0	MAT1	MAT1	QMT1	
	37	11	12	81	
WhatsApp, YouTube, Telegram	4	-	1	1	6
WhatsApp, Telegram	-	-	3	1	4
YouTube, Telegram	-	2	-	2	4
YouTube	-	2	-	1	3
Telegram	-	3	1	-	4
Number of academic groups	4	7	5	5	21

Table 5 shows mathematics/statistics performance by course. Mathematics/statistics performance was measured by grade point.

Table 5

Descriptive statistics of mathematics/statistics performance by course

Course	Mean grade point	N	SD	Minimum	Maximum
MAT037	2.90	118	0.878	0.67	4.00
MAT111	3.41	180	0.798	0.67	4.00
MAT112	3.29	127	0.980	0.00	4.00
QMT181	3.18	114	0.863	0.67	4.00
Total	3.22	539	0.893	0.00	4.00

Using Pearson product-moment correlation coefficient (r), result showed there was a statistically significant weak, negative correlation between number of social media used in ODL and mathematics/statistics performance ($r = -0.204$, $p < 0.001$). Result indicated that high grade points in mathematics/statistics were associated with smaller number of social media used in ODL. The possible explanation for this result is, by using more than one social media for academic purposes may cause distraction on what students are doing. Students may lose focus on what they are doing and may misuse the social media due to the attractiveness and free features of the social media. Distractions and exposure to unregulated

messages or information were some critical issues arose from the use of WhatsApp as highlighted by (Ahad and Lim, 2014).

Research question 4 investigates the comparison between combination of social media used (YouTube, Telegram, and WhatsApp) with and without lecturers’ supervision, guidance, and collaboration on mathematics/statistics performance. For this current study, with lecturers’ supervision, guidance, and collaboration refers to usage of YouTube, Telegram, and WhatsApp in mathematics/statistics ODL while without lecturers’ supervision, guidance, and collaboration refers to usage of YouTube, Telegram, and WhatsApp for personal use. Results revealed that the combination of YouTube, Telegram, and WhatsApp used with lecturers’ supervision, guidance, and collaboration significantly ($F(4, 534) = 10.223, p < 0.001$) affecting mathematics/statistics performance while there was no significant effect ($F(5, 533) = 0.583, p > 0.05$) between combination of YouTube, Telegram, and WhatsApp used without lecturers’ supervision, guidance, and collaboration as shown in Table 6. Table 6 shows the comparison between combination of social media used with and without lecturers’ supervision, guidance, and collaboration on mathematics/statistics performance. The result conforms with the study by (Al-Rahmi et al., 2014). The result concluded that in order to make sure social media used effectively in learning, lecturers’ supervision, guidance, and collaboration were needed. The significant difference in mathematics/statistics performance when social media used with lecturers’ supervision, guidance, and collaboration may be due to different teaching styles, different delivery techniques, or different online teaching platforms used by the lecturers. Without supervision, guidance, and collaboration from lecturers, many students lose focus and get sidetracked from what they should be learning (Al-Rahmi et al., 2014; Al-rahmi et al., 2015; Szapkiw and Szapkiw, 2011; Htay et al., 2020).

Table 6
Comparison between combination of social media used with and without lecturers’ supervision, guidance, and collaboration on mathematics/statistics performance

Social media used WITHOUT lecturers’ supervision, guidance, and collaboration					Social media used WITH lecturers’ supervision, guidance, and collaboration					
Combination of social media used	Mean mathematics/statistics grade point	SD	F	Sig	Combination of social media used	Number of groups	Mean mathematics/statistics grade point	SD	F	Sig
YouTube	1	2.67	.		Telegram	4	103	3.25	0.920	
YouTube, Telegram	1	3.67	.		Youtube	3	83	3.58	0.704	
WhatsApp, Telegram	51	3.11	1.042		Whatsapp,Telegram	4	91	3.48	0.682	
WhatsApp	61	3.20	0.899	0.583	YouTube, Telegram	4	98	3.13	0.867	10.223**
WhatsApp, YouTube, Telegram	319	3.27	0.859	0.713	Whatsapp,YouTube, Telegram	6	164	2.94	0.980	0.000
WhatsApp, YouTube	106	3.15	0.921							
Total	539	3.22	0.893		Total	21	539	3.22	0.893	

*** Significant at 0.001 level

SD – standard deviation

Impact of most frequent social media used during online distance learning (ODL) and mathematics/statistics courses on mathematics/statistics performance

Research question 5: What is the impact of most frequent social media used during ODL and mathematics/statistics courses on mathematics/statistics performance?

Research question 5 investigates the impact of most frequent social media used during ODL and mathematics/statistics courses on mathematics/statistics performance. From the three social media used (YouTube, Telegram, and WhatsApp) to support and complement ODL, the most frequent social media used by 21 academic groups studied was 10 groups frequently used YouTube, 8 groups frequently used Telegram, and 3 groups frequently used WhatsApp. On average, students who frequently used Telegram, YouTube, and WhatsApp spent 4.65 hours per day, 4.60 hours per day, and 3.98 hours per day respectively for academic purposes. There was a statistically significant difference in daily time spent on social media for academic purposes for the three social media groups ($F(2, 536) = 3.576, p < 0.05$).

A two-way between-groups analysis of variance (ANOVA) was conducted to explore the impact of most frequent social media used during ODL and mathematics/statistics courses on mathematics/statistics performance as measured by grade points. The effect on interaction between mathematics/statistics courses and most frequent social media used during ODL was not statistically significant ($F(1, 534) = 2.055, p > 0.05$). There was a statistically significant main effect for most frequent social media used during ODL ($F(2, 534) = 9.546, p < 0.001$). Multiple comparisons using post-hoc Tukey test indicated that the mean grade point for YouTube (mean = 3.23, SD = 0.878) and Telegram (mean = 3.36, SD = 0.823) were statistically different from the group using WhatsApp (mean = 2.90, SD = 1.007). The group using YouTube did not differ significantly from group using Telegram. The main effect for the course ($F(1, 534) = 0.033, p > 0.05$) did not reach statistical significance. The results are shown in Table 7. These results hope to stimulate lecturers to use social media in supporting mathematics/statistics teaching and learning processes and simultaneously enhancing the instructional method using YouTube, Telegram, and WhatsApp.

Table 7

Two-way ANOVA for most frequent social media used during ODL by mathematics/statistics courses

Most frequent social media used in ODL (1)	Descriptive statistics				Tests of Between-Subjects Effects			Multiple comparison		
	Course (2)	N	Mean mathematics/statistics grade points	SD	Source	F	Sig	Mean difference	Sig	
YouTube	Mathematics	163	3.30	0.867	(1)	9.546***	0.000	YouTube > WhatsApp	0.3321**	0.007
	Statistics	94	3.11	0.888						
	Total	257	3.23	0.878						
WhatsApp	Mathematics	88	2.90	1.007	(2)	0.033	0.857			
	Total	88	2.90	1.007						
Telegram	Mathematics	175	3.34	0.836	(1) * (2)	2.055	0.152	Telegram > WhatsApp	0.4542***	0.000
	Statistics	19	3.49	0.687						
	Total	194	3.36	0.823						

**Significant at 0.01 level

***Significant at 0.001 level

(1)(2) means the interaction effect between most frequent social media used in ODL (1) and course (1) on mathematics/statistics performance.*

Telegram, YouTube, and WhatsApp in mathematics/statistics online distance learning from lecturers' perspectives

Feedbacks were also gathered from lecturers teaching the mathematics/statistics courses by using open-ended questionnaire via WhatsApp. From the feedbacks, some advantages of using Telegram, YouTube, and WhatsApp were gathered. It was found that Telegram had more advantages compared to the other two social media from the lecturers' perspectives. Through Telegram, a lecturer can construct a channel where he or she can post notes, videos, and other related materials while students can comment about the particular post only. The channel makes it easy for students to ask questions regarding the subject matter. Lecturers can also create a poll for the students and mathematics/statistics quizzes can be given to students by using quiz bot. Lecturers can also schedule notes via Telegram in the google classroom. In learning mathematics/statistics, using calculator is important, hence, lecturers can share or record live videos to demonstrate how to use a calculator using a Telegram. Notes and video storage in Telegram are more effective compared to WhatsApp. The files are autosaved in the Telegram folder desktop for which the deleted files can easily be retrieved. For chatting purposes, Telegram can create a chat folder. If there is a problem with the smartphone, Telegram can still be accessed using laptop or other devices. Telegram can send all types of files as heavy as video cam and the videos or pictures sent via Telegram are better. The present study revealed students who used Telegram perceived that Telegram had broadened their general knowledge (78.2%), they can easily communicate with their classmates (64.3%) and other friends (66.5%) regarding academic matters, and they have learnt many new things (85.7%) from using Telegram. In a study by Suryati and Adnyana (2020) students learning mathematics using Telegram-assisted blended learning strategies outperformed the conventional mathematics learning students and Telegram-assisted strategies also had an effect on students' learning styles.

As for WhatsApp, from lecturers' perspectives, some advantages when using in mathematics/statistics learning are such as getting a very quick response as students are used to using WhatsApp. WhatsApp allows a video call to individual student to explain the step-by-step method to work on a mathematical problem. Panah and Babar (2020) listed some other advantages of WhatsApp; students can easily reach the lecturer, the lecturer can give valuable feedback on students' assignments, the lecturer can support in course discussion, WhatsApp allows students to academically engage with lecturers and peers anytime and anywhere, WhatsApp helps to send graphics such as pictures or charts directly to the students, WhatsApp is a good tool for sharing knowledge with others, and WhatsApp allows interaction with others through the use of group discussion. Mota and Ferreira (2020) suggested that even though WhatsApp worked as a distractive device, it may be used beneficially to develop students' learning of mathematics through collaborative autonomy which could be achieved through peer dialogue by creating a virtual group in which students were able to explore situations, place questions and doubts, solve tasks without the teachers' interventions, and allowed students to communicate with their reasoning and mathematical ideas. Through the communication, WhatsApp may motivate, encourage, and allow students and lecturers to share information on the course. In another study by Arthur et al (2020) revealed that convenience and easy passage of mathematical information to peers as two major factors that influence the use of WhatsApp Messenger among university

undergraduate students. In order to foster quick and easy sharing of information among students, Arthur et al (2020) also recommended WhatsApp could be integrated in the learning of mathematics among students.

YouTube is also very helpful in learning mathematics. Some advantages of using YouTube in ODL mathematics/statistics classes gathered from the lecturers are; learning mathematics are more interactive and enjoyable as explanation can be made clearer. Next, students can repeatedly watch the video on a topic for better understanding at any time and they can also watch and listen to explanation from other lecturers teaching the same topic for a better understanding of the topic. Using a keyword for a topic, a search engine can easily be found and easily be learned by students. Sukarni (2013) highlighted that the advantages of using YouTube in learning mathematics as potential, practical, informative, interactive, shareable, and economical. Sari et al (2020) concluded that students could learn mathematical material using YouTube in a more relaxed atmosphere, more interesting offerings that could be accessed anywhere and anytime. YouTube could also be a source of learning for digital age students that could enhance interest and support student learning styles. Tisdell (2016) found that over 71% of students chose to use the YouTube videos for their learning and more than 96% of students responded that the videos were a useful learning resource. The study by Tisdell (2016) also revealed that students used YouTube particularly during revision periods for tests, catching up on missed materials, and preparing for classes.

Discussion and Conclusion

Due to diversified functions of social media has led to extensive usage by social media users for personal and social uses. A total of 539 pre-diploma and diploma business management students in a public university of ages between 18 years to 23 years old participated in this study. The findings of the study revealed that WhatsApp (99.4%) is the most favourite used social media platform, followed by Instagram (89.3%), YouTube (79.3%), Telegram (68.5%), Twitter 55.9%), Facebook (24.1%), Pinterest (17.2%), TikTok (10.2%), Facebook Messenger (4.1%), and Snapchat (2.6%). Without considering the ages of social media users, Facebook is the most favourite used social media in Malaysia (NapoleonCat.Stats, 2021), however when only age group of 18 years to 23 years was considered, Instagram has become more popular than Facebook. For this age group, male students were found to favour Facebook while female students favoured Twitter, Pinterest, and Telegram more than males. Older (20 – 23 years old) and senior (Part 2 and higher) students preferred to use Twitter while Instagram and Pinterest users were higher among younger (18 – 19 years old) and junior (Pre-diploma/Part 1) students. Twitter users were also higher among students residing in urban areas, enrolling in insurance discipline of study, and taking statistics course. No difference in social media usage among students of different family income group and across students' level (Pre-diploma or diploma).

Students who used Instagram and YouTube perceived that the frequent usage of social media was not a problem to them as it has improved their academic performances. Students perceived Instagram to offer positive influence, be valuable, useful, and is effective to be used for academic purposes. Among Instagram users, they felt it was easy to engage in academic discussion, and use to disseminate knowledge to their friends when using the platform. Students using Instagram also perceived the platform benefited them in doing revision with their friends and further resulting in improving their academic performances. Students

perceived that they used Instagram and Telegram to communicate with their classmates and other friends for discussing academic matters.

Nowadays, having smartphones, surfing internet, and visiting social networking sites had become important routine activities for many people. It is a weird thing if a person did not own a smartphone. Almost all students used smartphones to visit their favourite social networking sites. Female students were found to spend more hours on social media per day and they also spent more hours on social media for academic purposes compared to males. The present study found that one, two, or three social media was used during online distance learning (ODL). YouTube, Telegram, WhatsApp, or any of the combinations were used as educational tools to support ODL for mathematics/statistics courses. Mathematics/statistics performance and number of social media used during ODL were found to be significantly negatively associated. Using more than one social media for academic purposes may cause distraction on what students are doing. Students may lose focus on what they are doing and may misuse the social media due to the attraction and free features of the social media. Using more than one social media means that more time will be spent on social media which may cause distraction on what students are doing is the most probable explanation for this result. Combination of YouTube, Telegram, and WhatsApp were used with lecturers' supervision, guidance, and collaboration during ODL had significantly affected mathematics/statistics performance while there was no significant effect when combination of YouTube, Telegram, and WhatsApp were used without lecturers' supervision, guidance, and collaboration. Therefore, in order to make sure social media is used effectively in mathematics/statistics learning, lecturers' supervision, guidance, and collaboration are needed. Without lecturers' supervision, guidance, and collaboration, many students tend to lose focus and divert from the learning purposes. Result of the study also revealed that mathematics/statistics performance for groups who frequently used YouTube and groups who frequently used Telegram were significantly higher than groups who frequently used WhatsApp. Groups who frequently used YouTube did not differ significantly in mathematics/statistics performance from groups who frequently used Telegram. It can be concluded that YouTube and Telegram are beneficial and effective as educational tools to assist in mathematics/statistics learning.

Future Research

From the findings, as Instagram was the second most favourite social media used by students, it is recommended that Instagram to be used by lecturers and students to support and complement mathematics/statistics learning apart from YouTube, Telegram, and WhatsApp. Even though Instagram is popular among students, there were limited studies especially in relation to Instagram usage in mathematics/statistics learning activities. Based on the other favourite social media used among students, it is also encouraged to explore how Facebook, Twitter, Pinterest, TikTok, Facebook Messenger, and Snapchat can be used effectively not only for social purposes but also for academic purposes especially in mathematics/statistics learning.

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