Use and Attitudes towards Mobile Technology for Learning during COVID-19 Pandemic

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Abstract

This study examined students' use and attitudes towards mobile technology for learning during the COVID-19 pandemic. The study also sought to determine whether there was a relationship between students' attitudes towards mobile technology and sex, age and year group. Participants were also asked to identify the types of assistance they needed to support their academic activities, and suggest measures to enhance their use of mobile technology for learning. The study employed a survey research methodology to examine use and attitudes towards mobile technology. Participants consisted of 364 students from one university in Trinidad and Tobago. Questionnaire responses were analyzed quantitatively through the use of means, standard deviation, t-tests, and Analysis of Variance (ANOVA) using the Statistical Package for Social Scientists (SPSS) software. Results revealed that students used their mobile devices for various academic activities such as accessing course materials, finding and sharing resources, and communicating with peers. Overall, students had positive attitudes towards the use of mobile technology for learning. Female students had more positive attitudes than males. The types of assistance students identified included training in the use of mobile devices for educational purposes, improved access to the internet and access to software. Implications and recommendations are suggested to support students' use of mobile technology in an online environment.

Keywords: mobile learning, teacher training, smart phones, mobile technology, online learning

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Introduction

The Corona Virus (COVID-19) pandemic interrupted education systems globally, requiring schools and universities to physically close. Institutions invariably adopted immediate, diverse measures to address the crisis, and like many countries across the world, Trinidad and Tobago embraced remote learning as an emergency response. During this transition, mobile technology emerged as a crucial tool for students and educators to facilitate learning continuity in Higher Education Institutions (HEIs) (Marinoni & van't Land, 2020). Instructors were forced to use several technologies to facilitate teaching and learning. Lectures and assessments were delivered using learning management systems (e.g., Moodle, CANVAS), virtual meeting platforms (e.g., Zoom, Microsoft teams, Google Meet), and other educational portals. While students have different options to access learning materials, such as desktop computers and laptops, research suggests that most students prefer to use mobile devices (Al-Emran & Salloum, 2017; Almaiah & Alyoussef, 2019). However, further exploration is needed to delve into the essential aspects of challenges that undergraduate students encounter while utilizing mobile technologies.

Research Problem and Purpose

The COVID-19 pandemic necessitated a shift to remote learning, with mobile technology playing a significant role in facilitating educational continuity. Despite the high adoption rate of technology in many countries, there are many students who do not have access to a functional mobile device. Furthermore, several researchers (Blackman, 2022; Figaro-Henry & James, 2015; Oguntuase & Bakare, 2022) found that there is poor readiness on the part of universities to fully adopt mobile learning to bridge the wide gap created by COVID-19. Therefore, there is a need to explore the specific challenges, benefits, and perceptions associated with mobile technology use in this context.

Recent studies of mobile learning in the Caribbean have highlighted both opportunities and challenges. A study by Kalloo et al. (2020) found that while adding online learning components can enrich students' learning experiences beyond the walls of the classroom, there was the likelihood that the most vulnerable groups in society could be marginalized and alienated if steps were not taken to provide needed technology resources. Concerns about the impact on disadvantaged groups, and learning loss generally, are not misplaced because of the potential to affect human development and economic growth in small and large societies alike as the world emerges from the pandemic. Parsanlal (2020), for example, found that disparities in household income and resources led to an estimated sixty thousand students not having the necessary hardware or social support to access online education. The urgency to find ways to address and in future to avoid increasing disparities in education outcomes is apparent.

A study conducted in an Australian university found that students were not sure about the benefits that mobile learning brought to them (Kinash et al., 2012). Additionally, a study by Botros (2020) reported that students used their electronic devices in both online and face-to-face classes for purposes other than classroom activities and were easily distracted by these devices. As such, there is a need to investigate whether students hold positive attitudes towards mobile learning. The problem is further complicated by the fact that technological and internet access in many areas may not be good enough to support students' learning.

The majority of studies about educational technologies using behavioural intentions took place in formal school settings and very few are conducted in informal settings (Crompton et al., 2017). The COVID-19 epidemic made online learning a necessary and vital learning approach for students. As such, students' perception of mobile learning may be different, because mobile devices are applied as formal learning tools on a large scale in an informal context such as the home. The purpose of this research was therefore to investigate students' use and attitudes towards mobile technology for learning during the COVID-19 pandemic and post-pandemic. The study aimed to:

1. Examine the extent to which students utilized mobile technology for learning during the pandemic.
2. Explore the attitudes and perceptions of students towards the use of mobile technology for learning.
3. Investigate any differences in mobile technology use and attitudes based on demographic factors such as age, gender, and year group.
4. Identify how mobile technology was used by students during remote learning.
5. Identify what kinds of assistance students would like to support their academic learning using mobile technologies.
6. Provide recommendations and insights for educational policymakers, institutions, and educators to enhance the effective use of mobile technology for learning in emergency and post-pandemic contexts.

Background

Trinidad and Tobago is a post-colonial society that gained independence from Britain in 1962. The educational system in the country follows the model of the British education system and is overseen by the Ministry of Education. Students can access free education from kindergarten up to secondary school. Internet access is widely available through several companies on the island. According to Hunte (2021), only a small percentage of homes in Trinidad and Tobago are without internet access or mobile coverage. Those who do not have connectivity either cannot afford the service, or live in rural areas where service may not be available. The former Chief Executive Officer (CEO) of the Telecommunication Services of Trinidad and Tobago (TSTT), Lisa Agard, stated that a study showed that 84 percent of households are connected with high-speed broadband while 55 percent utilise mobile internet (Hunte, 2021). The current study was conducted at the education faculty of a university in Trinidad and Tobago. At this university, prospective teachers are exposed to a four-year Bachelor of Education Degree Programme consisting of a wide range of content, professional and pedagogical courses and the practicum.

Definition of mobile learning

Mobile learning has been defined and conceptualised in diverse ways since the idea was introduced. Talan (2020) defined mobile learning as the ability of learners to access information independently of time and space through mobile devices and to manage their own learning processes based on their individual differences and needs. In the broader sense, mobile learning extends from the use of mobile computing devices in a formal, physical location (such as a physical classroom or laboratory); to the use of personal mobile technologies to support informal, contextualised learning anywhere, anytime, and on the move; to an even wider conceptualisation of learning in a mobile society characterised by the mobility of people and knowledge alike (Sung et al., 2016).

Crompton (2017) defined mobile learning as "learning across multiple contexts, through social and content interactions, using personal electronic devices" (p. 4). This definition, which we utilized in this article, incorporates more than technical attributes, and combines the five central constructs to mobile learning: pedagogy, mobility, technological devices, context, and social interactions.

Mobile learning is a multifaceted educational approach encompassing five key constructs that collectively contribute to its holistic understanding. First, pedagogy emphasizes the instructional methods employed, acknowledging that mobile learning extends beyond devices to encompass how learning is facilitated and structured (Talan, 2020). Second, mobility distinguishes mobile learning by freeing it from physical constraints, allowing learners to engage with educational content on-the-go, promoting flexibility in schedules and locations. The concept of mobility aligns with the idea that learning is not confined to a specific place or time, enabling learners to access information independently (Sung et al., 2016). Third, technological devices, such as smartphones and tablets, play a central role and impact the learning experience significantly (Crompton, 2017). The fourth construct, context, recognizes the diverse settings and situations in which mobile learning occurs, highlighting the adaptability of learning experiences (Talan, 2020). Lastly, social interactions emphasize that learning is not solitary; mobile devices facilitate collaborative and social learning experiences, fostering connections and shared knowledge among learners (Crompton, 2017). The selection of these constructs is justified by their collective ability to provide a comprehensive understanding of mobile learning, incorporating technological, pedagogical, social, and environmental dimensions (Talan, 2020; Crompton, 2017; Sung et al., 2016). Therefore, the five constructs capture the versatile nature of learning through mobile devices in various contexts.

Research Questions

1. How did students use mobile technology for learning during COVID-19 pandemic?
2. What are students' attitudes towards the use of mobile technology for learning?
3. Are there differences in students' attitudes towards the use of mobile technology based on sex, age and year groups?
4. How did mobile devices assist students in the Bachelor of Education programme during the COVID-19 pandemic?
5. What kinds of assistance did students require with the use of mobile technology during the COVID-19 pandemic?

Theoretical Framework

The Technology Acceptance Model (TAM) proposed by Davis (1989) provides a theoretical framework to understand users' acceptance and attitudes towards technology. In the context of the use and attitudes towards mobile technology for learning during the COVID-19 pandemic, TAM can help analyze the factors influencing students' acceptance and usage of mobile technology for educational purposes.

The TAM consists of two key constructs: perceived usefulness and perceived ease of use, which directly influence users' attitudes and behavioural intentions towards using technology. The model suggests that these constructs mediate the impact of external variables, such as personal and contextual factors, on users' acceptance and usage behaviour.
Davis (1989) defines perceived usefulness as the prospective user's belief that using a specific technological innovation will enhance his or her job or life performance. Perceived usefulness refers to the extent to which individuals believe that using mobile technology for learning during the COVID-19 pandemic will enhance their learning experience and academic outcomes. Several factors may influence students' perception of usefulness, including: Accessibility, Flexibility and Communication and Collaboration.

Perceived ease of use can be defined as the degree to which the prospective user expects the technological innovation to be free of effort. In this instance, the term is used to refer to the extent to which individuals perceive mobile technology as easy to use for learning purposes during the COVID-19 pandemic. Factors influencing perceived ease of use may include: technical proficiency, user-friendliness and technical support. Examining these factors could provide empirical evidence to facilitate effective use of mobile devices in online classrooms as well as enhance learners' experiences.

Seliaman and Turki (2012) conducted a study of students' use of mobile devices and smart phones using the TAM model. The findings suggested that students' perceived usefulness of mobile learning was closely related to the ease of accessing course materials, searching for information related to their disciplines, sharing knowledge, and finishing their assignments.

The applicability of the TAM has been well supported by a considerable body of previous research across a wide range of educational settings (Pituch & Lee, 2006). By applying the TAM framework, researchers can explore the relationships among perceived usefulness, perceived ease of use, attitudes, and behavioural intentions to gain a comprehensive understanding of students' acceptance and usage behaviour of mobile technology in education during challenging times.

Literature Review

The consequences of the rapid shift towards remote and online learning necessitated by the COVID-19 pandemic have been extensively explored in research literature. During that time, mobile technology emerged as a crucial tool for facilitating educational continuity. Mobile devices include numerous electronic products, such as laptops, the new iPads, iPhones, iPods, Android phones and Android tablets. The new generation of portable devices, namely smartphones and tablets, has become popular, because they are easy to carry, help people to stay connected to the Internet almost continuously, allowing them to communicate, entertain themselves, and be informed (Alepis & Troussas, 2017). Mobile technology played a crucial role during the pandemic, because it helped students raise their technological awareness, engage in conversations with peers, join social media, and find answers to their questions. The technology also facilitated team collaboration, allowed knowledge sharing, and hence leveraged students' learning outcomes (Al-Emran et al., 2016).

There are numerous ways that mobile technology can be used by students for educational purposes. Rossing et al. (2012) found that the mobility of mobile devices has reduced the limitations of time and location associated with traditional learning methods. This advancement allows users to conveniently access educational content. Matzavela and Alepis (2021) state that students acquire knowledge through the use of dedicated online applications designed for academic purposes. For instance, social networking platforms such as Twitter and game-based learning platforms are used. Additionally, students benefit from frequent communication with both peers and teachers, interactive sessions that foster collaboration and effective learning, as well as mobile assessments (Matzavela & Alepis, 2021).

Furthermore, studies have shown that mobile technology facilitates the maintenance of students' engagement outside the classroom (Garrett & Jackson, 2006). In a study conducted by Bere and Rambe (2016) that explored mobile learning in higher education within a developing nation, it was revealed that mobile learning facilitated collaborative learning by encouraging knowledge sharing, fostering academic communities, and enabling instant communication. This approach to education transcends physical boundaries, allowing teaching and learning to take place at any location and at any time (Corbeil & Valdes-Corbeil, 2007). Moreover, it was observed that mobile learning contributed to the enhancement of students' technological skills, promoted knowledge sharing, and fostered the development of their learning abilities (Al Emran et al., 2016).

In research conducted by Dashti and Aldashti (2015) at the College of Basic Education in Kuwait, students' attitudes towards the utilization of mobile learning were investigated. The study involved 300 female students, and the findings revealed that 80.3% of them expressed satisfaction with the use of mobile devices as a learning tool. Furthermore, they reported that mobile learning had a positive impact on their English language proficiency, contributing to the enhancement of their knowledge in this area (Dashti & Aldashti, 2015).

According to a survey conducted by the Educause Center for Applied Research [ECAR] (2012) regarding the utilization of mobile technology in higher education, students are at the forefront of integrating mobile devices into their learning environments. Additionally, 67% of the surveyed students emphasized the significant role of mobile technology in their academic accomplishments and activities. According to Gikas and Grant (2013), mobile technology has become an essential component of the educational process in higher education institutions. Its integration presents numerous opportunities and challenges for both students and educators. Additionally, smartphones have been recognized as a motivating factor and a tool that aids in learning and the development of individual capabilities (Campbell, 2007).

Positive sentiments among students reveal a high level of acceptance toward mobile learning, with more than 80% expressing agreement or strong agreement regarding the use of mobile devices in the classroom (Nikolopoulou, 2018). Hong et al. (2012) argued that mobile phones are popular among students, because they increase their social communication and expand their opportunities for establishing social relationships. Similarly, Oguntuase and Bakare (2022) revealed that undergraduate students in Nigerian Universities make use of their mobile phones to access applications such as Facebook messenger, WhatsApp, Google Talk, MSN, WordPress, Blogger, and also to access Library resources.

Many studies have found that there are no significant differences between male and female students with respect to their attitudes towards mobile technology. For example, Pruet et al. (2016) observed comparable positive attitudes among both male and female learners concerning the utilization of tablet computers. According to research conducted by Diemer et al. (2013), gender did not play a significant role in classroom activities involving iPads. Likewise, Al-Emran et al. (2016) found that while there were no gender differences, attitudes towards mobile technology varied significantly based on age within a university in the Arab Gulf region.

Studies (Sabah, 2016; Wang et al., 2009) have also indicated that students' attitudes towards mobile technology were not significantly influenced by their gender. However, studies by Taleb and Sohrabi (2012), and Khaddage and Knezek (2013) suggested significant gender-based differences in students' attitudes. Specifically, female students exhibited a more positive attitude towards mobile technology compared to their male counterparts. This suggests that there is no consensus in the literature on the differences between males and females in their attitudes to mobile technology.

Methodology

The study is quantitative and employed a survey research methodology. The survey collected data from a diverse sample of students to understand their experiences, perceptions, and utilization of mobile technology in the context of remote learning during the COVID-19 pandemic. Three hundred and sixty-four students participated in the study. The sample consisted of 86 (23.6%) male and 278 (76.4%) females. There were 147 (40.4%) Year 1, 125 (34.3%) Year 2, 64 (17.6%) Year 3, and 28 (7.7%) Year 4 students. The ages of students ranged from 20 years and under, 206 (56.6%), 21-25 years, 107 (29.4%) and over 25 years, 51 (14.0%).

The data collection instrument for the study was a questionnaire survey. The items for the questionnaire were derived from existing literature (Alfawareh & Jusoh, 2014; Al- Emran et al., 2016). The survey instrument consisted of 6 sections. The first section elicited demographic data (gender, age and academic year group) of the participants. The second section focused on the type of mobile technology/devices used by students and access to the internet. The third section required students to indicate the general uses of mobile technology such as for e-mails, chat with friends, and listening to music. The fourth section asked students to indicate the different ways they used mobile technology for learning during the COVID-19 pandemic such as to access course modules, read lecture notes, consult online with lecturer or classmates; and the mobile applications they found useful for learning. The fifth section consisted of 11 attitude statements that assessed students' attitudes towards mobile learning (Al-Emran et al., 2016). Students were required to indicate their level of agreement with each statement on a 5- point Likert scale ranging from Strongly Disagree to Strongly Agree with 1 being Strongly Disagree and 5 being Strongly Agree. Examples of these statements are: 'Mobile technology is a useful tool for my study' and 'Mobile technology can help me in finding resources related to my study'. The Cronbach alpha reliability coefficient of the attitude scale was 0.98, indicating the scale was highly reliable.

The sixth section consisted of two open-ended questions which asked students to state how mobile phones assisted them during the COVID-19 pandemic, and what kinds of assistance they need with regards to the use of mobile technology for learning. A pilot test of the questionnaire was conducted on a sample of 20 students to check for any ambiguity and clarity of instructions. Results revealed that questions were clearly understood by students.

Data Analysis

The questionnaire responses were analyzed quantitatively. Statistical tests such as means, percentages, t-tests and Analysis of Variance were computed using the Statistical Package for Social Scientists software (SPSS). Frequency distribution and percentages were used to analyze demographic data, general use of mobile technology and use of mobile technology for learning purposes during the COVID-19 pandemic and educational applications used by students. Means and standard deviations were used to rate students' attitudes to the use of mobile

technology. Independent sample t-tests and Analysis of Variance (ANOVA) were computed to determine differences in students' attitudes based on sex, age and year group.

Analysis of Data and Findings

Out of 364 participants, 350 (96.2%) had smart phones, 81 (22.3%) used a tablet computer, 21 (5.8%) used a smart watch, while 11 (3%) had a pocket PC, and 5 (1.4%) used a PDA (personal digital assistant).

With respect to access to WiFi Internet, the majority - 355 (97.5%) - of participants had WiFi access at home and at the University, and 186 (51.1%) stated they had access elsewhere such at the cafeteria, or at a neighbour's or relative's residence.

General uses of mobile technology

The most common uses of mobile technology were for chatting with friends 356 (97.8%), taking pictures 342 (94.0%), listening to music 341 (93.7%), uploading pictures on the Web such as Facebook 295 (81%), creating and editing texts 290 (79.7%), editing pictures 286 (78.6%), managing their schedule 281 (77.2%) and posting comments on social media 255 (70.1%). Other general uses that were cited were bank transactions/shopping 147 (40.4%), drawings 128 (35.2%), recording movies 122 (35.5%), animations 98 (26.9%), uploading movies 93 (25.5%) and editing movies 86 (23.6%) (Table 1).

Table 1

General Uses of Mobile Technology

General uses of mobile technology	Number	%
E-mail	338	92.9%
Chat with friends	356	97.8%
Take pictures	342	94.0%
Listen to music	341	93.7%
Upload pictures	295	81.0%
Create and edit texts	290	79.7%
Edit pictures	286	78.6%
Manage schedule	281	77.2%
Post comments on social media	255	70.1%
Synchronize with home computer	236	64.8%
Bank transaction/shopping	147	40.4%
Drawings	128	35.2%
Record movies	122	33.5%
Animations	98	26.9%
Upload movies	93	25.5%
Edit movies	86	23.6%
Other	211	58.0%

Research Question 1: How did students use mobile technology for learning?
This question asked students to indicate how they used mobile technology for learning in their academic programme. Over 90% stated that they used their mobile devices for checking Canvas announcements, checking time tables, sharing notes with colleagues, surfing the web for learning material, taking photos of content/work and managing group assignments (Table 2).

Other frequent uses reported by students were: communicating with colleagues (88.5% (322)) and consultations with lecturer (83.5% (304)), access to social media to share content and materials (81.0% (295)) and online discussion with regard to academic issues (86.8% (316)). These findings are supported by Hong et al. (2012) who found that students used mobile technology, because it increased their social communication and expanded their opportunities for establishing social relationships. Students also used mobile technology for the submission of assignments (73.1 % (266)), conducting literature searches (72.8% (265)) and reviewing lecture notes (66.5% (242)).

Table 2
Uses of Mobile Technology for Learning

Learning	**Number**	**%**
Canvas announcements	350	96.2%
Look up course timetable	341	93.7%
Share notes with classmates	340	93.4%
Surf web for learning material	339	93.1%
Take photos of work	339	93.1%
Manage group assignments	339	93.1%
E-mail lecturer/classmates	322	88.5%
Read lecture notes	320	87.9%
Discuss academic issues/online discussion	316	86.8%
Consult online with lecturer	304	83.5%
Access social media to help with studies	295	81.0%
Submit assignments	266	73.1%
Library/literature searches	265	72.8%
Watch lecture capture	242	66.5%
Watch academic related movies	182	50.0%
Make movies of their work	96	26.4%

Research Question 2: What are students' attitudes towards the use of mobile technology for learning?

This research question investigated students' attitudes towards the use of mobile technology for learning. Students generally had very positive views with regard to the use of mobile phones for learning. Students viewed mobile technology as most valuable for finding educational resources (M= 4.23, SD=1.29), providing opportunities for communication and team work (M= 4.23, SD=1.31) and as a useful tool for enhancing learning (M= 4.18, SD=1.32). Students also valued the flexibility of mobile technology as they can access course material anytime and anywhere (M= 4.18, SD=1.31). Other characteristics of mobile devices that students rated favorably were obtaining feedback from instructors (M = 4.13), and increased opportunities to share course material with their peers (M = 4.13). Learning tools of mobile devices also allowed students to manage their study time (M = 3.88) and to become more independent and self-regulated learners (Table 3).

Table 3
Attitudes toward Mobile Technology for Learning

Learning	Mean	Standard Deviation
Mobile technology is a useful tool for my study	4.18	1.32
Mobile technology can offer opportunities for communication and teamwork	4.23	1.31
Mobile technology can help me in finding resources related to my study	4.24	1.29
Mobile technology can bring many opportunities to the learning process	4.15	1.27
Mobile technology can help me to access the course material anytime anywhere	4.18	1.31
Mobile technology can be an easy way to get feedback and notifications from my instructors	4.13	1.30
Mobile technology can help me to exchange the course material with my friends	4.13	1.29
Mobile Apps can help me to manage my study	3.88	1.34
Mobile technology can help me do my coursework	3.91	1.35
Mobile technology can help me to develop my learning skills	3.96	1.32
Mobile technology can help me to learn more independently	3.96	1.33

Research Question 3: Are there differences in students' attitudes towards the use of mobile technology based on sex, age and year groups?

(a) **Differences based on Sex**
The results of the t-tests showed that there was a significant difference between male and female students' attitudes towards the use of mobile technology. Female students had a more

positive attitude (M=4.18) than males (M= 3.79) towards the use of mobile technology for learning
(Table 4).

Table 4
T-test Results Comparing Male and Female Students' Attitudes

Sex	N	Mean	S.D.	t	Sig
M	86	3.79	1.43	-2.31	.022*
F	278	4.18	1.12		

*p < 0.001

(b) **Differences between Age Groups**
Results of the Analysis of Variance indicated that there was no statistically significant difference in students' attitudes according to age groups (F (2, 361) = .466, p = .628) (Table 5).

Table 5
Analysis of Variance Results for Age Groups

	Sum of Squares	df	Mean Square		F	Sig
Between Groups	1.38	2	.691	.	466	.628
Within Groups	535.5	361	1.48			
Total	536.9	363				

P < 0.05

(C) **Differences between Year Group**
The Analysis of Variance showed that there was no statistically significant difference in students' attitudes towards the use of technology according to year group (F (3, 360) = .186, p = .906)
(Table 6).

Table 6
Analysis of Variance Result for Year Groups

	Sum of Squares	df	Mean Square	F	Sig
Between Groups	.831	3	.277	.186	.906
Within Groups	536.1	360	1.49		
Total	536.9	363			

P < 0.05

Research Question 4: How have mobile devices assisted students in the Bachelor of Education Programme during the COVID 19 pandemic?

Table 7
Uses of Mobile Technology During Covid-19 pandemic

Category	No. of students	Percentage of Students
Convenient Communication	310	85.2%
Creating a community to share information	221	60.7%
Flexibility in attending classes	293	80.5%
Ease of completing assignments	252	69.2%
Access to resources	301	82.7%
Create resources	107	29.4%
Digital Assistant	56	15.4%

Three hundred and sixty-four respondents were asked how mobile devices assisted them in the Bachelor of Education Programme during the COVID 19 pandemic. Twenty-six respondents (7%) did not answer the question. The remaining respondents (93%) stated many ways mobile devices assisted them during the COVID 19 pandemic. The majority of the respondents (85.2%) indicated that their mobile devices allowed for convenient communication between their colleagues and their lecturers. A large percentage (82.7%) indicated that their mobile devices allowed them to access resources necessary for completing assignments. Many respondents (80.5%) reported flexibility in attending classes, submitting assignments and collaborating with colleagues. More than two-thirds (69.2%) of participants suggested that mobile devices allowed them to complete assignments easier. Less than two-thirds (60.7%) of the respondents reported that mobile devices allowed them to create a community to share information and resources. The ability to create resources with their mobile devices was reported by less than one-third of the respondents (29.4%). It was interesting to note that about 15.4% of the respondents used their mobile devices as a digital assistant to provide due dates for assignments, meetings with colleagues and events (Table 7).

About two-thirds of the students (60.7% or 221) also indicated they used applications related to Education. Educational applications that they found most valuable to their studies were Free Dictionary, Calculator, Classcraft, Word Cloud, Microsoft Word, PowerPoint, DuoLingo, SignLang App, Canvas, PhotoMath, Pinterest, Mimix, Braille and Grammarly.

Research Question 5: What kinds of assistance do students require for the use of mobile devices for learning?

Table 8
Kinds of Assistance Students Require for the Use of Mobile Devices for Learning

Category	No. of students	Percentage of Students
Pedagogical Training		
Creation of resources, in the use of apps	282	77%
Better internet infrastructure		
Stable Internet	102	28%
Access to software		
Financial assistance to purchase software	96	26%
No assistance	28	8%

Three hundred and sixty-four respondents were asked about the kinds of assistance they require to use their mobile devices for learning. Sixty-seven respondents (18.4%) did not answer the question. The remaining respondents gave answers that were placed into four categories. The majority (77%) of the respondents indicated that they require training in the creation of resources and the use of different types of apps that they believe can assist in their learning. Less than one-third (28%) of the respondents reported that they require a stable internet connection. About one-quarter of the respondents stated that they need to acquire different types of software to assist in the creation of resources. It is important to note that a very small number (8%) of respondents wrote that they did not require any assistance with the use of their mobile devices for learning (Table 8).

Discussion

The findings showed that the majority of the participants used their mobile devices for pedagogical purposes, entertainment, and communication. When students have their own mobile devices, they are more inclined to use them for academic purposes (Al Emran et al., 2016). In this study, students were using their mobile devices in a variety of ways to support their learning such as access course material, read lecture notes at any time and place, collaborate on group assignments and online discussion. These findings are consistent with other researchers such as Matzavela and Alepis (2021), and Alfawareh and Jusoh (2014) who also found that students use mobile technology for pedagogical uses, communications between students and teachers, interactive sessions which increase collaboration and promote effective learning, and mobile assessments.

Rossing et al. (2012) found that the portability of mobile devices has diminished the time and place restrictions of learning with traditional practices and provides the opportunity to the users to access educational content as it is convenient to them. According to Matzavela and Alepis (2021), students learn by using specific online applications for academic purposes like social

networking sites, for example Twitter and game-based learning. A study by Bere and Rambe (2016) also found that mobile technology created opportunities for collaborative learning through knowledge sharing, developing academic communities, and immediate communication.

Students generally had very positive views about the use of mobile technology for learning. They viewed mobile technology as most valuable for finding educational resources**,** providing opportunities for communication and teamwork, and as a useful tool for enhancing learning. Students also valued the flexibility of mobile technology as they can access course material anytime anywhere. Other characteristics of mobile devices that students rated favorably were obtaining feedback from instructors and increased opportunities to share course material with their peers. These findings support those of Seliaman and Turki (2012) whose study also found that students' use of mobile devices and smart phones was linked to the perceived usefulness and ease of use in accessing course materials, searching for information related to their disciplines, sharing knowledge and finishing their assignments. In the Trinidad context, Ahmad (2020) found that students valued mobile phone use for collaboration (84%), communication (75%) and seeking teacher assistance (79%).

Indeed, from observation of students in class (prior to COVID-19), it appears that smart phones or IPads were becoming an integral part of their lives as many students had replaced their personal computer with mobile technologies and seemed comfortable using these technologies in a variety of ways to support their learning.

The results of the t-tests showed that there was a significant difference in male and female students' attitudes towards mobile technology. Female students had a more positive attitude than males towards the use of mobile technology for learning. These findings differ from many researchers (Diemer et al. 2013; Al-Emran et al. 2016) who found that there were no significant differences due to gender. However, the findings from studies by Taleb and Sohrabi (2012) and Khaddage and Knezek (2013) have indicated that there are significant differences among the students' attitudes in terms of their gender where female students held more positive attitudes towards the use of mobile technology when compared to male students. In the South African context, North et al. (2014) reported gender differences, with female students showing increased mobile phone use for the purposes of safety and socializing. This suggests that there is no consensus on the differences between males and females in their attitudes to mobile technology, and this area requires further investigation.

The findings also revealed that there were no significant differences in students' attitudes according to age and year groups. For example, a study by Nikolopoulou et al. (2020) also found no age difference when they evaluated students' intention to use or accept mobile phone devices for their studies, although the study reported gender differences.

Indeed, the majority of students had a smart phone and were very familiar with mobile technologies and were already using mobile phones for socializing, taking pictures, chatting

with friends, listening to music and posting comments on social media (Table 1). Prensky (2005) and Haverila (2013) described university students today as digital natives who have grown up in the age of smartphones and are likely to be more accepting of using mobile technologies for academic purposes**.**

Students valued features of mobile phones that allowed them to learn independently and also work collaboratively in groups. During the COVID-19 Pandemic, students liked the easy and convenient communication and rapid access to course content and resource materials for their programme. In the absence of face-to-face classes, mobile devices provided opportunities for students to communicate directly with lecturers and receive quick feedback on assignments. Students were also able to keep track of their group assignments on WhatsApp group chat and collaborate with their peers on group projects. Some studies (Alturki & Aldraiweesh, 2022; Masadeh, 2021) have reported on how mobile phone applications supported learning and communication during the COVID-19 pandemic. In their study of students' perceptions of the use of social networking sites for educational purposes, Hamid et al. (2015) found that students felt that social networking could enhance their interactions with each other, with their instructors and with the educational content. Bere and Rambe (2016) also reported that mobile technology created opportunities for collaborative learning through knowledge sharing, developing academic communities and immediate communication.

Students gave several suggestions that can be adopted to assist the use of mobile devices for learning. For example, the data showed that the majority of students (77%) would benefit from training in the use of mobile devices for educational purposes, such as the creation of resources and the use of apps. This is likely because many students are not familiar with the latest educational technologies and how to use them effectively. As a result, they require training on how to use mobile devices for learning, such as how to access and use educational apps, how to create and share content, and how to collaborate with others online.

Additionally, less than one third (28%) of the students indicated that they require a more reliable internet service. This is necessary, because mobile devices cannot access online resources with an unreliable or unstable internet service. According to Hunte (2021), many students who do not have internet connectivity either cannot afford the service, or live in rural areas where service may not be available. There is therefore an urgent need to expand the internet service network to include students who live in rural areas.

Some students (26%) would benefit from financial assistance to purchase software. This is important, because many students cannot afford to purchase the software they need for their studies. In addition, some students were unable to afford the cost of mobile devices or mobile data plans. As a result, they require financial assistance to purchase or upgrade their devices and to pay for mobile data plans.

By providing the necessary assistance, higher education institutions can help students to succeed in their studies even when they are learning remotely. It is important to note that the

data does not specify the needs of each student. For example, some students may need training on how to use specific apps, while others may need help with their internet connection. Additionally, some students may need financial assistance to purchase specific software. As a result, it is important to conduct a needs assessment in order to determine the specific needs of each student.

Conclusion

The results of this study contributed to the existing literature on mobile-learning by unpacking undergraduate university students' attitudes towards the use of mobile technologies during the COVID-19 isolating period. It is also relevant in situations where blended or fully online modes of delivery continue to be used. This study found that university students held positive attitudes towards the use of mobile learning, and they mostly tended to use smartphones, followed by tablets and laptops. Students valued the portability and flexibility of mobile devices which provided access to resources and course material anytime and anyplace, especially during the COVID-19 pandemic when the library services shifted from the physical to an online environment. The use of educational applications such as WhatsApp fostered interactions with peers and allowed for direct communication with instructors. The findings also support Davis' (1989) TAM framework which posits that students' positive attitudes towards mobile technology can positively influence students' use of smartphones for their academic activities.

The results have important implications for teaching and learning, as well as for instructors, educational administrators and policy makers. Instructors can provide more opportunities for students to experience the usefulness of mobile technologies and educational applications in the delivery of courses at the university. Educational administrators can design training course for both teachers and students to improve technology skills to ensure technology integration in teaching and learning.

Recommendations

The following recommendations are made based on the findings of the study. The University should address:

1. Support and Resources: a. Provide adequate technical support and resources to ensure seamless access to mobile technology and online learning platforms for all students. b. Develop comprehensive guidelines and tutorials to help students navigate and utilize mobile technology effectively for learning purposes. c. Establish a dedicated support system, such as a helpline or online chat service, to address technical issues and provide timely assistance to students.
2. Digital Skills and Literacy: a. Incorporate digital skills training into university curricula to equip students with the necessary competencies to use mobile technology effectively for learning. b. Offer workshops or online courses to instructors and students to enhance

their digital literacy, information literacy, and critical thinking skills related to mobile technology usage.

3. Engagement and Interaction: a. Encourage active student engagement through interactive mobile learning applications, virtual discussion boards, and collaborative online platforms.
4. Flexibility and Personalization: a. Design mobile learning experiences that offer flexibility in terms of time, location, and pace, allowing students to learn at their own convenience and adapt to their individual learning preferences.

By implementing these strategies, universities can support students' academic success, engagement, and well-being in the digital learning environment.

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