Students' behavioural intention and challenges to *bring your own device* (BYOD) in higher education during COVID-19 and beyond

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ABSTRACT: In this article, the authors report on the behavioural intention and challenges encountered by students with the *bring your own device* (BYOD) strategy at a university of technology in South Africa, and the impact of COVID-19 on this approach. The participants comprised of 210 Agricultural Mechanisation I students. Of these students, 61.9% were female and 38.1% male. A mixed method was used to collect data: the behavioural intention construct of the technology acceptance model (TAM) questionnaire and open-ended questions. Quantitative data was analysed through SPPS, while for the qualitative data analysis the authors used Atlas.ti. The results showed that 79.6% of students plan to continue using BYOD in the future. The findings revealed challenges relating to technical problems, balancing learning and personal activities, and the lack of familiarity with BYOD for learning. However, not all students encountered challenges with the BYOD strategy. It is recommended that upon the return of students to campus, after the pandemic the provision of, and access to, Wi-Fi be increased.

INTRODUCTION

The coronavirus pandemic drove *education institutions to transform teaching and learning rapidly, develop innovative and creative ways to keep learning in the disruption* [1]. During uncertain times, most higher education institutions have adopted emergency remote learning, teaching and assessment to save the 2020 academic year [2]. Social distancing regulations provided an opportunity for students to use mobile devices and other technologies for learning while at home. Masilo et al argue that most students in higher education possess one or more mobile devices and have been using them for learning [3].

Many higher education institutions introduced the *bring your own device* strategy before the COVID-19 outbreak [4-6]. The BYOD strategy is in action when students bring their own mobile devices to university and use them for learning [7]. Almost all students entering an institution of higher learning now have mobile devices [5]. It has been pointed out that 87% of tertiary students use a personal smartphone [8]. Research shows that the BYOD strategy has increased in a classroom setting [5].

It has been pointed out that students have the intention to use mobile devices to engage with academic tasks as long as it has a feature to help them [1]. This is because mobile technologies offer many exciting and distinct features in educational settings [9]. For this reason, the students' intention to use a mobile device determines the actual use of the relevant application and their attitudes towards the device affect the intention [5]. This was revealed in the study conducted by Elmunsyah et al who indicated that a student's interest in learning media usage contributed to improving the student's behaviour by 23% [8].

Behavioural intention is the measure of the likelihood of a person employing the application [10]. In the original technology acceptance model, behavioural intention is determined by both attitude and perceived usefulness [11]. In this study, the student's behavioural intention of using their mobile devices in performing tasks during the pandemic should be known, so that this process is a success [1]. However, some studies revealed that the pandemic posed a serious digital divide, exposed the lack of access to technology, lack of network and Wi-Fi challenges among students [1][2].

As much as the BYOD strategy has been used in higher education, various challenges were experienced. Stonebraker et al stated that some students in their study were not comfortable regularly taking their devices to class or sharing them with their classmates [12]. The lack of support from educational institutions was reported by Parsons and Adhikar [13]. Furthermore, Jamal et al indicated that

> *…the main security concern was not about the devices or the information inside the organization, but it was about controlling the access from the user and the device to the organizational information and the increased exposure of the enterprise network to malware due to the lack of control and visibility of mobile devices* [14].

Challenges identified by Kibar et al included the lack of mobile devices, inability to use them (about 50% of the surveyed students indicated that some of them cannot use and do not have mobile devices), and inequality in learning experienced by students without mobile devices [15].

The aim of this study was to investigate students' behavioural intention and challenges to use BYOD in the context of the COVID-19 pandemic in higher education. Firstly, the behavioural intention construct of the technology acceptance model (TAM) questionnaire was used to determine students' behavioural intentions to use their BYOD during the lockdown. Secondly, challenges associated with the use of BYOD in class before the pandemic were identified to inform the University about students' intentions and possibilities to use their devices while studying during tough times.

The following two research questions were formulated:

1. What are the students' behavioural intentions (BI) to use bring your own device (BIUB) in higher education during the COVID-19 pandemic?
2. What are the challenges experienced by students with the use of bring your own device?

METHOD

A mixed method was used. The core assumption of using mixed methods is that a combination of statistical (quantitative) data with nonnumeric (qualitative) data, such as personal experiences, comments from questionnaires and interviews, provides a richer material for the researcher to draw the right conclusions than either form of data alone [16].

There were 210 participants in this study (61.9% female and 38.1% male first-year Agricultural Mechanisation I students). More than half, i.e. 122 (58.1%) participants were between 18-20 years old, 83 (39.5%) between 21-25 and five (3.4%) were 26+ years old. In terms of the mobile device used, the majority, i.e. 193 (91.9%) students owned a smartphone. Few students (4.3%) owned a laptop and eight (3.8%) owned a tablet/iPad.

While students were on campus, they had access to Wi-Fi in the classroom, as well as hotspot areas out of class [1]. When they had to study from home, those who completed the institutional survey were provided with the relevant data. The socio-economic background, as well as the digital divide posed challenges. The University opted for multimodal learning, teaching and assessment strategy to ensure that no student was left behind [2]. Study packs in a print format were couriered to students.

The technology acceptance model instrument was used to collect quantitative data. The (BIUB) construct with five items was used to collected information from students studying at home during the COVID-19 pandemic and lockdown. The collected data were analysed using SPSS frequency distribution and percentage.

An open-ended questionnaire with three questions was applied to collect qualitative data. The typical questions posed were as follows:

1. Were there any challenges you encountered while using your mobile device?
2. Was it easy for you to use your mobile device? Yes/No. Explain.
3. Were there any difficulties you encountered while using your mobile device?

Atlas.ti was utilised to analyse the data. One hundred and twenty-nine codes were created from two primary documents. The system generated 259 quotations. The codes were clustered into two categories relating to yes, challenges with BYOD and no challenges. The BYOD challenges theme was grouped into categories.

RESULTS AND DISCUSSION

Behavioural Intention to Use BYOD

To determine the validity of the BIUB, the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity were used. The results revealed that in terms of sphericity, the Kaiser-Meyer-Olkin (KMO) was 0.91, which was statistically significant ($p < 0.05$).

Cronbach's alpha was used to establish the reliability value for the BIUB scale in terms of the internal consistency, and it was found to be 0.78. Reliability for each item calculated in terms of the internal consistency was found to be BIUB1 = 0.75; BIUB2 = 0.71; BIUB3 = 0.69; BIUB4 = 0.70; and BIUB5 = 0.86. This suggests that the items are a valid measure of their underlying construct. The reliability test indicates that 0.70 is good [17]. The results from this study are comparable to those reported in the relevant literature [1][18].

Regarding five items of the BIUB construct, it may be observed from Table 1 that for the first question, the students had to indicate if they always try to use BYOD to perform a task whenever it has a feature to help them. The results reveal

that 70% of the students strongly agreed or agreed with this statement. This finding suggests that three-quarters of students were keen and prepared to use their mobile devices for learning as long as lecturers give them a task that has a corresponding feature on their devices to perform the given task. This is in accord with the findings of Cheng et al that 61.1% of the surveyed students were comfortable to use their mobile devices for learning [18]. Further, using BYOD provides a more student-centred approach [19][20].

For the second question, the students had to indicate if they intend using BYOD frequently for their courses. The results show that 62.4% of the students strongly agreed or agreed with this statement. This finding suggests that students intend using mobile devices frequently for their courses. The BYOD has the potential to promote active learning experiences [20]. In this regard, Sánchez et al argued that BYOD allows students to carry out activities effectively in any context in a way that is productive, because they are familiar with their personal devices [21].

In terms of the third question, the students had to point out if they intend using BYOD as often as possible. The results reveal that 65.7% of the students strongly agreed or agreed with the possibility of using the BYOD strategy. This finding suggests that more than half of the students like using a mobile device as often as possible. Tinmaz opined that BYOD gives more responsibilities to students regarding their learning processes and increases the levels of participation [20]. In this case, Elmunsyah et al mentioned that the best indicator of student behaviour is shown by using practical ICT tools [8].

In the fourth question, the students had to indicate whether they plan to continue using BYOD in the future. The results show that 79.6% of the students strongly agreed or agreed with this statement. This finding suggests that more than three-quarters of the students plan to continue using BYOD in the future. This is supported by the theory of motivation which states that satisfaction encourages achievement and passion for learning [8]. If students continue to use BYOD, it might influence transferring their informal learning processes to formal learning and *vice versa* [20].

With regard to the fifth question, the students had to indicate whether they expect their use of BYOD to continue in the future. The results reveal that 78.1% strongly agreed or agreed with this statement. This finding suggests that more than three-quarters of the students expect their use of BYOD to continue in the future. As Elmunsyah et al argued, the current teaching should not emphasise the theoretical facts using digital media [8]. Students should be expected to use BYOD to promote interaction with other peers to apply knowledge and approaches from various disciplines [9].

In this study, it may be argued that the University should have taken advantage of the BYOD strategy before the COVID-19 pandemic to ensure smooth adoption to emergency remote teaching. Looking closely at the study results, it is clear that students' behavioural intention to use BYOD was positive. They showed interest and willingness to learn with their own devices. This promoted student-centred learning and encouraged active learning. Students took ownership and responsibility for their learning.

Table 1: Frequency distribution (N [%]) of students' behavioural intention to use BYOD.

Item		Strongly agree	Agree	Neutral	Disagree	Strongly disagree
BIUB 1	I always try to use BYOD to do a task whenever it has a feature to help me perform it	55 (26.2)	92 (43.8)	46 (21.9)	14 (6.7)	3 (1.4)
BIUB 2	I intend to use BYOD frequently for my courses.	52 (24.8)	79 (37.6)	48 (22.9)	24 (11.4)	7 (3.3)
BIUB 3	I intend to use BYOD as often as possible	60 (28.6)	78 (37.1)	52 (24.8)	13 (6.2)	7 (3.3)
BIUB 4	I plan to continue using BYOD in the future	86 (41.0)	81 (38.6)	27(12.9)	10 (4.8)	6 (2.9)
BIUB 5	I expect my use of BYOD to continue in the future	91 (43.3)	73 (34.8)	29 (13.8)	12 (5.7)	5 (2.4)

BYOD CHALLENGES

Despite students' positive behavioural intentions to use the BYOD strategy, they had mixed feeling about the challenges they encountered. Figure 1 shows two categories that were generated from the theme of BYOD challenges. The categories related to yes, challenges and no challenges. This implies that the majority of the students agreed that they experienced challenges with the use of BYOD in learning. While few indicated, no challenges experienced.

Concerning the yes response to challenges with BYOD, the students identified challenges relating to their smartphones, technical problems, Wi-Fi in the classroom, lack of data, slow access to the Internet, learning management system, balancing learning and personal activities, frustration and the lack of familiarity with BYOD for learning. This is supported by Welsh et al who stressed the importance of network security when connecting student devices to the university Wi-Fi system and inequality between students' different device capabilities [5].

Some of the students struggled to get their smartphones to connect to the institutional Wi-Fi. One student, Lerato said: *my phone was not connecting at all*. Those who were able to connect, for some reasons, while they were doing the on-line

assessment, the system disconnected them. Another student, Melusi indicated that: *the system kicked us out whilst doing online assessments*. It was also found that some students came to class with their phones on low battery, not working, the battery went off while working or they had to wait for the battery to charge. It is important to indicate that the classroom did not have a power socket for students to charge their phones. Sánchez et al also confirmed this sentiment [21].

The findings revealed that the students complained about slow access to the Internet when executing a particular task. Jane said: *the rate at which the Internet works is sometimes slow*. George also indicated that: *the Internet is slow sometimes*. Slow access to the Internet triggers frustration in students. Mandla pointed out that: *slow access to the Internet causes frustration*, during his tasks. In the study by Elmunsyah et al, the students did not experience this obstacle, their easy access to the Internet increased their ability to acquire and process information when learning [8]. It is imperative that when students study at home their access to the Internet be considered, especially during the pandemic. Most of the studies conducted from the disadvantaged communities without electricity, network connections and appropriate infrastructure report student frustrations over those issues [2][4].

It was also found that a lack of data was an issue for students when learning at home. Students in this study had access to the Internet when on-campus hotspot areas and in class. Michael mentioned that: *yes; I have difficulty accessing some of the files when studying late at home because of lack of data*. This challenge was also raised by some of the lecturers in the study by Masilo et al, whereby students complained about the lack of data to access IMFUNDO during the lockdown [6]. Some of the participants indicated that they were not familiar with learning using BYOD. For example, Enhle said: *I was not familiar with it, it was a little bit of a challenge*.

The findings showed that students had problems with access to the learning management system (LMS) on their smartphone; the LMS interface was not user-friendly on mobile devices. Mawande indicated that: *sometimes you find that the screen [is partially blank] when using the LMS if your phone does not rotate it does not show some content*. It was found that students needed assistance to operate the LSM on their devices. It may be argued that even though the Generation Z students had behavioural intention to use BYOD, they were irritated by the university old technologies, which were not compatible with their devices.

It was established that some students found it difficult to balance learning and personal activities. Lwazi mentioned that: *using my phone for academic work does not balance*. Nomsa said: *yes, there was a task that was put on the LMS and you are supposed to do it, but then when you receive a call, you get or you receive a message; the task would be submitted and saved without you having done it. This would jeopardise my marks*. Potential distraction from learning with personal devices was reported by Tinmaz [20]. Students often use their mobile devices for entertainment, chatting, social media, digital games and watching videos [20].

With regard to no challenges comments, some students found the BYOD strategy adequate for learning. Nolwazi said: *no, everything was fine and smooth*. Mandla indicated that: *no, it was perfectly fine*. Other students also found it is easy to learn with their devices. Karabo said he: *did not experience challenges because he was familiar with learning on his mobile device; and it was easy to use*. When students consider BYOD a necessity, it provides them with an opportunity to easily learn at anytime and anywhere [9].

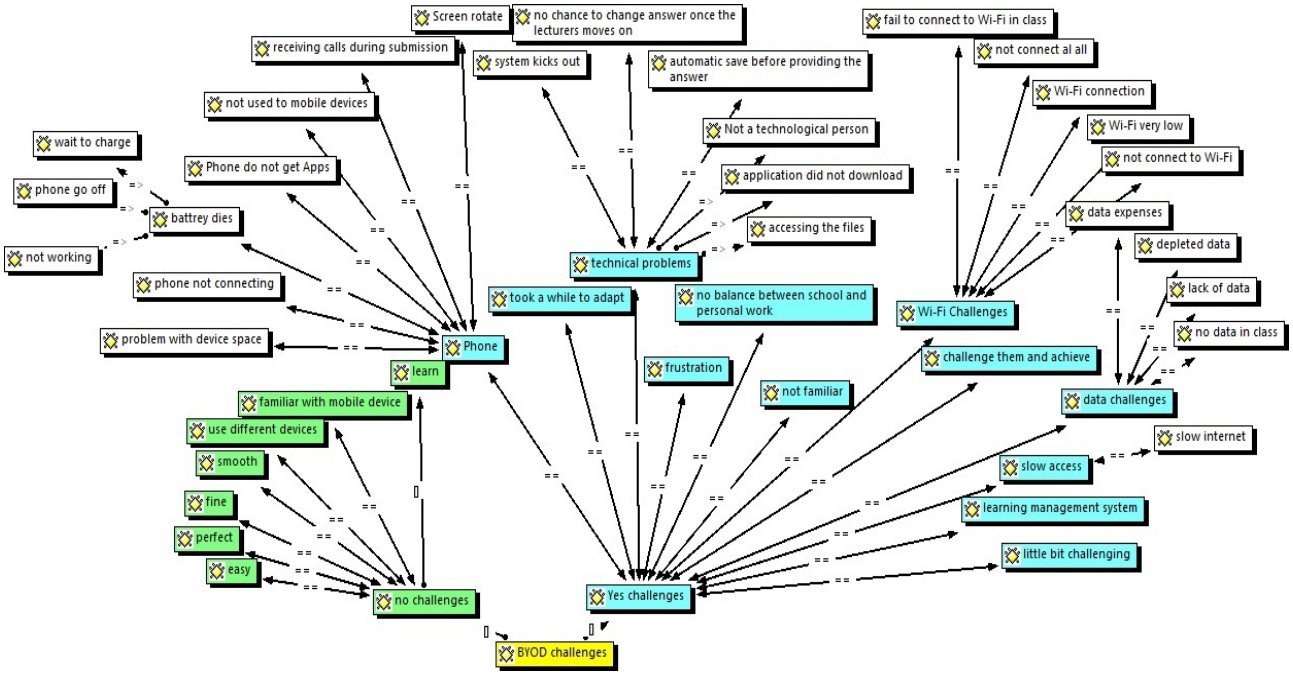

Figure 1: BYOD challenges during the learning and teaching process.

The findings showed that some students used different devices to access learning material without encountering problems. In this regard, Michael indicated that he: *used different devices and there was no problem, he did not experience challenges*. Literature shows that mobile devices come in small sizes with numerous exciting and distinct features in educational settings [9]. These devices offer flexibility and a range of innovative strategies for learning and teaching.

It may be argued that the students who did not encounter challenges with BYOD were those that used tablets for learning in high school. Learning with BYOD was continuous from previous experience; hence, it was easy to learn.

CONCLUSIONS

It was mentioned in this study that the COVID-19 pandemic forced education institutions to rapidly transform teaching and learning. It was indicated that during tough times, most higher education institutions adopt emergency remote learning, teaching and assessment. The BYOD strategy was used in most higher education institutions before the outbreak of COVID-19. It was also reported that many students entering tertiary education own personal smartphones.

It may be concluded that in this study, students' behavioural intention to use BYOD to engage with academic work was positive. Also, it can be stated that students were keen and prepared to use their own mobile devices for learning, as long as lecturers give them a task that has a corresponding feature on their devices to perform the given task. Students had positive intentions in regard to BYOD and plan to continue using it in the future. This implies that students would be eager even during the pandemic to use their devices, even though academics were more concerned about the issue of access to technology and data.

The pandemic posed a serious challenge and exposed the digital divide, lack of access to technology, lack of network and Wi-Fi connections at university, and therefore not all the students were able to apply the BYOD strategy. However, various challenges were also identified with the use of BYOD, and they related to smartphones, technical problems, Wi-Fi in the classroom, and the lack of familiarity with BYOD for learning. On the other hand, it may be seen that some of the students did not experience challenges with the use of BYOD.

RECOMMENDATIONS

It is recommended that students' behavioural intention to use BYOD be taken into consideration to ensure the appropriate provision of learning material. It is recommended that a BYOD policy be in place for successful implementation in the institution of higher learning. Upon the return of students to campus, after the pandemic, the provision of, and access to, Wi-Fi be increased to avoid barriers to the BYOD learning and teaching strategy. There should be terms and conditions between the student and the institution for using mobile device management tools to remotely reset or delete certain partitions of data from a BYOD user's device for security purposes.

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