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Research Article

Assessing the identity of digital technology in education in the age of digital communication

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ABSTRACT

Digital technology has become a part of undergraduate daily life as digital assistant in the age of digital communication (social media and smartphones), purchasing necessities (online shopping), releasing stress (online game) and education resources supply (social media) during or after COVID-19 pandemics especially those involved in online education. However, excessive participation in these technologies raises concerns among the society. The most visible impact will be academic performance, physical and mental health. This research aims to analyze the addiction level and impacts of digital culture in undergraduates who involved in digital education, using empirical study. 320 scholars from a private university are invited to participate in the study. Pearson correlation and descriptive analysis are performed using SPSS in data analysis. The result shows that 62.05% of the respondents fall under a moderate level of addictive digital. Social media addiction, smartphone addiction, online game addiction, and online shopping addiction do not significantly affect undergraduate academic performance, but they have a significant impact on physical and mental health. This research brings new perceptions of different digital technologies to undergraduates in a comprehensive view in terms of digital technology empowerment or endangerment in education in this age of digital communication. This is useful as guidance to policy makers in the future design of online education.

Keywords: digital culture, social networks, smartphone, online shopping, online game, digital communication

INTRODUCTION

Definition of the Internet users including individuals who access the Internet using different devices such as a smartphone, personal computer, laptop, iPad, etc. The Internet users in Malaysia reported to increase consistently from 64.1% (2012) to 88.7% (2020) and near 64.4% of the world population in January 2023 are Internet users (ITU, 2020; Kemp, 2022; MCMC, 2020; Petrosyan, 2023; World Bank, 2020). According to Kemp (2022), 89.6% of the Malaysian population are the Internet users (29.55 million). Among the online activities performed by Malaysians are 98% in text communication, 93% on social media, 87% on videos, 81% on voice/video communication, 64% on online shopping, 68% on online reading, 65% on music, 64% on financial transactions, and 43% on gaming (MCMC, 2020). The level of Internet addiction has increased due to this digital culture (online social life, online shopping, online entertainment, and online games), especially among adolescents and adults. For example, 91.7% of Malaysian are social media users, with 82.4% using Facebook; YouTube–23.6 million Malaysian users; and Instagram–59.1% Malaysian users (Kemp, 2022). Smartphones and laptops are the two most popular devices (MCMC, 2020). According to Kemp (2022), there is a 127.7% of the Malaysian population with an active mobile connection to the Internet in 2022! The impacts of digital culture are the predominant issue to investigate in this modern age in view of the fact that digital technologies enable task accomplishment efficiently but also endangering factors that reduce mental and physical well-being. Therefore, this study focusses on exploring the addictive level of popular digital technologies, namely smartphones, social media, online shopping, and online games among undergraduates with associated impacts on academic performance, mental, and physical health, using the data analytics method–Pearson's correlation. Although undergraduates are heavily relying on the digital technologies, does it mean that they are addicted to the technology? Will there be another "new term" to describe this new phenomenon of using technology in digital communication and the completion of tasks rather than describing it as "addiction"? It is crucial to reveal insights from this phenomenon since the digital culture is penetrating our living. The application of technology could be utilized in empowering communication to disseminate important information in politics, education, commercial and society. Identifying which specific digital technology that bring higher impacts among undergraduates is important as it guides the communicator to use that technology to effectively deliver message to the target. The findings of this study are also crucial as input for researchers and educators in predicting the conditions to avoid drop out by designing appropriate counseling or learning and teaching policy that assist in developing an ideal individual.

RELATED WORKS

Adolescent Scholars–Undergraduates

The late adolescent group refers to the age group of 18-24 years that is in the stage of developing their physical, sexual, cognitive, social, and emotion. Among the group, those attending higher education, college, or university experience additional educational and social challenges with unlimited exposure to digital culture. This group of young generation is specifically called adolescent scholars. The mental and physical health of adolescents is important to shape a great future generation that contributes to society and the country. Therefore, this study will focus on a group of adolescent scholars (undergraduates) in a private university.

Social Media Usage and Addiction

Social media refers to any website or mobile application that allows users to share content with the world. 10 popular types of social networks (with the sequence of popularity) including social networks (e.g., Facebook), media sharing networks (e.g., YouTube), discussion forums (e.g., Reddit and Digg), bookmarking and content curation networks (e.g., Pinterest and Flipboard), consumer review networks (e.g., Yelp and TripAdvisor), blogging and publishing networks (e.g., WordPress and Tumblr), social shopping networks (e.g., Shopee), interest-based networks (e.g., Instagram and Snapchat), sharing economy networks (e.g., Airbnb and Uber), and anonymous social networks (e.g., Whisper and Ask.fm) (Smith, 2020). The purpose of social media usage varied between adolescents with distinctive impacts. In Malaysia, the most popular social media platform is Facebook (91.7%), which is used to publish news, public service announcement, entertainment, and humorous content. The sharing of educational content is decreasing from 71.3% (2018) to 36.4% (2020)

(MCMC, 2020). These phenomena raise concern about the effects of social networks on scholars. Among the impacts that gain high attention are mental health (Cunningham et al., 2021; Smith, 2020; Valkenburg et al., 2022) and academic performance (Al-Menayes, 2015; Alomari, 2019; Lim et al., 2021). Most researchers conclude that there are significant or at least minor effects of social media usage on academic performance and mental health of scholars. However, less research is concerned about the purpose of using social networks and their impact (Lim et al., 2021). Although the previous study by Lim et al. (2021) shows significant relationship between purpose of usage and academic performance, the study only involves an educational purpose. There is a lack of investigation of noneducational purposes as a factor. Could there be different impact on academic performance of scholars if the activities performed on social media were different (entertainment, educational, gain knowledge)? Furthermore, there is a lack of research on the possibility of social media usage impacts on physical health (Faridah et al., 2020). Therefore, this study will bridge the research gap by looking at how different social media usage purposes affect social media addiction (SMA) and bring different impacts on physical health.

SMA is measured using the same indexes as the Internet addiction test (Young & Cristiano, 2010), which includes compulsive use with prolonged time than planned to result in behavioral changes. This phenomenon is becoming very common with the increase of the internet user, with 91.7% of them using Facebook (MCMC, 2020). The advancement of low-budget smartphone, ubiquity of Wi-Fi and affordable data plan, nearly all mobile phones relate to variety of social media applications all around. The topic of SMA is compulsory research to reflect the latest identity of social networks in society, especially among educational institutions, to improve quality education. There is a lack of proper measurement of SMA using the Internet addiction test in students from a private university in Malaysia.

Smartphone Usage and Addiction

Advancement of smartphone technologies and telecommunication facilitate the accessibility and coordination of many activities of society that promote a new digital culture (Yuen Fook et al., 2021). According to MCMC, the Malaysian government 2020 report, Internet consumption through smartphone devices has reached 98.7% in 2020, followed by laptops, with only 37.9% (MCMC, 2020). Does this digital culture support adolescent scholars or result in losses in their academic life? Among some major concerns about the impacts of smartphone usage impacts including academic performance (Khan et al., 2021; Shakoor et al., 2021; Yuen Fook et al., 2021), mental health well-being (Serra et al., 2021; Yuen Fook et al., 2021; Zhong et al., 2022), social life (Ghosh et al., 2021), and physical health (Wacks & Weinstein, 2021).

According to Health Minister Khairy Jamaluddin at the 72nd Western Pacific Regional Committee Meeting 2021 in Himeji, Japan, the Malaysian government will invest more in necessary interventions in the mental health assistance of adolescent scholars (New Straits Times, 2021). It is crucial to identify various factors that could affect mental health, which includes smartphone addiction. Mental health issues including cognitive emotion preoccupation, attention control, stress, depression, anxiety, and sleep quality (Dana et al., 2022; Meng et al., 2021; Serra et al., 2021; Wacks & Weinstein, 2021; Yuen Fook et al., 2021; Zhong et al., 2022). Cognitive emotion preoccupation means excessive thoughts of technological use. For example, one cannot control himself if left without the smartphone for a whole day. This is a deterrent factor in judging one's smartphone addiction level. Meanwhile, attention control brings distraction effects that are caused by anxiety (Chu et al., 2021). This finding expands the scope of the traditional "processing efficiency theory" and opens more possibilities for the use case of the term "attention control" (Eysenck et al., 2007).

Sedentary behaviors are defined as activities carried out with less physical movement, such as lying and sitting. Researchers have found that digital culture, such as the use of social media and the addiction are among the main reasons for sedentary behaviors with a declining physical health. Kim and Lee (2022) found a significant correlation between adolescents' smartphone addiction and physical activities conducted every day. It is suggested that to prevent smartphone addiction, physical activities for more than five days a week (Chu et al., 2021).

Online Shopping and Addiction

Online shopping is becoming a trend in Malaysia. 50% of the population participated in online shopping in 2019, estimated e-commerce payments increased from MYR28.5 billion in 2021 to MYR55.7 billion in 2025

(GlobalData, 2021). Shopee, PGMall, and Lazada are three top-most visited e-commerce websites in Malaysia competing aggressively every month with double date sales, for example, month 4.4, 5.5, and 11.11 sales (Statista Research Department, 2022). With the emergence of online shopping, shopping addiction, also known as compulsive buying behavior (CBB), was first recognized by Emil Kraepelin (German psychiatrist) in 1915. He defined the disorder 'oniomania' that is derived from two Greek words, onios (means 'for sale') and mania (meaning 'insanity'). Shopping addiction was cited as a psychiatric disorder in the early twentieth century by Bleuler and Kraepelin (Black, 2007).

Shopping addiction, or compulsive buying is known as compulsive thoughts or the impulses to buy unnecessary items in spite of the negative consequences especially debts. As the shopping medium slowly transitioned to online shopping, a new form of shopping addiction emerged as online shopping addiction (OSA). It is perhaps the most socially acceptable addiction today. Much research is carried out in finding the factors of adoption and addiction: online advertisement, product risk, delivery risk, information security (Puah et al., 2021).

Meanwhile, investigation on OSA impacts including mental health (Neha & Kiran, 2019), financial trouble, strained relationship, compulsive and impulsive buying behavior (de Guzman et al., 2022). de Guzman et al. (2022) reported that OSA helps users cope with stress. Does stress also serve as a factor that causes OSA? This study will look at this aspect. However, the depression rate is increasing and about 3.8% of population worldwide suffers from depression–about 280 million people (WHO, 2021). Depression raises great concern in WHO as it will lead to suicide, which is the fourth leading cause of death among adolescents and adults aged 15-29. Online shopping becomes addictive when it brings an antidepressant effect to patients, resulting in uncontrolled buying behavior (Neha & Kiran, 2019). Therefore, OSA is said to be associated with depression.

Another factor of OSA is self-esteem, which is defined as a global, personal judgment of one's own worth (Crocker, 2001). Low self-esteem is reported to negatively affect OSA (Andreassen et al., 2015). Compulsive buyers try to shop online to gain material satisfaction and uplift self-esteem. This behavior will be cycled when buyers find it successful and satisfactory (Hanley & Wilhelm, 1992; Uzarska et al., 2023). These findings stated that irrational beliefs such as 'buying a product will make life better' and 'shopping this item will enhance my self-image' can trigger excessive shopping behavior in people with low self-esteem.

However, the contradictory result shows an insignificant relationship between self-esteem and OSA (Uzarska et al., 2023). Therefore, the relationship between self-esteem and OSA depends on different geographical locations and populations. It is essential to carry out the analysis in a population of different localities. Finally, materialism, also known as Materialistic, has been commonly defined as a trait, where an individual is overly possessed with material goods, which in return indicates the achievement of life goals or desired status (Richins & Dawson, 1992).

Online Games and Addiction

Online games are interpreted as massive multiplayer online games (MMOGs), casual or social games played through the Internet browser or installed client platform. Smartphone penetration and data plan are the main factors in the fast-growing online gaming industry with an estimated users' penetration rate of 14.8%, 5.1 million by 2026, out of which 19.2% are users aged 18-24 (adolescents) in 2021 (Statista, 2021). Educators use of educational games (game-based learning–GBL) to increase the interest in learning process, decrease their stress level, improve understanding and thus increase their academic performance (Adžić et al., 2021; Caroline, 2019; Elkhamisy & Wassef, 2021; Eltahir et al., 2021; Katemba & Sinuhaji, 2021; Katemba et al., 2022). It is undeniable that incorporating games in learning process empowering the education quality.

The other concern is that noneducational games unconsciously penetrate the life of adolescent scholars through the advancement of 4G and 5G networks, which forms an online gaming culture that is more addictive compared to offline games (Montag et al., 2021; Singh, 2019). Among the impacts of online games that show significant negative effects on adolescents' scholars are academic performance (Haidar, 2022), physical health (such as eye strain, headache, dizziness, nausea, vomiting, and sleep quality) (Altintas et al., 2019; Moore et al., 2022; Singh, 2019), and mental health (Elhai et al., 2021; Moore et al., 2022; Wenzel et al., 2009). Among these impacts, mental health (depression, anxiety, and attention control), age, study quality,

Table 1. Reliability level of questionnaire items

Questionnaire items sections	Cronbach's alpha based on standardize items	Number of items
Social media usage	0.854	14
Social media addiction measurement	0.907	12
Smartphone addiction measurement	0.884	12
Online shopping addiction measurement	0.941	12
Online game addiction measurement	0.918	12
Mental health measurement	0.944	63
Physical health measurement	0.837	15
Total		140

and physical health appear as predictors of gambling addiction (Kim et al., 2022; Moore et al., 2022; Teng et al., 2021).

This study focusses on four digital culture, namely social networks, smartphones, online shopping and online games, and defined the addiction as digital addiction (Kesici & Fidan Tunc, 2018). The purposes of digital tool usage in Kesici and Fidan Tunc (2018) only include communication, game, research, film music, social network, and shopping without considering the usage of different technologies in different purposes that could provide insights to researcher on the most impactful technology. Based on the literature review, the following research questions are constructed for this study to bridge the research gap.

RQ1: What is the level among private university undergraduates in private universities in Malaysia?

RQ2: What are the impacts of digital addiction on the academic performance, mental health, and physical health?

MATERIALS AND METHODS

A cross-sectional study is carried out in a specific population of adolescent scholars from Faculty of Computing and Information Technology (FOCS), bachelor's degree year 1, 2, and 3, Tunku Abdul Rahman University of Management and Technology (TAR UMT Kuala Lumpur Campus) for three months. This population is selected based on convenient sampling method and simple random sampling since the researchers are working within FOCS, which ease data collection. The main reason for the selected population is that FOCS meets the requirements of extensive usage of digital technologies among adolescent scholars compared to other faculties in TAR UMT. The Google survey form is distributed through email addresses provided by FOCS (approved by the faculty research committee) with the consent of the willingness to participate before the start of the survey. A total of 320 respondents participated in this survey.

There are five sections designed to adopt questionnaire items from the previous research (**Appendix A**): section 1–demographic information; section 2–social media use purposes (Alomari, 2019); section 3–digital technologies and culture addictive measurement (Young & Cristiano, 2010); section 4–mental health (Chu et al., 2021; Kil et al., 2021; Kroenke et al., 2010; Richins & Dawson, 1992; Rosenberg, 1965); and section 5–physical health (Krishnan et al., 2020; Zamani et al., 2009). The dataset will be cleansed and analyzed by IBM SPSS statistics 26. Four different addictive measurements will be calculated and reported using descriptive analysis, including SMA, smartphone addiction, OSA, and online gaming addiction. Pearson correlation is used to test the impact of digital addiction on academic performance, mental, and physical health. The hypotheses of this study are, as follows:

H1: There is a significant relationship between digital addiction and academic performance.

H2: There is a significant relationship between digital addiction and mental health.

H3: There is a significant relationship between digital addiction and physical health.

RESULTS

Reliability Analysis

The pilot test is carried out on about 50 students from FOCS. The result of the reliability test ranges from good to excellent (0.80-0.95). Cronbach's alpha test is conducted to test the reliability of the questionnaire

Table 2. Demographic information of the participants

Characteristics	Frequency (n)	Percentage (%)
Age		
19	8	2.4
20	160	48.2
21	76	22.9
22	57	17.2
23	19	5.7
24	5	1.5
25	4	1.2
26	2	0.6
28	1	0.3
Gender		
Male	235	70.8
Female	97	29.2
Current GPA		
3.75-4.00	87	26.2
3.51-3.74	96	28.9
2.75-3.50	113	34.0
2.51-2.74	11	3.3
2.00-2.50	14	4.2
0.00-1.90	11	3.3
Year of study		
1	5	1.5
2	285	85.8
3	41	12.3
4	1	0.3
Total	332	100.0

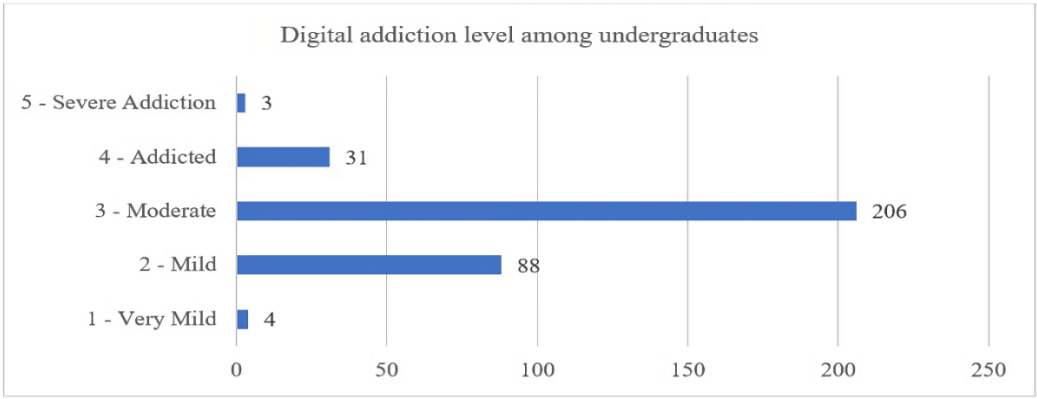

Figure 1. Digital addiction level among undergraduates with five levels: very mild, mild, moderate, addicted, and severe addiction (Source: Authors)

items again after collecting data from 332 FOCS students. The result is summarized in **Table 1**. The reliability level is good (0.80-0.89) and excellent (>0.90) (George & Mallery, 2003) (**Table 1**).

Demographic

A total of 332 undergraduates participated in this study with their demographics, as shown in **Table 2**. There is a total of 70.8% of male undergraduates with a majority of age 20-22 (88.6%). 89.1% of the undergraduates' current GPA score 2.75-4.0 and 85.8% of the students are in the year 2 of bachelor's degree.

Digital Addiction Level among Undergraduates

The next descriptive analysis performed on the collected data is to analyze the digital addiction among undergraduates at post-pandemic (**Figure 1**). There are five levels of addiction identified, which are very mild, mild, moderate, addicted, and severe addiction. The mean addictive level for each respondent is calculated, and 62.05% of the respondents fall under moderate addictive level. Only 10.24% of undergraduates fall under the level of addicted and severe addiction, which shows a healthy sign of private university undergraduates in digital culture.

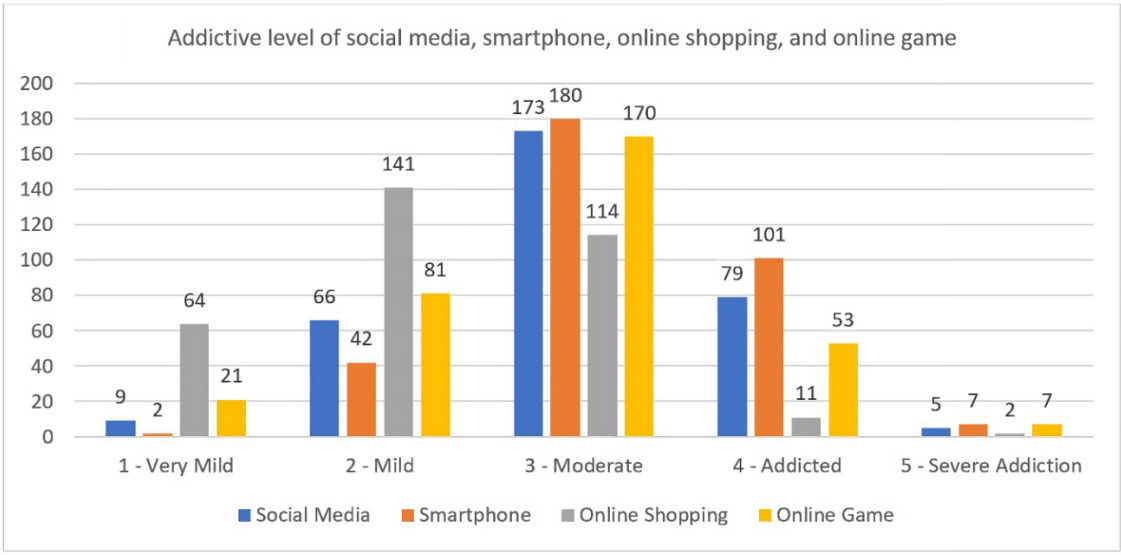

Figure 2. Level of digital addiction among undergraduates with five levels: very mild, mild, moderate, addicted, and severe addiction on social media, smartphone, online shopping, and online games (Source: Authors)

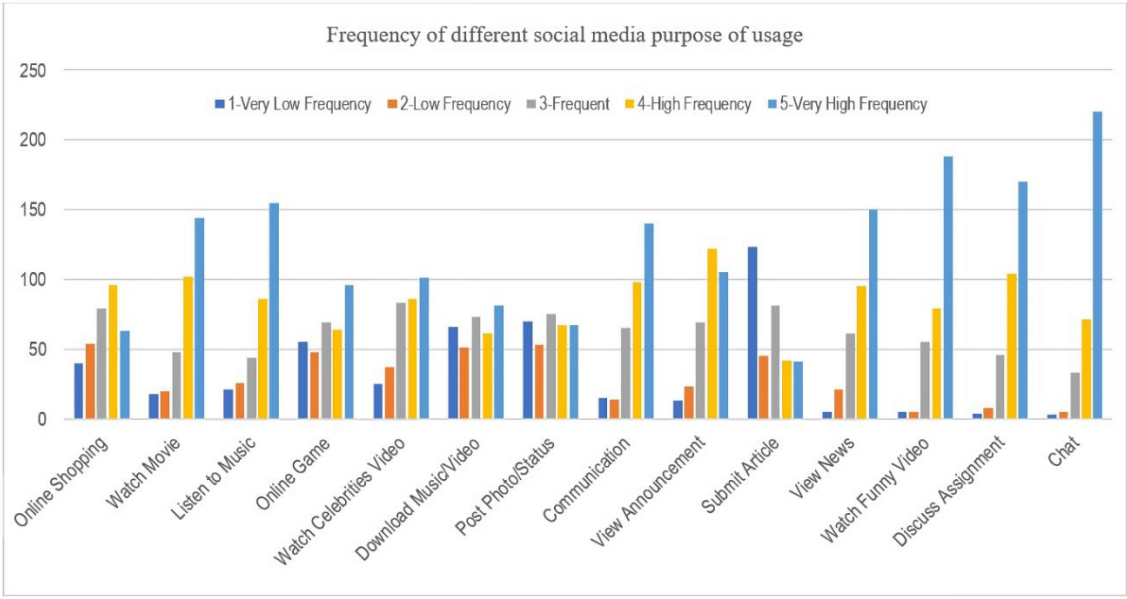

Figure 3. Different purposes of social media usage among undergraduates (Source: Authors)

The addictive patterns are further drilled down in detail to show the addictive level in different digital cultures–social media, smartphone, online shopping, and online games (**Figure 2**). The total number of undergraduates that fall under the moderate, addicted, and severe addiction level of each digital culture is reported according to ascending order as: smartphone (288), social media (257), online game (230), and online shopping (127). This phenomenon is as expected, as smartphone usage also including browsing social media, online game, and online shopping. Therefore, it is commonly used by all under-graduates as a medium in many daily activities. The online game is also prevalent among undergraduates, which requires further study to explore its impact on the academic performance, mental and physical health of an individual.

To explore the different usage of social media among undergraduates, top-5 activities (according to the highest frequency statistic) are the following: chat (220), watch humorous/funny video clips (188), discuss assignment (170), listen to music (155), view news (150). It is interesting to find that assignment discussion through social media has become a trend among Malaysian private university (**Figure 3**).

Table 3. Correlation between digital addiction & current GPA, mental health, physical health, & BMI

	Current GPA	Mental health	Physical health	BMI	Standard deviation
Social media addiction					
Pearson's correlation	-0.067	0.476**	0.281**	0.020	
Sig. (2-tailed)	0.225	0.000	0.000	0.716	0.779
n	332	332	332	318	
Smartphone addiction					
Pearson's correlation	-0.064	0.442**	0.244**	-0.006	
Sig. (2-tailed)	0.247	0.000	0.000	0.911	0.705
n	332	332	332	318	
Online shopping addiction					
Pearson's correlation	-0.095	0.294**	0.234**	0.116*	
Sig. (2-tailed)	0.082	0.000	0.000	0.039	0.818
n	332	332	332	318	
Online game addiction					
Pearson's correlation	-0.037	0.383**	0.244**	0.054	
Sig. (2-tailed)	0.502	0.000	0.000	0.335	0.845
n	332	332	332	318	

Note. **Correlation is significant at 0.01 level (2-tailed) & *correlation is significant at 0.05 level (2-tailed)

Impact of Digital Addiction on Academic Performance, Mental Health, and Physical Health

Pearson's correlation is first performed on dependent variables (current GPA, mental health, physical health, and BMI) and independent variables (digital addiction–social media, smartphone, online shopping, and online game). The findings in **Table 3** show that digital addiction has significant positive impacts on both mental health and physical health (**H2** and **H3** are supported). However, none of the digital addiction criteria has a significant impact on the current GPA (**H1** is rejected). Lastly, only OSA shows significant positive impact on BMI. Another research is carried out by Caleb et al. (2022) on online class students which corresponds to this study's result in which online game is not significantly affecting academic performance.

DISCUSSION

Online education is welcomed by educators and learners around the world due to its advantages of 'anywhere, anytime, and anything'. Classes can be conducted anywhere, learning can be carried out at any time, and most assessments can be performed virtually. Thus, digital technologies play an important role in the success of online education implementation. Students are exposed to digital technologies and applications such as smartphones, social networks, online shopping, and online games, with greater participation and much more time compared to the former times. Digital addiction is inevitably increasing among these generations. Based on the results of this study, it was found that 72% of the participants are moderately to severely addicted to digital technologies, especially smartphones, social media and online games. Although addiction does not significantly affect student academic performance, the addiction significantly affects mental and physical health. This result is different from other research (Haidar, 2022), and the main reason could be due to the mode of education, online versus offline classes. Since this study involves students attending online classes, the assessment criteria are different from those of an offline class. More comprehensive assessment criteria are required to fully reflect the student's competencies in a subject. This is a challenge in digital education.

If we want to drill down the details of digital technologies usage in academic purpose, the answer to the result of nonsignificant impact of digital addiction to the academic performance would be found. Based on **Figure 3**, today students use social media to chat and discuss assignments, online games act as entertainment to relieve stress, and online shopping ease daily time management. All these activities empowered online education (Adžić et al., 2021; Elkhamisy & Wassef, 2021). Therefore, digital addiction does not significantly affect academic performance. However, the significant impact on physical health and mental health cannot be ignored. A detailed breakdown of the impact is necessary to identify specifically which health index is affected.

There are other interesting facts from **Table 3** that show that addiction to digital technologies positively affects mental and physical health. This also means that when the student is involved in digital technologies,

their health will be affected positively but not negatively. Does this mean that they are getting healthier instead of unhealthy? This requires further research on different aspects of health impacts caused by digital addiction. However, a new insight is discovered from this study: undergraduates are getting smarter at using digital technologies to ease daily living and release stress while maintaining their academic performance.

CONCLUSIONS

Are technologies innocent or should they be held accountable for harm? Arnold and Pearce (2015) argue that humans should be responsible for the chain of causality. This research proves the concept that, although digital technologies cause digital addiction, the addiction might not negatively impact academic performance, physical, and mental health. On the other hand, digital addiction significantly and positively impacts physical and mental health. This finding opens a new discussion among educators and learners on how to fully utilize online education mode in many institutions during the post-COVID-19 pandemics. Perhaps the generation changed the technology and the technology in return changed how the new generation communicates, works, relaxes, and learns. Does digital addiction need to be called 'addiction' or should there a new positive term to replace "addiction" to interpret the level of dependency on technologies with minimal/without negative effects? Undoubtfully, digital technologies will become a useful tool or main channel or the fastest way to educate people on new knowledge, propaganda, policy, or vision, either in private sectors or public sector (e.g., government). Now, the new issue will be how these technologies should be integrated to fulfil different purposes with minimal negative impacts. The limitation of this study is on the convenient sampling used in one private institution, which limits the generalization of the result. It is interesting to explore further the differences between countries.

Another interesting issue to further research into in digital culture would be the latest technology that has arisen recently, ChatGPT. Some institutions have accepted this technology to help the teaching-learning process. For example, setting assignment, exercises, etc. Although there are many arguments regarding the breach of academic integrity, it is still up to educators to decide whether ChatGPT, a newly arisen digital technology, could improve teaching-learning process.

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Declaration of interest: Authors declare no competing interest.

Data availability: Data generated or analyzed during this study are available from the authors on request.

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APPENDIX A: QUESTIONNAIRE DETAILS

Table A1.

Section	Questionnaire item	Options
Demographic	Gender	Male/female
	Age	-
	Current GPA	3.75-4.00; 3.51-3.74; 2.75-3.50; 2.51-2.74; 2.00-2.50; 0.00-1.90
	Year of study	Year 1; year 2; year 3; year 4
Social media: Tell us more about your social media usage (e.g. YouTube, Facebook, Twitter, & Instagram)		
I use social media for online shopping.		Very low frequency
I use social media to watch movies/shows.		1
I use social media to listen to music.		2
I use social media to play online games.		3
I use social media to watch video clips about celebrities.		4
I use social media to download music/video.		5
I use social media to post photos/update my status.		Very high frequency
I use social media to communicate with teachers/classmates (for educational purposes).		
I use social media to read important announcements from college/industries.		
I use social media to submit article (e.g. blog).		
I use social media to get the latest news.		
I use social media to watch humorous/funny video clips.		
I use social media to discuss assignment(s) with classmates.		
I use social media to chat with friends.		
Digital culture dependency		
I often neglect my schoolwork because of my usage of:		Social media: SA; A; N; D; SD
I often find life to be boring without:		Smartphone: SA; A; N; D; SD
I find it difficult to sleep after using:		Online shopping: SA; A; N; D; SD
I will be upset if I have to cut down the amount of time I spend using:		Online game: SA; A; N; D; SD
My school grades have deteriorated/decreased because of my usage of:		
I often cancel meeting my friends because I am occupied with:		
I cannot pass my days without:		
I think about _____ all the time		
I use _____ in order to change my mood.		
I feel that I have to use _____ more & more to obtain same satisfaction as before.		
I have decided to use _____ less but have not been able to do so.		
I feel bad if (for some reason) I have to stop from using:		
My daily maximum hours I spend on:		
My daily minimum hours I spend on:		<1hr;1-2hrs;3-4hrs;4-5hrs;>5hrs
Mental well-being: Please rank the following index based on how frequently you have this experience.		
I feel		
Little interest or pleasure in doing things.		Almost never
Down, depressed, or hopeless.		Usually not
Trouble falling or stay asleep or sleeping too much.		Occasionally
Tired or having little energy.		Usually
Poor appetite or overeating.		Almost always
Feel bad about myself or that I am a failure or have let myself/my family down (disappointed).		
Trouble concentrating on things, such as reading the newspaper, textbook, or watch tv.		
Moving or speaking so slowly that other people could have noticed. Or opposite–being so fidgety or restless that I have been moving around a lot more than usual.		
Thoughts that I would be better off dead or hurting myself in some way.		
I feel		
I am a person of worth, at least on an equal plane with others.		
I have a number of good qualities.		
I am not a failure.		
I am able to do things as well as most other people.		
I have much to be proud of.		
I take positive attitude toward myself.		
On the whole, I am satisfied with myself.		
I have enough respect for myself.		
I do not feel useless at all times.		
I am good at all.		

Table A1 (Continued).

How often do you have the following experience?	
I admire people who own expensive homes, cars, and clothes.	
I admire some of the most important achievements in life include acquiring material possessions.	
I place much emphasis on the amount of material objects people own as a sign of success.	
I pay much attention to the materials objects other people own.	
I usually bought things I do not need.	
I enjoy buying a lot.	
I like a lot of luxury in my life.	
My life would be better if I owned certain things I don't have.	
I put emphasis on material things than my friends.	
I do not have all the things I really need to enjoy life.	
I would be happier if I could afford to buy more things.	
I cannot imagine happiness without material things.	
How often do you have the following experience?	
I am intolerant of anything that keeps me from getting on with what I am doing.	
I feel I am rather touchy (easily upset or offended; oversensitive).	
I find it difficult to relax.	
I find myself getting agitated (feeling or appearing troubled or nervous) easily.	
I tend to overreact to situations.	
How often do you have the following experience?	
When trying to focus my attention, I have difficulty blocking out distracting thoughts.	
When I need to concentrate, I have trouble focusing my work.	
When working on something, I still get distracted by mobile phone/ social media/ online shopping/ online game.	
When I have not been using _____ for some time, I become preoccupied with the thought of using it.	Social media: SD;D;N;A;SA Smartphone: SD;D;N;A;SA
I would feel lost if I was unable to use _____.	Online shopping: SD;D;N;A;SA
It is hard to distract myself (stop myself) from thinking about _____.	Online game: SD;D;N;A;SA
I think obsessively about using _____ applications when I am not using them.	
I find myself unable to stop thinking about using _____.	
Thoughts about using _____ intrude into my daily activities.	
Physical well-being	
Height (cm)	
Weight (kg)	
Please rank your sleep quality.	Excellent 1,2,3,4,5 Worst
Sleep latency: time taken from fully awake to sleeping.	<15min;15-30min;31-60min;>60min
Daily average sleep duration.	<5hr;5-6hr;6-7hr;>7hr
Having sleep disturbances (e.g. Insomnia, Snoring, SleepApnoea, Parasomnia, Narcolepsy).	Sleep quality >85%;Sleep quality is 75-84%;Sleep quality is 65-74%;Sleep quality <65%; I have sleep disturbances; I use sleep medication
Daytime dysfunction (e.g. absence, tardiness, falling asleep during class and interference with academic achievement).	No problem; Slight problem; Somewhat a problem; Very big problem
Please rank your experience in the following aspects:	
I feel in need of a good tonic (e.g. some medication to boost my energy).	Strongly disagree
I have been feeling run down and out of sorts (out of energy).	Disagree
I have been felt that I am ill.	Neutral
I have been getting a feeling of tightness and/or pressure in your head.	Agree
I have been getting pains in my head.	Strongly agree
I have been getting a feeling of tightness and/or pains on my shoulder.	
I have been feeling dizzy in the morning.	
I have been feeling numbness on my hands/feet.