The Relationship between Digital Communication, Digital Literacy, and Digital Safety on Online Behaviour

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Abstract
Information Communication and Technology (ICT) has become crucial to human life. Nowadays, people rely on technology to carry out their daily activities and is used extensively across the globe. Individuals can communicate, work, learn and entertain themselves more effectively. However, there were also some threats that need to be considered by individuals while surfing the internet and need to be safety. This paper aims to identify the relationship between digital intelligence competencies focusing on Digital Communication, Digital Literacy, and Digital Safety on Online Behaviour among university students. The respondents of this research were students from a public university in Terengganu, ranging from pre-diploma to postgraduate programs, who involved themselves in online activities. The questionnaires were adopted from previous research, and a link to Google Forms was given to students using WhatsApp application. The questionnaires are related to the digital intelligence quotient and online behaviour. There were 184 questionnaires used for the analysis. Data were analysed using SmartPLS version 3.99. Based on the findings, a significant relationship exists between digital communication, digital literacy, and digital safety in online behaviour.
Keywords: Digital Communication, Digital Literacy, Digital Safety, Online Behaviour

Introduction
The rapid development of technology and the broad availability of the internet impact many aspects of our lives, including employment, education, and personal life. The internet has

become a critical tool in our daily lives, and it is critical to understand how digital technology affects human behaviours as we rely most of our time on it. In addition, online behaviour is one of the critical contexts as it reveals how individuals interact, communicate, and make decisions in the digital world. It helps us understand how technology affects our social interactions and personal well-being.

Sreejesh et al. (2020) discussed two perspectives of interactivity in their research; first is related to users interacting with each other, focusing on interpersonal communication, and the second is about users engaging with the system, focusing on the characteristics of the media. This definition is close to Huang's (2012), as interactive communication empowers users to control the information they receive, engage in direct communication, and engage in mutual communication with one or more entities.

Taylor et al. (2011) defined social networks as a platform that share features such as allowing users to create their profiles, maintain lists of friends, and browse their connections. In addition, the advancement of social media has transformed decision-making and dissemination and reduced the influence of traditional advertising channels (Duffet, 2015). According to Yilmaz and Enginkaya (2015), the extensive coverage of social media platforms contributes to the influence of users' feedback, surpassing the traditional word-of-mouth impact. Rosario et al. (2020) found that digital literacy is associated with respondents' online information seeking behaviour during the COVID-19 pandemic. Contrary to the common perception that users' interactivity heavily relies on social media for seeking information on a study conducted by Salleh (2020) found that respondents rarely use social media as their primary source of information. Most of the respondents did not depend on social media to find information.

However, the purchasing process through Instagram, Facebook, Amazon, and Pinterest has shown the importance of information technology and digital transformation in our lives (VanVeldhoven & Vanthienen, 2022). This change shows that consumers' purchasing ways have transformed from formerly shopping at physical stores to social media or e-commerce platforms (Pillai et al., 2022). Thus, Pena-Garcia et al. (2020) explained that online purchase intention is the degree to which a consumer is willing to buy a product through an online store.

Although users are extensively exposed to the world of digital internet and ICT, where its usage includes interaction in social media, shopping, entertainment, or banking, the crucial aspect to emphasize is the safety of the internet. Dworkin (2013) pointed out that respondents who go online for information and social support are satisfied. However, they are still hesitant to trust online tools and are still determining the reliability of the information.

The discussion about implications of digital intelligence and technology on our daily lives has been documented, mostly on specific behaviour such as purchasing, marketing, and advertising and online learning, to name a few. Nevertheless, there is lack of literature reveals how it is influencing online behaviour among students. There is notable gap in our understanding of how digital intelligence competencies, specifically digital communication, digital literacy, and digital safety, directly shape the online behaviour of students. As a result, this study aims to investigate the relationship between these competencies and the online behaviour of students.

Literature Review
Digital communication

Digital communication refers to the exchange of messages, data, and information using electronic devices and digital technologies, which involves transmitting and receiving information through digital tools. This process involves the transmission and reception of information through digital tools, enabling organization and individuals to interact with each other in real-time or exchange messages at different times and collaborate remotely (Bordi et al., 2018) which may not be separated from the workflow (Wajcman & Rose, 2011). However, previous research has highlighted the demands related to ICT, which include response expectations, increased workload, constant availability, poor communication, and the volume of digital communication (known as the most demanding aspects) (Stich et al., 2015).

In a study conducted by Bordi et al. (2018), respondents were found to have preferences for instant messaging, email, teleconferencing and attending remote meetings and trainings. Moreover, the research associated with the well-being of respondents found that digital communication has been identified as mostly perceived as demanding to other factors, with six themes affecting the well-being at work, such as volume digital communication, expectations of constant connectivity, the quality of the messages, the adaptation of new tools, technical problems, and flexibility in communication (Bordi et al., 2018)

Furthermore, another research on communication through WhatsApp found changes in communication behaviour during the COVID-19 lockdown, with most chats experiencing increased message activity (Seufert, 2022). These findings suggest that while digital communication has enabled remote collaboration, it also poses challenges faced by individuals in the workplace that need to be addressed.

Digital literacy

Bawden (2001) pointed out that digital literacy is efficiently learning beyond utilising digital gadgets. It includes a variety of skills used in performing activities in digital contexts such as acquiring knowledge while browsing the internet, understanding user interfaces, generating, and sharing online content, conducting database searches, participating in digital gaming, and communicating through social networks (Hargittai, 2008).

According to the research done by Kayaduman et al. (2020), there was a significant positive correlation between students' digital literacy and distance education perceptions. This finding is supported by Jan (2018), who found the importance of students' proficiency in digital literacy. The findings indicated that respondents have a high level of digital literacy, enabling them to utilize basic ICT tools and applications for accessing, interpreting, and communicating. Thus, students who possess higher levels of digital literacy, use tablets and smartphones, have received computer training, and use computers often are likelier to have a positive attitude toward utilising ICT (Jan, 2018).

The study conducted by Alaba et al. (2009) found no significant connection between gender, ICT literacy level, and monthly income among respondents, but a significant relationship between gender, ICT literacy level, and subject discipline. It was suggested that technology concepts should be integrated into the curriculum to increase the female respondents' involvement in ICT. However, research conducted by Tomczyk (2019) found the different levels of digital literacy, with technical subject teachers scoring the highest and natural science teachers scoring the lowest. Furthermore, age was not a determinant to explain of

the ICT expertise. The research explained that beginner teachers or a young teachers had a low level of digital literacy and safety skills than older teachers.

In conclusion, digital literacy involved skills in internet research, content creation and online communication. Studies from several authors explain a positive link between students' digital literacy and their perception of distance learning and emphasising digital literacy in education. Thus, gender, income, and subject discipline are related to digital literacy levels. However, integrating technology concepts into the curriculum may enhance the ability to learn ICT and enable respondents to be literate in digital.

Digital safety

Due to the growing importance of digital technologies and the internet, particularly in the lives of the current generation, there has been a lively discussion on the benefits and challenges of using information and communication technology. Digital safety is a complex and nuanced idea that includes a wide range of concerns directly or indirectly related to the physical and mental health of digital media users who use digital media. It is not a clear-cut or precise definition; instead, it involves a wide range of worries and factors that all work to guarantee a safe and healthy experience in the digital world (Gasser et al. 2010).

Research conducted by Martin et al. (2021) on digital safety of school children found that parents are concerned about their children's digital safety including exposure to inappropriate content, online predators, cyberbullying, and excessive screen time. The research highlighted the crucial role of parental involvement in safeguarding digital safety among school children which involved implementing rules, utilizing parental control software, and encouraging open communication.

Online behaviour

As our lives become more intertwined with digital devices and services, it is crucial to understand how our online behaviour can affect our overall well-being. Hinds et al. (2021) noted that these devices and services connect us to each other, record our interactions, tasks, and movements, and impact how we interact online.

The term "online behaviour" refers to the actions we perform in the online environment (Kaye et al., 2022), such as posting content and engaging in conversations with others (Meier & Reinecke, 2020). This behaviour can be categorised into passive usage, which involves consuming content without engaging with it, and active usage, which can be one-way or two-way communication (Meier & Reinecke, 2020). Kaye et al. (2022) proposed the Online Behaviour Taxonomy (OBT) framework to better understand the complexities of online behaviour, which divides online behaviour into three types. The first type is online-exclusive behaviour, such as social media interactions, emailing, internet research, online purchases, and hacking. The second type is online-mediated behaviour, which refers to offline actions facilitated by internet-enabled platforms, such as video calls and live streams. Finally, online-recorded behaviour refers to actions that occur offline but are recorded and shared online, such as virtual assistants and Strava. By recognising individuals' online and offline behaviours, the OBT framework provides a comprehensive understanding of our digital lives (Kaye et al., 2022).

A study was conducted to examine the online behaviour of experienced users concerning their attitudes on security and privacy online. According to the research, it has been explained that most users are aware of the potential threats that exist and undertake some measures to safeguard themselves. However, some users still disregard these threats as it takes much

time and effort (Orehovački et al., 2008). Therefore, it can be concluded that individuals experienced in ICT exhibit a lack of awareness regarding threats that happen online or fail to change their behaviour accordingly (Orehovački et al., 2008).

It has been discussed by Goode et al. (2007) that generating loyal customers online is more complex and important than offline retailing due to the erosion of consumer loyalty. The research conducted by Goode (2007) extends the existing research on online behavioural intentions including the factors of online reputation, banner advertising, online security, reliability, appearance and site design, and website presentational consistency. Additionally, Ghadirian et.al (2014) pointed out that individuals can readapt and reconstruct knowledge by considering multiple perspectives and challenging their understanding. This aspect is vital for online behaviour as knowledge sharing is crucial. Furthermore, Zafar et al. (2014) discussed research related to the behaviour of users in discussion forums and found that users were more engaging in non-imposed forums compared to imposed discussions forum. This is because users have more freedom to express their thoughts and engage in meaningful discussions.

According to a study conducted by Ozan and Ozarslan (2016), users who watched online video lectures scored higher on their final exams than those who did not. The study also discovered that the characteristics of the lecturers were the main factor in influencing the learners to watch the video in full screen mode, especially when the lecturer is a female. Additionally, it was found that the watching patterns and percentage rate of completely watching the video higher in shorter videos. These findings suggest that the lecturer's characteristics and the video length should be considered when using online video to maximize the learning outcome.

Previous studies related on online behaviour found that users with intellectual disabilities tend to engage in various online activities such as socialising with friends, watching videos, listening to music, playing online games, participating in social networks, and consulting websites (Gómez-Puerta & Chiner, 2019). Unfortunately, educators may not be fully aware of the problematic online behaviours experienced by these users. It is concerning that the highest percentage of users, 77.5%, engage in illegal access to online accounts. Other concerning behaviours include sending or receiving inappropriate material related to drugs, violent content, fraud or scams, and harassment with a clear sexual intention. Furthermore, users face other factors that pose problems online (Gómez-Puerta & Chiner, 2019). Interestingly, Starcevic et al. (2023) found that the most common problematic online behaviour was problematic online shopping, followed by problematic online gambling, problematic use of social networking sites, problematic cybersex, problematic online gaming, and cyberchondria. It is important to note that these behaviours can have grave consequences and negatively impact the lives of learners with intellectual disabilities (Starcevic et al., 2023). Therefore, educators must be aware of these behaviours to ensure the safety and well-being of all learners.

Methodology

The methodology used in this research includes questionnaire design and data collection procedure. The respondents were students from a public university in Terengganu who engaged in internet usage and online activities, ranging from pre-diploma to postgraduate programs. The questionnaires were distributed using Google Forms to ensure wider reach. The questionnaires consisted of five sections, with the first section collecting demographic data, the second, third and fourth sections comprising questions related to the digital

intelligent quotient (digital communication, digital literacy, digital safety) and in the last section the respondents' online behaviour.

The questionnaires of the item in digital intelligent quotient used in this study were adapted from previous research studies by Na-Nan et al. (2020) while the questionnaires for online behaviour were adapted from Ybarra ML et al. (2007) and Ozan & Ozarslan (2016). The questions for digital intelligence quotient and online behaviour measures use a seven-point Likert Scale ranging from one, strongly disagree to seven, strongly agree. The collected data were then analysed using PLS 3.99 for convergent and discriminant validity tests. Of the 211 returned questionnaires, 184 respondents (87.20%) were used for analysis.

Discussion
Demographic Profile
Table 1:
Respondent's Demographic Profile

No	Demographic	Frequency	Percentage (%)
1.	**Gender**		
	Male	38	20.7
	Female	146	79.3
2.	**Age**		
	18 - 20	116	63
	21 – 23	58	31.5
	24 – 26	5	2.7
	30 and above	5	2.7
3	**Program**		
	Diploma	152	82.6
	Degree	27	14.7
	Master	4	2.2
	PhD	1	0.5
4	**Frequency engages online**		
	Less than once a week	2	1.1
	Once a week	2	1.1
	Two to three times a week	11	6.0
	Once a day	17	9.2
	Several time a day	152	82.6
5	**Time spent online**		
	Less than 1 hour	14	7.6
	2 – 3 hours	58	31.5
	4 – 5 hours	56	30.4
	More than 5 hours	56	30.4

The table summarises the respondents' demographic profiles in this study. The data explains demographic characteristics, program students currently enrolling in online engagement patterns, and time spent online. The data were analysed using the Statistical Package for Social Science (SPSS) Version 27. This study's total number of respondents is 184, 20.7% male and 79.3% female students. The respondents are categorised into four programs of the educational level they currently enroll in, ranging from diploma to PhD level. The highest percentage is the Diploma level students, recorded at 82.6%, followed by Degree level student, at 14.7%, Master students at 2.2% and 0.5% of PhD level students. The total of 184 students is categorised into four age groups ranging from 18 to 20 years old, recorded at 63%, 21 to 23 years old at 31.5%, 24 to 26 years old making up 2.7%, and 30 years and above, recorded at 2.7%. Based on the result, most students are engaged online for several times a day, making up for 82.6%, followed by 9.2% engaging themselves online once a day, 9.2% online for 2 to 3 times a week and only 1.1% less than once a week. Most of the students also spent more than 5 hours per day, representing 30.4%, followed by 30.4% who spent their time for 4 to 5 hours per day online, 31.5% spent for 2 to 3 hours per day online, and 7.6% have spent less than an hour per day online.

Model Testing

The research aims to identify the relationship between digital communication, digital literacy and digital safety and their impact on online behaviour of students in a public university in Terengganu. The model was assessed using the PLS-SEM approach version 3.99. The measurement of the model was conducted to identify the relationship between the constructs and the indicators to ensure the reliability and validity of the path model. Using this approach, the study aimed to provide an understanding of the factors that influencing online behaviour among students and their relationship with digital communication, digital literacy, and digital safety.
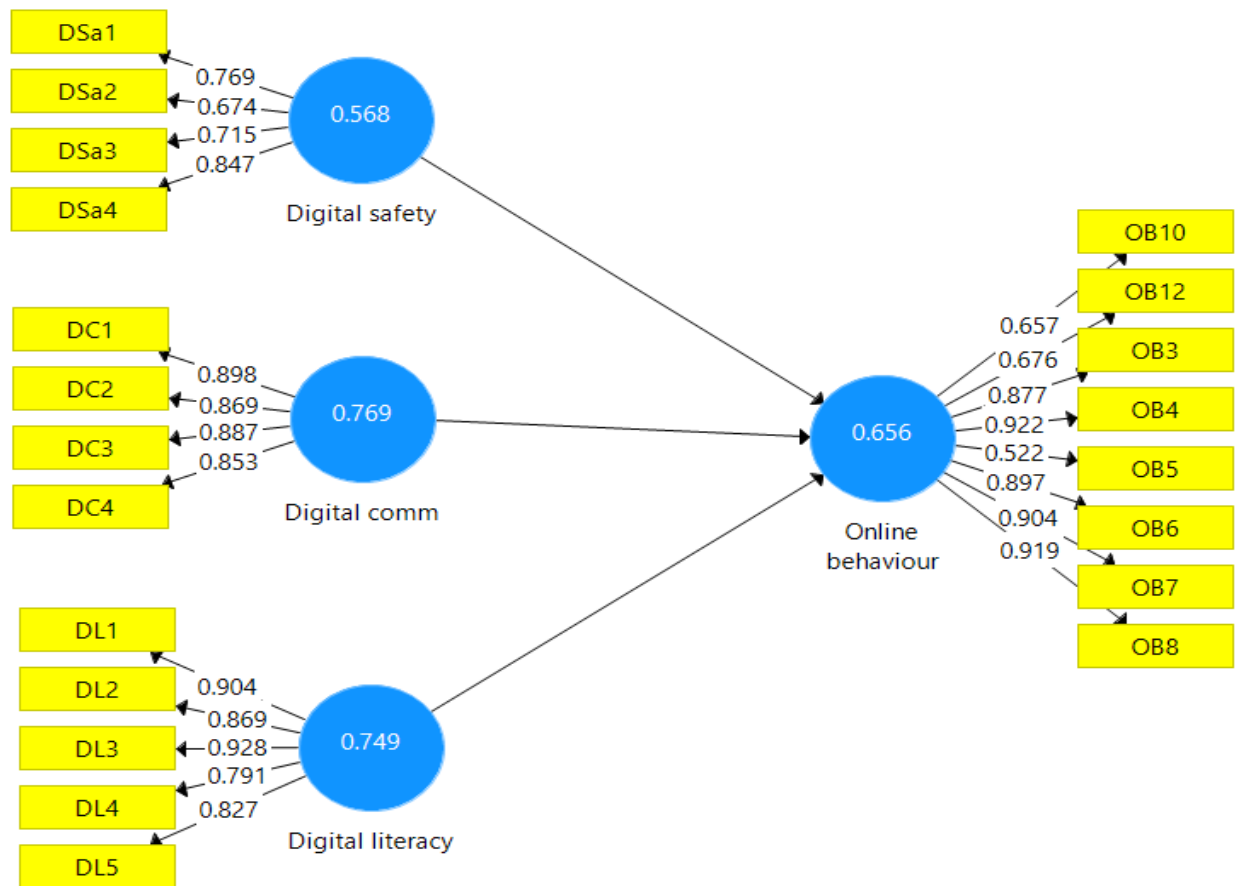
Figure 1: AVE

Table 2:
Convergent Validity

CONVERGENT VALIDITY				
Constructs	**Items**	**Loadings**	**CR**	**AVE**
Digital Safety	DSa1	0.769	0.759	0.568
	DSa2	0.674		
	DSa3	0.715		
	DSa4	0.847		
Digital Comm	DC1	0.898	0.900	0.769
	DC2	0.869		
	DC3	0.887		
	DC4	0.853		
Digital literacy	DL1	0.904	0.917	0.749
	DL2	0.869		
	DL3	0.928		
	DL4	0.791		
	DL5	0.827		
Online Behaviour	OB10	0.657	0.920	0.656
	OB12	0.676		
	OB3	0.877		

OB4	0.922
OB5	0.522
OB6	0.897
OB7	0.904
OB8	0.919

OB1, OB2, OB5, OB9, OB11, OB13, OB14, OB15, OB16, OB17, OB18, OB19 and OB20 in Online Behaviour were deleted due to low loadings.

Construct validity for each latent variable in the model was first verified through convergent validity test. The measurement model used in this study comprise of four latent constructs: Digital Safety, Digital Communication, Digital Literacy and Online Behaviour. Table 2 presents the output assessment of reliability and validity in the study's data. The composite reliability (CR) values of more than 0.70 indicates that these constructs possess an adequate level of internal consistency (Gefen et al. 2000). Additionally, the average variance extracted (AVE) values above the minimum threshold value of 0.5 demonstrate good convergent validity (Bagozzi and Yi 1988). It shows that the items in each construct explain more than 50% of the construct's variances (Hair et al. 2014). As a rule, item loading higher than 0.5 for indicator reliability is considered necessary (Kim, 2010). However, items with a loading between 0.4 and 0.5 can be considered for removal if they reduce the CR and AVE beyond their respective thresholds (Kim, 2010), and any item loadings that are less than 0.4 it can be considered for removal. In this study 13 items: *OB1, OB2, OB5, OB9, OB11, OB13, OB14, OB15, OB16, OB17, OB18, OB19 and OB20* in Online Behaviour were dropped due to low loadings from their respective constructs to achieve the acceptable level of convergent validity. Removing these items was meant to raise their corresponding construct's AVE values above the 0.5 threshold. Nonetheless, there were no issues pertaining to each construct's CR before removing these 13 items. The convergent validity is now verified, and the analysis can now assess the discriminant validity of the data.

Analysis factor of digital intelligence.
Table 3:
Discriminant Validity (HTMT)

Constructs	1	2	3	4
Digital comm				
Digital literacy	0.841			
Digital safety	0.573	0.564		
Online behaviour	0.386	0.421	0.559	

As shown in Table 3, the discriminant validity of all latent variables in the model was determined using the heterotrait-monotrait (HTMT) ratio of correlations criterion (Henseler et al. 2015). Since the correlation values corresponding to the respective constructs did not exceed HTMT 0.90 criterion's threshold (Henseler et al., 2015), it is safe to say that discriminant validity is established in the measurement model.

Hypothesis testing

A bootstrapping procedure is applied to test the hypothesis to generate results for each path relationship, as shown in the table below. A bootstrap sub-sample with 1000 cases was computed to allow the procedure to estimate the model for each subsample (Hair et al. 2014). The study develop three hypotheses as follows.

H1: Digital communication has a relationship with online behaviour.
H2: Digital literacy has a relationship with online behaviour.
H3: Digital safety has a relationship with online behaviour.

Table 3:
Hypothesis testing

Hypothesis	Relationship	Beta	Standard Deviation (STDEV)	T-Value	P-Values	Decision
H1	Digital comm -> Online behaviour	0.900	0.019	48.293	0.000	Supported
H2	Digital literacy -> Online behaviour	0.917	0.018	50.937	0.000	Supported
H3	Digital safety -> Online behaviour	0.759	0.039	19.638	0.000	Supported

Table 3 show the path relationship in the model. Based on the result, the three path relationships are found to be significant at 0.05 significant level at a 95% confidence level (Digital comm -> Online behaviour, $\beta=0.900$, $p \leq 0.05$; Digital literacy -> Online behaviour, $\beta=0.917$, $p \leq 0.05$: Digital safety -> Online behaviour $\beta=0.759$, $p \leq 0.05$). Beta value for H1 (0.900) and H2 (0.917) indicate that there are strong relationships between digital communication and online behaviour, and strong relationship between digital literacy and online behaviour, while for H3 (0.759) explains that there is positive relationship but slightly lower than H1 and H2. In short, as the P value is 0.000 for all three hypotheses, it is concluded that the relationship is significant. The statistical relationship also determines by the t-values. H1 has a t-value of 48.293 and H2 has 50.937 t-values indicating high significant relationship between digital communication and online behaviour and digital literacy with online behaviour. As for H3, the t-value score 19.638, which is slightly lower but still there is significant relationship between digital safety and online behaviour. In conclusion, the three hypotheses in this study are supported.

Conclusion and Future Research
This research paper investigated the relationship between digital literacy, digital safety, and digital communication on online behaviour among students. The analysis of this study presented a significant relationship between the digital communication, digital literacy, and digital safety on online behaviour. Therefore, the hypotheses were supported. In conclusion, it is evidence from the findings that digital communication, digital literacy, and digital safety have a significant and positive impact on online behaviour. This indicate that users with digital communication skills, digital literacy, and have competency in digital safety are more likely to exhibit certain online behaviours. Besides, it also have important implication towards understanding the potentially influence online behaviours in various context. The study also

found that users who possess knowledge of the online environment are more literate with technology and aware of the potential cyber-attack threats that may harm their safety and involvement in online activities. In Addition, the findings also revealed the importance of digital communication and personal responsibility in shaping online behaviour. However, educating users on online safety is crucial to securing their activity, especially against potential cyber threats.

This finding is consistent with the research conducted by Boehmer et al. (2015), which found that personal responsibility positively related to safety behaviour which indicated that individuals are more likely engage in safe online behaviour. In this context of an online environment, personality responsibility is the obligation taken by individuals while they are online and take proactive measures to protect themselves. Furthermore, previous research has shown that users with a higher level of familiarity with the technical aspects of the internet are more likely to exhibit responsible privacy control behaviour while using the internet, as user knowledge plays a vital role in managing privacy online (Park, 2011). Other related studies have also found a positive correlation between digital literacy and self-regulation in online interaction, indicating that a positive attitude and skills on digital technology may help users manage online interactions effectively (Kayaduman, 2022). Thus, similar research conducted by Sullivan et. al (2020) found that digital communication positively affects relationship satisfaction and closeness.

The study has important implications and highlights the need for further research to identify the needs and impact of technology continues to play an increasingly significant role in our lives. The study has revealed several key findings, highlighting the importance of exploring additional variables to identify the needs and implications of technology use among other respondents. While the study has established a significant relationship between digital communication, digital literacy, and digital safety with online behaviour, future research could investigate deeper to explore the causality and direction of these relationships. Understanding which factors drive changes in online behaviour can be valuable for developing targeted interventions. Further investigation is required to develop interventions that improve digital literacy among diverse populations, including young and older people. Moreover, threats such as cyberbullying, identity theft, and privacy breaches were identified as areas requiring further investigation. Additionally, digital communication emerged as a crucial variable influencing the actions of internet users, as individuals increasingly rely on digital platforms to communicate, engage with social media, and acquire knowledge. Practitioners and policymakers should recognize online security as a critical factor and collaborate to implement comprehensive policies against theft and data breaches. In conclusion, further research is necessary to enhance our understanding of user behaviour in the online environment and create a more secure, well-informed, and accountable online community. This study also can be replicated in different contexts and with diverse populations to validate the findings. Replication studies can enhance the findings on the relationship and generalizability of the observed relationships between the variables.

Acknowledgement

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