

UNIVERSITY OF GHANA
COLLEGE OF HUMANITIES

**THEORISING MOBILE TECHNOLOGY ADDICTION:
EVIDENCE FROM A DEVELOPING COUNTRY CONTEXT**



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UNIVERSITY OF GHANA

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UNIVERSITY OF GHANA BUSINESS SCHOOL

**THEORISING MOBILE TECHNOLOGY ADDICTION:
EVIDENCE FROM A DEVELOPING COUNTRY CONTEXT**

BY

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**THIS THESIS IS SUBMITTED TO THE UNIVERSITY OF GHANA, LEGON IN
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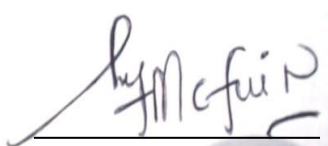
DEPARTMENT OF OPERATIONS AND

MANAGEMENT INFORMATION SYSTEMS

FEBRUARY 23, 2023

DECLARATION

I do hereby declare that this work is the result of my own research done under supervision and has not been presented by anyone for any academic award in this or any other university.



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ABSTRACT

Several unprecedented benefits of mobile technology have been realised globally. In developing countries, this seemingly ubiquitous technology has created socio-economic impacts, including post-economic recovery after the COVID-19 pandemic. Despite this promise, there are unintended consequences which tend to threaten the social behaviour of its mobile adopters or users and thereby have the potential of marring the sustainability of its benefits. Mobile technology addiction (MTA) is one of the unintended consequences of adopting and using this mobile technology that requires attention. Operationally, MTA is defined as a non-chemical (behavioural) addiction which involves human-technology interaction. The urgency of the attention is echoed in the 5th edition of the American Psychiatric Association (APA) Diagnostic and Statistical Manual of Mental Disorders.

However, attempts to address this urgency in literature face four main research gaps. The first gap is the lack of a multidisciplinary and stakeholders' understanding of MTA from a developing country context. The second gap is the lack of theorisation in research that recourse is drawn from a socio-technical perspective per the multifaceted nature of mobile technologies. Currently, no socio-technical theorisation exists in the literature. The third gap is the lack of theorising the moderating effects of Fear of Missing Out (FoMO) and self-regulation in one study since they are the two main moderators with opposing effects. The relationship between MTA and its outcome is either strengthened or weakened by these two moderators. The fourth gap is that developing countries are less represented in literature. The Global Mobile Economy data reports that 5.3 billion people subscribed to mobile services globally as of 2021. The future growth is estimated to be driven by younger people from developing countries in Asia and Sub-Saharan Africa (SSA). MTA is a threat to this potential growth and needs urgent attention. A study among young people in universities with a higher potential for meaningful use of mobile technology from a developing country context is needed.

This study consolidates the Technology Acceptance Model 3 (TAM3) and Unified Theory of Acceptance and Use of Technology 3 (UTAUT3), Flow Theory, and Stimulus Organism Response (S-O-R) Framework to address the gaps in the literature. The combination of these theories addresses the weaknesses in the existing literature that sought to theorise MTA (particularly smartphones and tablets) from either a social or technical perspective. Adoption theories (i.e., TAM3 and UTAUT3) present MTA's technological dimension. The flow theory describes how the interaction between users and mobile technologies leads to flow and triggers MTA. The S-O-R framework explains how a *stimulus* (user attributes and technology attributes) leads to the *organism* (social presence, flow and telepresence) and triggers a *response* (MTA and negative consequences). This study is conducted from a critical realism perspective using a mixed methodology. It uses a survey of 528 respondents for the quantitative and a multi-case study approach for the qualitative. Structure Equation Modelling (Smart Partial Least Square) is used for the quantitative and thematic content analyses for the qualitative. The above approaches and methods present a comprehensive view of MTA, enabling qualitative data and results to provide rich explanations for the quantitative findings.

The first objective is *to understand from multidisciplinary and stakeholders' perspectives the nature and causes of technology addiction in a developing country context*. The findings from Ghana suggest a multiplicity of perspectives by professional practice or experiential knowledge from health-related disciplines (i.e., psychiatry, psychology, nursing and medicine). They describe MTA as a mental health disease which involves users' over-dependence on mobile technology despite harmful consequences. Even among healthcare professionals, differences exist per their practice. Neuroscientists describe MTA as an altered brain condition where the brain can get into a state of uncontrollability toward external stimuli like mobile phones and their contents. Religious leaders in Ghana Pentecostal and Charismatic Council (GPCC) describe MTA as a sickness caused by strange spirits. Technology developers described MTA

as a technological disorder caused by ubiquitous, communicative, responsive, flexible, and attractive multimedia interfaces of mobiles, which enable users to engage in online social behaviours that lead to addiction. Finally, the definition deduced and agreed upon by all stakeholders for MTA is *a chronic brain condition where one feels preoccupied with an uncoerced compulsion to repeat or continue using mobile technology with severe negative consequences or outcomes*. The process of addiction is divided into four stages, experimental use, regular use, abusive use and addictive/dependence use (see Fig 8.6).

The second objective is to explain how the socio-technical interaction between users (university students) and mobile technology leads to mobile technology addiction. This study posits that users must be motivated by their *self-traits, hedonic and utilitarian values* to be socially connected to mobile technology, thus *social presence*. Mobile technologies must have *usability and interactivity* attributes to aid *telepresence*. The interaction between social presence and telepresence results in *flow*, which predicts MTA. This study explained the concept of flow as the result of users' interest, abilities, and skills to effectively use mobile technologies that have immersive capabilities to result in total immersion and absorption to the extent that the user may eventually lose control of time and immediate environment which result in addiction, for the detailed structures and mechanisms that trigger MTA (see Fig 9.1).

The third objective is to explore the moderating effects of *Fear of Missing Out (FoMO)* and *Self-Regulation*. This research found that FoMO intensifies the relationship between MTA and their outcomes, while self-regulation weakens the relationship between MTA and their outcomes. Therefore, if FoMO is intensified, the relationship between MTA and its impact on academic performance and/or well-being is increased negatively. However, if self-regulation is enhanced, the relationship between MTA and its impact on academic performance and well-

being is weakened. This study conceptualised FoMO and self-regulation as *IS Use Regulation* moderating construct in the final MTA Model (see Fig.9.2).

The fourth objective is to investigate and explain the effect of mobile technology addictions on university students' academic performance and well-being in a developing country context. This study found that MTA significantly predicted negative academic performance. The qualitative findings explain the negative effects of academic performance as school abandonment, playing truancy, phubbing, and learning table disruptions and on well-being as mental health disorders, relationship complications, emotional and psychological instability and impaired social behaviour.

This study contributes to research, theory, policy and practice. First, this research describes MTA and presents its nature and causes from a multidisciplinary and stakeholder perspective. It discovers the stages in the process of addiction and reveals the socio-technical structures and mechanisms that trigger MTA and its impact on outcomes. This research contributes to theory by extending flow theory from the original four (4) dimensions to five (5) dimensions. It hypothesised and empirically tested *presence* as the fifth dimension and found it to be significant (see Table 6.7). For contribution to the S-O-R framework, this study proposed new constructs for stimulus (user attributes and technology attributes), organism (flow) and response (MTA and negative consequences), which is a unique way of applying it in literature (see Fig 9.2). Finally, this study develops an MTA framework and model from a socio-technical perspective which could be equally used to study other forms of addictions. Per the findings, researchers, practitioners and policy-makers must start thinking about developing design principles and artefacts to regulate, block and mitigate MTA. This study proposes that MTA interventions should be regulatory, market-based and voluntary. The contributions have been published in two (2) book chapters and three (3) conference articles. The three journal articles are currently being worked on for publication in three leading information systems journals.

DEDICATION

This thesis is dedicated to my beloved wife, Immaculate and our children, Kekle, Keli and
Kafui



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LIST OF ABBREVIATIONS / ACRONYMS

NO.	ABBREVIATIONS	DEFINITIONS
1	ACM	Association for Computing Machinery
2	ADANCO	Advanced Analysis of Composites
3	AI	Artificial Intelligence
4	AIS	The Association for Information Systems
5	AIT	Association in Information Technology
6	AMCIS	The Americas Conference on Information Systems
7	APA	The American Psychiatric Association
8	AVE	Average Variance Extracted
9	BI	Behavioural Intention
10	CB-SEM	Covariance Based Structural Equation Modeling
11	CNN	Cable News Network
12	COVID	Coronavirus Disease
13	CR	Composite Reliability
14	DOI	Diffusion of Innovation Theory
15	DSM	Diagnostic and Statistical Manual of Mental Disorders
16	DSTV	Digital Satellite Television
17	DV	Dependable Variables
18	ECIS	European Conference on Information Systems
19	ERP	Enterprise Resource Planning
20	FC	Facilitating Conditions
21	FFM	Five-Factor Model
22	FIFA	International Federation of Association Football

23	FOMO	Fear of Missing Out
24	GA	Gambling Anonymous
25	GPA	Grade Point Average
26	GPCC	The Ghana Pentecostal and Charismatic Council
27	GSMA	The Groupe Speciale Mobile Association
28	GUI	Graphic User Interface
29	<i>HCI</i>	Human Computer Interaction
30	HICSS	Hawaii International Conference on System Sciences
31	HM	Hedonic Motivation
32	HTMT	Heterotrait-Monotrait
33	IAT	Internet Addiction Test
34	<i>ICIS</i>	International Conference on Information Systems
35	ICT	Information Communication Technology
36	ICT4D	Information and Communication Technology for Development
37	IDT	Innovation Diffusion Theory
38	<i>IEEE</i>	The Institute of Electrical and Electronics Engineers
39	IIPGH	The Institute of ICT Professionals, Ghana
40	IS	Information Systems
41	ISO	The International Organisation for Standardisation
42	IT	Information Technology
43	IV	Independence Variable
44	JSTOR	Journal Storage
45	LISREL	Linear Structural Relations

46	LV	Latent Variable
47	MIS	Management Information Systems
48	MISQ	Management Information Systems Quarterly
49	MMORPG	Massively Multiplayer Online Role-playing Games
50	MPAT	Mobile Phone Addiction Test
51	MPCU	Model of PC Utilisation
52	MSD	Media System Dependency
53	MTA	Mobile Technology Addiction
54	PACIS	The Pacific Asia Conference on Information Systems
55	PE	Performance Expectancy
56	PEOU	Perceived Ease of Use
57	PI	Personal Innovativeness
58	PIWC	Pentecost International Worship Centre
59	PLS-SEM	Partial Least Squares Structural Equation Modeling
60	PU	Perceived Utility
61	PV	Price Value
62	SCOT	Social Construction of Technology
63	SEM	Structural Equation Modelling
64	SIGHCI	Special Interest Group on Human- Computer. Interaction.
65	SMS	Short Message Service
66	SNS	Social Networking Site
67	SOR	Stimulus Organism Response
68	SPSS	Statistical Package for the Social Sciences

69	SRMR	Standardized Root Mean Squared Residual
70	SSA	Asia and Sub-Saharan Africa
71	SST	Social Shaping of Technology
72	TA	Technology Addiction
73	TAM	Technology Adoption Model
74	TAPM	Technology Addiction Process Model
75	TFC	Technology-Family Conflict
76	TPB	Theory of Planned Behaviour
77	TRA	Theory of Reasoned Action
78	TREO	Technology, Research, Education, and Opinion
79	UB	Use Behaviour
80	UHAS	The University of Health and Allied Sciences
81	UI	User Interface
82	UTAUT	Unified Theory of Acceptance and Use of Technology
83	VIF	The Variance Inflation Factor
84	ZMET	Zaltman Metaphor Elicitation Technique



CHAPTER ONE

INTRODUCTION

1.1 Research Background

There are unprecedented benefits of mobile technology across the globe. In developing countries, this ostensibly ubiquitous technology has produced socio-economic impacts, such as the post-economic recovery following the COVID-19 pandemic outbreak (Abdul, Khan, & Umar, 2022; James, Zhang, Li, Ziegelmayr, & Villacis-Calderon, 2022). Despite this promise, unintended consequences threaten the social behaviour of mobile adopters or users and thus can potentially mar the benefits of sustainability. Mobile technology addiction (MTA) is one of the unintended consequences of adopting and using this mobile technology that requires attention (Zhan, Wei, & Hong, 2021). Consequently, an aspect of information systems (IS) research is devoted to exploring the negative use of information technology (IT), known as “the dark side” of IT (Qahri-saremi, Turel, & Vaghefi, 2020). This research defines addiction as a chronic condition where one feels preoccupied with an uncoerced compulsion to repeat or continue the behaviour that has severe negative consequences or outcomes. Operationally, mobile technology addiction is defined as “non-chemical (behavioural) addiction which involves human-machine interaction” (Griffiths, 1995, p.15). This study theorises the structures, mechanisms, and processes that lead to MTA.

According to world prevalence statistics, more than 210 million people suffer from mobile technology-related addictions (i.e., mobile devices, the internet, and social media). However, only 8.2% of technology addicts are aware of their status (Zuckerman, 2020). This implies that about 92.8% of mobile technology addicts are unaware of their status. Two (2) systematic literature reviews on mobile technology-related addictions by Cheng and Li (2014) and Dahl and Bergmark (2020) put the global prevalence rate at 6.0% and within the range of 0.7% to

27.5%, respectively. Data from Africa was conspicuously missing, as no research paper from the continent met the criteria for the two systematic literature reviews. However, according to Statista, there were 476.28 million smartphone users on the continent of Africa as of 2021; this figure is predicted to increase to 662.87 million by 2025 (Degenhard, 2021). So, there is a need to explore MTA to understand the phenomenon from the perspective of Africa.

Mobile technology is defined as “handheld IT artefacts that encompass hardware (devices), software (interface and applications), and communication (network services)” (Jarvenpaa & Lang, 2005, p.8). They are portable or ubiquitous two-way communication devices that have installed applications and are connected by networking technologies. The software applications originally on PCs have been repackaged, developed, and installed on mobile devices due to their ubiquitous nature, enabling users to interact and share in real-time, irrespective of location (Lin & Lu, 2015). The impact of mobile technologies on developing economies has been extensively researched in literature (Boateng & Hinson, 2014; Donner, 2008; Duncombe & Boateng, 2009). The outbreak of COVID-19 has made mobile technology a central component of everyday life (Dwivedi et al., 2020; James et al., 2022). However, the excessive use of mobile devices and their applications may lead to psychological and behavioural maladaptive dependencies, resulting in adverse problems (Zhang, Chongyang, & Matthew, 2014). The addictive nature of technology use has resulted in negative and distressing consequences, which may sometimes require users to seek treatment. For example, a couple's three-month-old daughter died of starvation while her parents were busy raising a virtual child in an online video game (Salmon, 2010; Alexander Serenko, 2020, p.82).

The prevalence and surge of mobile technology addiction has generated significant concerns among various stakeholders (Barnes, Pressey, & Scornavacca, 2019; Joël Billieux, Maurage,

Lopez-Fernandez, Kuss, & Griffiths, 2015). Additionally, mobile technology addiction studies are mainly conducted by scholars in health-related disciplines such as *psychology* (Young, 2004; Griffiths, 2005; Griffiths & Nuyens, 2017), *psychiatric or mental health* (Dong & Potenza, 2016; Dong, Wang, Du, & Potenza, 2017); *social science* (Jamaluddin, Ahmad, Alias, & Simun, 2015) and *neuroscience* (Turton, Bruidegom, Cardi, Hirsch, & Treasure, 2016; Weinstein, Livny, & Weizman, 2017). While scholars from diverse backgrounds are exploring MTA from their disciplines, there is limited research to understand the phenomenon from multidisciplinary and multi-stakeholder dimensions (Turel, Serenko, & Giles, 2011; Vaghefi, Lapointe, & Boudreau-Pinsonneault, 2016). This research interrogates or engages multi-stakeholders from varied disciplines or backgrounds to know their diverse perspectives on MTA from a developing country.

Technology addiction related research includes online gaming addiction (Charlton & Danforth, 2007; Vinet & Zhedanov, 2010), internet addiction (Akin & İskender, 2011; Jia & Jia, 2009), smartphones or mobile phones addiction (Billieux, Maurage, Lopez-Fernandez, Kuss, & Griffiths, 2015; Zhang, Chen, Zhao, & Lee, 2014), mobile email addiction (Turel & Serenko, 2010), instant messaging addiction (Huang & Leung, 2009), social network sites (SNS) addiction, and excessive usage (Andreassen, 2015). This thesis focuses on addiction to mobile technology. Through the continuous use of mobile technology, users tend to create a constant digital presence and continuous touch (Balducci, Impedovo, Macchiarulo, & Pirlo, 2020; Ramírez-Correa, Rondán-Cataluña, Arenas-Gaitán, & Martín-Velicia, 2019). However, mobile devices must have applications installed on them to be addictive (Nyamadi, Boateng, & Asamenu, 2020).

From a social perspective, some theories and frameworks are developed to consider human motivations and outcomes, such as the Prime Theory of Motivation or Addiction Theory and Components Model of Addiction (Griffiths, 2005; West, 2006). These theories do not consider technologies, IT artefacts, or feature-level technology utilisation. In Information Systems, theories or models used in technology addiction research focus on antecedents (causes) or consequences (outcomes). A typical example is the first technology addiction (TA) model, which suggests that online auction addiction is caused by perceived ease of use, perceived usefulness (extrinsic), and perceived enjoyment (intrinsic) (Turel, Serenko, & Giles, 2011). Consequently, scholars must explore both the antecedents and consequences (Tarafdar, Gupta, & Turel, 2013).

The socio-technical interaction between human motivation systems (social) and mobile technology attributes (technical) are the antecedents of MTA in this study. The technical view considers mobile technology attributes (King, Delfabbro, & Griffiths, 2010; Lai, 2016). In terms of virtual realities and mobile technology, these attributes are researched based on *interactivity* and *usability* (Zollet, 2014). Users have internal traits that may influence their technology adoption to addiction. The internal traits of users identified in the literature for this study are; hedonic values, utilitarian values, and self-traits (Etemad-Sajadi & Ghachem, 2015; Khang, Woo, & Kim, 2012; Venkatesh, Thong, & Xu, 2012). There is a lack of literature regarding the socio-technical interaction between users and technologies and how this leads to mobile technology addiction.

The main theories that guide this research to develop a comprehensive framework and a causal model for MTA are; the Unified Theory of Acceptance and Use of Technology (UTAUT2) and Technology Adoption Model (TAM3), Flow Theory, and the Stimulus Organism Response

(S-O-R) framework (Brooks, Schneider, & Wang, 2016; Csikszentmihalyi, 1990, 1975; Davis, 1989; Engeser, 2014). While developing a causal model, there is a need to find variables that modify the strength of the relationship between the dependent and independent variables (Aguinis, 2004). Previous literature revealed self-regulation as a moderator that mitigates the negative effect of MTA on university students' academic performance and well-being (Cliffs & Hall, 1991; Osatuyi & Turel, 2020; Wang, Yang, & Zhang, 2020). Fear of Missing Out (FoMO) is also hypothesised and investigated as a moderator that enhances MTA's effect on students' academic performance and well-being (Karg & Polat, 2020; Of & Reviews, 2020; Out, Science, Communication, & Master, 2017).

Mobile technology addiction may lead to undesirable outcomes. These outcomes are primarily behavioural implications of these technologies (Griffiths, 1995a; Turel, Serenko, & Giles, 2011; Turel & Serenko, 2012). In addition, MTA may result in adverse and disruptive outcomes on the user's personal life, social life, family life, emotional functioning, work, academics, etc. (Block, 2008; Ferraro, Caci, D'Amico, & Di Blasi, 2007; Morahan-Martin & Schumacher, 2000; Young, 2007). This study will explain how MTA impacts the lives of students in terms of their academic performance and well-being.

1.2 Research Problem

This study identifies and tries to provide solutions to four main interconnected problems. First and foremost, there is a lack of understanding the nature and causes of MTA from the multidisciplinary and stakeholder perspectives by holistically providing evidence from a developing country (Chen & Nath, 2016; Greenfield, 1999; Morley, Lawrence, & Smith, 2016) holistically. MTA has significantly been researched in developed countries (Osatuyi & Turel, 2020; Qahri-saremi et al., 2020; Turel, Serenko, & Giles, 2011b; Wang et al., 2020).

Additionally, MTA research has been advanced mainly from health-related disciplines such as neuroscience, psychology, psychiatric or mental health, and social sciences (Dong et al., 2017; Griffiths & Nuyens, 2017; Jamaluddin et al., 2015; Turton et al., 2016). Relatively, literature on MTA is under-researched in IS discipline (Turel, Serenko, & Giles, 2011; Vaghefi, Lapointe, & Boudreau-Pinsonneault, 2016). The main problem is that every discipline understands MTA differently. Neuroscientists understand MTA as an altered brain condition and that the brain's reaction to behavioural addictions is similar to substance addiction (Spitzer, 2014; Weinstein et al., 2017; Wilson, Sayette, & Fiez, 2004). The American Psychiatric Association (APA) 5th edition describes MTA as a mental health condition (APA, 2013). First, MTA was listed as an online gaming disorder, prompting more investigation (APA, 2013). Clinical Psychologists also describe mobile technology addiction as a compulsive-impulsive disorder that has mainly been researched around the obsessive use of mobile devices, the internet and video games (Block, 2008; Young, 1998). In addition, a special issue in *Internet Research* suggested that exploring mobile technologies from adoption to addiction is a complex interdisciplinary issue with the imbrication of social, cultural, technological well-being and other salient dimensions (Seo, Dolan, & Buchanan-Oliver, 2019). Hence, there is a need to understand MTA from a multidisciplinary and a stakeholder perspective from a developing country context.

Second, the existing literature reveals the lack of theorisation in research that recourse is drawn from a socio-technical perspective per the multifaceted nature of mobile technologies (Clegg, 2000; Elhai, Levine, Dvorak, & Hall, 2016; Turel & Serenko, 2012). Theories, models, and frameworks used to study MTA focused on humans (social) and technologies (IT Artifacts). Therefore, there is a need to investigate MTA by delving into the socio-technical interaction between social networking sites' user attributes (social) and technology attributes of online

mobile games and smartphones (technical) and how this interaction leads to TA. Furthermore, theories advanced in other fields, such as psychology, neuroscience, and psychiatry, do not consider technology attributes that may influence users' adoption and eventual addiction (Turel, Serenko, & Bontis, 2008). Some standard attributes of technologies cause them to be addictive (Griffiths, 2005; King et al., 2010). Mobile users have psychological mechanisms to respond to cues generated by the devices, so they are unable to self-regulate, leading them to addictions (Kowert, Vogelgesang, Festl, & Quandt, 2015). Hence, this research examines the causal mechanism of socio-technical interactions between users and technologies from a critical realism perspective. Mobile technology features and users' self-traits are the main factors influencing mobile technology adoption, leading to MTA (Tan & Yang, 2014; Theotokis & Doukidis, 2009). The understanding is that previous literature focused on technologies (technical) or users' traits (social). Furthermore, the literature is limited to models and frameworks that examine MTA from antecedents to consequences. Scholars advocate for context-specific theorising, so it would be useful to develop a framework and a model for MTA by encompassing both the antecedents and consequences from a developing country context (Andoh-Baidoo, 2017; Alexander Serenko & Turel, 2021).

Third, two main constructs with opposing effects emerged in the literature as moderators. These are Fear of Missing Out (FoMO) and self-regulation. FoMO enables and intensifies MTA (Karg & Polat, 2020; Of & Reviews, 2020; Wegmann, Oberst, Stodt, & Brand, 2017). Self-regulation mitigates mobile TA (Mahapatra, 2019; Osatuyi & Turel, 2020; Wang et al., 2020). Previous literature suggests that future research on FoMO should explain the relationship between MTA and its effect on users (Baker, Krieger, & Leroy, 2016). Also, previous literature on self-regulation as corrective IS use behaviour is split into two streams; the first stream looks at IS discontinuance behaviour which may explain the happenings leading to MTA, while the

second stream focuses on effective mitigation of post harms effects associated with MTA (Maier, Laumer, Weinert, & Weitzel, 2015; Osatuyi & Turel, 2020). Previous studies failed to theorise FoMO and self-regulation as moderators with opposing effects in one study. This research develops a framework for MTA and uses FoMO and self-regulation as moderators to regulate the relationship between MTA and its impact on users.

Fourth, there is a lack of research that explores MTA's effect on users' academic performance and well-being from a developing country context (Azizi, Soroush, & Khatony, 2019; King, Delfabbro, Billieux, & Potenza, 2020). The Global Mobile Economy data reports that 5.3 billion people subscribed to mobile services globally as of 2021. The future growth is estimated to be driven by younger people from developing countries in Asia and Sub-Saharan Africa (SSA) (GSMA, 2022). Additionally, the numerous benefits of mobile technology have been expounded from developing country contexts (Ansong & Boateng, 2018; Boateng & Hinson, 2014; Shaw & Sergueeva, 2019). MTA threatens this potential growth or benefits and needs urgent attention. A study among young people in universities with a higher potential for meaningful use of mobile technology from a developing country context is needed. This study was conducted among university students in Ghana, a developing country in Sub-Saharan Africa.

Four main problems are identified in theorising mobile technology addiction from a socio-technical perspective by providing evidence from a developing country. First is the lack of a multidisciplinary and stakeholders' understanding of MTA from a developing country context (Chen & Nath, 2016; Greenfield, 1999; Morley, Lawrence, & Smith, 2016). Second is the lack of theorisation in research that recourse is drawn from a socio-technical perspective per the multifaceted nature of mobile technologies (Clegg, 2000; Elhai et al., 2016; Turel & Serenko,

2012). Theories, models, and frameworks used to study MTA focused either on users or technologies. Third, previous studies failed to theorise the moderating effects of Fear of Missing Out (FoMO) and self-regulation in one study since they are the two main moderators with opposing effects. Fourth, developing countries are less represented in literature; there is a need to investigate MTA from a developing country context.

1.3 Research Purpose

The purpose of this study is *to theorise mobile technology addiction from a socio-technical perspective and developing country context*. Currently, there is no theorisation of MTA in the literature that recourse is drawn from a socio-technical perspective. This study focuses mainly on addiction to mobile technology (only smartphones and tablets embedded with applications) because, according to Statista, there were 476.28 million smartphone and tablet users on the continent of Africa as of 2021; this figure is predicted to increase to 662.87 million by 2025 (Degenhard, 2021). Also, the future growth of new mobile subscriptions is estimated to be led by the Asia Pacific and Sub-Saharan Africa. MTA is a threat to this potential growth and needs urgent attention. A study among young people in universities with a higher potential for meaningful use of mobile technology from a developing country context is needed.

1.4 Research Objectives

The gaps identified in the research problem are used to formulate these research objectives:

- a. *To understand the nature and causes of mobile technology addiction from multidisciplinary and stakeholders' perspectives and developing country context.*
- b. *To explain how the socio-technical interaction between users (university students) and mobile technology leads to mobile technology addiction.*

- c. *To explore the Fear of Missing Out (FoMO) and Self-Regulation as moderating effects of the Mobile Technology Addiction (MTA) model.*
- d. *To investigate and explain the effect of mobile technology addictions on university students' academic performance and well-being from a developing country context.*

The first gap stipulates that MTA is a complex interdisciplinary issue and needs to be understood by consolidating the views of diverse stakeholders from multidisciplinary backgrounds (Seo et al., 2019). Previous literature revealed that MTA has predominantly been studied in developed countries (Osatuyi & Turel, 2020; Sigerson, Li, Cheung, & Cheng, 2017). To achieve the first objective, stakeholders from varied backgrounds, such as; Tech Addicts, Relatives of Addicts, a Lecturer and Mobile Application Developer, a Clinical Psychologist, a Neuroscientist, a Psychiatrist, a Professional Cyber Counselor, Students, a Leader of a Prayer Center and a Mental Health Nurse were all interviewed to understand MTA.

The second research objective was formulated based on the second research gap. This gap shows existing literature lacks the theorisation of MTA from a socio-technical perspective (Clegg, 2000; Elhai et al., 2016; Turel & Serenko, 2012). Theories, models, and frameworks used to study MTA focused on social (humans) or technologies (IT artefacts). The reviews of the technological, social, and socio-technical determinisms (see section 2.10). To answer the above objective, this study examines mobile technology to develop a model for MTA that describes how the socio-technical interactions between users' traits and technology features lead to the virtual presence (flow, social presence, and telepresence) and results in MTA.

The third objective shows that in developing a model that describes MTA from antecedents to consequences, there is the need to explore Fear of Missing Out (FoMO) and self-regulation as

moderators of MTA to regulate the influence of the relationship between MTA and its effects (Karg & Polat, 2020; Osatuyi & Turel, 2020; Surya & Aulina, 2020). Objective three was answered by formulating Fear of Missing Out (FoMO) as a moderator that explains the relationship between MTA and its effect on academic performance and well-being (Baker et al., 2016). In MTA literature, self-regulation as a corrective IS use behaviour is split into two streams (Maier et al., 2015; Osatuyi & Turel, 2020; Stein et al., 2015). Therefore, self-regulation is used as a moderator before and after MTA to explain the relationship between virtual presence constructs (i.e., flow, social presence, and telepresence) and MTA and between MTA and consequences.

The fourth research objective investigates and explains the impact of MTA on students' academic performance and well-being in a developing country context (Saidon, Musa, Harun, & Adam, 2016). Using one study to provide a comprehensive effect of MTA on university students' academic performance and well-being is also missing in the literature (Azizi et al., 2019; Mascia, Agus, & Penna, 2020). Additionally, some studies found that MTA negatively impacted users' personal life, social life, family life, emotional functioning, work, and academics in developed countries (Block, 2008; Ferraro, Caci, D'Amico, & Di Blasi, 2007; Morahan-Martin & Schumacher, 2000; Young, 2007). Others also found no significant relationship between MTA and students' academic performance (Dhir, Chen, & Nieminen, 2015; Usman, Alavi, & Shafeq, 2014). This study found that MTA negatively predicted academic performance. The effect of the MTA on well-being and academic performance has been explained in the main thesis.

1.5 Research Questions

The objectives guided the formulation of the research questions. The answers provided for these questions helped in realising the objectives. The research questions are as follows:

- a. *What are the multidisciplinary and stakeholders' perspectives of the nature and causes of mobile technology addiction from a developing country context?*
- b. *How does the socio-technical interaction between users (university students) and mobile technologies result in addictions?*
- c. *What are the moderating effects of Fear of Missing Out (FoMO) and self-regulation on the Mobile Technology Addiction (MTA) model?*
- d. *What is the effect of mobile technology addiction on university students' academic performance and well-being in a developing country context?*

1.6 Research Significance

This study contributes to research, theory, policy and practice. First, this research describes MTA and presents its nature and causes from a multidisciplinary and stakeholder perspective. It discovers the stages in the process of addiction and reveals the socio-technical structures and mechanisms that trigger MTA and its impact on outcomes. This study brings together stakeholders' wide-ranging perspectives and experiences from multidisciplinary disciplines to explain the nature and causes of MTA. Thus, this study provides data on MTA from the continent of Africa, which the two previous reviews and meta-analyses of MTA did not find to estimate the prevalence rate of the phenomenon on the continent (Cheng & Li, 2014; Dahl & Bergmark, 2020). Therefore, it is imperative to state that this doctoral dissertation in Information Systems has become one of the first to provide qualitative and quantitative data about MTA, which could be used in any future meta-analysis of the phenomenon from the continent of Africa.

Furthermore, this study is significant to research as it theorises MTA from a socio-technical perspective which is novel in IS research. It conceptualises and develops the MTA model based on adoption theories (TAM3 and UTAUT2) (Lai, 2017; Venkatesh et al., 2012), flow theory (Csikszentmihalyi, 1990; Nakamura & Csikszentmihalyi, 2009), and stimulus - organism - response (S-O-R) framework (Hebb, 1949; Mehrabian & Russell, 1974). The socio-technical principle is the most effective system and model development in information systems research (Clegg, 2000). As a response to the first MISQ seminar works on technology addiction by Turel, Serenko, and Giles (2011a), this study develops a model that vividly describes MTA from antecedents (causes) to consequences (effects).

This study conceptualised *usability* and *interactivity* as attributes of mobile technologies that enable addiction. The user attributes are; *self-traits*, *hedonic*, and *utilitarian values*. It further posited that *user attributes* and *technology attributes* lead to *virtual presence*, which is considered a multidimensional construct and theorised as the interaction of flow, social presence, and telepresence, eventually resulting in MTA. All these are significant contributions to theory and research. In addition, this study has produced new S-O-R framework constructs for *stimuli* (user traits, hedonic values, utilitarian values), *organisms* (social presence, flow and telepresence), and *response* (mobile technology addiction and outcomes). The theorisation of the moderating effects of self-regulation and Fear of Missing Out (FoMO) to explain the regulatory mechanism (mitigating and enabling effects) for the MTA model is also a unique contribution to research. Additionally, this study has produced a new construct known as *IS Use Regulation*. Also, it is important to note that this study finds and explains the impact of MTA on university students' academic performance and well-being in a developing country context (Clegg, 2000; Whetton & Georgiou, 2010). Finally, since the research is from the

critical realism paradigm, it is equally important to note that the powers and causal mechanisms underpinning the MTA model are well enumerated and explained.

In terms of policy, this study informs governments and state agencies about the impact of MTA on the academic performance and well-being of university students from a developing country context. This is significant to policy development and implementation to regulate mobile technology usage on campuses and mitigate MTA's negative effect on students and other users. Beyond the campuses, this study becomes the foundation on which the impact of MTA on work and productivity from a developing country context could be researched and regulated as in developed nations (Jing & Hock, 2012; Lee et al., 2017). For example, the Gaming Commission of Ghana must use this research to advance further research and regulate the online gaming industry. Ghana Education Service and University authorities are now aware of the menace of MTA. Hence, they can develop and implement policies to regulate online betting and gambling on campuses. This thesis can guide the development and implementation of policies that will educate the public against MTA and regulate the usage of mobile applications such as; Facebook, Snapchat, LinkedIn, Twitter, and Hi5 during working hours (Ernkvist & Strom, 2008; LaRose, Lin, & Eastin, 2003). Finally, manufacturers of mobile devices and mobile app developers can use the findings to develop and implement policies on digital well-being and parental controls.

Two workshops were organised for practitioners, i.e., Institute of ICT Professionals, Ghana (IIPGH) and Health Professionals into Addiction Management, for post-study evaluation of the model; the developers explained that hitherto to the workshop, they were not concerned about the socio-technical dimension of the processes leading to technology addictions, and were not aware of most of the outcomes and regulatory IS use measures put forward by this research. The finding should cause the IS community to start thinking about developing design principles

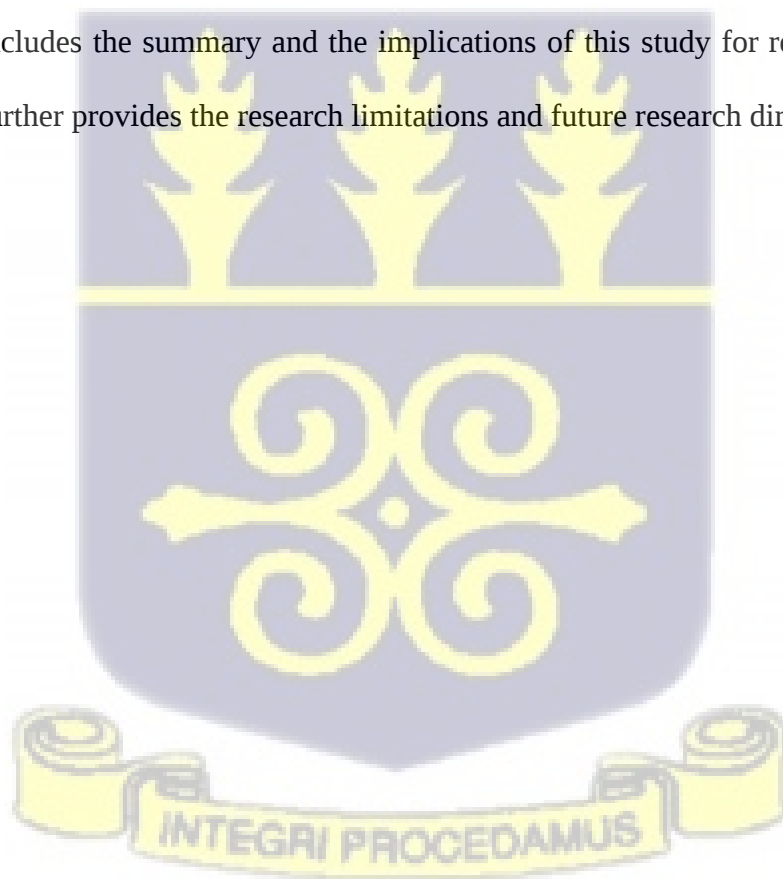
to block or mitigate MTA. The number of those affected when a user (gamer) is addicted is enormous, so preventing technology addiction is important, especially in developing countries (Király et al., 2020; Xu, Turel, & Yuan, 2012). Unfortunately, MTA is dominant among young people (Kuss & Griffiths, 2011). From the design perspective, Manufacturers and Mobile Application Developers are now aware of technology's addictive features (*usability and interactivity*) and how MTA occurs.

Furthermore, they are now aware of the IS use regulatory measures (*self-regulation and FoMO*), so they can use some of the measures provided by this research to update their digital well-being and parental control settings of these devices. Health Professionals will also use the findings to educate technology users on the regulatory mechanisms available. According to health practitioners, some findings fit into substance addiction treatments. This is the practical evidence of the literature, which suggests that most treatment methods for substance addiction are also suitable for technology addiction treatment (Du, Jiang, & Vance, 2010). Finally, this study is important to inform users of technology addiction and its negative consequences. This influences them to self-regulate or configure settings under digital well-being and parental controls and install mobile applications to help manage their time and presence on these technologies to prevent technology addiction. Parents are also exposed to the negative consequences of these technologies and so will use the findings to regulate their kids.

1.7 Chapter Synopsis

This thesis is made up of nine chapters. The first chapter provides the research background, research problem, research purpose, research objectives and questions, research significance, and chapter synopsis. The second chapter presents the literature review on MTA, focusing directly on smartphones, SNS addictions, and mobile applications addiction. The third chapter

provides the detailed theoretical foundations on theory overview and justifications of the choice of theories, assumptions, and constructs of selected theories, revisions to theories and their usage by other scholars, criticisms and critiques, measurable constructs and variables, gaps for future research and this thesis. The fourth chapter builds on the preceding chapters to present the research's theoretical and conceptual frameworks. It discusses the framework's constructs, prepositions, and their relationships. The fifth chapter examines the research methodology, paradigm, approaches and methods, sampling approach, data collection, and data analysis techniques. The sixth chapter presents the quantitative results and analysis, and chapter seven presents the qualitative results and analyses. Chapter eight discusses both the quantitative and qualitative results and analyses. Chapter nine draws conclusions and recommendations for the study, which includes the summary and the implications of this study for research, practice, and policy. It further provides the research limitations and future research directions.



CHAPTER TWO

A REVIEW OF LITERATURE

2.1 Chapter Overview

The main purpose of chapter two is to review the literature underpinning this study. This chapter reviews key concepts, definitions, components, methodologies, and theories underpinning technology addictions. It provides insights into where the literature has reached and gives a precise meaning to the need for a framework or model that describes and explains the socio-technical structures and mechanisms that result in MTA and its impact on university students' academic performance and well-being. Specifically, this chapter discusses addiction to technologies, technology addiction beyond platforms, different problematic behaviours, and mobile technology addiction.

A literature review is an aggregation of research work by “building on each other’s (research) results” (Iivari, Hirschheim, & Klein, 2004, p.314). Information Systems (IS) “is an interdisciplinary field straddling other disciplines; you often must look not only within the IS discipline when reviewing and developing theory but also outside the field” (Webster & Watson, 2002, p.16). Levy and Ellis warned that to propose a new theory, “researchers should ensure the validity of the study and the reliability of the results by using the quality literature to serve as the foundation for their research” (Levy & Ellis, 2006, p.183-184). The review for this study was based on Webster and Watson (2002), who suggested that for quality and effective literature review, the focus should be moved from a chronological or author-centric to a concept-centric approach. This study builds on the previous theories to develop a model for MTA. Although peer-reviewed or practitioner-oriented journals are the most acceptable for literature review, Weber and Watson put forward that in IS, scholars “should also examine the selected conference proceedings, especially those with a reputation for quality” (Weber &

Watson, 2002, p.16). Therefore, this thesis also considers very revered IS conference articles published by the Association for Information Systems (AIS).

2.2 Definitions / Overview / Conceptualisation of Addiction

The characteristics, keywords, concepts, behaviours, and platforms related to addiction and other related terms have been expounded to clarify meaning and situate them in this study. This built and positioned these critical concepts in a context that explained the work and provided the foundation for other chapters.

To find a concise definition of addiction, an article reviewed 52 addiction related studies and suggested that to define the concept of addiction reasonably, the following elements should be considered: “(a) engagement in the behaviour to achieve appetitive effects, (b) preoccupation with the behaviour, (c) temporary satiation, (d) loss of control, and (e) suffering negative consequences” (Sussman & Sussman, 2011, p.1). American Psychiatry Association (APA) also defined it as the continued making of maladaptive choices, even in the face of the explicitly stated desire to make a different choice (APA, 2013). Several other scholars from varied disciplines have tried to define addiction, but the literature suggests that “there is no unique definition globally accepted for technology addiction” (Nyamadi & Boateng, 2018, p.1). Addiction is researched in diverse habit-forming contexts, including cigarettes (Bickel, Odum, & Madden, 1999), alcohol (Baltagi & Griffin, 2002), cocaine (Grossman & Chaloupka, 1998), opium (Liu, Liu, Hammitt, & Chou, 1999, pp. 795–810), caffeine (Olekalns & Bardsley, 2016) and pathological gambling (Mobilia, 1993; Smith, Mattick, Jamadar, & Iredale, 2014). This research operationally looks at addiction as a chronic condition where one feels preoccupied with an uncoerced compulsion to repeat or continue the behaviour that has severe negative consequences or outcomes.

2.2.1 Definitions of Technology Addictions Characteristics / Components

The best way to determine whether mobile technologies are addictive or not is to compare these technologies against criteria already established in clinical research (Griffiths, 1995). Therefore, Griffiths compared technology addictions with common components of substance addictions, such as salience, euphoria, tolerance, withdrawal symptoms, conflict, and relapse (Griffiths, 1995). Lapointe and his friends proposed seven (7) core attributes of TA: preoccupation, saliency, tolerance, sense of withdrawal, relapse, mood modification or change, and conflict (Lapointe, Boudreau-Pinsonneault, & Vaghefi, 2013). Literature suggests that the magnitude of the six components or the seven core attributes may vary, but typically all six or seven must be present before a conclusion can be drawn that a user is experiencing some degree of technology addiction (Alexander Serenko, 2020). It is imperative to conclude that these attributes or components constitute MTA. The individual components, their definitions, and references are presented in Table 2.1 below:

Table 2. 1 Definition of the Characteristics and Components of MTA

Characteristics/ Components of MTA	Definitions	Studies
Preoccupation	Excessive levels of use, craving, or feeling tension or arousal while using it.	(Beard, 2005; LaRose, Lin, & Eastin, 2003; Young, 1999, 2004)
Saliency	The technology dominates a user's thoughts and behaviours.	(Griffiths, 1998; Griffiths & Dancaster, 1995; Mehroof & Griffiths, 2010; Turel, Serenko, & Giles, 2011b)
Tolerance	Increasing large 'doses' of	(Byun et al., 2009; Chou & Ting,

	the activity are needed to achieve the same effect.	2003; Ng & Wiemer-Hastings, 2005; Serenko, Turel, & Giles, 2009; Turel, Serenko, & Giles, 2011)
Sense of Withdrawal	Negative emotions arise if a person cannot use technology.	(Murali & George, 2007; O'Reilly, 1996; Shapira, Goldsmith, Keck, Khosla, & McElroy, 2000; Turel, Serenko, & Giles, 2011)
Relapse	A user is unable to reduce the use of the technology voluntarily.	(Beard, 2005; Chou & Ting, 2003; Serenko et al., 2009; Young, 1999)
Mood Modification or Change	Using technology offers thrills and relief.	(Ferraro et al., 2007; Greenfield, 1999; Lemmens, Valkenburg, & Peter, 2009; Mehroof & Griffiths, 2010; O'Reilly, 1996; Widyanto & Griffiths, 2006b; Young, 2004)
Conflict	The use of technology conflicts with other tasks, which impairs normal functioning.	(Lemmens et al., 2009; Serenko et al., 2009; Turel, Serenko, & Bontis, 2008)

Source: The components and characteristics of technology addiction Lapointe et al. (2013)

2.3 Conceptualisation of Technology Addictions

The umbrella term for uncontrollable and irrational use of information technology is referred to as “technology addictions” (TA) (Turel, Serenko, & Giles, 2011). A technology addict is someone who, due to dependence or abusive use of technologies, is experiencing preoccupation, saliency, tolerance, a sense of withdrawal, relapse, mood modification or change, and conflict (Lapointe et al., 2013). Over the years, academics have focused on a number of different types of technology addictions. Examples are internet addictions (Zuckerman, 2020), smartphones addictions (Duke & Montag, 2017; Jeong et al., 2016; Zhang,

Chongyang, et al., 2014), social network sites (SNSs) excessive usage (Andreassen, 2015), and virtual reality addiction (Gainsbury, King, Russell, Delfabbro, & Hing, 2017; Park et al., 2016).

The negative effects of using technologies have spawned the expression “technology addiction,” abbreviated TA, which is of significant concern for information systems scholars (Qahri-saremi et al., 2020; Sigerson et al., 2017). Several authors from varied disciplines tried to define TA. However, the literature suggests there is “no unique definition globally accepted for technology addiction” (Nyamadi & Boateng, 2018, p.1). From a psychological perspective, TA is “the compulsion to repeat a behaviour regardless of its consequences” (Liu & Chang, 2016, p.906).

Technological addictions have been studied around individual psychological well-being and are attributed to developing or exacerbating psychological problems in developed countries (Beard, 2005). This eventually results in social incompetence, extreme despair and distress (Shapira et al., 2003). This research examines the effect of technology addiction on users’ well-being from a developing country context. The unfettered access to and use of technologies prevents the users from having enough time and vigour to put up their best during work activities, which may result in termination of work, excessive financial debt, loss of social life, academic failure, and health complications (Beard, 2005; Nalwa & Anand, 2003; Young, 1999). Agogo and Hess (2018) categorised and analysed 190 technology addiction related articles out of 1542 articles from 14 Information Systems (IS) journals. They used the words “stress,” “anxiety,” and “phobia” in the search and had articles from 1963 to 2014 for their review. The three main conclusions from the review that informs this research are that (1) scholars need useful theories or models in researching technology addictions; (2) there is a need for more study to link affective responses to technology with behaviour and performance

results, both empirically and theoretically; and (3) there is the need to develop and measure relevant IS constructs to theorise the concept that guides technology addiction research. These conclusions guided this study to come out with useful constructs that assisted in developing a framework and a model that theorised mobile technology addiction.

The emergence of trends regarding the excessive, dependence, problematic, compulsive, and addictive use of technologies is getting scholars' attention from diverse disciplines. For example, the frequency of technology (internet) use has been linked to previous mental health treatments and suicidal intents in the literature (Widyanto & Griffiths, 2006). In addition, the problematic use of technology is a significant public health issue associated with poor mental health conditions (Elhai et al., 2016). Kuss and Griffiths, 2011 reviewed the psychology literature and discovered that personality traits such as extraversion and introversion were associated with increased SNS usage frequency, resulting in SNS addiction. However, their motivations vary to the extent that extroverts stay connected online socialising with their communities; introverts, conversely, use social media to make up for their lack of social interaction (Kuss & Griffiths, 2011, p.3544). In neuroscience, the brain's cue-induced activities, several commonalities, and reactions to technology addiction are similar to the brain's reaction to substance addiction (Spitzer, 2014; Weinstein et al., 2017; Wilson et al., 2004). While several disciplines are examining various aspects of technology addiction, this thesis in information systems attempts to understand the nature of technology addiction from a multidisciplinary and stakeholder viewpoint in the context of a developing country. It further uncovers the unintended consequences of technologies (Cheung, Lee & Lee, 2013, p. 8; Turel, Serenko & Giles, 2011).

Furthermore, theories developed in other disciplines either totally neglect or inadequately explain technologies' characteristics that are addictive (Williams & Jr, 2018, p. 1). This thesis describes the socio-technical interaction between users and technology attributes in a virtual environment, how the interaction results in technology addiction, and its negative consequences. This thesis seeks to develop a framework from antecedents to consequences which will become a bedrock for future research in TA.

2.3.1 The Conceptualisation of Mobile Technology Addiction beyond Platforms

Mobile technology provides a platform for other activities to be carried out. Some of these specific activities on mobile technology platforms are rather addictive and not the platforms (Joel Billieux, 2012; Gamito et al., 2016). Literature reveals a number of them, such as: “online auction addiction” (Turel, Serenko, & Giles, 2011), “online gaming addiction” (Xu, Turel, & Yuan, 2012), “understanding the development of problematic use of massively multiplayer online game” (Lee, Cheung, & Chan, 2015), online dating (Drouin, Miller, Wehle, & Hernandez, 2016; Odac & Kalkan, 2010), online pornography or cybersex (Tripodi et al., 2015), and virtual reality addiction (Gainsbury et al., 2017; Park et al., 2016). This research theorised MTA beyond mobile devices and applications by incorporating addictive activities such as online gaming, betting, gambling, and relationships.

2.3.2 Different Types of Technology Addiction Problematic Behaviours

The technology addiction literature has revealed seven (7) different terms used to describe problematic behaviours associated with high engagement or consumption of technologies. These are addictive (Alexander Serenko & Turel, 2015), excessive (Pornsakulvanich, 2017), compulsive (Bighiu, Manolică, & Roman, 2015), voluntary (Tsai, Compeau, & Meister, 2017), mandatory (Reinders, Frambach, & Kleijnen, 2015), dependency (Lin & Chiang, 2017), and

habitual (Vishwanath, 2015). The various terms are similar, but the literature distinguishes them. For example, dependent behaviour lies in the same physical and psychological attachment continuum as addictive behaviour (Hooper & Zhou, 2007). However, several researchers disagreed with this assertion. They believe the attached importance and social norm differ from addictive behaviour and motivate dependent behaviour (Becker & Murphy, 1988). Mandatory behaviour is also defined as a behaviour one must execute, follow, or comply with, usually because it is required by law or compelled by parents (Aoki & Downes, 2003). Mandatory behaviour is often driven or spurred by environmental repercussions in terms of incentives (Aoki & Downes, 2003). Voluntary action is a reasoned behaviour that is supposed to be driven by specific motivations, but voluntary behaviour is towards positive effects (Kang et al., 2007). This conduct is necessary for obtaining the desired information and social benefits, such as healthy interpersonal relationships and a sense of belongingness (Kang et al., 2007). Ampt and Gleave (2003) asserted that social and personal benefits are the primary motivators for voluntary behaviour. They found that humans exhibit voluntary behaviour when it is consistent with their lifestyle and core values. The inability to restrict or regulate an impulse is compulsive behaviour and an impulsive disorder (Faber, Guinn, Faber, & Guinn, 1992; Hanley & Wilhelm, 1992; O'Guinn & Faber, 1989).

While addictive behaviour tends to be a continuing or unending pattern, compulsive behaviour is frequently associated with relieving stress (Rook & Rook, 1987). Compulsive behaviour is often attached to attaining interpersonal and self-esteem goals; it reinforces compulsive behaviour when the first attempt is successful (Hanley & Wilhelm, 1992; O'Guinn & Faber, 1989). A habit regularly performed is often termed habitual behaviour (Biel, Dahlstrand, & Grankvist, 2005). Habits are everyday activities done almost automatically without difficulties (Albanese & Mitchell, 1993). Habituation is termed as an unconscious stimulus-specific and

habitual behaviour which is primarily motivated by attitudes and social norms (Lester, 2013). This study uses addiction because it is broadly accepted in IS literature. The term is associated with the highest level of negative use of technology platforms with severe negative consequences.

2.4 Conceptualising Mobile Technology Addiction

The various applications on personal computers are now developed and installed on smartphones as mobile applications (Lin & Lu, 2015). These mobile technologies assume new characteristics; they are easily- accessible, ubiquitous, and readily available to users (Choi, Kim, & Qu, 2015; Wang et al., 2016). Mobile applications are similar to general embedded computer applications with common issues such as integrating device hardware, security, performance, reliability, and storage limitations (Dalmasso, Datta, Bonnet, & Nikaein, 2013). Mobile technologies have some unique requirements, such as; (a) potential interaction with applications, (b) sensor handling, (c) native and hybrid (mobile web) applications, (d) families of hardware and software platforms, (e) security, and (f) testing complexity (Dalmasso et al., 2013). Literature suggests that users usually rely on mobile applications when on smartphones (Najjar & Ngoc Bui, 2012). The installation of mobile applications may require users to allow applications to access information stored on their phones, which may sometimes include private and confidential pieces of information (Najjar & Ngoc Bui, 2012). While there is limited research on mobile technology addiction in IS, this thesis examined mobile technology addiction among university students from a developing country context perspective (Kwon, So, Han, & Oh, 2014; Wei, Huang, & Zheng, 2018). This study focuses on examining MTA among university students in Ghana.

While some papers found that female participants are more addicted to mobile applications and mobile devices than male participants (Ding et al., 2016; Lin & Chiang, 2017), others showed that males are more addicted than females (Al-Barashdi, Bouazza, & Jabur, 2015). Several mobile technology operating systems identified in the literature include Apple iOS, Google Android, RIM Blackberry, Symbian, Windows Mobile, Windows 7 Phone, HP Palm webOS, MeeGo, and Samsung bada (Charland & Leroux, 2011). Mobile technologies are addictive because they are handheld devices that tend to provide a richer user interface (i.e., 2D, 3D, animations, and high multimedia technologies), support multiple platforms, have a streamlined back-end communication capability, support for app extensions, access to additional built-in features, and are open source (Dalmaso et al., 2013). Mobile technology addiction is broadly investigated in this research by reviewing internet addiction, smartphone addiction, mobile application addiction, Social Media Site Addiction and Technology Addiction.

2.5 Methodology for the Review

The terms “internet addiction,” “smartphone addiction,” “mobile applications addiction,” “Social Media Site Addiction,” and “technology addiction” were used to search journals from the databases such as; AIS Senior Basket, Elsevier, Wiley Online, Taylor and Francis, and JSTOR for this review. The second search was based on conference literature indexed in the AIS database. The approach of doing a review utilising an electronic database is appropriate because it is a typical occurrence in the information systems discipline (Hwang & Thorn, 1999; Petter & Mclean, 2009). The preliminary search based on title, keyword, abstract, and general content returned 1430 for internet addiction, 1572 for smartphone addiction, 980 for technology addiction, 1002 for Social Media Site Addiction, and 897 for mobile applications addiction. The total search of databases returned 5881 papers. Theses, technical reports, book chapters, and other items not published in a journal or presented at a conference were not

considered. The next phase looked at each article to see if it made any new contributions to the MTA literature, not just references. This study used one hundred and sixty-four (164) journal publications and one hundred and ten (110) top-ranked articles from the Association of Information Systems (AIS) conference that met the criteria. The AIS baskets' journals were individually searched at the journal level, while journal articles were searched at the database level, resulting in 274 articles being accepted and used in this study.

The AIS electronic library was searched for all Information Systems (IS) conferences to find the publications relating to MTA. Thirteen (13) conferences published articles on MTA. The researcher used the second phase to search each conference, which helped them accept 110 articles from the thirteen (13) conferences for this paper; this practice was consistent with other IS reviews (Duncombe & Boateng, 2009; Ngai & Wat, 2002; Yang & Tate, 2012).

The classifications were Global, Cross-Continents, Asia, North America, South America, Australia, and Africa. In this study, the following levels of analysis were considered: micro, macro, meso, and meta-levels. The 274 articles used for this review were guided by theories, models, and frameworks. Four (4) subthemes in the conference and journal papers were reviewed: pre-addiction, addiction, post-addiction, and pre/post addictions. The elements that influence or lead a person to become addicted to their mobile applications were examined in the pre-addiction subthemes, which accounted for 30.5 percent of all articles. The addiction subtheme papers, which accounted for 27.3 percent of journal and conference articles, focused on the prevalence, pervasiveness, and rivalry among various mobile app user groups. However, 21.9 percent of the papers were in the post-addiction category, which focused on the impact of addiction on addicts' livelihoods, treatment options, or quitting. The pre/post-addiction papers

investigated the factors contributing to MTA and the consequences; this group accounted for 20.3 percent of the papers (Chan, Cheung, Lee, & Neben, 2014; Li, Garland, & Howard, 2014).

2.6 Theories / Conceptual Frameworks Used to Address Research Questions

This literature review produced several theories used to describe the concept of MTA. These theories, their numbers identified in this literature review, and their respective percentages are in Table 2.2 below. The first two highest theories were technology acceptance and flow theory. Therefore, these two theories were accepted and used for this research. The Stimulus Organism Response Framework was used to structure and subdivide the final model of MTA into stimulus (cause and nature), organism (sociotechnical interactions), and response (technology addiction).

Table 2. 2 Literature Classification of Research Theories / Frameworks /Models

Research Theories / Frameworks / Model	Number(s)	Percentage(s)
No Theory	84	25.69%
Technology Acceptance Model (TAM)	28	8.56%
Flow Theory	21	6.42%
Uses and Gratification Theory	15	4.59%
Expectation confirmation theory	15	4.59%
Cognitive Behavioural Theory	12	3.67%
Theory of self-regulation	9	2.75%
Self-Control Theory	9	2.75%
Personality Theory	9	2.75%
Unified Theory of Acceptance & Use of Tech. (UTAUT)	6	1.83%
Social Cognitive Theory	6	1.83%
Media System Dependency (MSD) Theory	6	1.83%
Attachment Theory	5	1.53%
Diffusion Theory	4	1.22%
Sensitivity Theory	4	1.22%
Reinforcement Sensitivity Theory	4	1.22%
Theories of Reward and Self-Control	4	1.22%
Depletion Theory of Self-Control	3	0.92%
Social Exchange Theory	3	0.92%

Rational Addiction Theory	3	0.92%
Theory of Consumption Values	3	0.92%
Actor-Network Approach	3	0.92%
Unified Theory of Acceptance & Use of Tech. (UTAUT) 2	3	0.92%
Self-Control Framework	3	0.92%
Diffusion of Innovation Theory (DOI)	3	0.92%
Cognitive-Behavioural Model of Pathological Internet Use	3	0.92%
Cultural Dimension of Uncertainty Avoidance	3	0.92%
Theory of Cognitive Dissonance	3	0.92%
Five-Factor Model (FFM)	3	0.92%
Social Identity Theory	3	0.92%
Grounded Theory	3	0.92%
Transactional Model of Stress	3	0.92%
Learning theory	3	0.92%
Stimulus-Organism-Response Model	3	0.92%
Attribution-Theory	3	0.92%
“Technology-Family Conflict” (TFC)	3	0.92%
Zaltman Metaphor Elicitation Technique (ZMET)	3	0.92%
Four-Category Motivation Framework	3	0.92%
Cognitive Model of Addictive Behaviour	2	0.61%
Consumer Value Theory	2	0.61%
Player Motivation Model	2	0.61%
Theory of Conditioning	2	0.61%
General Strain Theory	2	0.61%
Self Determination Theory	2	0.61%
Extended Self-Theory	1	0.31%
Use Diffusion Model	1	0.31%
Hierarchical Model of Personality	1	0.31%
Psychodynamic Theory	1	0.31%
The Demand Control Model	1	0.31%
Activity Theory	1	0.31%
Resource-Based Theory	1	0.31%
Typological Theory	1	0.31%
Structuration Theory	1	0.31%
Dual Systems Theory	1	0.31%
Mass Communication Theory	1	0.31%
	327	100.00%

Source: Author’s Construct

2.7 Technological, Social and Socio-technical Determinisms

This study's second research question examines how socio-technical interactions between users and technologies lead to addiction. Therefore, there is a need to review how technology influences users and societies (technological determinism) and how users and societies influence technologies (social determinism). Furthermore, this section reviews the socio-technical perspective of how humans and technologies influence each other to produce an output.

2.7.1 Technological Determinism

In technological determinism or perspective, technology evolves alone and is the agency; it influences society but is not influenced by society (Heilbroner, 1994; Zuboff, 1988). Nevertheless, technologies continue to be developed out of social interactions, influencing the political, economic, and social world. The technical subsystem comprises the devices, tools, and techniques required to convert inputs into outputs to improve economic performance. It may also include organisational structure and processes. The theories identified in the literature to focus on technical or technologies as urgency are listed in Table 2.3 below:

Table 2. 3 Literature Classification of Deterministic Technological Theories

Technological Determinism	Theories / Models / Frameworks
Technical Theories	Technology Acceptance Model
	Media System Dependency Theory
	Unified Theory of Acceptance & Use of Technology (UTAUT)
	The Diffusion of Innovation Theory (DOI)
	Zaltman Metaphor Elicitation Technique (ZMET)

Source: Author's Construct

2.7.2 Social Determinism

In social/human determinism or perspective, agency is associated with humans, and there are two forms of perspectives in social determinism. These are; “Social Construction of Technology (SCOT) and Social Shaping of Technology” (SST) (Bijker, 1987). SCOT researchers asserted that technology does not determine human activities; rather, technology is socially constructed by humans (Bijker, 1987). SST researchers have a lot in common with SCOT researchers. However, they do not believe that technology structure is separate from human activities during use (Orlikowski, 2000). In social determinism, humans are considered as the agency.

The social system comprises employees (at all levels), the information, skills, attitudes, beliefs, and needs they bring to work, as well as the organisation’s compensation system and power structures (Evans & Davis, 2005; Talja, 2005). Later, some authorities broadened the definitions to include the organisation’s broader reach, such as customers, suppliers, and the official and informal laws and regulations that regulate the organisation’s relationships with society as the environmental subsystem (Cho & Yi, 2022; Khaykin & Toeckina, 2021; Yang, Liu, & Wei, 2016). The achievement of a design approach aimed at the joint optimisation of subsystems is that any organisational structure can only optimise performance if the interdependence of these subsystems is acknowledged explicitly. As a result, each design or redesign must consider how each subsystem affects the others. The design’s goal should be to achieve superior results by ensuring all subsystems are in sync. The social theories identified in the TA literature reviewed are listed below:

Table 2. 4 Literature Classification of Deterministic Social Theories in MTA

Sociological Determinism	Research Theories / Frameworks / Model
SCOT	Flow Theory

Expectation confirmation theory
Cognitive Behavioural Theory
Cognitive-Behavioural Model of Pathological Internet Use
Theory of self-regulation
Self-Control Theory
Personality Theory
Social Cognitive Theory
Attachment Theory
Sensitivity Theory
Reinforcement Sensitivity Theory
Stimulus-organism-response model
Theories of Reward and Self-Control
Depletion Theory of Self-Control
Social Exchange Theory
Rational Addiction Theory
Theory of Consumption Values
Actor-Network Approach
Self-Control Framework
Diffusion of Innovation Theory (DOI)
Cultural Dimension of Uncertainty Avoidance
Uses and gratification Theory
Theory of Cognitive Dissonance
Five-Factor Model (FFM)
Social Identity Theory
Grounded Theory
Transactional Model of Stress
Learning theory
Attribution-Theory
Four-Category Motivation Framework
Cognitive Model of Addictive Behaviour
Consumer Value Theory
Player Motivation Model
Diffusion Theory
Theory of Conditioning
General Strain Theory
Self Determination Theory
Extended Self-Theory
Hierarchical Model of Personality
Psychodynamic Theory
The Demand Control Model
Resource-Based Theory

	Typological Theory
	Structuration Theory
	Dual Systems Theory
	Mass Communication Theory
	Zaltman Metaphor Elicitation Technique (ZMET)

Source: Author's Construct

2.7.3 Socio-technical Determinism

Some system developers ignore IT projects' human and organisational aspects (Whetton & Georgiou, 2010). Systems development projects have traditionally been considered technical rather than socio-technical change activities; most IT investments are technology-driven, showing an overly technical focus (Clegg, 2000). The adoption of techno-centric development approaches can be a skewed strategy. It encourages developers to focus on delivering and implementing the information system first and only then, if at all, on customising it to the organisation's needs. (Benlian, Poulymenakou, & Holmes, 1996). This thesis acknowledges the need to incorporate human and organisational issues in information systems development (Hornby, Clegg, & Robson, 1992).

This study is from a socio-technical perspective and has an underpinning consideration that humans can influence technologies and vice versa. The interaction between humans and technologies leads to socio-technical determinism. This study considered *technical* determinism to come from the attributes of technologies that lead to telepresence and *social* to be the attributes of users that lead to social presence. Therefore, the socio-technical interaction between telepresence and social presence leads to flow and addiction. The main theory identified in the literature that studied TA from a socio-technical perspective is technology-family conflict (TFC) (Turel et al., 2008; Turel, Serenko, & Bontis, 2011). This theory was

used to distinguish work-related conflicts from technology-related conflicts in families and thus may not be used for this study.

2.8 Gaps to be Addressed by this Doctoral Research

The first gap in the literature is that research has largely focused on the negative consequences of mobile technology addiction from diverse disciplines in developed countries. The various scholars conceptualise the nature and causes of addiction to these technologies differently based on their respective disciplines. Therefore, this research will focus on understanding the nature and causes of mobile technology addiction from a multidisciplinary and stakeholder viewpoint in a developing country context. It will also uncover the unintended consequences of mobile technologies (Cheung, Lee & Lee, 2013, p. 8; Turel, Serenko & Giles, 2011). Experts from various backgrounds, including legislators, regulators, technology developers, academics, mobile technology addicts, and users, will be interviewed to discover the nature and causes of mobile technology addictions from a developing country context.

The second gap discovered in the literature is the theory gap. This literature review reveals a high number of articles without theories. Also, this study's literature review fails to establish a framework or model that vividly describes and explains the MTA's cause-and-effect dimensions. Theories and models found in the literature for researching MTA are primarily from health-related disciplines. Therefore, they do not consider technology attributes, which will inform IS practitioners and scholars about using IS design principles to mitigate MTA. Theories identified and listed in the literature review focus on MTA's social or technical aspects (see Table 2.3 and Table 2.4). Therefore, to address the theory gap, this thesis will develop a useful framework and model that describes and explains the socio-technical structures and mechanisms that result in mobile technology addiction and its impact on university students'

academic performance and well-being. This framework will be moderated by self-regulation as a mitigation construct and the Fear of Missing Out (FoMO) as the enabling construct of MTA.

The next gap is the methodology gap. This literature review found that the MTA was examined mainly by using quantitative methods. All the other methodological approaches were less used. To explain further, 71.1% of the papers reviewed for this study used quantitative methodology, 16.4% used qualitative, 9.4% adopted the mixed method, and only 3.1% used design sciences (i.e., experiments and simulations). As a result, future research should focus on mixed methods, simulations, and design sciences. This thesis, therefore, adopted a mixed method to examine mobile technology addiction. The quantitative methodology will help the researcher to determine MTA's prevalence, causes, and consequences among students from developing countries. The qualitative methodology will help move beyond the empirical to provide additional insights and rich explanations of the quantitative data and the MTA phenomenon.

The fourth gap discovered in this literature was the level of analysis gap. The MTA levels were divided into Micro, Meso, Macro, and Meta categories. Micro-level came first with 71.77%, followed by the Meso level with 18.55%, and then Macro and Meta came up with 4.84%, respectively. Four (4) papers could not be classified into any levels, so they were not analysed in the level of analysis section. This research focuses on mobile technology addiction at the institutional level. Thus, this study samples students' views from three different universities in Ghana to represent the general opinions of university students in Ghana. It will guide government policy development and implementation to mitigate or prevent technology addictions.

The fifth gap is the geographical gap. Asia topped the ranking in terms of context and geographical gaps with 30.5%. Then the global focus recorded 28.9%; articles in this category focused on looking at MTA's global dimension and data gathered over the internet (globally). North America accounted for 13.3% of the total. Europe recorded 11.7%. Some papers focused on or collected data from multiple continents; these articles were classified as Dual/Multi and recorded 9.4%. South America recorded 3.1%. Oceania recorded 2.4%, and Africa recorded the least percentage, 0.7%. This evaluation posed a major challenge for the IS community, particularly scholars of African descent, to explore MTA. Research has generally focused on developed countries; therefore, this research will present the MTA overall view from a developing country context.

2.9 Chapter Summary

This chapter reviewed the definitions and characteristics of the concepts for this study. This chapter captured these in subheadings as characteristics of addictions, conceptualising technology addiction and technology addiction beyond platforms, different types of technology addiction problematic behaviours, and conceptualising MTA. This chapter also reviewed the methodologies, theories, models, and conceptual frameworks used to address the research issues, gaps/questions for future research, gaps to be addressed by this doctoral research, and the chapter summary.

The literature search returned 5881 papers in total, using the inclusion and exclusion criteria; this research settled on a total of 274 papers, which were peer-reviewed journals and top-ranked AIS conference papers.

These gaps identified are as follows:

- 1) Issue Gap; the need to research MTA from a multidisciplinary and stakeholder perspective.

- 2) Theory Gap; the lack of theorisation of MTA from a socio-technical perspective taking cognisance of cause and effect and using appropriate moderators to regulate the negative consequences.
- 3) Methodology Gap; quantitative methods were mainly adopted over all other methodological approaches. Research is needed to adopt mixed-method and designed sciences to help go beyond the figures and provide further explanations and insights into the phenomenon.
- 4) Level of Analysis Gap; literature is mainly at the Micro level, followed by Meso, Macro, and Meta. Aside from the micro, further study at the macro and micro levels is required to inform policy and regulation.
- 5) Geographical gaps; MTA has a limited knowledge level from a developing country context.



CHAPTER THREE

THEORETICAL FOUNDATIONS AND RESEARCH FRAMEWORK

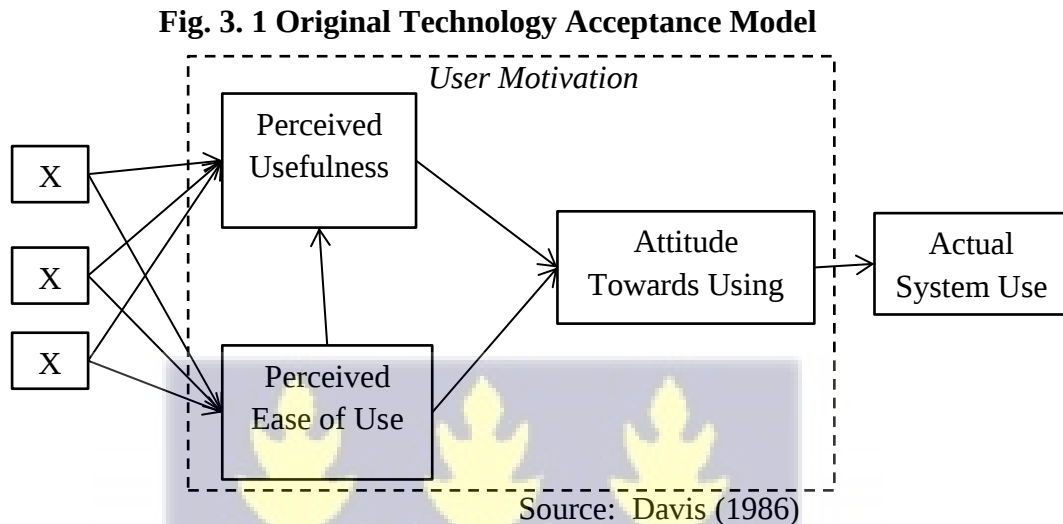
3.1 Chapter Overview

The theoretical underpinning for this study is established in this chapter. While chapter two reviewed the literature on MTA, identified some theories utilised by previous studies' research gaps and provided ways by which this doctoral research would address the gaps, this chapter focuses on foundational theories for this study. The TAM, UTAUT, and Flow Theory were the dominant theories identified in the literature review for studying MTA. The Stimulus-Organism-Response (S-O-R) Framework assisted in identifying and organising various constructs in the MTA framework. This chapter has four main sections; the first section is the overview, and the three other subsections are each dedicated to one of the theories.

3.2 Technology Acceptance Model (TAM)

The Technology Acceptance Model (TAM) is a widely-used theoretical framework that explains the factors influencing individuals' technology acceptance and use. The model was originally developed by Davis (1989), who identified two key factors determining users' intention to adopt technology: perceived usefulness and ease of use. Perceived usefulness refers to the degree to which a user believes technology will enhance their performance or productivity. On the other hand, perceived ease of use refers to the degree to which a user believes that technology is easy to use and understand. These factors have been found to significantly influence users' acceptance of technology (Davis, 1989). Subsequent research has extended the TAM to incorporate additional variables that may influence users' acceptance of technology. For example, Venkatesh and Davis (2000) proposed a model incorporating social influence and cognitive instrumental processes.

According to Davis (1986), the Technology Acceptance Model (TAM) *user motivation* explains and predicts how users respond to systems (systems response), systems capabilities, and features causing these responses and is based on perceived usefulness, perceived ease of use, and attitude towards using, as shown in the diagram below:

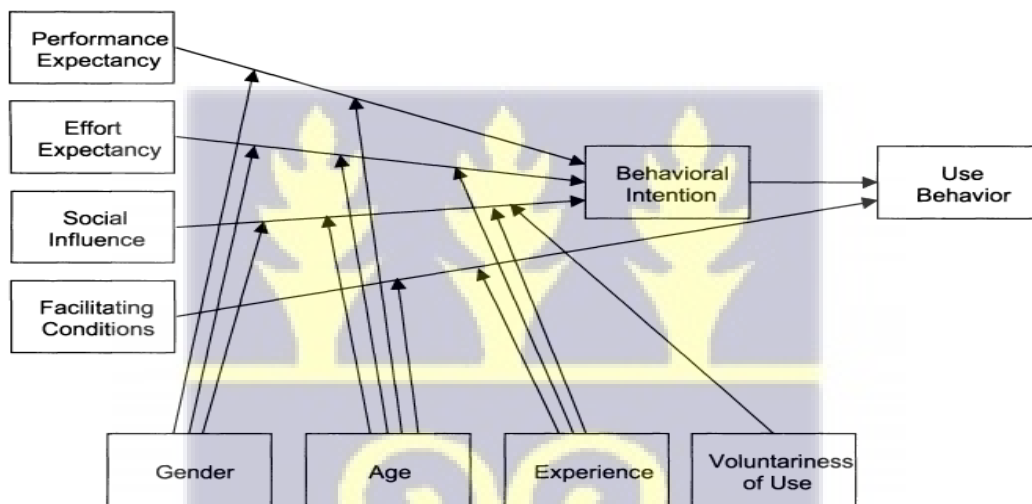


3.2.1 Overview of the Adoption Theories

Before TAM, the Theory of Reasoned Action (TRA) was proposed by Ajzen and Fishbein in 1975 and later updated in 1980 (Ajzen & Fishbein, 1975; 1980). TAM went through several modifications, such as the first modified version of the Technology Acceptance Model (TAM), Technology Acceptance Model (TAM) 2, and Technology Acceptance Model (TAM) 3. Each of the successive models was an enhancement resulting from the previous criticism. In 2003, the original UTAUT was introduced after a thorough review of eight (8) acceptance and use theories, such as the Theory of Reasoned Action (TRA), Motivational Model (MM), Technology Acceptance Model (TAM), Theory of Planned Behaviour (TPB), Model of PC Utilisation (MPCU) and Innovation Diffusion Theory (IDT). After almost a decade of testing the UTAUT theory, it was extended in 2012 to UTAUT 2 (Venkatesh et al., 2012). This extended model examined the acceptance and use of technology in a consumer context.

The comparison and testing of the eight (8) models or theories empirically resulted in seven (7) constructs being significant determinants of the intention or usage in either one or more individual models. Four constructs were theorised to play roles as direct determinants of user acceptance and usage behaviour significantly. These constructs are; performance expectancy, social influence, effort expectancy, and facilitating conditions, while attitude toward using technology, anxiety, and self-efficacy appeared not to be direct determinants of intention. Therefore, the model proposed for UTAUT is in the diagram below:

Fig. 3. 2 Unified Theory of Acceptance and Use of Technology (UTAUT) Model



Source: Venkatesh, Morris, Davis, and Davis (2003, p447)

The Unified Theory of Acceptance and Use of Technology (UTAUT) is a theoretical framework that explains the factors that influence users' acceptance and use of technology. The model was developed by Venkatesh et al. (2003) and incorporates four key constructs: performance expectancy, effort expectancy, social influence, and facilitating conditions. Performance expectancy refers to the degree to which a user believes technology will enhance their performance or productivity. Effort expectancy, similar to the TAM, refers to the degree to which a user believes that technology is easy to use and understand. Social influence refers

to the degree to which an individual's social network or community influences their technology use, and facilitating conditions refer to the degree to which an individual has access to the necessary resources and infrastructure to use the technology (Venkatesh et al., 2003).

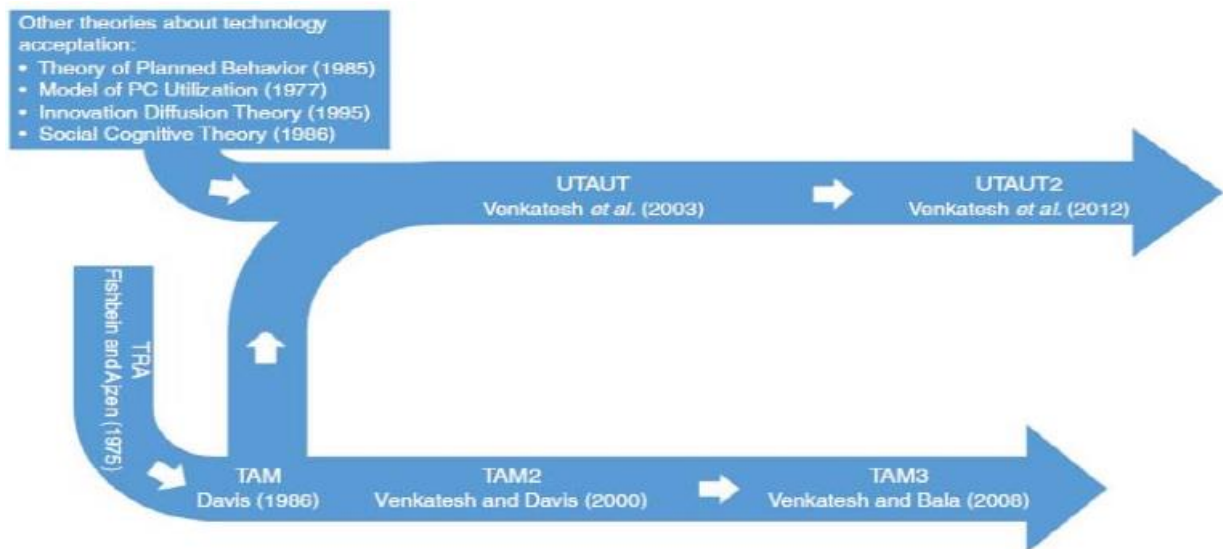
Since its development, the UTAUT has been tested and validated in numerous studies across various contexts and populations. For example, in a study of the adoption of mobile payment systems, Wu et al. (2018) found that performance expectancy, effort expectancy, and facilitating conditions significantly influenced users' intention to adopt the technology.

3.2.2 Comparison of TAM3 and UTAUT3 Models

Researchers have developed multiple models, theories, and frameworks to understand human behaviour under different conditions and contexts. Some theories, frameworks, and models tend to explain and predict users' acceptance and use of technologies and systems. When developing the original UTAUT, only TAM and TAM2 constructs were available. The rest of the constructs for TAM3 are computer self-efficacy, perceptions of external control, computer anxiety, and computer playfulness. This model was extended later, and three (3) new constructs were added (Gunasinghe, Hamid, Khatibi, & Azam, 2019; Lai, 2017). The technology adoption models discussed above are in the diagram below:



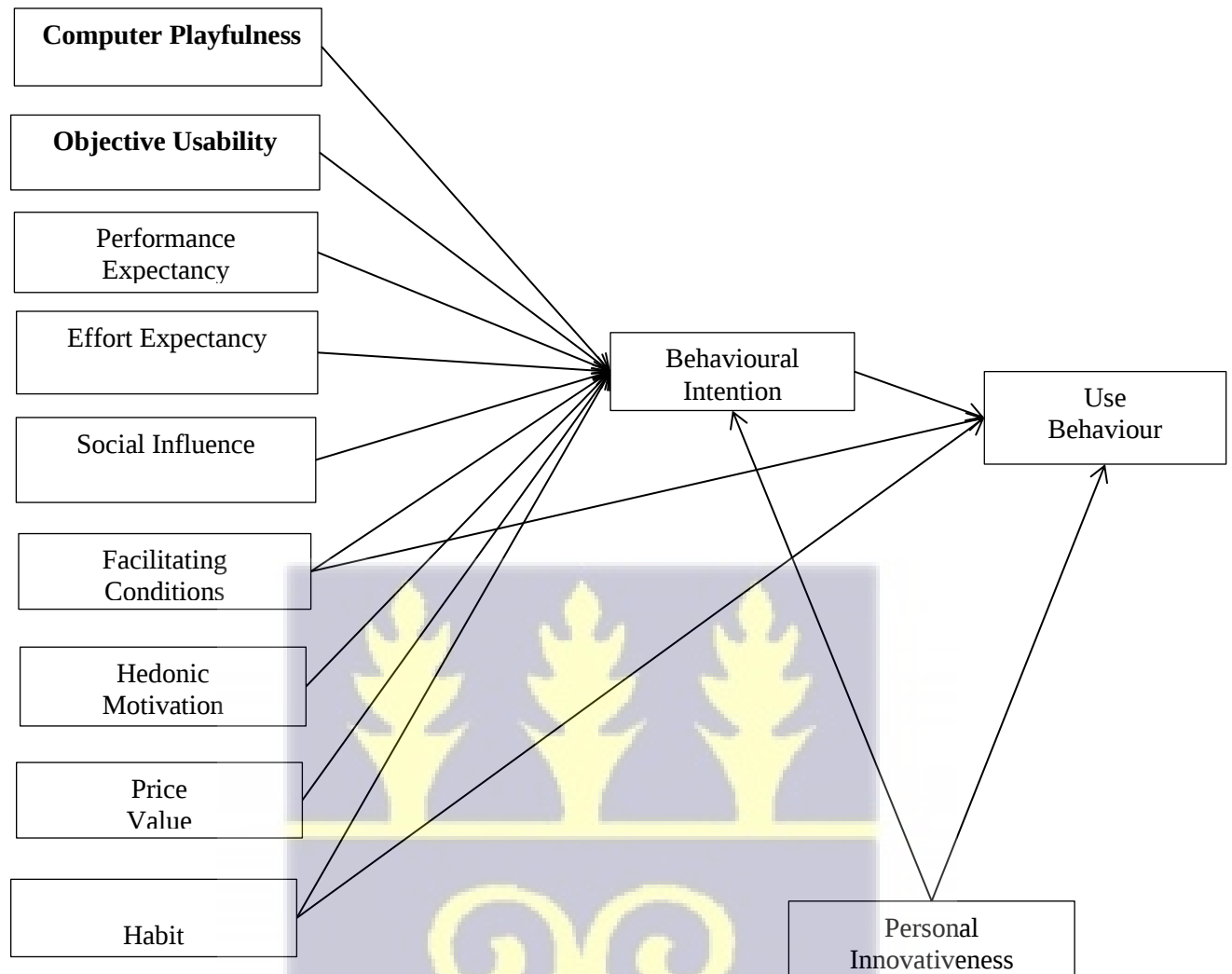
Fig. 3. 3 Comparing TAM Models and UTAUT Models



Source: Gunasinghe et al. (2019, p.32)

The UTAUT2 framework was extended to UTAUT3 by adding an independent construct known as personal innovativeness (Farooq et al., 2017). A study compared and reviewed theories of technology acceptance and their uses in assessing academic acceptance of online learning technologies and posited that “intention and attitude are the two main significant factors determining technology adoption behaviour, influenced by several other independent antecedent variables such as perceived usefulness (performance expectancy), ease of use (effort expectancy), perceived risk (anxiety), perceived behavioural control (self-efficacy), social influence and facilitating conditions” (Gunasinghe et al., 2019, p.36). While almost all constructs used in TAM3 were linked to and taken care of in UTAUT2, two constructs were found that UTAUT2 and UTAUT3 did not consider. These constructs are *computer playfulness* and *objective usability*. Therefore, this study posits to situate these constructs within the virtual environment context and proposes that interactivity and usability constructs be hypothesised and tested for mobile applications’ features.

Fig. 3. 4 Extending TAM3 and UTAUT3 Model



Source: Author's Construct

3.2.3 Dimensions of the Theory

Technology Adoption and Use Models compared TAM3 with UTAUT3 and considered some key elements such as constructs, variables, prepositions, and hypotheses. The subsequent sections will explore these constructs to explain the ones suitable for this doctoral research.

3.2.4 Constructs and Assumptions

a. Dependent Variables

The model has two (2) dependent variables, namely, use behaviour (UB) and behavioural intention (BI), based on the original TAM (Davis et al., 1989). These two dependent variables were derived from systems adoption theories. An attitude is the feeling (positive or negative) that a user exhibit using a particular system (behaviour response). The original TAM used the attitude but changed to use behaviour in TAM 3 and UTAUT 3. Behavioural intention (BI) may be a future behaviour. It is the degree to which a systems user has tangible plans to achieve or not when using a particular system. This research examines and measures the two dependent variables with the notion that UB will significantly influence BI.

b. Independent Variables

Perceived utility (PU) and perceived ease of use (PEOU) are the independent variables for TAM (Davis, 1989). These constructs in TAM 3 assume new roles as antecedents and modifiers in TAM 3. Perceived usefulness (PU) in TAM is when system users feel and recognise that the system usage will advance their performance. Also, the extent to which a system's user feels that the system is easy or simple to use is known as perceived ease of use (PEOU).

The original UTAUT was constituted by four (4) independent variables or exogenous constructs such as; “effort expectancy (EE), performance expectancy (PE), facilitating conditions (FC), and social influence (SI)” (Venkatesh et al., 2003). In UTAUT2, three (3) additional variables were added, i.e., “hedonic motivation (HM), price value (PV), and habit (H)” (Venkatesh et al., 2012). UTAUT3 has also added personal innovativeness (PI) (Farooq et al., 2017). This study posits that in IS literature, *computer playfulness (CP)* and *objective*

usability (OU) constructs are considered in broader terms as usability and interactivity (Zollet, 2014).

3.2.5 Criticisms of the Theories

The Technology Adoption Model (TAM) was created with the goal of better understanding the system's users' acceptance of simple, voluntary software applications. TAM is applied to complex involuntary ERP software and systems. It led to one-time cross-sectional research and measuring issues such as low measure validity and single-task measurement (Williams et al., 2009). The main limitation of the original Technology Acceptance Model (TAM) was the usage of a self-reporting scale (Lee et al., 2003).

The original TAM was extended as stipulated earlier to the TAM2 due to the limitation of TAM in its original form in terms of explanatory power (R^2). TAM2 kept all the original TAM constructs and introduced some important drivers for perceived usefulness (PU) and usage intention (UI). These determinants varied based on the user's experience with a particular system (Venkatesh & Davis, 2000, p.187). TAM2 used all the TAM constructs and focused on the factors influencing perceived usefulness (PU) and intention to use (UI) constructs. TAM3 completed the determinants of PEOU and UI.

The original UTAUT was developed after TAM2. Lai (2017) posited that performance expectancy was formed by five similar constructs: perceived usefulness, extrinsic motivation, job-fit, relative advantage, and outcome expectations. This thesis incorporates these constructs as independent variables or attributes of technologies. Since UTAUT2 was developed after TAM3, it considered almost all constructs except *computer playfulness* and *objective usability*. This thesis incorporates these constructs as independent variables or attributes of technologies.

3.2.6 The Relevance of the Theories to this Study

The literature review for this study revealed that the technology acceptance and use theories, TAM theories, and UTAUT are used to look at the adoption and use of technologies, as shown in Table 2.2 above. This research reviewed these theories and came up with usability and interactivity as the two (2) main constructs influencing the degree to which technologies can be addictive. The UTAUT3 and TAM3 at their current stages have thrown many challenges as gaps to guide future research directions. While literature continues to produce new exogenous mechanisms, new endogenous mechanisms, and new moderation mechanisms, the main gap identified in the literature for both models is how to generate *new outcome mechanisms* (Venkatesh, Thong, & Xu, 2016). This research considered the new outcome mechanism of these theories as MTA.

Research in IS predominantly focuses on providing answers to what drives the acceptance and use of technologies (King & He, 2006; Venkatesh et al., 2003), the continuous usage of IS systems (De Guinea & Markus, 2009; Kim & Zhang, 2010) to now problematic usage, i.e., addiction (Gao, Liu, & Li, 2017; Snodgrass et al., 2014; Turel, Serenko, & Giles, 2011). While several theories and technologies tend to explain the initial adoption to continuous usage of technologies, the two (2) main theories for predicting the behavioural intention to the actual usage of the IS systems and technologies are TAM3 and UTAUT3. Therefore, these two theories are relevant to measuring acceptance and usage, which is the foundation of every technology addiction. This study theorises that for users to be addicted to these technologies, they must first and foremost adopt and use them before they eventually become addicted. This research looks at the acceptance and use of these technologies as the foundation of mobile technology addiction.

3.2.7 Application of the Adoption Theories

The adoption theories (i.e., TAM and UTAUT) have taken centre stage in IS literature and have become very popular and used extensively to examine and predict user behaviours in the acceptance and use of technologies (Lai, 2017; Lee, Kozar, & Larsen, 2003; Venkatesh, Thong, & Xu, 2016). The centrality of these theories in IS literature cannot be overemphasised; various versions have been used extensively in IS literature to research various subject areas. For example, in MISQ, an extended TAM was used to examine whether the degree of a user's addiction to technology influences their views and behaviour in a paper entitled "Integrating Technology Addiction and Use: An Empirical Investigation of Online Auction Users" (Turel, Serenko, & Giles, 2011). It was found that users' addiction to technologies modifies their belief systems in general and their perceived enjoyment, ease of use, and usefulness. The study examined how eBay users perceived their intrinsic and extrinsic gain perceptions from using the site concerning their online auction addictions. It is possible that the system will be easier to use and will better meet users' extrinsic and intrinsic demands and behaviours.

TAM has been used in several other research works, such as internet abuse and internet addiction in the workplace (Griffiths, 2010), "predicting user's intentions: comparing the technology addiction model with the theory of planned behaviour" (Mathieson, 1991), and extrinsic and intrinsic motivation to use computers in a workplace" (Davis et al., 1992). The Unified Theory of Acceptance and Use Theory has been used severally in IS literature. Examples of such studies include; "using UTAUT to investigate the intention to use physical apps (Liu et al., 2019); exploring users' behaviour on smartphones (Dang et al., 2011) and developing a model that looks at users behaviour from adoption to addiction (Theotokis & Doukidis, 2009).

3.3 Flow Theory

3.3.1 Overview of Theory

Flow, often known as “optimal experience” or “the zone,” was first conceptualised by Mihaly Csikszentmihalyi and is defined as “the holistic experience that people feel when they act with total involvement” (Csikszentmihalyi, 1975, p. 36). “It is the mental state of operation by which one is deeply engrossed in an activity such that there is complete absorption causing loss of time and sense of reasoning” (Csikszentmihalyi, 1975, p.36). Csikszentmihalyi (1991) explained further that the flow is “the state in which people are so involved in an activity that nothing seems to matter; the experience itself is so enjoyable that people will do it at great cost, for the sheer sake of doing it. He further clarified that “a sense of one’s skills is adequate to cope with the challenges in a goal-directed, rule-bound action system that provides clear clues about how one performs. Concentration is so intense that no attention is left to think about anything irrelevant or worry about problems. Self-consciousness disappears, and the sense of time becomes distorted. An activity that produces such experiences is so gratifying that people are willing to do it for its own sake, with little concern for what they will get out of it, even when it is difficult or dangerous” (Csikszentmihalyi, 1991, p.71).

3.3.2 Dimensions of the Flow Theory

From the outset, four (4) dimensions of flow theory were identified by Csikszentmihalyi (1975). These were attention, control, curiosity, and intrinsic interest. These components of flow were later substituted and increased to eight (8) dimensions, such as “clear goals and immediate feedback, merging of action and awareness, the equilibrium between the level of challenge and personal skills, the sense of potential control, loss of self-consciousness, altered sense of time, and experience becoming autotelic or self-rewarding” (Csikszentmihalyi, Abuhamdeh, & Nakamura, 2014).

The antecedents of the dimensions of flow as identified in the literature are *clear goals*, which are used to define the task to perform; *immediate feedback*, which is the quick response by users to any given task; and *skills or challenge matched and relatively high* which are the opportunities available for users to act which must commensurate or balance with the ability (Khang, Kim, & Kim, 2013; Sweetser & Wyeth, 2005). For the characteristics of the dimensions presented by flow theory, the *merging of action and awareness* are the distinctions when the action and the actor disappear or are infused together. It would be difficult to distinguish between the action and the actor. *Focused concentration* is known as the total focus/attention of the present technology usage regardless of whatever is happening around the user. *A sense of potential control* is the feeling that a user gets to be in total control of the situation or the mobile technology. Loss of *self-consciousness* is when the user stops worrying about what is happening around them regarding physical appearance. *Time distortion* describes the event that the user loses track of time or the sense of time is lost /altered by the user such that they become unaware of the time. *Autotelic experience* is the self-rewarding part of the flow theory (Engeser, 2014; Thomas P. Novak, Hoffman, & Yung, 2000; Pavlas, 2010).

3.3.3 Flow Constructs and Assumptions

Flow theory's main constructs and assumptions for this study are control, attention focus, time distortion, intrinsic interest, and curiosity (Novak et al., 2000). The other relevant constructs identified in the literature are as follows:

- a) **Interactivity** - to identify whether the various technologies are interactive or not. The assumption will be whether the computer or the technology responds quickly to the user, whether there's a waiting time between actions and responses, and whether the interactions between users' actions are slow or tedious. These may be intuitive or

otherwise, narrow or wide manipulation, and finally, whether there are different actions available for users to explore with these technologies (Novak et al., 2000).

- b) *Positive Effect*** - this construct determines if the technology makes the user happy or unhappy, pleased or annoyed, satisfied or unsatisfied, contented or melancholy.
- c) *Telepresence*** - will help examine how the users feel, whether they are more in the “technological world” or the “real world.” It tests whether technology users forget their immediate surroundings when using the technologies or otherwise and whether they pay more attention to their physical world than the technological world or not (Novak et al., 2000; Stavropoulos, Alexandraki, & Motti-Stefanidi, 2013).

3.3.4 Criticisms of the Flow Theory

Flow theory is criticised based on the theory itself and how it concerns this study. Therefore, the criticism is in two parts. This theory is criticised using Little John’s Five Criteria, which centred on scope, appropriateness, heuristic value, validity, and parsimony (Carl, 1994; Littlejohn & Foss, 1992).

The Scope - the main criticism of the flow theory in terms of scope argues that the philosophy of the theory is overly Western in nature and psychic phenomenon and applies to males much more than females (Sun, 1987; Csikzentmihalyi, 1988). Thus, the theory is goal-directed and too active to represent panhuman traits (Csikzentmihalyi, 1988). Flow experience varies from culture to culture and from one society to another. The dynamics of the flow experience are seen to be universal and cut across all cultures and societies.

Appropriateness - the flow theory assumes that the world is in a state of disorder and that humans, in turn, are in a state of chaos, i.e., technology users are intrinsically motivated to look out for some of these experiences to promote order and consciousness out of this chaos. As a

result, the assumption that flow occurs when technological challenges match users' abilities may not always be true. For example, two computer game players, FIFA, may have equal skills, and the game will present an equal challenge. However, they may not simultaneously attain flow or optimal experience due to several factors, such as individual self-traits. Although the opportunity for a flow state may be present in the game, it does not mean that the game players will attain a flow experience. Sometimes, the players must recognise this and then consciously act on the information to attain the flow state. Flow theory is consistent with the assumptions that the world is in a state of chaos, but maybe every human will like to act on a piece of the given information and provide order, and by so doing, will attain flow. Some external environmental forces and individual internal elements may not allow users to attain that optimal experience (Khang et al., 2013; Nakamura & Csikszentmihalyi, 2009).

Heuristic Value - some researchers believe that the theory is too ethereal, bordering on mystical or supernatural, and lacks solid data (evidence) to support its claim (Carl, 1994). Therefore, it may be difficult to apply this theory to social sciences and management research (Csikszentmihalyi, 1988). Initially, this assertion was accurate, but over the past years, there have been a lot of empirical support and practical applications of this theory in various disciplines (Carl, 1994).

Validity - there is a very high significant validity for this theory. The quality of human experience is a concern, and flow becomes relevant. Several empirical studies have proven that flow is a universal phenomenon applicable to all nations, cultures, and situations. This theory explains why some people become absorbed in their work and bored during their free time. This theory helps to give clear meanings to the user's motivation for their thoughts and actions. The founder of this theory was not concerned about "why people do the things they do, but with how flow feels and how it can be controlled" (Carl, 1994, p.19). The focus of this theory was shifted from causality to consequences; that is to say, the goal was not so much to figure

out what causes conduct as it was to figure out what psychological benefits it delivers (Carl, 1994; Csikszentmihalyi & Csikszentmihalyi, 1992)

Parsimony - to assume that flow is achieved when challenges of a technology match or are equal to the user's skills is quite parsimonious and may become confusing when the three physiological and psychological terminologies subsystems of consciousness, attention, awareness, and memory are brought up for discussion. Attention is about user perceptions; awareness is about their cognition, motivation, emotions, and memory is about their prior experiences. Another criticism of this theory is that, as propounded and discussed by Csikszentmihalyi in his publications, it only portrays *flow* as *a psychology of optimal experience*, which gives indicators of the flow experience. However, how exactly this flow state is achieved is not explicitly explained.

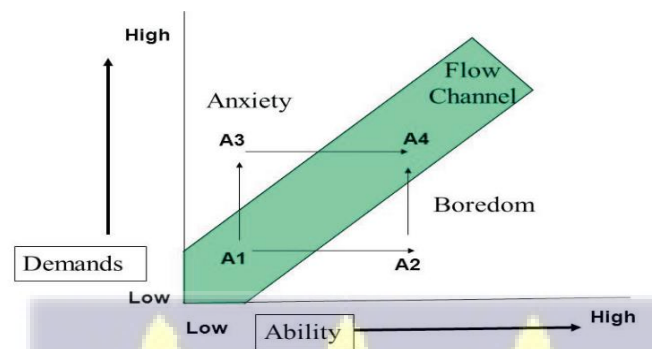
This study considers flow as a multidimensional construct focusing on attention, control, curiosity, and intrinsic interest, the four main constructs identified by the proponent (Csikszentmihalyi, 1975). This theory explains users' cues and mental states when interacting with technologies.

3.3.5 The Relevance of the Theory to this Research

According to the literature review presented in the second chapter of this thesis, the flow theory is the second most used theory for technology addiction studies. This shows that the flow theory is relevant for this study. The Flow theory helped to unravel what happens after the initial adoption and use of technology. This thesis used this theory to examine MTA. Thus, when technology is integrated into the user(s) life, users naturally develop some technology skills. Anytime the skills developed by the user are equal to the demand of the technology, there is a likelihood that the user will get into a flow. This thesis will explore how interactions between telepresence (IT artefacts) and social presence (social and information artefacts) lead to the

flow towards mobile technology addiction. Also, this research will combine both the antecedents and the consequences in a new way, i.e., the socio-technical interactions among the antecedents and how that influences flow. Future research directions identified will be used to produce the research framework.

Fig. 3. 5 Flow Theory depicting the demand and ability resulting in anxiety or boredom.



Source: Csikszentmihalyi (1992)

3.3.6 Application of the Flow Theory

According to the literature, flow theory has been applied extensively in various fields and disciplines, including Information Systems. Thus various researchers have studied flow in diverse IT and IS contexts such as online gaming (MMORPGs) (Nyamadi & Boateng, 2018), exploring consumers' experiences in using Facebook through mobile devices (Ho, Liao, & Sun, 2012), the role of Flow experience in Cyber - Game addiction (Chou & Ting, 2003), "Online Flow experiences, problematic internet Use and Internet procrastination" (Thatcher, Wretschko, & Fridjhon, 2008), factors affecting individual intention to purchase Smartphones from technology adoption to technology dependency perspective (Negahban, 2012). Flow in online gaming as a cognitive state involves skills and control, challenge and arousal, focus, interactivity, and telepresence (Novak et al., 2000).

Flow theory has examined situation flow within the broader context of positive functioning. For example, it was posited that two models of well-being conceptualise flow as an aspect of personal expressiveness, “Eudaimonia” or “self-realisation,” which could be viewed with the spectacle of “hedonia” or “pleasure” experiences (Ryan & Deci, 2001; Waterman, 1993). Other researchers also tried looking at flow within different contexts; for example, the growth of flow experiences was considered vital engagement via accumulated historical life experiences, interpersonal, and other connections that endow absorbing activities with meaning (Nakamura & Csikzentmihalyi, 2003). Furthermore, the flow was looked at in the tripartite model of happiness, which treated flow as the manifestation of “engaged” lives. The flow measured adults’ orientation towards achieving happiness through pleasure, engagement, or meaning (Peterson, Park, & Seligman, 2005).

3.4 The Stimulus - Organism - Response (S-O-R) Framework

3.4.1 Overview of Framework

The Stimulus-Organism-Response (S-O-R) Framework may be traced to cognitive psychology, which is associated with great philosophers like Socrates and Aristotle (Hebb, 1949). Woodworth developed the S-O-R concept as a functionalist approach to psychology (Woodworth, 1958; Woodworth, 1918). Some scholars directly linked S-O-R to environmental psychology and the revolutionary work of Mehrabian and Russell, which suggested that every facet of the environment can play the role of stimulation, which can elicit behavioural responses in any creature or organism (Mehrabian & Russell, 1974).

The process between environmental stimuli (input) and organisms’ responses (output) is mediated by the initiating internal processes (process), which prepare the organism for final

responses (Mehrabian & Russell, 1974). This logic follows the input-process-output as in computer and information systems.

3.4.2 Dimensions of S-O-R Framework

The S-O-R framework comprises stimuli as an independent variable, the organism as a mediating variable, and response as the dependent variable (Goi, Kalidas, & Zeeshan, 2014). This framework has become a multidisciplinary theory and has been used in varied and diverse disciplines such as tourism, hospitality, marketing, business, management, information systems, etc. Each discipline has modified the variables to suit its needs and has categorised its elements under the three (3) main variables. The next section will stipulate the S-O-R framework and its respective variables in the industries in which it is applied.

3.4.3 S-O-R Measurable Constructs / Variables

The Stimulus Organism Response (S-O-R) theory, as stipulated earlier, consists of three (3) variables such as stimulus as an independent variable, organism as a mediating variable, and response as the dependent variable (Spies et al., 1997; Turley & Milliman, 2000; Yoo et al., 1998; Vieira, 2013). Each of these constructs has varied dimensions, as shown in the review in Table 3.1 below:

Table 3. 1 Stimulus Organism Response Constructs Used in Literature

Citation	Industry	Stimulus	Organism	Response
(Yoo, Park, & MacInnis, 1998)	Retailing	Product Assortment Value of Merchandise Salesperson Service After-Sale Service Facilities Atmosphere Store Location	Positive Emotions Negative Emotions	Store Attitudes
(Turley & Milliman, 2000)	Review of Past Literature	Exterior General Interior	Employees Customers	Employee Customers

		Store Layout Interior Displays Human Variables		
(Lin, 2004)	Review	Visual Cues Auditory Cues Olfactory Cues		Emotional Cognitive Behavioural
(Kaltcheva & Weitz, 2006)	Experiment, Participants View Computer Screens	Environment Characteristics	Arousal Pleasantness	Shopping Behaviour
(Fiore & Kim, 2007)	Literature	Ambient Cues Design Cues Social Cues	Cognition Consciousness Affect Emotion	Actual Resource Expenditure Perceived Resource Expenditure Behavioural Intentions Composite Measures
(Kim & Moon, 2009)	Restaurant	Facility Aesthetics Layout Electric Equipment Seating Comfort Ambient Conditions	Pleasure-feeling Perceived Service Quality	Revisit Intentions
(Lam, Chan, Fong, & Lo, 2011)	Casino	Ambience Navigation Seating Comfort Interior Décor Cleanliness	Customer Satisfaction Cognitive Affective	Desire to Stay Intention to Revisit
(Walsh, Shiu, Hassan, Michaelidou, & Beatty, 2011)	Coffee Shops	In-Store Music In-Store Aroma Merchandise Quality Service Quality Price	Emotions (Arousal, Pleasure)	Outcome Store Satisfaction Store Loyalty
(Animesh et al., 2011)	Information Systems (Virtual World)	Technological (Interactive, Sociability) Spatial (Density and Stability)	Telepresence Flow Social Presence	Intention to Purchase
(Daunt & Harris, 2012)	Hospitality	Physical Servicescape Social Servicescape		Customer Disaffection (inequity, Dissatisfaction)
(Wong, Osman, Jamaluddin, & Yin-Fah, 2012)	Shopping Mall	Mall/Store Quality Quality of Merchandise Convenience Enhancement Price Orientation		Shopping Enjoyment

(Dong & Siu, 2013)	Theme Park Visitors	Substantive Staging (Background, Functional) Communicative Staging (Employee, behaviour, employee image, culture, atmospherics)	Service Experience Evaluations	Experience Intensification Experience Extension
(Vieira, 2013)	Past Literature Review	The Environment Characteristics	Emotional Pleasure Arousal Dominance	Shopping Behaviour
(Zhang, Lu, Gupta, & Zhao, 2014)	Information Systems	Perceived Interactivity Perceived Personalisation Perceived Sociability	Social Social Presence Flow	Social Commerce Intention
(Yao & Cao, 2017)	Information Systems (Social Networking Overuse)	Social Interaction Overload Invasion of Work Invasion of Privacy	Perceived Usefulness Technostress Perceived Enjoyment	Rational Usage Intention
(Li, 2019)	Information Systems (Social Media Context)	Video Quality Video Credibility	Cognitive Image Affective Image Perceived Interactivity	Visit Intention
(Kim, Lee, & Jung, 2020)	Tourism	Authentic Experience	Cognitive Affective (Enjoyment, Emotional Involvement, Flow State)	Attachment to Virtual Reality Visit Intention
(Lin, Lin, Turel, & Xu, 2020)	Information Systems (social media)	Information Overload Communication Overload Social Overload	Fatigue	Discontinuance Intentions
(Moqbel, 2020)	Information Systems	Smartphone Addiction	Mindfulness	Health and Technostress
(Fu, Chen, & Zheng, 2020)	Information Systems	Smartphone Overuse	Insomnia Nomophobia Poor Eyesight	Academic Performance

Source: Extended Version of S-O-R Theory Dimension by Goi et al. (2014)

3.4.4 Revisions of the S-O-R Framework

The S-O-R framework is largely based on how organisms respond to stimuli (environment) (Animesh et al., 2011). In this work, the organism is the dynamics of what happens in the virtual world (virtual presence). Stimulus focuses on users' attributes (self-traits, hedonic and utilitarian values) and technologies. In information systems, there are two divergent views; one refers to stimuli as information technologies (Liang & Xue, 2009), and the other views complex adaptive systems as interactive agents (users) that respond to stimuli and stimulus-response behaviour is defined. In terms of 'simple rules,' users adapt by changing their rules and accumulating their experiences (Benbya & McKelvey, 2006).

For external stimuli trigger responses, the responses' actual nature is normally determined not by the stimuli but by the organism's structure. As a result, the structure dictates what may and may not be used as a stimulus by the organism (Mingers, 2001). The actual response may be positive or negative. The positive behavioural actions are the desire to explore, act, stay, affiliate, or work positively on a stimulus, while the negative response is the opposite (Mehrabian & Russell, 1974). The main target in the S-O-R framework at the time was emotional responses. Later, Bitner (1992) added cognition and physiology and expanded the applications of the theory to servicescapes. In 1976, Wohlwill focused on the emotional qualities or responses to surroundings as aesthetic incitement (Wohlwill, 1976). An integrative S-O-R was developed to combine cognitive and emotive systems that considered all previous experiences and incorporated long-term memory (Jacoby, 2002). The S-O-R concept claims that virtual experiences modulate the effect of environmental stimuli on users' behaviour. For smartphone overuse, information, nomophobia, and poor eyesight represented the organism, and poor academic performance was the response (Fu et al., 2020).

3.4.5 Criticisms and Critique of Framework

The S-O-R Theory has been criticised in the literature. The main constructs and their relations that make up the main model are static and rigid such as ovals or rectangles (Jacoby, 2002). The S-O-R Model has been criticised as suitable for only linear depictions (Jacoby, Berning, & Dietvorst, 1977, p.23). Therefore, this theory may not be helpful when the studied phenomena are nonlinear. In addition, the linear depictions tend to cause the researcher to overlook other important or critical conditions and relationships that may impede the holistic understanding of the phenomenon (Jacoby, 2002). Even when so many linkages and rectangular or circular boxes portray a particular phenomenon, the model assumes an “intimidating appearance of a pipe-fitter’s nightmare” (Hoyer & MacInnis, 1997, p.13).

One other important criticism is the confusion concerning where to position the constructs. Sometimes the pictorial representation of the constructs and their respective writeups make it difficult to precisely determine whether the construct should be used or placed under the stimulus or move to an organism or response. Where exactly to fix the constructs becomes the researcher’s prerogative, though it is sometimes confusing (Jacoby, 2002). An example was the most influential model developed by Angel, Backwell, and Miniard, where the “marketer-dominated and other stimuli construct in their respective boxes, were placed at the left side of the model while social constructs in terms of the reference group, family, and aquaculture and their situational influences were placed on the extreme right” (1986, p. 35). In the above model, social constructs may likely influence or give the organism input stimuli to respond (Jacoby, 2002).

This thesis conceptualises user input stimuli as *social* and technology as *technical*. The virtual world revolves around interactivity and usability regarding technical attributes (Zollet, 2014).

Interactivity became a very critical construct for consideration in the middle of the 1980s. Scholars modelled outside the main boxes and arrow connections. There is a need to define stimuli, organisms, and responses and set boundaries in TA research. Like the various fields that use this theory, scholars continue to conceptualise new variables and constructs. It can generate some level or degree of arbitrariness or uncertainty.

3.4.6 The Relevance of the S-O-R Theory to this Research

This thesis compared TAM3 with UTAUT3 theory to determine the types and attributes of technologies which may influence end-users to accept and adopt those technologies, eventually resulting in addiction. The attributes of the technologies identified, which tend to cause users to accept and adopt the technologies that may result in addiction, are usability and interactivity (Animesh et al., 2011; Gunasinghe et al., 2019; Zollet, 2014). The technology attributes are considered in developing and theorising mobile technology addiction.

The S-O-R framework is the best framework that rightly situates the process of technology addiction in a context that clearly shows how user attributes and technology features behave in a virtual world and how that results in flow and causes responses (mobile technology addiction). It segregates the constructs into their respective sections for easy explanation. The S-O-R framework is relevant for this study because it can carefully integrate the previously discussed theories and provide a response element. Additionally, this framework can cover the three main parts of technology addiction, which are relevant and convenient to guide this research work.

There is a gap in the general S-O-R framework, where several dimensions and constructs are used for the various constructs. There are no distinctive constructs for the various models; all disciplines continue to churn out their constructs and relationships regarding how organisms

respond to stimuli (Engel, Kollat, & Blackwell, 1968; Hoyer & MacInnis, 1997, p.13). Therefore, this research set boundaries and determined the MTA constructs for stimulus, organism and response.

3.4.7 Applications of the S-O-R Theory

This framework was used in several other research works. In relation to this work, the S-O-R framework was extended to the social media context and validated among the Chinese (Li, 2019). A research article used the S-O-R framework to study the negative consequences of high Facebook usage for different purposes. The study was centred on how cognitive, hedonic, and social uses of Facebook induced stress and exhaustion, influencing users' intention to quit Facebook usage voluntarily. The external stimuli (excessive social use, excessive hedonic use, excessive cognitive use) influence the internal state of users (technostress and SNS-exhaustion) to respond either positively or negatively, which may lead to discontinuance usage intentions (Luqman, Cao, Ali, Masood, & Yu, 2017).

In the IS literature, the first MISQ paper that looked at the socio-technical dimension of the virtual S-O-R framework examined how technological (interactivity and sociability) and spatial (density and stability) and how stimuli affect users' virtual experiences known as an organism (social presence, telepresence, and flow) and how that influences users' response (intention to purchase virtual goods) (Animesh et al., 2011). Additionally, a study developed a framework for technostress by relating how IT characteristics in terms of how users' perception of IT features and attributes (stimuli) influences organisms (stressors due to IT use) and their responses (strains due to IT use) (Ayyagari, Grover, & Purvis, 2011).

3.5 Chapter Summary

This chapter looks at the overview, constructs/variables, revision, criticisms, relevance, and applications of the three theories used for the research. This study looked at the inadequacies of the adoption theories from TAM1 to TAM3 and UTAUT to UTAUT3, compared the two theories, and came up with relevant variables essential for researching technology addiction. The two main constructs that emerge from the adoption theories are *usability* and *interactivity*. The flow theory is critically reviewed, and the deficiencies, limitations, and roles to play in the TA framework development are posited. The S-O-R framework is also interrogated, and the boundaries are set for the TA framework development.



CHAPTER FOUR

RESEARCH FRAMEWORK

4.1 Chapter Overview

The framework for the research is developed in this chapter. There are eight (8) sections in the theoretical framework chapter. The first section (1) gives an overview of the chapter. The background of this framework (technology addiction process model (TAPM)) is described in section two (2). The logic of the framework is discussed in Section three (3). The framework's constructs are outlined in Section four (4). Section five (5) discusses the framework's relationships and develops the framework's hypotheses. The link between the framework and the research objectives is discussed in Section six (6), and the questionnaire structure is provided in section seven (7). Finally, section eight (8) summarises the entire chapter.

4.2 Background of the Technology Addiction Model

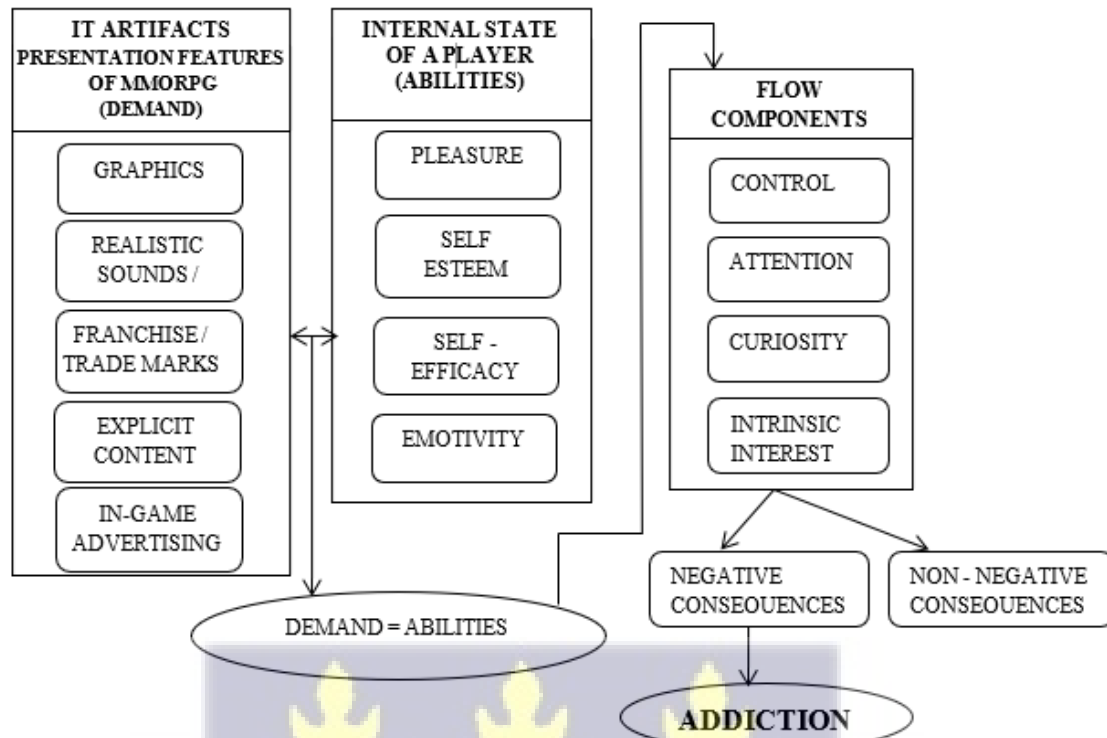
The summary of the work on theory by Anderson, Curtis and Wittig (2014) is that theories symbolise the attempts “to construe the world by observing particular phenomena and endeavouring to determine why they are as they appear to be”(Ajibade, 2018, p.3).

When a researcher applies the essential principles of a theory to see and understand an event, it means the researcher accepts the theory's core principles. Academics have explained theoretical frameworks in various ways; for example, “a theoretical framework is a set of relationships between various concepts” (Oandasan et al., 2004, p.69). A theoretical framework is “a model which details the structure of a study, through the interconnected relationships between the explanations of which theory is comprised” (Ajibade, 2018, p.3). Theoretical frameworks serve two purposes; first, they make research fits into what is already known (relationship to existing theory and research), and second, they show how research contributes to a topic (its intellectual goals) (Maxwell, 2005, p123; Rockinson-szapkiw, 2000).

The “theoretical framework is a component of a broader conceptual framework” (Ngulube, Mathipa, & Gumbo, 2015, p.44). Theories guide the creation of theoretical frameworks and are not to be confused with conceptual frameworks. The basic blocks for forming theories are constructs, prepositions, variables, and hypotheses (Bacharach, 1989). These theories create conceptual frameworks by combining various constructs, concepts, models, and interactions. The fundamental distinction between theoretical and conceptual frameworks is that conceptual frameworks are derived from concepts directly related to the research issue. In contrast, the theoretical frameworks comprise theories and constructs serving as a research roadmap. Methodological decisions are clarified, explained, and justified using conceptual frameworks (Ravitch & Riggan, 2012; Ravitch & Riggan, 2016).

This study uses the researcher’s constructs derived from TAM3 and UTAUT3, the Flow Theory, and the S-O-R Framework to develop the theoretical framework. This theoretical framework was used to create a conceptual model based on the process model presented at the Americas Conference on Information Systems by the researcher and his supervisor (AMCIS) (Nyamadi & Boateng, 2018). The initial process model adapted players’ internal states from a social perspective, such as pleasure, self-esteem, self-efficacy, emotivity, and flow (Chollet & Rodhain, 2015). When the embedded IT artefact features, on the other hand, are below the users’ skill or capacity to play the games, the user is likely to get boredom. From the flow definition, “the components used for this model are control, attention, curiosity, and intrinsic elements” (Csikszentmihalyi, 1975). A positive or negative outcome could result from a flow condition. Addiction occurs when the flow state severely impacts the user’s or player’s life. As stated by Griffith, “activity cannot be described as an addiction if there are few (or no) negative consequences in the player’s life” (Griffiths, 2010, p.119). This is shown in Figure 4.1 below:

Fig. 4. 1 The Process Model for Internet Gaming Addiction



Source: Nyamadi and Boateng, (2018)

In this doctoral research, the initial concept of socio-technical interaction between users (information and social artefacts) and mobile technology (technology artefacts) is enhanced and expanded, where the attributes of users to adopt and use technologies are influenced by a variety of other causal mechanisms (attributes), in addition to users' internal states (abilities). Environmental characteristics, location attributes, organisation attributes, task attributes, and events (time) attributes are some of the causative processes in external elements that greatly influence users' response to technology acceptance and use (Venkatesh et al., 2016). It means that before a user is motivated to accept and use technologies, these attributes are the causal mechanisms influencing users to *respond* to the *drives* by the technology. This thesis suggests that these elements stimulate users to adopt and use technologies. User responses lead to *social presence* (Han, Min, & Lee, 2015). Anytime the acceptance and use of technologies produce *drives* that cause users' *responses* to flow, it leads to MTA.

Telepresence is enabled by technological components that provide sensory stimuli (drives) (Steuer, 1992). In virtual environments, telepresence and social presence boost the subjective intensity of the users' flow experience and their intention to continue using it (Animesh et al., 2011; Cyr & Head, 2008; Steuer, 1992). The virtual environment becomes the users' extended self, causing them to focus more on knowledge and social objects to the point where they have little or no attention for anything else. The combination of social presence, telepresence, and flow leads to continuous use, which can have negative consequences (Animesh et al., 2011; Stavropoulos et al., 2013). The model in Figure 4.2 below depicts the journey from user responses and technology drives to addictions and how it relates to student academic performance. Fig. 4.3 is the MTA Research Model consisting of only antecedents, and Fig.4.4 is the Integrated MTA Research Model consisting of antecedents and consequences. The following diagrams show the Technology Addiction Process Model (TAPM) and conceptual frameworks deduced from the literature:

Fig. 4. 2 The Technology Addiction Process Model (TAPM)

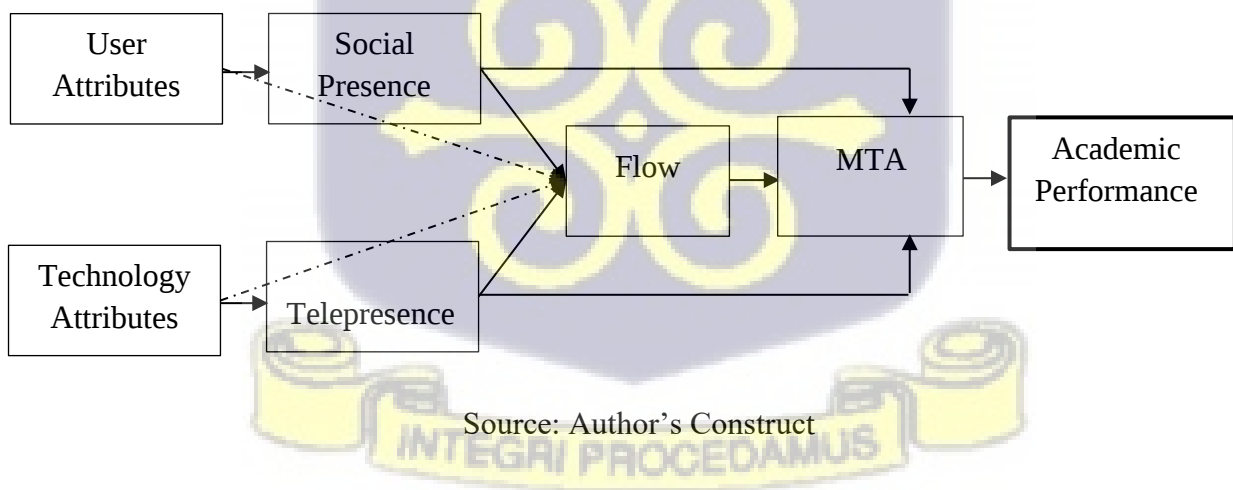


Fig. 4. 3 THE MTA RESEARCH MODEL: Antecedents of MTA

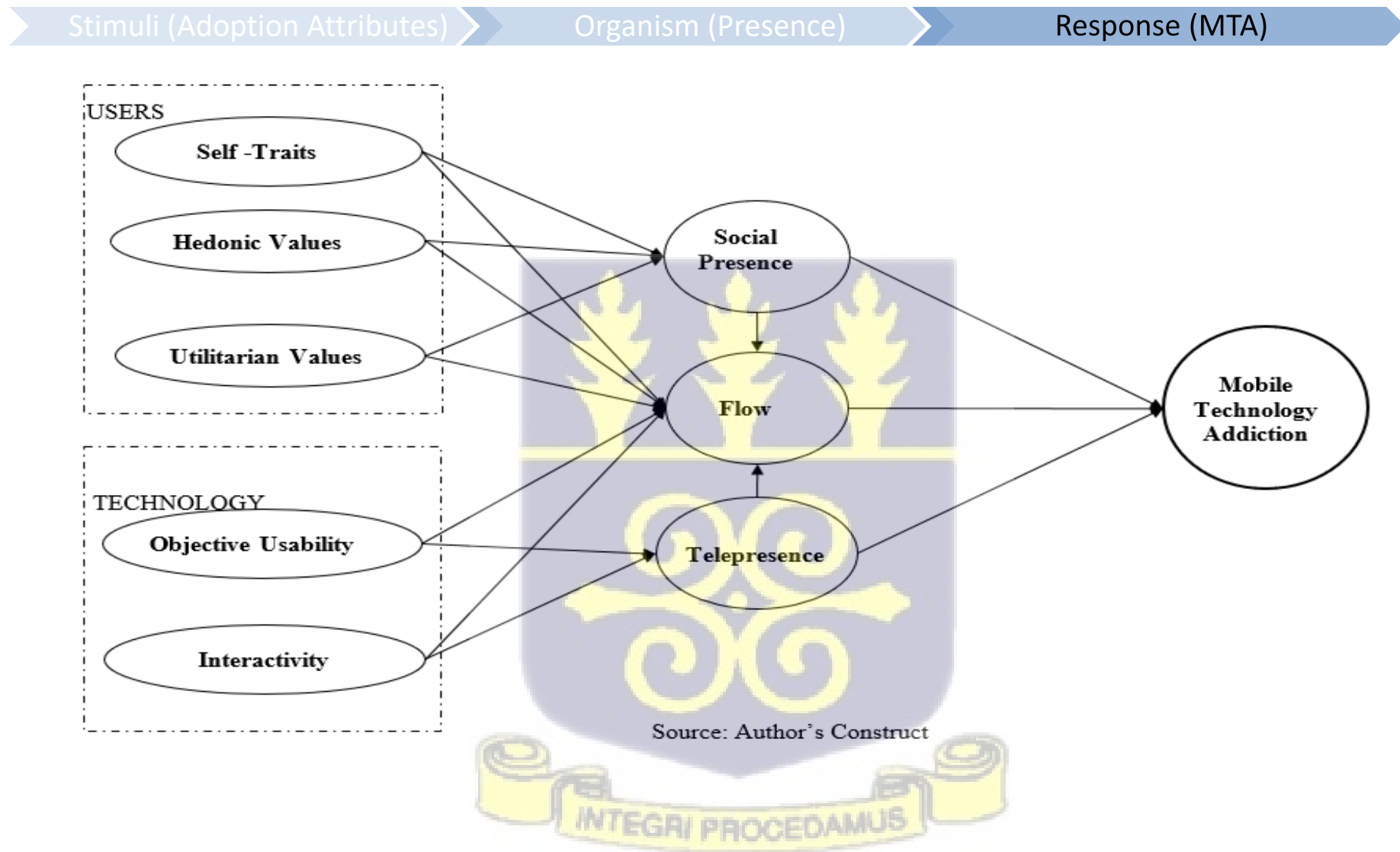
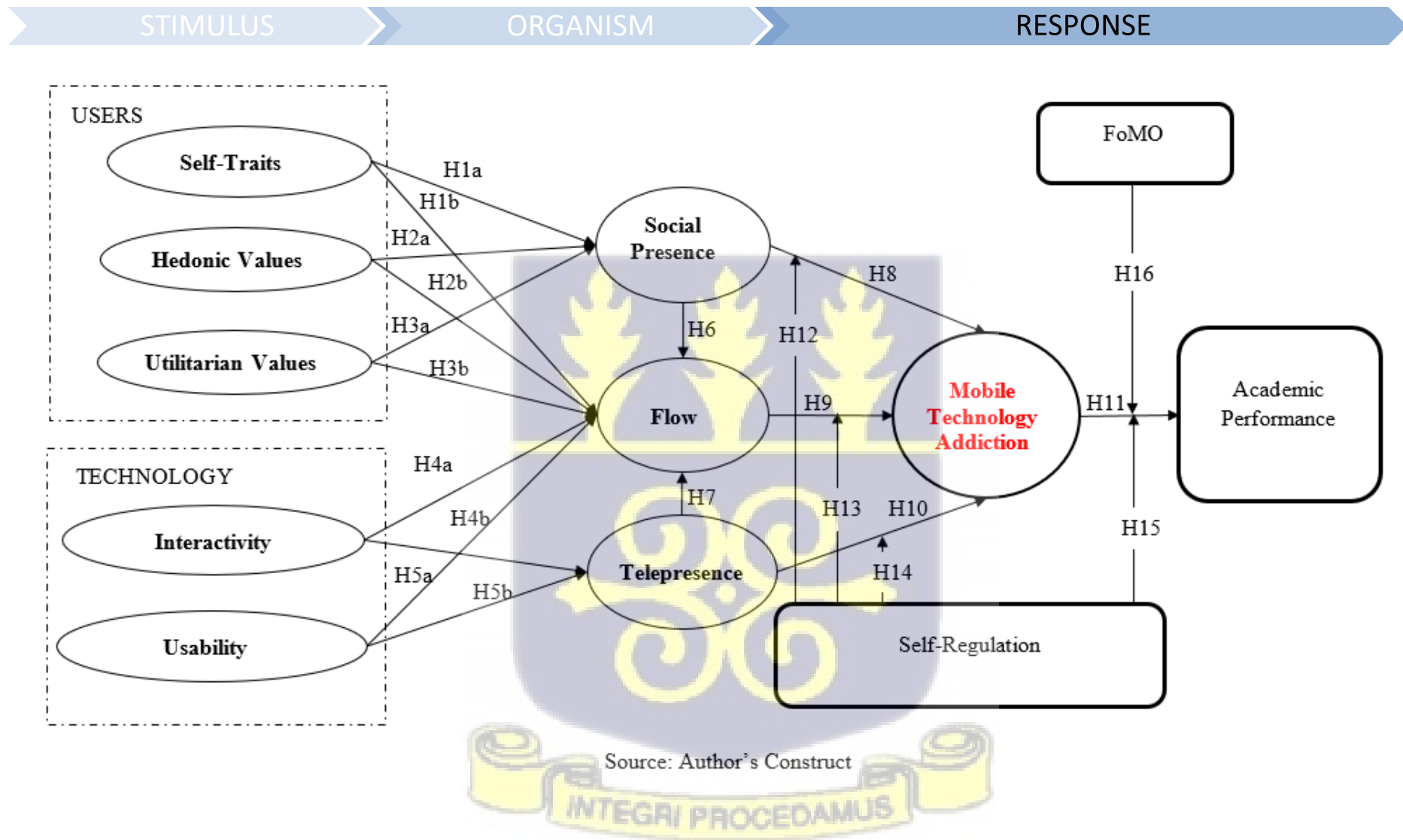


Fig. 4. 4 THE INTEGRATED MTA MODEL: Antecedents and Consequences on Academic Performance



4.3 The Logic of the Integrated MTA Model

Antecedents of human motivations are user attributes, such as external and internal stimulation and self-traits (Khang, Kim, & Kim, 2013). Technology attributes are usability and interactivity (Zollet, 2014). Human motivation constructs are strictly guided by users' intrinsic motivation to adopt the technologies (Wu & Lu, 2013). The combination of the constructs for users' attributes is from the reviewed paper entitled "Unified Theory of Acceptance and Use of Technology: A synthesis and Road Ahead" (Venkatesh et al., 2016). The usability and interactivity of the technologies should be considered when designing the systems or technologies. Humans (users) now perceive presence in virtual worlds, which is defined by a presence theory as "a sense of being there" (Park & Hwang, 2009, p.1). Regarding human feelings of being together in a virtual environment, presence refers to social presence (Biocca, Harms, & Burgoon, 2003; Gao et al., 2017). Regarding the fundamentals of IS design, social presence is felt through information and social artefacts at the feature level (Lee et al., 2015).

IS designs indicate these features are at the *technology artefacts* level (Lee et al., 2015). Virtual environments are experienced through *telepresence*, which aligns with technical or technological determinism (Animesh et al., 2011; Steuer, 1992). Telepresence is enabled by technology features or attributes that provide sensory stimuli (Steuer, 1992). Telepresence and social presence in virtual environments boost the subjective intensity of users' flow states and their intention to continue using them (Animesh et al., 2011; Cyr & Head, 2008; Steuer, 1992). The virtual environment becomes the users' extended self, forcing them to focus more on information and social objects to the point where they have little or no attention for anything else. The virtual interaction of social presence, telepresence, and flow eventually leads to a desire to use the service again (Animesh et al., 2011; Stavropoulos et al., 2013).

4.4 Constructs and Measuring Variables of the Integrated MTA Model

The essential principle guiding this framework development is that self-traits, hedonic, and utilitarian values result in social presence. The adoption theories suggest two attributes: *usability* and *interactivity* of technologies to result in addiction. These two technology adoption constructs are used as DVs, which lead to *flow* or *telepresence*. This research's main organism is the *presence* caused by the socio-technical interaction between telepresence, social presence, and flow, resulting in *TA*. These are moderated by *Fear of Missing Out (FoMO)* and *self-regulation*. The optimal flow experience may result in negative or positive (non-negative) consequences in the framework above. Addiction occurs when the flow state has severe negative implications in the user's life; as stated by Griffiths, "activity cannot be described as an addiction if there are few (or no) negative consequences in the players' life" (Griffiths, 2010, p.3).

4.4.1 Technology Addiction

As Turel, Serenko, and Giles (2011) defined, this thesis examined the term TA in depth. It is "a psychological state of maladaptive dependency on the use of technology to such a degree that the following typical behavioural addiction symptoms arise

Salience - the technology dominates a user's thoughts and behaviours

Withdrawal - negative emotions arise if a person cannot use the technology

Conflict - the use of the technology conflicts with other tasks, which impairs normal functioning

Relapse and reinstatement - a user is unable to reduce the use of the technology voluntarily

Tolerance - a person has to use technology to a greater extent to produce thrill and

Mood modification- using the technology offers thrill and relief and results in mood changes"

(p.1044). As a result, the MTA's constructions and scale items were mapped into the definition's six key symptoms, which were connected to the MTA's outcome in the framework.

4.4.2 Flow Construct Composition

The flow constructs are examined from the multi-dimension perspective. This research will add *time distortion/loss of time* to the initial four elements of flow components used in drawing the first model in Figure 4.1 above. Therefore, the flow will be studied using the following: control, curiosity, attention, intrinsic interest, and loss of time (Csikzentmihalyi, 1975; Trevino & Webster, 1992, pp.539-573). Flow in this context represents how technology users get immersed in mobile applications. It involves an optimal psychological state (Csikszentmihalyi 1975;1991). This research posits that when users reach a flow state on mobile technology, they observe; a loss of time, loss of control, curiosity, focused attention, and intrinsic interest. These individual flow components found in the literature are discussed below:

- a. Control:** this variable will determine how technology users have absolute regulation or control over the respective technologies. The assumptions will be to determine whether technologies influence or are being influenced by users, whether the user or the technology is dominant or submissive, and will determine if the technology is autonomous or depends on the user.
- b. Curiosity:** technology users became curious and developed the “desire to know or learn more” about the technology, which took their time and caused them to lose track of time.
- c. Focused Attention:** the focus attention variable will be used to determine whether the respective technologies can cause users to focus their attention on them or otherwise. It determines whether the users can switch between the technologies and their immediate environments by assuming whether the users are deeply engrossed or otherwise, absorbed intently or not, focused or not, and concentrated or not.
- d. Intrinsic Interest:** technology users form their own goals and targets. They have an inherent interest in meeting their targets and becoming immersed in the process so that they cannot strike a balance between the technological world and the real world.

- e. **Time Distortion / Loss:** this will help determine whether the time goes very fast or quickly when users are utilising the technologies or otherwise. We may also assume that the users normally lose track of time or otherwise.

4.4.3 Social Presence

Social presence is very important in online environments (Ogara, Koh, & Prybutok, 2014a, 2014b). It is the “degree of salience of the other person in the interaction and the consequent salience of the interpersonal relationships” (Short, William, & Chrisie, 1976, p.65). This construct has been linked to the user’s motivation to be online (Han, Min, & Lee, 2016; Kim & Song, 2016). It is the quality with which a person stands out and is particularly noticeable, achieving prominence. It is the feeling of being involved psychologically and socially in the interaction (Animesh et al., 2011; Schroeder, 2006; Short et al., 1976).

Social presence is “thus likely to enhance participants’ concentration on their activities in the virtual world and generate a sense of flow” (Animesh et al., 2011, p.797). It has a positive impact on an individual’s interactions with systems. It brings togetherness and enforces a sense of psychological closeness that leads to flow (Animesh et al., 2011; Gao et al., 2017). Previous literature suggests that “users perceive a high level of social presence through their interactions with SNS” (Gao et al., 2017). Therefore, this research will broaden the discussion to cover mobile technology use. This research examined the negative effect of social presence on technologies, leading to MTA.

4.4.4 Telepresence

Telepresence is the “extent to which one feels present in the mediated environment, rather than in the immediate physical environment” (Steuer, 1992, p.79). He further defined the

telepresence construct as “the experience of *presence* in an environment through a communication medium” (Steuer, 1992). This research perceives telepresence as the state of how the users feel, whether they are more in the “technological world” than in the “real world.” Whether they forget their immediate surroundings when using the technologies or not, whether they pay more attention to their physical world than the technological world. Hoffman and Novak posited that telepresence directly influenced consumers and increased their flow state (Hoffman & Novak, 1996). In virtual environments, avatars become the users’ extended self, influencing users to have highly focused attention, concentration, emersion, and intrinsic interests (Animesh et al., 2011). It results in consumers (users) losing track of time and physical environments (Novak et al., 2000). The telepresence was situated in the bigger context of technology acceptance and use.

4.4.5 Technology Acceptance and Use

For the model's technology adoption and use construct, this research heavily relies on the constructs derived from the TAM3 and UTAUT3. While almost all constructs used in TAM3 were linked to and taken care of in UTAUT2, two dependent constructs were found that UTAUT2 and UTAUT3 did not consider. These constructs are *interactivity* and *usability*.

4.4.6 Interactivity

Interactivity is a difficult construct with several definitions and meanings. However, this research will adopt the definition that it is the “extent to which one can control the virtual environment in modifying the form and the content of the environment” (Steuer, 1992, p.6). The environment, in this context, is the technological environment. Interactivity features allow participants (users) to relate with virtual objects in a mediated virtual environment by modifying the content (information) or landscape (videos, images and audios) (Animesh et al.,

2011; Steuer, 1992). This research looks at interactivity as the extent to which users, through their motivations, use mobile technology features to produce presence.

4.4.7 Usability

The International Organisation for Standardisation (ISO) 9241 - 11 “defines usability as the extent to which a product can be used to achieve specified goals with effectiveness, efficiency, and satisfaction in the specified context of use” (Agarwal & Venkatesh, 2002; Peevers, Douglas, & Jack, 2008). It has been suggested that the usefulness of mobile applications is based on their *usability*. A literature review suggested that the usability construct is normally measured using three attributes: effectiveness, satisfaction, and efficiency (Harrison, Flood, & Duce, 2013). The ISO standard also outlined three measurement attributes: effectiveness, efficiency and satisfaction (Baber, Smith, Butler, Cross, & Hunter, 2009). Scholars have identified certain issues regarding mobile devices: mobile context, connectivity, small screen size, different display resolution, limited processing capability and power, and data entry methods (Bardram, 2009). The usability practitioner must also include mobility and consequences (Harrison et al., 2013).

4.4.8 Self-Traits

A literature search on self-traits concerning technology and media addiction revealed that scholarly work mainly focuses on self-efficacy, self-control, and self-esteem (Baumeister, 1999; Caplan, 2010; Khang, Woo, & Kim, 2012; Kim & Davis, 2009). Several pieces of research have proven that personal innovativeness is a personality trait (self-trait) that plays a significant role in users' acceptance and use of technologies (Agarwal & Prasad, 1998; Dutta, Gwebu, & Wang, 2015; Farooq & Radovic-Markovic, 2016; Karahanna, Ahuja, Srite, & Galvin, 2002). Therefore, this thesis considered user self-traits of mobile technology users.

- a. **Self-Esteem** refers “to an individual’s self-assessment, which involves favourable or unfavourable attitudes” (Khang et al., 2013, p.2417). Research on excessive technology engagements proposed self-esteem as an antecedent to flow and technology addiction (Khang et al., 2013, 2012). Users with low self-esteem are likely to be addicted to technologies and media such as online games, smartphones and the internet (Anderson, 1994; Bianchi & Phillips, 2005). Users who lack self-esteem are perceived to be more susceptible to technology addiction than those with high self-esteem (Khang et al., 2013; Kim & Davis, 2009; Yea & Kim, 2003)
- b. **Self-efficacy** refers to an individual’s self-assessment of his/her capacity for accomplishing a given task (Albert Bandura, 1986, 1999; Khang et al., 2013). It is a cognitive process related to users selecting diverse tasks to complete or perform a task (Albert Bandura, 1999). The emotions attached to self-efficacy are derived from the level of accomplishment in performing tasks using technologies (Klimmt & Hartmann, 2006; Pavlas, 2010).
- c. **Self-regulation** has been treated in media addiction literature as strengthening habits from loss of control (Bandura, 1991). It is “the process of self-control through psychological sub-functionalism such as self-monitoring, judgment, and self-reactive” (Khang et al., 2013, p.2417). Therefore, deficient self-regulation is referred to as “a state in which conscious self-control is relatively diminished” (LaRose et al., 2003, p.232). Individuals with low self-control would have difficulty controlling themselves when using mobile technology and are more prone to be addicted (Song, 2004). The literature on self has reported that users’ attitudes about self are significant indicators of their over-reliance on technologies (Khang et al., 2013).

4.4.9 Control Variables

Although establishing the effect of the control variables on the dependent variable (MTA) would have assisted in avoiding hypothesised relationships, demographic variables such as gender, age, and education have been estimated but not used as control variables (Turel, Serenko, & Bontis, 2011). Previous research suggests that gender differences in task orientation and emphasis on instrumentality would become more pronounced with increasing age (Morris, Venkatesh, & Ackerman, 2005).

4.4.10 Gender and Age

Age and gender reflect people's differences in information processing (i.e., cue perception and processing process), affecting their reliance on habits to guide behaviour. Older people rely largely on automatic information processing (Hasher & Zacks, 1979; Jennings & Jacoby, 1993). Gender in this research refers to either males or females. Research on technology acceptance and use has demonstrated the difference between the two genders. For example, more men normally exert more effort to surmount hindrances to pursue their goals and achieve their objectives, while women focus on the magnitude of the effort needed and the required processes to follow to achieve their objectives (Hennig & Jardim, 1977; Morris et al., 2005; Rotter & Portugal, 1969). Age plays a critical role in user acceptance and usage of technologies. Technology users have more difficulty learning and using new technologies as they age. The inability to use new and complex technologies may be attributed to the decline in their cognitive and memory capacities due to ageing (Posner, Silbaugh, & others, 1996). The older generation emphasises adequate support over the younger generation (Venkatesh et al., 2012).

4.5 Hypotheses or Relationships for the Framework

H1a: A sense of self-traits influences social presence towards mobile technology addiction.

H1b: A sense of self-traits influences flow toward mobile technology addiction.

- H2a: Hedonic values of users directly influence social presence towards addiction.
- H2b: Hedonic values of users directly influence flow towards addiction.
- H3a: Utilitarian values of users directly influence social presence towards addiction.
- H3b: Utilitarian values of users directly influence flow towards addiction.
- H4a: Perceived interactivity relates to the sense of flow towards addiction
- H4b: Perceived interactivity relates to the sense of telepresence towards addiction
- H5a: Perceived usability relates to the sense of flow towards addiction.
- H5b: Perceived usability relates to the sense of telepresence towards addiction.
- H6: Telepresence positively relates to flow towards mobile technology addiction.
- H7: Social presence positively relates to flow towards mobile technology addiction.
- H8: Social presence directly predicts mobile technology addiction.
- H9: A sense of flow directly predicts mobile technology addiction.
- H10: Telepresence directly predicts mobile technology addiction.
- H11: Mobile technology addiction negatively influence academic performance.
- H12: The level of self-regulation significantly moderates the relationship between social presence and mobile technology addiction.
- H13: The level of self-regulation significantly moderates the relationship between flow and mobile technology addiction.
- H14: The level of self-regulation significantly moderates the relationship between telepresence and mobile technology addiction.
- H15: The level of self-regulation significantly moderates the relationship between mobile technology addiction and academic performance.
- H16: Fear of Missing Out (FoMO) significantly moderates the relationship between mobile technology addiction and academic performance

4.6 The Link Between the Framework and Research Objectives

Stakeholders were engaged from multidisciplinary perspectives to comment on the framework. For the first objective, stakeholders from varied backgrounds were interviewed for their knowledge of the nature and causes of technology addictions from their respective disciplines.

Second, this framework showed exactly how the socio-technical interactions between humans (university students) and features of mobile technologies either directly led to MTA or first led to flow and eventually resulted in MTA. This second objective clearly described and explained the process of MTA from a socio-technical perspective. The third objective investigated the combined effect of self-regulation and FoMO on MTA. The fourth objective investigated MTA's effect on university students' lives in a developing country context. This was considered in the research framework as MTA consequences.

4.7 Research Questions to Operationalise the Framework

There are four (4) research questions based on the objectives of this thesis. The conceptual framework developed for this work has led to the emergence of realigning the research questions. These questions emerged to operationalise the framework and practicalise the theoretical underpinnings. The research questions have been summarised under three headings, and their respective questions are detailed below:

a. The multidisciplinary and stakeholders' perspectives of the nature and causes of mobile technology addiction from a developing country context.

- i. What is the nature of MTA from a multidisciplinary and stakeholders' perspective from a developing country context?
- ii. What are the causes of MTA from multidisciplinary and stakeholders' perspectives?

b. Socio-technical interactions between users and technologies.

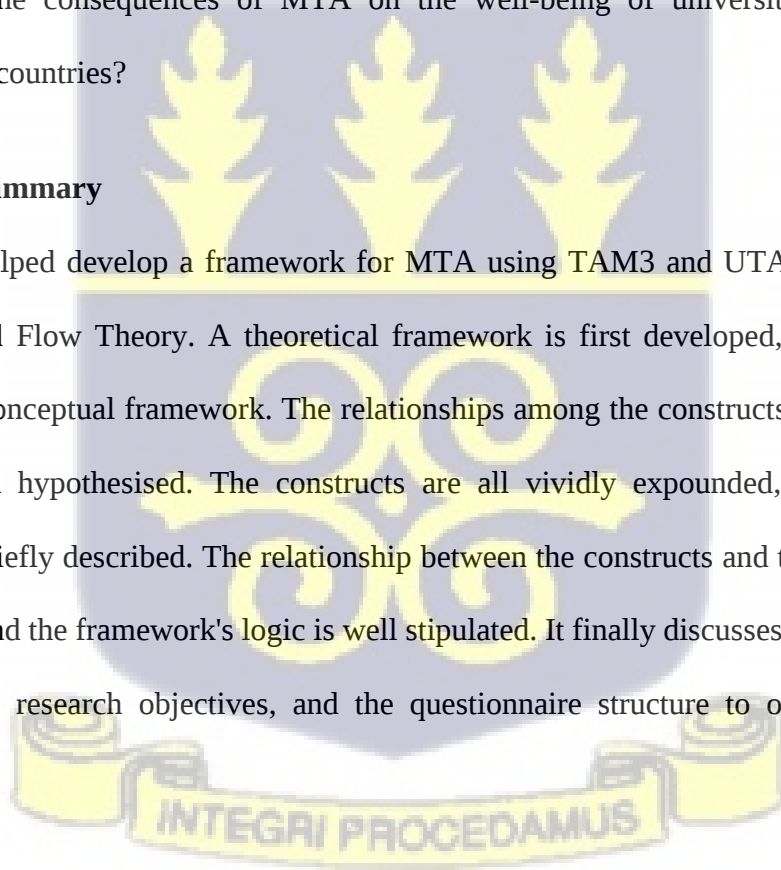
- i. How is MTA developed from mobile technology attributes to technology acceptance (telepresence) to produce flow?
- ii. How is MTA developed from users' attributes through the human motivation system (social presence) to produce user flow?
- iii. How do the socio-technical interactions between social presence and telepresence result in flow and eventually lead to MTA?

c. The effect of MTA on university students from developing country context.

- i. What are the consequences of MTA on the academic performance of university students from developing countries?
- ii. What are the consequences of MTA on the well-being of university students from developing countries?

4.8 Chapter Summary

This chapter helped develop a framework for MTA using TAM3 and UTAUT3, the S-O-R Framework and Flow Theory. A theoretical framework is first developed, out of which is constructed a conceptual framework. The relationships among the constructs have been well-established and hypothesised. The constructs are all vividly expounded, and the testing variables are briefly described. The relationship between the constructs and their prepositions is elaborated, and the framework's logic is well stipulated. It finally discusses the link between the framework, research objectives, and the questionnaire structure to operationalise the framework.



CHAPTER FIVE

RESEARCH METHODOLOGY

5.1 Chapter Overview

This chapter comprises seven (7) sections, including research paradigms, research approaches and methods, research sampling and data collection procedures. Also, the chapter discusses the data analysis tools and techniques used and concludes with the constructs' validity (i.e., internal and external) assessments, reliability assessments and ethical considerations.

5.2 Introduction to Research Paradigms

Paradigm is “ the basic belief system or worldview that guides the investigator not only in choices of methods but in ontologically, epistemologically, fundamental ways.” (Guba & Lincoln, 1994, p.105). Burrell and Morgan (1979, p.23) further explained that paradigm is intended to emphasise the commonality of perspective, which binds the work of a group of theorists together to be usefully regarded as approaching social theory within the bounds of the same problematic. Therefore, a paradigm can be considered an interpretive framework (Lincoln & Denzin, 2003). It is the common or shared beliefs of a group of researchers or theorists. These shared beliefs are focused on their views about reality, what constitutes acceptable knowledge, how to acquire that knowledge, and the group’s values regarding research, which in philosophical terms are referred to as ontology, epistemology, methodology and axiology (Flowers, 2009; Lincoln, Lynham, & Guba, 2011).

Ontology - it is “the science or study of being” by Blaikie (1993, p.6). He further applied this concept in social science to envelop “claims about what exists, what it looks like, what units make it up, and how these units interact with each other”(p.6). As a result, ontology describes the researcher’s perspective on the nature of reality (whether assertions or assumptions) to understand whether it is subjective or objective (Hatch & Cunliffe, 2006).

Epistemology - it is about what constitutes knowledge and the best methods of making inquiries into the nature of the universe (Easterby-Smith, Thorpe, & Jackson, 2008). Eriksson and Kovalainen (2008, p.292) also described it as “what knowledge is and what are the sources and limits of knowledge.” Oxford English Dictionary also “defined it as the theory or science of the method or grounds of knowledge” (p.671). Chia (2002, p.2) also wrote about epistemology as “how and what it is possible to know.” Hatch and Cunliffe (2006) explained epistemology as the study of how knowledge is generated, what distinguishes good from bad knowledge, and how reality is represented or described.

Methodology - Methodology refers to the systematic and scientific approach used in conducting research (Cecez-Kecmanovic, 2007). It is the process of collecting and analyzing data to test the hypotheses or research questions established under a particular research paradigm. Methodology under the research paradigm is an essential aspect of research design that includes the study's procedures, techniques, and data collection and analysis methods. The methodology utilized in the research paradigm is determined by the research objectives, research questions, and the type of data required for the research. Choosing an appropriate research methodology is crucial to ensure the validity, reliability, and generalizability of the research findings. Quantitative, qualitative, and mixed-method approaches are the three main types of methodology (Johnson & Onwuegbuzie, 2004; Venkatesh, Brown, & Bala, 2013).

Axiology – Axiology is the study of values and their role in research. It refers to the researcher's personal values and beliefs that may influence their choice of research questions, methods, and interpretation of findings (Lincoln et al., 2011). Researchers must acknowledge their values and biases and consider how they may affect the research process. Axiology is an essential component of the research paradigm because it helps the researcher to be self-aware and transparent about their positionality, which can influence their research in various ways (Guba & Lincoln, 1994).

For example, in a qualitative research study, the researcher's values and beliefs may shape their interactions with participants and affect the data collected. Similarly, in a quantitative research study, the researcher's values and biases may influence the design and analysis of the study. Thus, it is essential for researchers to reflect on their values and be transparent about their positionality in the research process. Axiology is critical to understanding how research is constructed and can be used to improve the rigour and validity of research findings (Denzin & Lincoln, 2018; Guba & Lincoln, 2005; Roulston & Shelton, 2015). Axiology is value-laden and value-free (e.g., moral and ethical values)

The paradigms as proposed by Burrell and Morgan are radical humanist, radical structuralist, interpretive and functionalist, and their relationships are shown below:

Fig. 5. 1 The Burrell and Morgan Research Framework

The Sociology of Radical Change		
Subjective	Radical Humanist	Radical Structuralist
	Interpretivist	Functional
The sociology of Regulation		
Objective		

Source: Burrell and Morgan (1979)

The functionalist paradigm is based on the sociology of regulation and treats its subject matter objectively. It is a concern for describing the current state of affairs, social order, consensus, social integration, solidarity, need fulfilment, and actuality. It takes a realist, positivist, determinist, and nomothetic approach to these broad sociological issues (Burrell & Morgan, 1979; Guba & Lincoln, 1994).

5.3 Research Paradigms

The three main paradigms in the IS discipline are positivism, interpretivism, and critical paradigms. However, a fourth paradigm, known as critical realism is gaining recognition. The subsequent paragraphs will describe the different types of paradigms in detail. Orlikowski and Baroudi (1991) provided three (3) classification schemes based on the work of Chua (1986). These three research paradigms are positivism, interpretivism, and critical. Positivism is the most widely utilised research paradigm in information systems, followed by interpretivism and critical thinking. The various dimensions of critical theory have been developed into a critical realism paradigm which is posited as a suitable paradigm for IS research (Dobson, 2002; Mingers, 2004; Venkatesh, Brown, & Bala, 2013).

Orlikowski and Baroudi's classification is similar to Guba and Lincoln's, and it is simply one of many widely accepted classifications in the IS research field (Klein & Myers, 1999; Ngwenyama & Lee, 1997; Richardson & Robinson, 2007; Stahl & Brooke, 2008).

5.3.1 The Positivist Paradigm

The positivist viewpoint is derived from natural science. Hypotheses are tested by measuring observable social realities and distinguishing them from existing theories (thus deductive or theory testing). Orlikowski and Baroudi (1991) looked at 155 articles from MISQ, Communications of the ACM (CACM), Management Science, and Proceedings of the International Conferences on Information Systems to further explain this paradigm between 1985 and 1989. According to their findings, the positivist paradigm dominated the IS research community (96.8%). Conversely, the interpretive paradigm received minimal attention (3.2%), and no empirical research was conducted utilising a critical paradigm (0%).

Chen and Hirschheim (2004) also examined 1893 articles published in eight major IS

publication outlets between 1991 and 2001. Positivist research still dominates 81% of published empirical research. US journals tend to be more positivist, quantitative, cross-sectional, and survey-oriented. An increase in qualitative research (30%) at the expense of laboratory experiments (18%) might suggest that IS researchers have become more interested in obtaining scientific knowledge.

Ontologically - the social world, according to positivists, exists objectively and externally. There is a general assumption in positivism that “the reality is objectively given and can be described by measurable properties which are independent of the observer (researcher) and his or her instruments” (Myers, 1997, p.3).

Epistemologically – positivists assume that knowledge is only valid if it is based on observations of the external world. If universal or general rules exist, or if generalisable theoretical models can explain cause-and-effect relationships and can be used to anticipate events. The reason, truth, and validity are the foundations of positivism (Blaikie, 1993; Easterby-Smith et al., 2008; Eriksson & Kovalainen, 2008; Hatch & Cunliffe, 2006).

Methodologically – the methodological assumption of a positivist is that facts are emphasised, which are obtained by direct observation and experience and objectively quantified through quantitative methods such as surveys and experiments, as well as statistical analysis (Blaikie, 1993; Easterby-Smith et al., 2008; Eriksson & Kovalainen, 2008; Hatch & Cunliffe, 2006). Hatch and Cunliffe (2006) linked this to the organisation's context. They stated that positivists think that knowledge can only be obtained by categorising and objectively measuring the behaviour of people and systems and that language accurately represents reality.

Axiologically - positivists contend that scholars may research without the imposition of their values to influence the outcome of the research (Hudson & Ozanne, 1988). Therefore, this

paradigm is value-free (Anderson, Ozanne, Hudson, & Ozanne, 1988; Burrell & Morgan, 1979).

5.3.2 The Interpretivist / Constructivism Paradigm

Hatch and Cunliffe (2006) described the interpretivism/constructivism paradigm as anti-positivist. Blaikie (1993) also described it as post-positivist since there is a fundamental difference between the subject matters of natural and social sciences. Conservative, constructivist, critical, and deconstructivist interpretivism are among the several types of interpretivism (Butler, 1998).

Ontologically - interpretivists believe that reality is socially constructed and constantly reconstructed via experience, resulting in a wide range of interpretations (Walsham, 2006). The researcher cannot be separated from the phenomenon under study (Lee & Huboba, 2009). Therefore, in interpretivism, multiple subjective realities exist and are based on “the researchers underlying social characteristics such as gender, race, age, and, of course, their individual personalities” (Mingers, 2004, p.302). They further explained that an interpretivists is in a position “to understand the psychological and social structures that may impede or facilitate” the reality (Mingers, 2004, p.302).

Epistemologically - in interpretivism, the researcher creates knowledge and tries to understand the phenomenon of inquiry based on the evidence available or frame of reference. “The aim of understanding the subjective meanings of persons in studied domains is essential in the interpretive paradigm” (Goldkuhl, 2012, p.137). Individuals and groups interpret events based on personal experiences, memories, and expectations.

Methodologically - interpretivism normally uses the qualitative method of inquiry and tries to gather data through field observation, interviews, etc.

Axiologically - it is value-laden, which means the researcher's values influence the process of gathering evidence and vice versa.

5.3.3 The Critical Paradigm / Theory

This paradigm “is from critical theory and is for the emancipation of individuals and groups in an egalitarian society” (Cohen, Manion, & Morrison, 2007, p.26). A critical business researcher, for example, strives not to understand the firm but to modify how it runs in order to enhance profit.

Ontologically - society defines and socially constructs social reality through media, institutions, and society. As a result, social conduct is the result of “particular illegitimate, and repressive factors, illegitimate in the sense that they do not operate in general interest - one person's or group's freedom and power is bought at the price of another's freedom and power” (Cohen, Manion, & Morrison, 2007, p.26). Critical paradigm is for emancipation and critical reasoning, most informed by asking relevant questions (Guba & Lincoln, 1994; Lincoln et al., 2011).

Epistemologically - media, institutions, and society all contribute to the social construction of knowledge. “What counts as worthwhile knowledge is determined by the social and positional power of the advocates of that knowledge” (Cohen et al., 2007, p.27). The transactional and subjectivist epistemological perspective is used. What can be learned is intrinsically linked to the interaction of a specific investigator with a specific object or group.

Methodologically - it is dialogic and dialectical, which involves a dialogue between the investigator and the inquiry subjects. The debate must be dialectical to change ignorance and

misunderstandings into a more informed consciousness (Guba & Lincoln, 1994).

Axiologically – it is a value-mediated situation. The investigator and the thing under investigation are thought to be interactively linked with the investigator's values, impacting the investigation inexorably. The aim is to critique transformation, restitution and emancipation. Generalisation is based on similarities in terms of the nature of knowledge and its accumulation, and knowledge is accumulated structurally with historical insights. Critical theory has a moral inclination toward elevation from an ethical standpoint (Lincoln et al., 2011).

Critical research is underrepresented in the information systems literature, and some authors have referred to it as “a missing paradigm” in the field (Chen & Hirschheim, 2004; Richardson & Robinson, 2007). Critical theory research can challenge prevailing assumptions for IS researchers. The critical perspective reminds us of humans' constantly changing potential and need not be confined by their immediate circumstances (Orlikowski & Baroudi, 1991).

Orlikowski and Baroudi (1991) classified research as critical when taking a critical stance toward “taken-for-granted assumptions” about organisations and information systems. The critical research aims to critique the status quo “through the exposure of what are believed to be deep-seated, structural contradictions within social systems.” This research is founded on the notion that critical theory's ontology analyses historical realism, which involves the virtual reality that is affected by social, political, economic, ethnic, and gender elements before crystallising through time. (Guba & Lincoln, 1994).

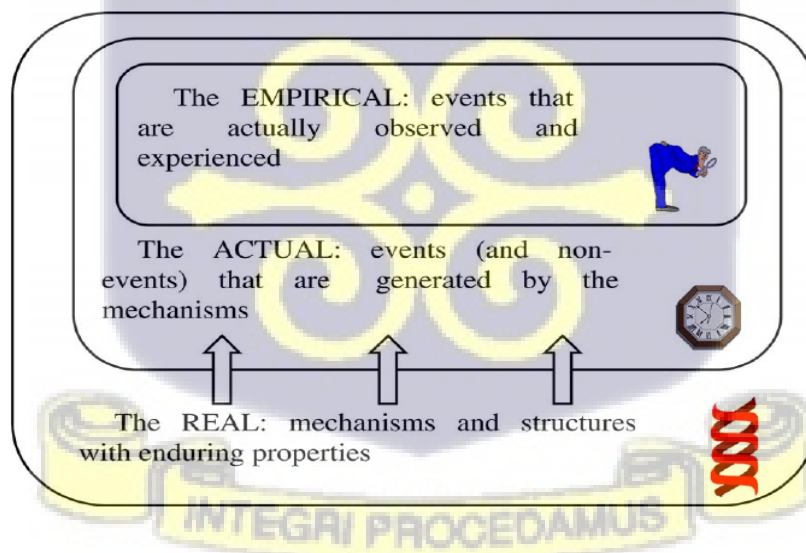
5.3.4 The Critical Realism Paradigm

Mingers has presented Critical Realism as a research philosophy based on Bhaskar (1989;1978;1979) with the idea of “providing a consistent and cohesive foundation philosophy

for information systems” in mind (Mingers, 2004, p.295). Critical Realism Theory is, therefore, a philosophical approach associated with Roy Bhaskar. It describes an interface between the natural and social worlds by combining a broad philosophy of science (transcendental realism) with a philosophy of social science (critical naturalism). To react to the "crisis of positivism," critical realism is a relatively recent philosophy that mixes critical theory with postmodernist theory. *Critical realism holds that the theory of knowledge, or epistemology, is different from a theory of being or ontology. Reality exists independent of its human conception* (Bhaskar, 1991, p.140).

Bhaskar is content with the term "critical" to describe his style of realism, which combines his philosophy of science with transcendental realism (Bhaskar, 1978), and critical naturalism, his social science philosophy (Bhaskar, 1979). Critical realism is the critical application of naturalism’s premise to the social sciences in general and IS in particular.

Fig. 5. 2 The Three Domains of the Real Critical Realism



Source: Mingers (2004)

Different processes/events and structures are different strata of social reality with different properties. A distinction is made between the ‘real,’ the ‘actual,’ and the ‘empirical,’ and the ‘empirical’ is part of the real and the actual experienced by social actors. The ‘real’ is the

structure associated with ‘causal powers,’ and the ‘actual’ are the processes and events (Fairclough, 2005).

Critical realism takes both positivist and interpretive positions. Realism, like interpretive perspectives, recognises the distinctions between natural and social sciences, as well as the fact that social reality is pre-interpreted. Realists, on the other hand, agree with positivists that science must be empirically based, logical, and objective (Flowers, 2009). Realists believe research from various perspectives and levels will improve understanding of the phenomenon. As a result, realism might be regarded as inductive or theory-building (Chia, 2002).

5.3.5 Justification for Critical Realism Paradigm for this Research

The exposition of the varied and diverse paradigms identified in IS literature early on warrants the choice of critical realism and why it is appropriate for this study. First and foremost, Critical Realism can open up the methodological space between empiricism or positivism and interpretivism (Mingers, 2004).

The purpose of critical social research is to change the world - actors, information systems, organisations, and society. Critical IS researchers go beyond interpretivism to question the phenomenon leading to an event. They also expose inherent conflicts and contradictions, hidden structures, and mechanisms accountable for these influences (Cecez-Kecmanovic, 2007).

This research adopts critical realism as a preferred paradigm because it can uncover, unearth or examine the effectual mechanisms and structures that underlie perceived events (Dobson, 2002). In critical realism, it is believed that the research process could be done in a retrospective manner. Thus, the phenomenon could be explained by examining its structures and mechanisms (Easton, 2010). Although the critical realism paradigm is new compared to

positivism and interpretivism, it has gained momentum in social science research, economics, etc. (Easton, 2010; Fleetwood, 1998).

This work aims to develop a model that looks at the antecedents (causes) to consequences (effects) of technology addiction on academic performance among university students. The researcher believes that critical realism will help unearth the causal mechanisms and underlying structures of socio-technical interactions between humans and technologies.

Knowledge is subjective and must be comprehended and interpreted through the lens of the researcher (Fitzgerald & Howcroft, 1998). As a result, it is concluded that social actors' perceptions are influenced by cognitive variables, resulting in many realities (Lincoln & Denzin, 2003). As a result, the Critical Realism paradigm underpins and guides this study.

5.4 Research Approach and Methods

The research approach involves the procedure used in conducting research centred on data collection methods, data analysis, and interpretations (Creswell, 2014). The approach to adopt in conducting research is based on the nature of the research problem, the researcher's paradigm, and the research's purpose, which includes questions/objectives. Creswell (2003) suggested three (3) approaches to conducting social science research: qualitative, quantitative, and mixed methods. Any paradigm could use all these three approaches (Mark Saunders, Lewis, & Thornhill, 2019). Each of these approaches is explained in the sections below:

5.4.1 Qualitative Research

Qualitative research (QR) “tends to explore the meanings, attitudes, values, and beliefs people associate with a phenomenon” (Ponterotto, 2005). Flick (2018) proposed four (4) features of qualitative research such as i) appropriateness of methods and theories, ii) perspectives of the

participants and their diversity, iii) reflexivity of the researcher and the research and iv) variety of approaches and methods in qualitative research. Creswell expanded these four (4) features further to eight (8) QR features: a natural setting, researcher key instrument, multiple methods, complex reasoning through inductive and deductive logic, participants' meanings, emergent design, flexibility, and holistic account. Patton (2005) proposed more comprehensive features comprising twelve sets categorised into three (3) strategies: design strategies, data collection, field strategies, and analysis strategies.

The analysis methodologies are unique case orientations, inductive analysis, creative synthesis, holistic perspective, context-sensitivity, voice, perspective, and reflexivity. QR is done using non-numeric data. However, to generate QR, scholars must necessarily decide to deploy a qualitative research method. The four types of qualitative research are phenomenology, grounded theory, ethnography, and case study (Sarker, Xiao, & Beaulieu, 2013). Qualitative research is normally about grouping data into themes with a special focus on rendering simple a complex phenomenon (Creswell, 2014). QR gives researchers room to explain each case in detail (Mahoney & Goerts, 2006). In QR, open-ended questions are normally deployed to give the participants the liberty to express themselves freely (Creswell, 2003). Also, in QR, the data analysis is subjective to the users and researchers conducting the study. Therefore, verifiable data replication is normally impossible (VanderStoep & Johnston, 2009).

5.4.2 Quantitative Research

Quantitative research aims to quantify variation in order to determine the scope of an issue or the link between different components of a phenomenon. Therefore, the research method seeks to test by approving or disapproving a proposed relationship between cause and effect (Venkatesh et al., 2013). For emphasis, the quantitative research approach tests variables

derived from theories (Creswell, 2014). Quantitative research is different from qualitative research because it is structured and follows a systematic process. It normally starts with hypotheses/questions derived from previous research or theory and uses a measurement scale or objective instrument to collect data from the selected sample. The quantitative research results are presented using inferences and statistics based on the sample size of the population. It is an objective study where the researcher is independent of the subjects used in the data collection. Quantitative research aims to quantify the variance in order to determine the scope of an issue or the link between different components of a phenomenon (Shaughnessy, Zechmeister, & Zechmeister, 2012).

5.4.3 Mixed-Methods Research

Mixed-methods research is a research method that involves both qualitative and quantitative research methods (Creswell, 2003). Mixed-methods research combines qualitative and quantitative research techniques. A mixed-methods approach is useful because it helps to get a more meaningful complete view and a true picture of the phenomenon of interest. It helps to go in-depth to understand the phenomenon of study and develop a stronger and more appropriate inference (Creswell, 2014; Venkatesh et al., 2013). It is a research method that integrates qualitative and quantitative research into a single study (Venkatesh et al., 2013).

In a single study project, mixed methods research assesses quantitative and qualitative data. When well-adapted, this method cancels the bias inherited in quantitative and qualitative studies (Denzin, 1978). While qualitative approaches are mostly inductive and interpretivism, they are commonly utilised for exploratory investigations to assist in creating new theoretical insights (Punch, 2013; Walsham, 2006); quantitative methods are used mainly for confirmatory research such as theory testing, although there may be few exceptions (Venkatesh

et al., 2013). Mixed methods studies can provide stronger inferences than either qualitative or quantitative methods can on their own (Teddlie & Tashakkori, 2009). The mixed-method approach can take advantage of both the strengths and drawbacks of qualitative and quantitative approaches, making meta-inferences more precise (Venkatesh et al., 2013). “Meta-inferences represent an integrative view of findings from qualitative and quantitative strands of mixed methods research and are considered essential components of mixed methods” (Venkatesh et al., 2013, p.25).

5.5 General Research Design

The general research design of this study focused on the strategy adopted, the survey instrument design, pre-testing and revising of the questionnaire.

5.5.1 Research Strategy

The research strategy is how the various tools and techniques are used to obtain or gather the research data for the phenomenon of interest (Remenyi, Williams, Money, & Swartz, 2003). It is the general plan of how the researcher will answer the research question(s) (Saunders, Lewis, & Thornhill, 2009, p.163).

This study adopts a mixed-method approach to help examine the research purpose through the research objectives and questions. It is consistent with the research framework designed. The qualitative method will uncover insights and explain technology addiction from multidisciplinary and stakeholder perspectives (Sarker, Sarker, Sahaym, & Bjorn-Andersen, 2012). The qualitative method helps move beyond the figures and the calculations to understand the processes leading to MTA and their outcomes. The qualitative method assists in explaining the actual events of each construct generated by the mechanism and provides rich meanings to the quantitative data.

Additionally, Structural Equation Modelling (SEM) is a quantitative technique adopted by this thesis because it explores the direct and indirect relationships among MTA's antecedents and consequences. The hypotheses were developed based on the constructs and their relationships to test and validate the model.

5.5.2 Survey Instrument Design

This research adopted a survey approach as a research method and used a survey instrument (questionnaire) to collect the quantitative data. Information system research is often adopted in causal studies and is valuable in examining respondents' thoughts, feelings, opinions, and so on about a particular phenomenon (Shaughnessy et al., 2012). This method permits collecting and analysing quantitative data for descriptive and inferential statistics. A survey method is an effective tool for sampling a population and generalising the outcomes (Creswell & Clark, 2007; Yin, 1984). This research adopts a survey method to sample the population of students from three (3) universities in Ghana.

The questionnaire was part of the ethical clearance forms reviewed and approved by the Ethics Committee of the Humanities of the University of Ghana. Furthermore, a consent form requesting voluntary participation in the study or otherwise was made available for the respondents to fill out before completing the questionnaire. The survey questionnaire consisted of two main sections. The first section consisted of demographic data questions on gender, age, highest educational qualification, type of mobile device, and the platform for accessing mobile technology.

The second section captured items relating to mobile applications' antecedents, mediators, moderators, and consequences. The various constructs or variables were operationalised by selecting measurement items from the literature on technology addiction and mobile applications addiction. *The presence* variable is a construct that emerged for flow as its fifth dimension; therefore, the scale developed for it was scoured from flow literature (Csikszentmihalyi, 1975; Novak & Hoffman, 2000). The participants ranked their opinions using a 5-point Likert scale ranging from 1 (Strongly Disagree) to 5 (Strongly Agree). The development of the questionnaire followed the guidelines proposed by Churchill (1987) and Straub (1989). These guidelines were adopted to ensure the reliability and validity of the data collection instrument. Table 5.1 shows the various constructs used to design the questionnaire, the number of items for each construct, and their respective sources. The individual items in these scales provided by the source documents were selected, modified slightly and adopted for this study.

Table 5. 1 Constructs, Number of Items and their Respective Sources

CONSTRUCT	NUMBER OF ITEMS	SOURCE
<i>Flow</i> (Control)	Four (4) items	(Huang, 2003; Cheng, 2000; Novak et al.,2000; Csikszentmihalyi,1975)
<i>Flow</i> (Attention Focus)	Four (4) items	(Huang, 2003; Cheng, 2000; Novak et al.,2000; Csikszentmihalyi,1975)
<i>Flow</i> (Curiosity)	Four (4) items	(Huang, 2003; Cheng, 2000; Novak et al.,2000; Csikszentmihalyi,1975)
<i>Flow</i> (Intrinsic Interest)	Four (4) items	(Huang, 2003; Cheng, 2000; Novak et al.,2000; Csikszentmihalyi,1975)
<i>Flow</i> (Presence)	Four (4) items	(Huang, 2003; Cheng, 2000; Novak et al.,2000; Csikszentmihalyi,1975)
Utilitarian Value	Five (5) items	(Gefen et al., 2003)
Hedonic Value	Five (5) items	(Huang, 2003; Cheng, 2000; Novak et al.,2000; Csikszentmihalyi,1975)
Self-traits	Five (5) items	(Tangney, Baumeister, & Boone, 2004; Scholz, Doña, Sud, & Schwarzer, 2002; Rosenberg, 1965)
Interactivity	Five (5) items	(Skadberg & Kimmel, 2004)
Usability	Five (5) items	(Nielsen, 1994; Agarwal & Venkatesh, 2002; Teo et al., 2003; Flavian et al., 2006)
Social presence	Five (5) items	(Gefen et al., 2003b)

Telepresence	Five (5) items	(Bouchard & Robillard, 2006)
Students' academic performance	Five (5) items	(Kubey et al., 2001)
Fear of Missing Out (FoMO)	Five (5) items	(Przybylski et al., 2013)
Self-regulation	Five (5) items	(Haagsma et al., 2013; Turel, 2005a)
Mobile technology addiction	Four (4) items	(Turel & Serenko, 2012)

5.5.3 Pre-testing and Revising the Questionnaire

Before finalising the main questionnaire for admission to respondents, pre-testing and revising the questionnaires are important steps toward identifying and removing any potential problems. The researcher's supervisors first reviewed the questions and suggested modifications, which assisted in refining the questionnaire for admission. The University of Ghana Ethical Clearance Committee for the Humanities further reviewed and approved the questionnaire. Afterwards, the preliminary version of the draft questionnaire was piloted by the University of Ghana Business School and Ho Technical University students. The questionnaire was later modified and the final version was administered to the participants from the three (3) universities such as the University of Ghana Business School (The Premier Public University in Ghana), Ho Technical University (Among the first Polytechnics to be converted to a Public Technical University in Ghana) and Valley View University (The First Private University in Ghana). The details of the questionnaire are shown in Appendix C.

5.6 Sampling Approach

There are five (5) topologies of mixed-method sampling approaches identified in the literature (Creswell, 2003; Teddlie & Yu, 2007), (a) The basic strategies are quantitative and qualitative sampling, normally based on stratified purposeful sampling and purposive random sampling, (b) sequential sampling, where the sampling first strand or phase of data collection, informs the second strand or phase, (c) concurrent sampling, sampling method, or approach is when the quantitative probability and purposeful qualitative sampling are integrated jointly or separated

as independent sampling procedures. An example is a survey that includes both open-ended and closed-ended questions; (d) multilevel sampling, which occurs when there are two or more units or levels of analyses and (e) sampling combining any of the strategies mentioned above (Creswell & Clark, 2007). This study adopted concurrent sampling where the qualitative purposely targeted the addicts mainly undergoing recovery, and quantitative data randomly targeted the undergraduate and postgraduate university students in Ghana.

5.6.1 Data Collection Process

This study adopts a combination of face-to-face and online surveys using google forms. Morse proposed mixed method data collection methods with varied topologies (Morse, 2003). This research collects both qualitative and quantitative data. Qualitative data collection occurred via purposive sampling and focused on individuals who have experienced the central phenomenon (technology addicts going through some rehabilitation) (Creswell & Clark, 2007). The data collection methods were based on three (3) of the five (5) methods identified in the information systems literature. These were interviews, direct observation, and physical artefacts regarding devices, outputs, and tools (Benbasat et al., 1987; Cook & Campbell, 1979; Webb, Campbell, Schwartz, & Sechrest, 1966). Moreover, different data collection methods are identified in the literature, such as meeting face-to-face with participants, telephone calls, postal services, sending electronic mail, and combining these methods (Cooper & Schindler, 2001; Zikmund, 2000). This study started with self-administered face-to-face interviews and observations but was later changed to online google forms due to the outbreak of the COVID-19 pandemic, which aligns with previous research (Davis, 1989; Volkow, Fowler, & Wang, 2003). Several advantages of using different data collection methods include speed, versatility, and cost-effectiveness (Chandio, 2011). It is consistent with previous technology acceptance and uses studies (Venkatesh & Bala, 2008; Venkatesh et al., 2003).

5.6.2 Sample Size (N)

This study was conducted by considering the sample size of the three (3) universities. The names of the universities, their respective populations at the time of this study, the total number of questionnaires distributed, and the response rate in percentages are shown in Table 5.1 below.

Table 5.1 Table for the Questionnaire Distribution and Response Rate

Name of the University	Population	Questionnaire Distributed	Questionnaire Returned	Response Rate Per Total No	Response Rate in %
University of Ghana (Graduate Students)	4, 820	$\frac{4820}{8359} \times 600 = 346$	300	55%	87%
Ho Technical University	1,974	$\frac{1974}{8359} \times 600 = 142$	140	25%	99%
Valley View University	1,565	$\frac{1565}{8359} \times 600 = 112$	110	20%	98%
TOTAL	8,359	600	550	100%	92%

5.7 Method of Data Analysis

This research adopts a mixed method for the data analysis to get a complete picture of the mobile technology addiction phenomenon (Hackney, Jones, & Löscher, 2007; Piccoli & Ives, 2003). The mixed method aims to provide complementarity, completeness, developmental expansion, corroboration/confirmation, compensation, and diversity of the phenomenon (Venkatesh et al., 2013).

5.7.1 Quantitative Data Analysis Techniques

Statistical Package for Social Sciences (SPSS) was used to code and organise the quantitative data, which was analysed with SmartPLS tools. Partial Least Square (PLS) is one of the Structure Equation Models (SEM) approaches. There are two main SEM approaches Covariance Based SEM (CB-SEM) and Variance-Based SEM (Partial Least Square). PLS-SEM is focused on analysing variance-based structural equation models, while CB-SEM is focused on analysing covariance-based models. This research adopted PLS-SEM for the analysis because the data distribution was skewed. CB-SEM is analysed using tools such as AMOS, Mplus and LISREL, while PLS-SEM is analysed using software packages such as ADANCO and SmartPLS (Hair, Risher, Sarstedt, & Ringle, 2019; Wong, 2019).

The main preference for PLS-SEM compared to covariance SEM is its ability to estimate complex causal models with multiple constructs and indicator variables and its superior predictive power. Furthermore, it can estimate complex relationships when the linkages are not directly observable or hypothetical (Williams, Vandenberg, & Edwards, 2009). Also, because the PLS-SEM is non-parametric, it provides more flexible data requirements, whereas the factor-based SEM requires multivariate normality. PLS-SEM, in particular, may yield reliable parameter estimates with small to moderate sample numbers, whereas factor-based SEM requires larger sample sizes. Regarding model specification, the PLS-SEM can easily accommodate both reflective and formative components, whereas the factor-based SEM can only handle reflective constructs. As previously stated, PLS-SEM can model constructs both explanatorily and predictively, but factor-based SEM can only model constructs explanatorily and has limitations in modelling construct associations predictively (Hair et al., 2019; Shmueli, Ray, Estrada, & Chatla, 2016; Shmueli et al., 2019). PLS-SEM estimates model parameters to maximise the variance explained by the endogenous or inner construct, whereas factor-based

SEM estimates model parameters to minimise the disagreement between the estimated and sample covariance matrices (Hair Jr., Matthews, Matthews, & Sarstedt, 2017).

SEM is a multivariate data analysis technique broadly adopted in IS literature to test the relationships between constructs and their validations (Gefen, Straub, & Boudreau, 2000). A path model depicts the relationships between hypotheses and variables and the estimated matrices in a Structure Equation Model study. Constructs, also known as latent variables (LV), are theoretical models specified by researchers in their conceptual framework and are used in statistical models. The constructs are measured using items known as indicators, which are observed variables that represent respondents' responses in the field (raw data) (Astrachan, Patel, & Wanzanried, 2014; Chin, 1998). The objective of this study is to look at the relationship between dependent and independent constructs by considering cause-and-effect relationships between latent variables and, most crucially, their predictive relevance, which is impossible to do with CB-SEM (Astrachan et al., 2014). Measurement and structural models are the two elements of the path model. The measuring model represents the relationship between the items or indicators and the constructs. The outer model refers to this portion.

5.7.2 Measurement Theory

Measurement theory, also known as the outer model, measures latent variables (LV) or unobserved variables. Reflective and formative measurement models are the two main types of measurement models (Hair Jr, Hult, Ringle, & Sarstedt, 2016; Jr et al., 2017; Wong, 2019). The measuring model establishes the association between the constructs and their related indicator variables. The link between the constructs and indicator variables in PLS-SEM is referred to as the outer model (Joseph F. Hair Jr, Hult, Ringle, & Sarstedt, 2014). The structural model's hypothesis testing improves when a good measurement theory exists. The construct and its indicator variables are linked directly in reflective measurement models. The reflecting

measurement model represents the underlying items that measure the construct. Because additional variables can measure the structures, these are usually viewed as error-prone (Joe F. Hair Jr. et al., 2017; Joseph F. Hair Jr et al., 2014). Because the components are interchangeable, missing one indication will not affect the other indicators' ability to explain or predict the construct. The reflective indicators include a sample of all items associated with the construct and are termed scales.

On the other hand, the formative measurement approach is predicated on the premise that indicator variables create the constructs and are hence incompatible. Formative indicators attempt to quantify the precise domain of constructs, meaning they provide meaning for the construct. This indicates that the formative indicator must be large in scope in order to accurately assess the construct, making it impossible to exclude an indicator without altering the construct domain (Joe F. Hair Jr. et al., 2017; Sarstedt, Nitzl, & Howard, 2020). Formative indicators do not need to be correlated and are hence independent. As a result, collinearity between formative indicators is always a concern, as the estimates connecting the indicators to the constructs are frequently unstable and nonsignificant. Therefore, formative indicators do not include an error component and are regarded as error-free in the usual sense (Joe F. Hair Jr. et al., 2017).

Determining whether a construct is reflecting or formative is a non-issue; nevertheless, this relies on the construct conceptualisation and the research objectives. Reflective measurement is more appropriate if the study's objective is to test theories (Sarstedt, Ringle, & Hair, 2017).

5.7.3 Measurement Model Assessment

The evaluation of the measurement model (also known as the outer model) includes composite reliability (CR) to determine internal consistency, individual indicator reliability, and average

variance extracted (AVE) to determine convergent and discriminant validity (Joe F. Hair Jr. et al., 2017; Sarstedt et al., 2017).

a. Internal Consistency Reliability

This subset of reliability is used to assess the consistency of results across variables. This determines whether the items used to measure a variable have a similar score distribution. Internal consistency reliability is determined by a CR threshold of 0.7 and above. When the CR value is less than 0.6, it indicates that the items lack internal consistency reliability (Hair, Hult, Ringle, & Sarstedt, 2014).

b. Convergent Validity

This term refers to the degree to which indicators correlate positively with alternative construct indicators. Convergent validity is established using the outer loadings of indicators and the average variance extracted (AVE). As a general rule, the outer loadings of indicators should be 0.5 or greater (Hair et al., 2014).

c. Discriminant Validity

This metric indicates the degree to which a variable is truly distinct from other variables in terms of its correlation with other variables and the extent to which its indicators represent only one variable. The discriminant validity was determined using Fornell and Larcker's (1981) criterion and cross-loading scores. To establish the LVs' discriminant validity, the square roots of the AVEs for all LVs should be greater than the correlations between the constructs (Fornell & Larcker, 1981). Additionally, the individual loadings of all indicators should be greater than their respective cross-loadings (Hair et al., 2014, 2019). Recent research indicates that the above-mentioned measure of discriminant validity is no longer appropriate, leading to the proposal of the correlations' Heterotrait-Monotrait (HTMT) ratio. HTMT is defined as the

mean correlations between items across constructs divided by the mean correlations between items measuring the same construct. HTMT threshold value of 0.85 or 0.9 has been posited (Hair et al., 2019; Henseler, Ringle, & Sarstedt, 2015).

d. Formative Measurement Models Assessment

When evaluating formative constructs using PLS-SEM, it is necessary to establish the construct's content validity. This must occur before establishing the formative measurement's empirical measurement. The content validity of a formative indicator is determined by ensuring that it captures the primary domain of the construct being measured, as this indicator does not co-vary. This is possible when the researcher conceptualises the formative construct through a thorough review of the literature and expert assessment of the indicators (Hair, Hult, Ringle, 2014; Hair et al., 2019). When evaluating the formative measurement models' PLS-SEM empirical results, convergent validity, individual indicator validity, and the indicator's significance and relevance must all be considered.

Convergent validity refers to an indicator's positive correlation with other indicators of the same construct. The researcher must use a formatively measured construct to predict an endogenous latent variable if the measures are highly correlated. When formative indicators are highly correlated, a phenomenon known as multicollinearity occurs, in which two or more indicators measure the same constructs in the same way (Hair, Hult, Ringle, 2014; Sarstedt et al., 2017). This should be verified because the two indicators should perfectly correlate, and the value should be 0.7 or greater. The variance inflation factor (VIF) is typically used to determine an indicator's collinearity. A VIF of 5 or greater indicates a high degree of collinearity between the formatively measured constructs. The ideal VIF value is 3 or less (Hair et al., 2019; Shmueli et al., 2016). Statistical significance or relevance is the third measure of formatively measured constructs that assesses the constructs' outer weights. The outer weights

are determined through a multiple regression analysis using the LV score as the dependent variable and the formative indicators as the independent variables (Hair, Hult, Ringle, 2014). Due to the nonparametric nature of PLS-SEM, bootstrapping is used to determine statistical significance. When the indicator's confident internal weight includes zero, the indicator is no longer statistically significant and can be removed from the measurement model. Significant loading of 0.50 or less indicates that they should be removed unless there is a compelling reason to keep them (Hair et al., 2019).

5.7.4 Structural Theory

The structural theory of path modelling assesses the relationship between the Latent Variable (LV) and its associated constructs. The path model is divided into left and right sections, and the sequence is determined by the researcher's prior knowledge or theory. The model's left section comprises independent variables, while the right section comprises dependent variables (DV) (Hair et al., 2014; Sarstedt et al., 2017).

When the LV is used exclusively as an independent variable (IV), it is referred to as an exogenous latent variable. When LV serves as ID and DV variables, they are referred to as endogenous latent variables. To assess the structural model, it is necessary to create a diagram and develop research hypotheses based on the path models. Additionally, the structural model is referred to as the internal model (Hair et al., 2014).

5.7.5 Structural Model Assessment

The measurement model evaluates the LV's reliability and validity; the structural or inner model is then evaluated to determine the relationship between exogenous and endogenous variables. The estimates to be measured in PLS-SEM under the structural model include the path coefficient, which is used to determine the model's significance and relevance; the R^2

value, which is used to determine the model's predictive accuracy; the Q^2 value, which is used to determine the model's predictive relevance; and the f^2 value, which is used to determine the significant impact of an exogenous variable on an endogenous variable (Hair et al., 2019; Usakli & Kucukergin, 2018).

a. Assessing R^2 Estimates

The coefficient of determination, abbreviated as R^2 , is used to evaluate structural models. The coefficient of determination determines the model's predictive accuracy and is calculated as the square correlation between the actual and predicted values of a set of endogenous constructs. The R^2 value indicates the combined effect of exogenous variables on endogenous latent variables. It also indicates the amount of variance explained by all exogenous constructs associated with the endogenous latent constructs (Hair, Hult, Ringle, 2014). Another term for R^2 is in-sample predictive power, which has a value between 0 and 1. Therefore, R^2 values of 0.75, 0.50, and 0.25 are significant, moderate, and weak. Because the R^2 value is proportional to the number of predictor constructs, the more predictor constructs, the greater the R^2 (Hair et al., 2019).

b. Assessing f^2 Values

The model's predictive accuracy can also be determined using the f^2 effect size. The f^2 effect size is used to determine the change in the R^2 value when an exogenous variable is removed from the model. This is estimated by removing specific predictor constructs and observing the effect on the R^2 of the endogenous construct. When comparing the size of the path coefficient and the f^2 effect size, the rank order of the predictor constructs whose relevance is explained by a dependent construct in the structural model is frequently identical. When the rank order of the constructs' importance in explaining an endogenous construct in the structural model differs when the size of the path coefficient is compared to the size of the f^2 effect size, the

researcher may report the f^2 effect size to explain the presence of partial or complete mediation. Generally, values greater than 0.02, 0.15, and 0.35 are used to estimate the effect sizes of small, medium, and large f^2 (Hair et al., 2019; Shmueli et al., 2016).

c. Assessing Q^2 Values

Calculation of the Q^2 value is based on the Stone–Geisser Q^2 value (Geisser, 1974; Stone, 1974). This metric is based on the blindfolding technique, which eliminates individual points from the data matrix, normalises the removed points, and estimates the model parameters. By blindfolding all endogenous variables with a 7-point omission distance, cross-validated redundancy Q^2 of all endogenous variables was obtained (Hair, Hult, Ringle, 2014; Hair et al., 2019). Small differences between predicted and original values result in a larger Q^2 value and, consequently, a higher predictive accuracy. As a general rule, Q^2 values should be greater than zero for a given endogenous construct to indicate the structural model's predictive accuracy for that construct. As a general rule, Q^2 values greater than 0, 0.25, and 0.50 indicate that the PLS path model has a low, medium, or high predictive relevance, respectively (Hair et al., 2019).

5.7.5 Mediation and Moderation Analysis

Mediation occurs when a third variable acts as a link between two other related constructs. Mediation analysis determines the causal relationship between the exogenous and endogenous variables (Hair, Hult, Ringle, 2014). To determine the mediation effect, both the direct and indirect effects must be determined. The direct effect is the relationship between two constructs (independent and dependent variables), represented by a single arrow. The term “indirect effects” refers to relationships that involve multiple relationships with at least one intervening construct and are visually represented by multiple arrows. However, this study omitted mediation analysis in favour of moderation analysis. The moderating effects of self-regulation

and FoMO are examined in this study. Moderation occurs when an independent variable or construct modifies the strength or direction of the relationship between two model constructs. Additionally, the moderation model is estimated using the PLS-SEM Software (SmartPLS 3.2.8) due to its robustness in determining moderating effects (Ringle et al., 2015). Moderation has been classified into two types by scholars: continuous and categorical. When the moderating variable is measured metrically, the effect is continuous; when the moderating variable is categorical, such as gender, the effect is categorical. The third objective of this study is to determine the continuous moderating effect of self-regulation and FoMO.

5.7.6 Qualitative Data Analysis Techniques

This study's data analysis techniques helped reveal the constructive and causal powers of the technology addiction phenomena. For the qualitative data, a descriptive data analysis was performed. After coding, the themes and subthemes that emerged from the themes guided the findings and discussions. The research purpose, objectives and questions directed this research and helped generate the codes for analysis. The theories were used to revise the codes' context by providing labels and defining the data to depict the raw data truly

a. Sample

Purposive random sampling was adopted. The researcher tries to identify and sample individuals who can influence the findings and vividly reveal the phenomenon of interest for the qualitative study. The first target was to sample the views of the addicts. Thirteen (13) perceived technology addiction users were first and foremost identified from various backgrounds and subjected to the internet addiction scale. Seven (7) met the criteria and were found to be addicts. The Internet Addiction Test (IAT) by Dr. Kimberly Young is a valid measure of addiction to the internet. It comprises 20 questionnaire items and measures mild, moderate, and severe internet addiction (Young, 2009). This scale helped the researcher find

six (6) addicts with severe forms of addiction and one (1) addict who had recovered at the Korle - Bu Addiction Center in Ghana and was sampled for this research.

Among these seven (7) participants, six (6) were solely addicted to mobile technology and one (1) to both substances and mobile technology. Two (2) relations of each addict were contacted to authenticate the interviewees' responses. Seven (7) experts or professionals, made up of two (2) females and five (5) males, were also interviewed to verify the findings of this study. The females were a Cyber Psychologist/Counsellor who lectures in the Psychology Department of the University of Ghana and a Mental Health Nurse, now a Deputy Director of the Mental Health Authority of Ghana. The males were a Clinical Psychologist in charge of the Korle Bu Addiction Center with 25 years of experience working with both substance and behavioural addicts, a Psychiatric Doctor lecturing at the University of Health and Allied Sciences, an Elder in charge of The Church of Pentecost Prayer Center in Ghana, a Lecturer of one of the addicts who is also a Mobile Applications Developer and a Neuro Scientist. These experts were interviewed to validate the findings of this research from the addicts and their relations. The seven (7) addicts were observed at different times within six months. Two (2) of their relations and colleagues were interviewed to corroborate the addicts' responses within that period.

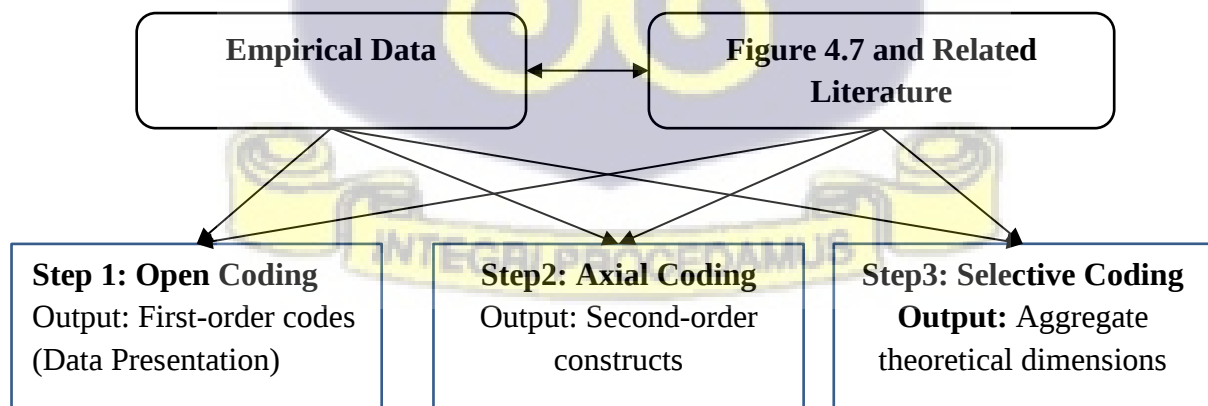
b. Reliability

To improve the reliability of this study, a case study protocol was created that included a data-gathering questionnaire and data collection procedures. Semi-structured interviews, private documentary information, and information from the internet and other public sources were all used to compile and analyse the data. The comprehensiveness of the questions was evaluated by the experts involved in the study and my supervisors. The instrument was improved based on their suggestions (Yin, 1984). Some questions were rewritten and others were restructured after the first round of interviews to improve the interview flow. The questions were divided

into three sections. Section 1 is for technology addicts, section 2 is for their relatives, and section 3 is for the experts (see Appendix D). The interviews' audio recordings were transcribed verbatim and returned to the interviewees for double-checking. The write-ups were grouped into umbrella codes and subcodes using a code tree after they were approved (see the full scale in Appendix E). The respondents who were found to be addicts were first subjected to the Internet Addiction Test (IAT) (Young, 2009). The participants in the study were found to be in the range of 80 to 100, which means they were in severe forms of addiction. One respondent scored 21, meaning his addiction was mild because he was recovering. The subsequent coding recommendations were based on the data-driven method, which enabled codes to be written sentence by sentence levels (DeCuir-Gunby, Marshall, & McCulloch, 2011). Individual participants were analysed independently, utilising the framework provided to improve the validity and reliability through analytical triangulation (Padgett, 1998).

The data were analysed using the three levels of qualitative coding proposed by Miles and Huberman. There are open coding, axial coding, and selective coding (Miles, Huberman, & Saldana, 2014). This research first analysed the quantitative data, which informed the qualitative design and analysis. The details of the above are shown in Figure 5.3 below:

Fig. 5.3 Qualitative Data Analysis Process



Source: Adapted from Tzeng (2018).

c. Construct Validity

To improve the construct validity of this study, the researcher adopted two (2) strategies. The first strategy is to gather information from the addicts individually at different times and from experts with varied backgrounds to triangulate the data (Yin, 2003). The researcher matched information collected from interviews with information gleaned from the literature. For example, we compared the cues generated and the reaction of the brain, as mentioned by the Neuroscientist, to what exists in literature and used that to guide the coding. We also analysed the comments of different interviewers to see if they agreed on the themes generated. When the data from the field agreed with the themes generated from the literature and the theories, the data was considered valid. Second, after the analysis, the findings were subjected to post-study evaluation. The Mobile Application Developers, Health Professionals, and Experts who participated in this work all agreed that the model developed was sound and that the findings were accurate.

d. Internal Validity

To improve the internal validity of our case studies, the researcher adopted three strategies. The first strategy is to construct causal relationships for the three theories used for this work. The framework designed from these theories established the foundation for this study. Additionally, the individual constructs from the framework were subjected to broader critics and relevance.

Second, this study tried to determine how the theories predictions matched the patterns in the data collected. The researcher observed convergent patterns and appropriately coded them to explain the constructs. For example, the researcher discovered that the theme generated by technology user self-traits could best be segmented into digital self-esteem, digital self-efficacy, and digital self-control, which agrees with the available literature (Khang et al., 2013).

Third, we performed a cross-case study, which compared the outcomes of the various cases and then subjected the outcomes to the experts' views and comments. The goal of this study was to see if the same result could be repeated in a new situation. For example, regardless of the case, the researcher identified the same pattern of sorts from the addicts based on their willpower to recover.

e. External Validity

To improve the external validity of the study, the researcher employed replication logic. The researcher began by collecting and analysing the data from addicts one at a time until the theoretical saturation was reached. At that point, no new themes or patterns appeared in the research (Yin, 2003). External validity is further promoted by including the relatives of the addicts who confirm or otherwise the data collected from the addicts. The experts from multidisciplinary backgrounds further enhanced the external validity. The study's findings were subjected to experts' views and comments, which helped provide rich explanations for each construct in the framework. The post-study evaluation finally approved the validity of the work and assisted in developing the final model

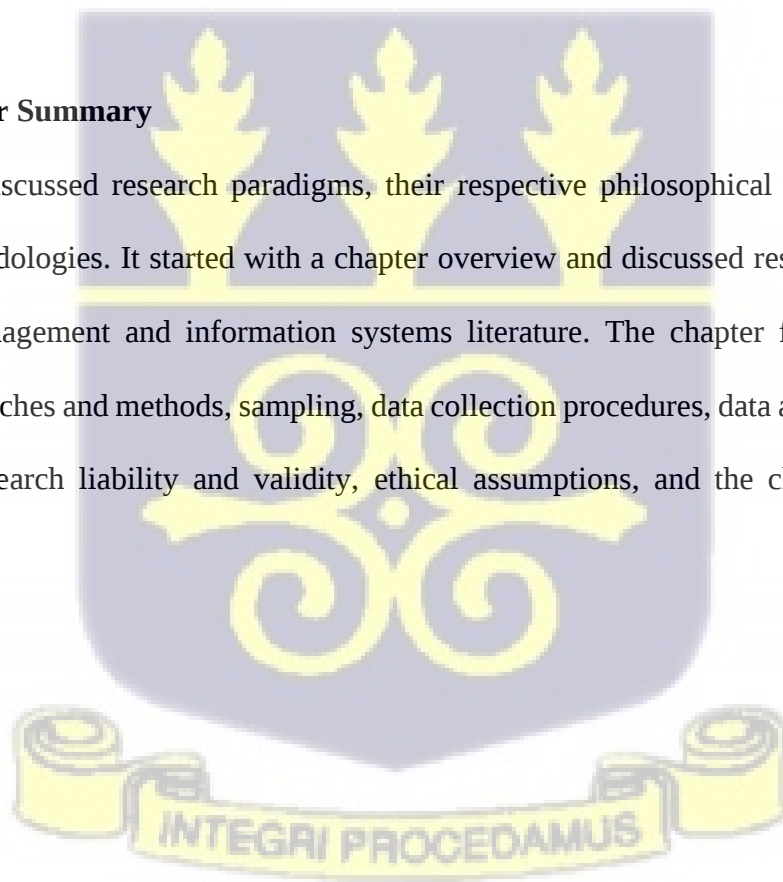
5.7.7 Ethical Considerations

The multi-stakeholders engaged in this study participated voluntarily without any compulsion. Permission was sought from the rehabilitation facility, the clinical psychologist in charge of the facility, and the individual addicts decided voluntarily to participate in this research. Participants were duly informed that this research was solely for academic purposes and their participation would contribute to knowledge. Therefore, there were no privacy or ethical breaches before, during, or after the interviews and observations.

The quantitative data were collected by admitting questionnaires physically and online. For the physical questionnaire admission, the participants were asked to either accept willingly to fill out the questionnaire or otherwise. For the online questionnaire admission, before the participants filled out the survey questionnaire, the first question was, *“filling this questionnaire is voluntary. However, your participation will be highly appreciated as it contributes to knowledge. Kindly select YES if you are willing to participate; otherwise, select NO and exit.”* All literature that supported and provided backing, clarification, or insight into this research are duly cited. It is to ensure this research adheres to the principles and standard protocols per the rules and regulations approved by the Ethics Committee for the Humanities of the University of Ghana.

5.7.8 Chapter Summary

This chapter discussed research paradigms, their respective philosophical assumptions and research methodologies. It started with a chapter overview and discussed research paradigms in general management and information systems literature. The chapter further discussed research approaches and methods, sampling, data collection procedures, data analysis tools and techniques, research liability and validity, ethical assumptions, and the chapter summary.



CHAPTER SIX

QUANTITATIVE RESULTS AND ANALYSIS

6.1 Chapter Overview

This chapter uses descriptive statistics, measurement model analysis, and structural model analysis to convey the data analysis outcomes. The previous chapter of this research presented an overview of the research paradigms and methodologies. It vividly described the sampling procedures, data collection procedures, data analysis tools and techniques, and ethical considerations. The outcomes of the data analysis, the presentation of the findings in descriptive statistics, the analysis of measurement models, and the analysis of structural models are all covered in this chapter. This chapter provides the descriptive statistics of the respondents, explains the measurement and structural models using the Partial Least Square Structural Equation Modelling (PLS-SEM), and analyses the moderation effects of Self-regulation and FoMO.

6.2 Demographic Characteristics

This section presents the demographic characteristics of the study. Out of the 550 responses collected from the field, only 528 responses were fully completed and used for this work. The results are shown in Table 6.1.



Table 6.1 Demographic Characteristics

Source: Constructed from analysis of survey data (Estimated by SPSS 25.0)

Characteristics	Frequency	Percentage (%)
<i>Gender</i>		
Male	328	62.1
Female	200	37.9
Total	528	100.0
<i>Age</i>		
<15 years	0	0.0
16-20 years	25	4.7
21-25 year	339	64.2
26-30 years	105	19.9
31-35 years	39	7.4
>35 years	20	3.8
<i>Highest Qualification</i>		
First Degree	228	43.2
Masters / PhD	300	56.8
Total	528	100.0

The table provided detailed information about the gender, age, and highest qualification of the participants. The total number of valid responses was 528. The table shows that more males participated in the study than females; since the questionnaire was admitted using random sampling, it shows that, on average, there is a higher number of males than females on university campuses in Ghana. Most participants were between 21 and 25 years; this also reveals that this is Ghana's dominant university student age group. Lastly, most participants are postgraduate students. This is because of the postgraduate sample size (n=4,820) while the undergraduate sample size (n=3,539). Therefore, the demographic data reveals more males than females, representing the larger population size. Furthermore, the average age range of students pursuing both graduate and post-graduate programs is within the age range of 21 years to 25 years.

6.3 General Mobile Technology Characteristics

Table 6.2 below presents the respondents' responses regarding mobile technologies (i.e., smartphones, social media and social games).

Table 6.2 General Mobile Technology Characteristics

Characteristics	Frequency	Percentage (%)
<i>Type of mobile device used</i>		
Smartphones	409	77.5
Tablets	95	18.0
Both	24	4.5
Total	528	100.0
<i>The platform on mobile devices mostly uses to access the mobile technology</i>		
Android	219	41.5
Apple iOS	185	35.0
Windows	110	20.8
More than one platform	14	2.7
Total	528	100.0
<i>Using a mobile device to access both applications and voice calls</i>		
Yes	495	93.8
No	33	6.2
Total	528	100.0
<i>Items mostly accessed on mobile devices</i>		
Social media	298	56.4
Social games	140	26.5
Both	90	17.0
Total	528	100.0
<i>Perceived addiction to mobile technology</i>		
Yes	9	1.7
No	519	98.3
Total	528	100.0
<i>Period of using mobile technology</i>		
Less than 1 year	21	4.0
1-5 years	235	44.5
6-10 years	170	32.2
Above 10 years	102	19.3
Total	528	100.0
<i>Total number of hours spent on mobile technology in a day</i>		
Less than 2 hours	271	51.4
2-4 hours	116	22.0
4-6 hours	32	6.1
More than 6 hours	108	20.5
Total	527	100.0
<i>Frequency of accessing mobile technology in a day</i>		
1-5 times	88	16.7

6-10 times	66	12.5
11-15 times	92	17.4
Uncountable	282	53.4
Total	528	100.0
<i>Males vs. females, who are likely to become more addicted to mobile technology</i>		
Male	231	43.8
Female	297	56.2
Total	528	100.0
<i>Respondents often use mobile technology to</i>		
Communicate	176	33.3
Learn	51	9.7
Socialise	117	22.2
Play	68	12.9
All the above	116	22.0
Total	528	100.0
<i>A most significant time for checking mobile technology</i>		
First thing in the morning	136	25.8
During lunch break	115	21.8
Just before sleep in the evening	129	24.4
None of the above	22	4.2
All the above	126	23.9
Total	528	100.0
<i>What automatically influences respondents to check their mobile technology</i>		
Voice calls	84	15.9
Text message alerts	91	17.2
Social media alerts	85	16.1
All the above	268	50.8
Total	528	100.0

Source: Constructed from analysis of survey data (Estimated by SPSS 25.0)

Based on the sampled data in Table 6.2 above, smartphones dominated the ecosystem as the most used device for browsing mobile applications. The data present that 41.5% of the sample used Android platforms, followed by Apple iOS (35%) and Windows (20.8%). Further, 93.8% of the sample used mobile devices to access applications and voice calls, while 6.2% denied it. In terms of items mostly accessed on mobile devices, 56.4% and 26.5% accessed social media and games, respectively, while 17% accessed both. For perceived addiction to mobile technology, only 1.7% confirmed that they are addicted, while 98.3% denied it. Most participants (n=426) used mobile technology within less than 1 year to 10 years, representing 80.7% of the total sample. The majority (n=387) of participants representing (73.4%) spent less

than 2 hours to 4 hours on mobile technology in a day while (n=32), representing (6.1%), spent 4 to 6 hours in a day and then (n= 108) spent more than 6hours, representing (20.5%).

Remarkably, when the respondents were asked how frequently they access mobile technology in a day, (n=282), representing 53.4%, stated they accessed uncountable times in a day while (n=245), representing 46.6%, used mobile technology 1 to 15 times a day. In terms of addiction to mobile technology based on gender, the result shows that females (n=297), representing (56.2%), were more addicted than males (n=231), representing (43.8%). Most respondents used mobile apps for communication and socialisation only (33.3% and 22.2%, respectively), while (22%) used mobile technology collectively for communication, learning, socialisation, and playing games.

Furthermore, when the sample was asked to indicate the most significant time for checking mobile technology, 25.8% indicated “first thing in the morning.” In comparison (24.4%) revealed they do it just before sleep in the evening. One hundred and fifteen (representing 21.8% of users) check their mobile applications during a lunch break. In comparison, (23.9%) can check mobile technology at any time. Lastly, the majority (50.8%) of the sample professed they are automatically influenced by voice calls, text message alerts and social media alerts to check their mobile technology. In comparison, (17.2%) were influenced by text message alerts only, while (16.1%) were influenced by social media alerts. Eighty-four participants (15.9%) of the sample indicated they were influenced by voice calls only.

6.4 Construct Descriptive Analysis

This section reports the descriptive statistics of the variables. The descriptive statistics include mean, standard deviation, skewness, kurtosis, minimum and maximum values in determining

the overall sample's perception of the constructs, a criterion of 3.2 mean scores implemented by Castro and Martins (2010) and Ledimo (2012). Thus, a mean score above 3.2 indicates a positive perception, while a mean score below 3.2 indicates a negative perception of the constructs. Table 6.3 shows the sample characteristics in terms of the descriptive statistics for the variables and their dimensions.

The results show that all the constructs except for FoMO and addiction have mean values above 3.2. This implies that the sample positively perceived the constructs or agreed with most statements. Further, the results show that the scores were generally above average, and the data were spread close to the mean. The skewness and kurtosis values were within the recommended normality range of -1 and +1, except for hedonic values. Similarly, the kurtosis values were within the suggested normality range of -2 and +2 except for hedonic values and utilitarian value/perceived usefulness, which means the data is not normally distributed. Therefore, this study adopted a non-parametric test by using PLS-SEM. For normality, skewness should be around zero, that is, between -1 and +1, and kurtosis should be between -2 and +2 (George & Mallery, 2010).

Table 6.3 Construct descriptive statistics

Variable	N	Minimum	Maximum	Mean	Std. Deviation	Skewness	Kurtosis
Control	528	1	5	3.27	0.54	-0.11	-0.08
Curiosity	528	1	5	3.63	0.61	-0.21	0.09
Intrinsic interest	528	1	5	3.22	0.53	-0.25	-0.09
Presence	528	1	5	3.52	0.63	-0.25	0.34
Utilitarian Value/Perceived Usefulness	528	1	5	3.78	0.53	-0.44	2.23
Hedonic Value	528	1	5	4.06	0.56	-1.41	6.85
Self-Traits	528	1	5	3.44	0.58	-0.35	0.01
Interactivity	528	1	5	3.71	0.55	-0.37	1.52
Usability	528	1	5	3.63	0.54	-0.41	1.64
Social Presence	528	1	5	3.83	0.56	-0.33	1.25
Telepresence	528	1	5	3.30	0.64	-0.24	1.05
Academic Performance	528	1	5	3.48	0.67	0.16	0.09

FoMO	528	1	5	3.14	0.64	-0.30	0.28
Self-Regulation	528	1	5	3.53	0.53	-0.15	1.12
Addition	528	1	5	3.03	0.80	-0.42	-0.01

Source: Constructed from analysis of survey data (Estimated by SPSS 25.0)

6.5 Tests of Normality

Normality tests were run for all constructs. The normality was assessed using the Shapiro-Wilk and Kolmogorov-Smirnov statistics. The results are presented in Table 6.4 below.

Table 6.4 Normality test results

Constructs	Kolmogorov-Smirnov ^a			Shapiro-Wilk		
	Statistic	df	Sig.	Statistic	df	Sig.
Control	0.094	528	0.000	0.979	528	0.000
Curiosity	0.089	528	0.000	0.981	528	0.000
Intrinsic interest	0.106	528	0.000	0.976	528	0.000
Presence	0.091	528	0.000	0.979	528	0.000
Utilitarian Value/Perceived Usefulness	0.128	528	0.000	0.943	528	0.000
Hedonic Value	0.184	528	0.000	0.864	528	0.000
Self-Traits	0.102	528	0.000	0.975	528	0.000
Interactivity	0.097	528	0.000	0.965	528	0.000
Usability	0.130	528	0.000	0.963	528	0.000
Social Presence	0.154	528	0.000	0.953	528	0.000
Telepresence	0.140	528	0.000	0.965	528	0.000
Academic Performance	0.134	528	0.000	0.972	528	0.000
FOMO	0.085	528	0.000	0.985	528	0.000
Self-Regulation	0.088	528	0.000	0.975	528	0.000
Addition	0.122	528	0.000	0.969	528	0.000
a. Lilliefors Significance Correction						

Table 6.4 illustrates the testing results for normality using the Shapiro-Wilk and Kolmogorov-Smirnov statistics. The normality of data is assumed if the $p \geq 0.05$ (Ho & Yu, 2015). The results show From Table 7.4, the Kolmogorov-Smirnov and Shapiro-Wilk statistics were significant ($p \geq 0.05$), and therefore, the conclusion was that the data was not normally distributed. Thus, statistics should be computed using non-parametric tests such as PLS-SEM.

6.6 Measurement Model Assessment

The measurement assessment model estimation helps the researcher to compare the real data collected with the model or theory adopted for the studies. This section of the analysis reports on the reliability and validity of the latent variables. The analysis begins by assessing the measurement models for reflective constructs and formative constructs (Hair et al., 2019; Shmueli et al., 2019). The results are presented in subsections 6.5.1 and 6.5.2.

6.6.1 Measurement of Reflective Constructs

Three main criteria were applied in examining the reflective measurement model. These are internal consistency, reliability and convergent validity, and discriminant validity. The results are discussed in subsections (a) and (b).

a) Reliability and Convergent Validity Tests

The item loadings, construct reliability, and convergent validity tests are reported in Table 6.4. As shown in Table 6.4 and Figure 6.1, fourteen (14) indicators recorded loadings less than 0.70. However, ten (10) out of the fourteen (14) were dropped to improve the composite reliability and convergent validity (AVE) (Hair et al., 2019). Given that the composite reliability and AVE of the indicators successfully met the threshold value after the other ten items' deletion, the indicators Inter1, Inter2, Self5, and Student2 were retained (Joseph F. Hair Jr et al., 2014; Nutsugah, 2019). Consequently, from the table, the composite reliabilities and AVEs for all the constructs exceeded the threshold of 0.7 and 0.5, respectively, indicating the measurements are reliable and convergently valid (Hair et al., 2019; Shmueli et al., 2019).

Table 6.5 Results on Reliability and Convergent Validity – Reflexive Constructs

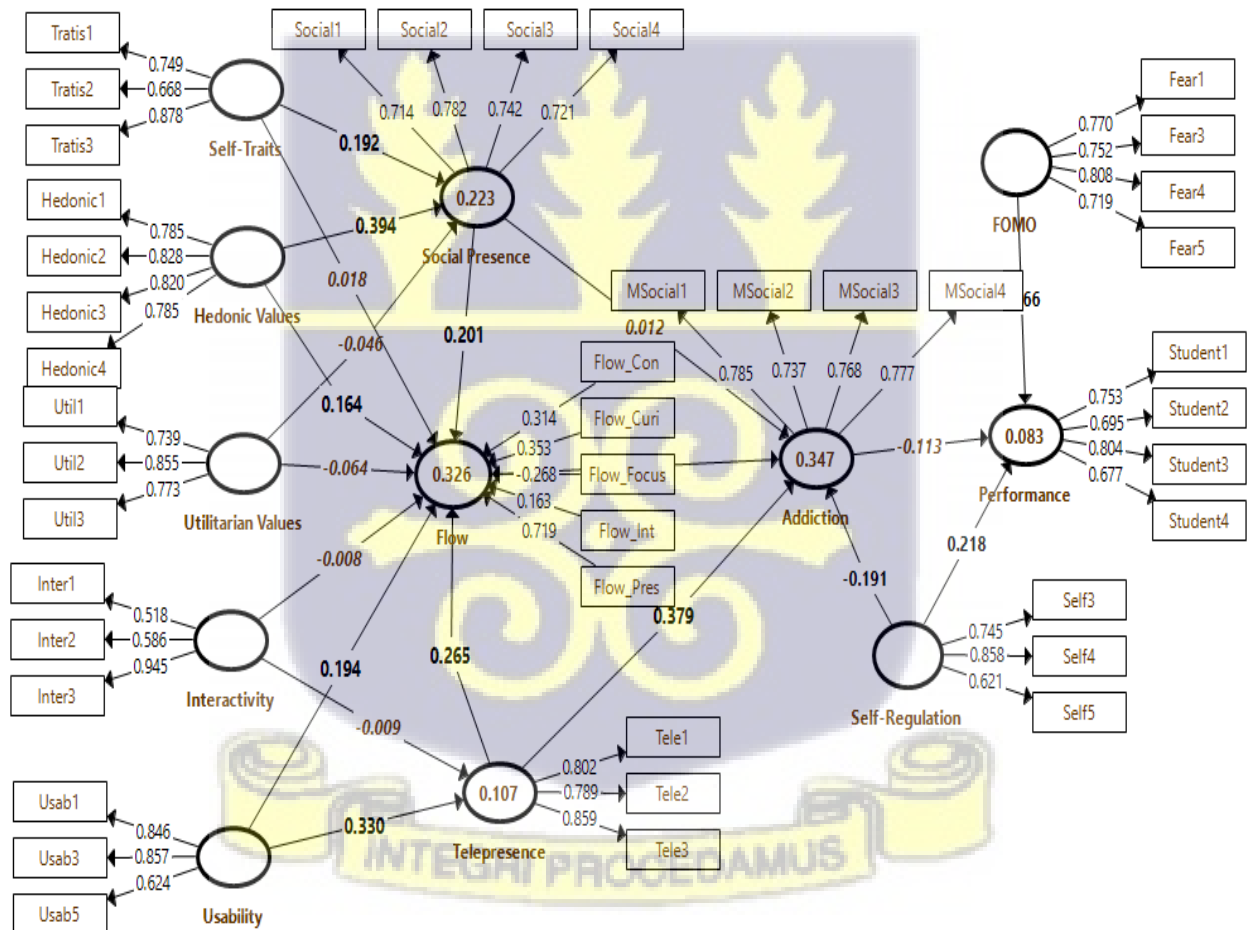
Variable	Indicator	Loading	CA	CR	AVE
FoMO	Fear1	0.770	0.765	0.848	0.582
	Fear2	0.184*			
	Fear3	0.752			
	Fear4	0.808			
	Fear5	0.719			
	Fear6	0.255*			
Hedonic Values	Hedonic1	0.785	0.818	0.880	0.647
	Hedonic2	0.828			
	Hedonic3	0.820			
	Hedonic4	0.785			
Interactivity	Inter1	0.518	0.629	0.737	0.502
	Inter2	0.586			
	Inter3	0.945			
	Inter4	0.269*			
Addiction	MTA1	0.785	0.768	0.851	0.589
	MTA2	0.737			
	MTA3	0.768			
	MTA4	0.777			
Self-Regulation	Self1	0.446*	0.607	0.789	0.559
	Self2	0.478*			
	Self3	0.745			
	Self4	0.858			
	Self5	0.621			
Social Presence	Social1	0.714	0.726	0.829	0.548
	Social2	0.782			
	Social3	0.742			
	Social4	0.721			
Performance	Student1	0.753	0.717	0.823	0.539
	Student2	0.695			
	Student3	0.804			
	Student4	0.677			
Telepresence	Tele1	0.802	0.752	0.857	0.668
	Tele2	0.789			
	Tele3	0.859			
	Tele4	0.035*			
Self-Traits	Tratis1	0.749	0.687	0.812	0.593
	Tratis2	0.668			
	Tratis3	0.878			
	Tratis4	0.021*			
Usability	Usab1	0.846	0.690	0.823	0.613
	Usab2	0.235*			

	Usab3	0.857	0.705	0.833	0.625
	Usab4	0.438*			
	Usab5	0.624			
	Util1	0.739			
Utilitarian Values	Util2	0.855			
	Util3	0.773			
	Util4	0.438*			

Note: *Items deleted from further analysis; CA = Cronbach's Alpha; CR = Composite Reliability; AVE = Average Variance Extracted

Source: Constructed from analysis of survey data (Estimated by SmartPLS 3.2.8)

Fig. 6. 1 Measurement model showing loadings



Source: Constructed from analysis of survey data (Estimated by SmartPLS 3.2.8)

b) Discriminant Validity Tests

The three approaches to assessing the constructs' discriminant validity (Fornell and Larcker criterion, cross-loadings and the Heterotrait-Monotrait [HTMT]) were applied. The results are depicted in Tables 6.5 to 6.7.

Table 6.5 reports the discriminant validity of the latent variables using the Fornell-Larcker criterion.

Table 6.6 Fornell and Larcker criterion of discriminant validity

Variable	1	2	3	4	5	6	7	8	9	10	11
1. Addiction	0.767										
2. FoMO	0.409	0.763									
3. Hedonic Values	0.008	0.078	0.804								
4. Interactivity	0.046	0.103	0.529	0.708							
5. Performance	-0.098	0.116	0.314	0.298	0.734						
6. Self-Regulation	-0.242	-0.018	0.118	0.113	0.243	0.747					
7. Self-Traits	-0.020	0.065	0.355	0.277	0.292	0.256	0.770				
8. Social Presence	0.202	0.242	0.438	0.419	0.232	0.150	0.316	0.740			
9. Telepresence	0.507	0.403	0.092	0.105	-0.101	-0.114	0.052	0.287	0.817		
10. Usability	0.246	0.307	0.322	0.345	0.096	0.074	0.233	0.507	0.327	0.783	
11. Utilitarian Values	-0.164	0.046	0.517	0.374	0.379	0.240	0.347	0.224	-0.115	0.171	0.791

Source: Constructed from analysis of survey data (Estimated by SmartPLS 3.2.8)

Table 6.5 the square roots of the AVEs are shown on the diagonals; the constructs below and above are correlated at the diagonals. From the table, all figures on the diagonals are greater than the figures below them, which indicates that discriminant validity has been achieved (Fornell & Larcker, 1981; Joseph F. Hair Jr et al., 2014). This implies that the items for each construct measure their respective constructs better than they measure other constructs. Hence the respective items for each construct are able to distinguish or discriminate the constructs as distinct constructs.

Table 6.6 shows the discriminant validity of the latent variables using the cross-loading criterion.

Table 6.7 Cross-loading criterion of discriminant validity of reflexive variables

Items	FOMO	Hedonic Values	Interactivity	Addiction	Self-Regulation	Social Presence	Performance	Telepresence	Self-Traits	Usability	Utilitarian Values
Fear1	0.770	0.039	0.079	0.247	-0.006	0.195	0.109	0.256	0.078	0.170	0.080
Fear3	0.752	0.026	-0.008	0.360	-0.023	0.154	0.065	0.345	-0.018	0.238	-0.078
Fear4	0.808	0.067	0.101	0.336	-0.047	0.157	0.094	0.349	0.028	0.243	0.040
Fear5	0.719	0.109	0.126	0.339	0.025	0.235	0.075	0.302	0.093	0.319	0.062
Hedonic1	0.070	0.785	0.358	-0.036	0.097	0.325	0.225	0.032	0.248	0.220	0.399
Hedonic2	0.081	0.828	0.408	0.090	0.063	0.347	0.257	0.107	0.297	0.290	0.391
Hedonic3	0.059	0.820	0.493	-0.021	0.137	0.380	0.331	0.055	0.351	0.250	0.459
Hedonic4	0.042	0.785	0.439	-0.014	0.085	0.356	0.194	0.096	0.243	0.273	0.414
Inter1	0.177	0.403	0.518	-0.078	0.166	0.262	0.447	-0.021	0.259	0.202	0.395
Inter2	0.029	0.452	0.586	-0.058	0.141	0.289	0.473	-0.022	0.258	0.180	0.426
Inter3	0.072	0.433	0.945	0.090	0.061	0.374	0.135	0.139	0.209	0.325	0.253
MSocial1	0.288	-0.069	0.035	0.785	-0.169	0.097	-0.139	0.385	-0.012	0.163	-0.200
MSocial2	0.288	-0.028	0.051	0.737	-0.205	0.126	0.002	0.338	0.001	0.166	-0.085
MSocial3	0.293	0.021	-0.024	0.768	-0.188	0.130	-0.034	0.441	-0.028	0.165	-0.087
MSocial4	0.375	0.085	0.079	0.777	-0.184	0.251	-0.117	0.386	-0.020	0.252	-0.130
Self3	-0.032	0.188	0.148	-0.206	0.745	0.207	0.170	-0.074	0.223	0.132	0.179
Self4	-0.054	0.068	0.039	-0.236	0.858	0.063	0.199	-0.164	0.203	0.019	0.228
Self5	0.086	-0.022	0.075	-0.061	0.621	0.062	0.184	0.031	0.139	0.006	0.109
Social1	0.229	0.260	0.212	0.180	0.122	0.714	0.142	0.239	0.230	0.455	0.104
Social2	0.161	0.435	0.393	0.084	0.162	0.782	0.271	0.095	0.317	0.381	0.283
Social3	0.194	0.289	0.274	0.233	0.039	0.742	0.077	0.343	0.176	0.349	0.098
Social4	0.128	0.307	0.369	0.087	0.130	0.721	0.208	0.160	0.209	0.312	0.178
Student1	0.161	0.284	0.228	0.020	0.188	0.246	0.753	0.063	0.273	0.171	0.278
Student2	0.102	0.169	0.137	0.008	0.126	0.167	0.695	-0.064	0.133	0.069	0.149
Student3	0.044	0.202	0.199	-0.202	0.199	0.044	0.804	-0.261	0.119	-0.069	0.348
Student4	0.042	0.262	0.306	-0.073	0.186	0.257	0.677	-0.001	0.341	0.141	0.297
Tele1	0.295	0.039	0.042	0.403	-0.133	0.177	-0.047	0.802	0.013	0.199	-0.142
Tele2	0.332	0.092	0.080	0.384	-0.048	0.224	-0.091	0.789	0.051	0.284	-0.072
Tele3	0.357	0.091	0.128	0.452	-0.100	0.292	-0.105	0.859	0.059	0.310	-0.075
Tratis1	0.030	0.328	0.248	-0.095	0.219	0.224	0.399	-0.018	0.749	0.115	0.347
Tratis2	-0.018	0.265	0.209	-0.171	0.281	0.186	0.200	-0.059	0.668	0.100	0.341
Tratis3	0.090	0.261	0.208	0.089	0.169	0.294	0.135	0.115	0.878	0.263	0.211
Usab1	0.256	0.284	0.304	0.258	-0.039	0.423	0.012	0.296	0.171	0.846	0.160
Usab3	0.256	0.240	0.262	0.197	0.110	0.414	0.090	0.310	0.200	0.857	0.098

Usab5	0.213	0.250	0.257	0.086	0.148	0.365	0.177	0.110	0.194	0.624	0.171
Util1	-0.020	0.419	0.326	-0.206	0.198	0.159	0.433	-0.194	0.282	0.084	0.739
Util2	0.067	0.438	0.336	-0.093	0.193	0.208	0.259	-0.004	0.241	0.200	0.855
Util3	0.042	0.374	0.230	-0.120	0.184	0.157	0.253	-0.122	0.319	0.097	0.773

Source: Constructed from analysis of survey data (Estimated by SmartPLS 3.2.8)

Table 6.6 reveals that the outer loading of each indicator was greater on its corresponding latent variable than its cross-loadings on any other latent variables. This as well approves that discriminant validity was accomplished.

Table 6.7 shows the discriminant validity of the latent variables using the Heterotrait-Monotrait Ratio (HTMT) analysis criterion.

Table 6.8 Results of Heterotrait-Monotrait Ratio Analysis Criterion of Discriminant

Validity											
Variable	1	2	3	4	5	6	7	8	9	10	11
1. Addiction											
2. FoMO	0.542										
3. Hedonic Values	0.099	0.106									
4. Interactivity	0.147	0.201	0.789								
5. Performance	0.168	0.156	0.406	0.690							
6. Self-Regulation	0.330	0.127	0.181	0.274	0.367						
7. Self-Traits	0.203	0.118	0.483	0.520	0.452	0.434					
8. Social Presence	0.261	0.322	0.565	0.605	0.374	0.236	0.424				
9. Telepresence	0.662	0.537	0.120	0.117	0.196	0.195	0.124	0.376			
10. Usability	0.312	0.438	0.436	0.487	0.268	0.221	0.303	0.720	0.419		
11. Utilitarian Values	0.238	0.124	0.682	0.722	0.536	0.354	0.560	0.309	0.207	0.249	

Source: Constructed from analysis of survey data (Estimated by SmartPLS 3.2.8)

As shown in Table 6.8, all HTMT values are below the threshold of 0.85. This is another confirmation of attaining discriminant validity which must be less than 0.85 for constructs that are conceptually different and 0.90 for constructs that are conceptually similar (Hair et al., 2019; Henseler et al., 2015).

6.6.2 Measurement of Formative Constructs

Flow is measured primarily as a formative construct based on literature. This is because it is formed from a combination of five components (control, attention focus, curiosity, intrinsic interest and presence), which result from a blend of certain indicators (Ringle, Sarstedt, Mitchell, & Gudergan, 2018).

Table 6.9 Measurement Properties of Formative Construct-Flow

Indicators	Weight	VIF	T-values	P-values
Control	0.314	1.054	3.508	0.000
Curiosity	0.353	1.049	4.709	0.000
Attention Focus	0.268	1.014	2.860	0.004
Intrinsic Interest	0.163	1.049	1.888	0.059
Presence	0.719	1.042	9.138	0.000

Source: Constructed from analysis of survey data (Estimated by SmartPLS 3.2.8)

Table 6.9 shows the indicator weight, the VIF, significance and relevance of the formative construct (Flow). From the table, all formative indicators were significant at $p < 0.05$ except for the Intrinsic Interest. The validity of formative constructs' general criteria requires that insignificant elements not be erased but preserved (Henseler, Hubona, & Ray, 2016; Henseler, Ringle, & Sinkovics, 2009). Hence both significant and insignificant indicators in the measurement mode are maintained as long as they are conceptually justified. Similarly, all the VIF values are less than 3, indicating a lower multicollinearity occurrence within the construct 'Flow' (Hair et al., 2019).

6.7 Results of the Structural Model

The structural model, collinearity, model fit (SRMR), predictive power and relevance checks were done. This is in line with the structural model assessment procedure outlined by Henseler et al. (2016), Hair et al. (2019), and Usakli and Kucukergin (2018).

6.8 Collinearity Assessment

Hair et al. (2019) state that the variance inflation factor (VIF) values above 5 indicate probable collinearity issues among the predictor constructs. Still, ideally, the VIF values should be close to 3 and lower. Tables 6.10 and 6.11 show the VIF statistics.

Table 6.10 Results of outer VIF

Indicators	VIF
Fear1	1.328
Fear3	1.627
Fear4	1.736
Fear5	1.436
Flow_Con	1.054
Flow_Curi	1.049
Flow_Focus	1.014
Flow_Int	1.049
Flow_Pres	1.042
Hedonic1	1.686
Hedonic2	1.842
Hedonic3	1.785
Hedonic4	1.585
Inter1	1.293
Inter2	1.383
Inter3	1.161
MTA1	1.583
MTA2	1.484
MTA3	1.453
MTA4	1.428
Self3	1.198
Self4	1.401
Self5	1.215
Social1	1.365
Social2	1.518
Social3	1.352
Social4	1.438
Student1	1.458
Student2	1.479
Student3	1.456
Student4	1.280
Tele1	1.529
Tele2	1.428
Tele3	1.603

Tratis1	1.314
Tratis2	1.386
Tratis3	1.316
Usab1	1.455
Usab3	1.479
Usab5	1.223
Util1	1.371
Util2	1.424
Util3	1.341

Source: Constructed from analysis of survey data (Estimated by SmartPLS 3.2.8)

As shown in Tables 6.10 and 6.11, all the VIF values (both outer and inner) are below the more conservative threshold of 3.3 (Diamantopoulos & Sigauw, 2006), indicating that collinearity does not pose a threat to the interpretation of the results (Hair et al., 2019; Henseler et al., 2016). This means that the constructs used in the model are flawless and meet the criteria for a linear combination of the independent variables; therefore, there are no multicollinearity issues.

Table 6.11 Results of inner VIF

Path	VIF
Self-Traits → Social Presence	1.194
Self-Traits → Flow	1.247
Hedonic Values → Social Presence	1.433
Hedonic Values → Flow	1.827
Utilitarian Values → Social Presence	1.424
Utilitarian Values → Flow	1.512
Interactivity → Telepresence	1.135
Interactivity → Flow	1.536
Usability → Telepresence	1.135
Usability → Flow	1.474
Social Presence → Flow	1.642
Telepresence → Flow	1.201
Social Presence → Addiction	1.309
Flow → Addiction	1.389
Telepresence → Addiction	1.246
Addiction → Performance	1.285
Self-Regulation → Addiction	1.056
FoMO → Performance	1.210
Self-Regulation → Performance	1.071

Source: Constructed from analysis of survey data (Estimated by SmartPLS 3.2.8)

6.9 Model Fit

Following Henseler et al.'s (2016) recommendation, the model fit was assessed using the standardised root mean square residual (SRMR) factor. This fit index must be met before testing the proposed model's hypotheses (Findıklı, Yozgat, & Rofcanin, 2015). The model fit index is presented in Table 6.12.

The SRMR value of the model indicates that the model fits well (SRMR = 0.110). A model in PLS-SEM is perfectly fit if SRMR is zero (SRMR = 0), is a good fit if SRMR is less or equal to 1.2 (SRMR $\leq$ 1.2), and is a bad fit if SRMR is above 1.2 (SRMR > 1.2) (Nutsugah, 2019). Further, the R^2 and Q^2 criteria were used to evaluate the structural model's predictive power and predictive relevance (Chin, 1998). The R^2 measures the amount of variance in the dependent variable that can be accounted for by the independent variable(s). As a rule of thumb, R^2 values of 0.75, 0.5, and 0.25 may be considered substantial, moderate, and weak (Hair et al., 2019). Blindfolding was used to cross-validate the model's predictive relevance for each individual's endogenous variables, the Stone-Geisser Q^2 value (Geisser, 1974; Stone, 1974). The R^2 coefficient and predictive relevance (Q^2) are shown in Table 6.11.

Table 6.12 Results of SRMR

Criterion	Saturated Model	Estimated Model
SRMR	0.085	0.110

Source: Constructed from analysis of survey data (Estimated by SmartPLS 3.2.8)

6.10 Predictive Relevance of the Model

Table 6.13 and Figure 6.1 show that self-traits, hedonic, and utilitarian values predict 22% ($R^2 = 0.223$) variation in social presence. Further, interactivity and usability predict 11% ($R^2 = 0.107$) of changes in telepresence; social presence, flow, telepresence, and self-regulation

predict 35% ($R^2 = 0.347$) of variance in mobile technology addiction; self-traits, hedonic values, utilitarian values, interactivity, usability, telepresence, social presence collectively predict 33% ($R^2 = 0.326$) of variation in flow while mobile technology addiction, self-regulation, and Fear of Missing Out (FoMO) predict only 8% ($R^2 = 0.083$) of changes in academic performance. Additionally, as depicted in Table 7.12, all the Q^2 values are greater than zero (0), establishing that the structural model has predictive relevance. These results show that the model has an acceptable level of predictive relevance and predictive power (Hair et al., 2019; Usakli & Kucukergin, 2018; Sanchez, 2013).

Table 6.13 Results of the Coefficient of Determination Analysis

Construct	R^2 Square	R^2 Adjusted	Q^2
Addiction	0.347	0.342	0.195
Flow	0.326	0.317	0.070
Performance	0.083	0.078	0.055
Social Presence	0.223	0.218	0.113
Telepresence	0.107	0.104	0.065

Note: Small: $0.0 < Q^2$ effect size < 0.15 ; Medium: $0.15 < Q^2$ effect size < 0.35 ; Large: Q^2 effect size > 0.35

Source: Constructed from analysis of survey data (Estimated by SmartPLS 3.2.8)

6.11 Hypotheses Assessment

To test the first set of hypotheses (H_1 to H_{11}), the path coefficients were assessed using bootstrap t-statistics based on 5,000 subsamples, with a bias-corrected bootstrap, testing for a two-tailed significance of 95% (Anderson & Gerbing, 1988). The hypotheses were judged and sustained based on the conventional significance level of 0.05. The results are presented in Table 6.14.

Table 6.14 Hypotheses Assessment

Hypotheses	Path	β	SE	T-Statistics	P-Values	f^2	Decision
H _{1a}	Self-Traits → Social Presence	0.192	0.045	4.222	0.000	0.040	Supported
H _{1b}	Self-Traits → Flow	0.018	0.062	0.289	0.773	0.000	Not supported
H _{2a}	Hedonic Values → Social Presence	0.394	0.050	7.896	0.000	0.139	Supported
H _{2b}	Hedonic Values → Flow	0.164	0.065	2.535	0.011	0.022	Supported
H _{3a}	Utilitarian Values → Social Presence	-0.046	0.050	0.936	0.349	0.002	Not supported
H _{3b}	Utilitarian Values → Flow	-0.064	0.080	0.790	0.429	0.004	Not supported
H _{4a}	Interactivity → Telepresence	-0.009	0.062	0.137	0.891	0.000	Not supported
H _{4b}	Interactivity → Flow	-0.008	0.056	0.141	0.888	0.000	Not supported
H _{5a}	Usability → Telepresence	0.330	0.049	6.754	0.000	0.108	Supported
H _{5b}	Usability → Flow	0.194	0.050	3.895	0.000	0.038	Supported
H ₆	Social Presence → Flow	0.201	0.058	3.465	0.001	0.036	Supported
H ₇	Telepresence → Flow	0.265	0.048	5.585	0.000	0.087	Supported
H ₈	Social Presence → Addiction	0.017	0.048	0.350	0.727	0.000	Not supported
H ₉	Flow → Addiction	0.243	0.047	5.208	0.000	0.070	Supported
H ₁₀	Telepresence → Addiction	0.356	0.049	7.201	0.000	0.176	Supported
H ₁₁	Addiction → Performance	-0.118	0.057	2.087	0.037	0.011	Supported

Source: Constructed from analysis of survey data (Estimated by SmartPLS 3.2.8)

As shown in Table 6.14, six (6) out of the sixteen (16) hypotheses are not supported. Specifically, outcomes involving self-traits showed that it significantly predicted social presence (H_{1a}; $\beta = 0.192$; $t = 4.222$; $p = 0.000$). Also, hedonic values significantly predicted social presence (H_{2a}; $\beta = 0.394$; $t = 7.896$; $p = 0.000$) and flow (H_{2b}; $\beta = 0.164$; $t = 2.535$; $p = 0.011$). Furthermore, usability significantly predicted telepresence (H_{5a}; $\beta = 0.330$; $t = 6.754$; $p = 0.000$) and flow (H_{5b}; $\beta = 0.194$; $t = 3.895$; $p = 0.000$); social presence (H₆; $\beta = 0.201$; $t = 3.465$; $p = 0.001$) and telepresence (H₇; $\beta = 0.265$; $t = 5.585$; $p = 0.000$) and significantly

predicted flow. Regarding the three predictors of mobile technology addiction, flow (H_9 ; $\beta = 0.243$; $t = 5.208$; $p = 0.000$) and telepresence (H_{10} ; $\beta = 0.356$; $t = 7.201$; $p = 0.000$) significantly predicted MTA. Similarly, MTA significantly predicted academic performance (H_{11} ; $\beta = -0.118$; $t = 2.087$; $p = 0.037$). Consequently, hypotheses H_{1a} , H_{2a} , H_{2b} , H_{5a} , H_{5b} , H_6 , H_7 , H_9 , H_{10} and H_{11} are significantly supported. On the contrary, self-traits positively predicted flow, while utilitarian values negatively predicted flow and social presence. Similarly, interactivity negatively predicted flow and telepresence. However, flow significantly predicted MTA, while MTA significantly predicted academic performance. Accordingly, hypotheses H_{1b} , H_{3a} , H_{3b} , H_{4a} , H_{4b} , H_8 , and H_{11} were rejected.

6.12 Moderation Analysis

Moderation analyses were conducted to assess if self-regulation moderated the relationship between MTA and its predictors (i.e., social presence, flow, and telepresence) on the one hand and MTA and academic performance on the other hand. Similarly, the moderating effect of FoMO on MTA and academic performance was examined. Hence, the moderation model was estimated using PLS-SEM Software (SmartPLS 3.2.8) because of its robust ability to determine moderating effects (Ringle, Wende, Becker, & others, 2015). The results are presented in Table 6.15 and Fig. 6.2.

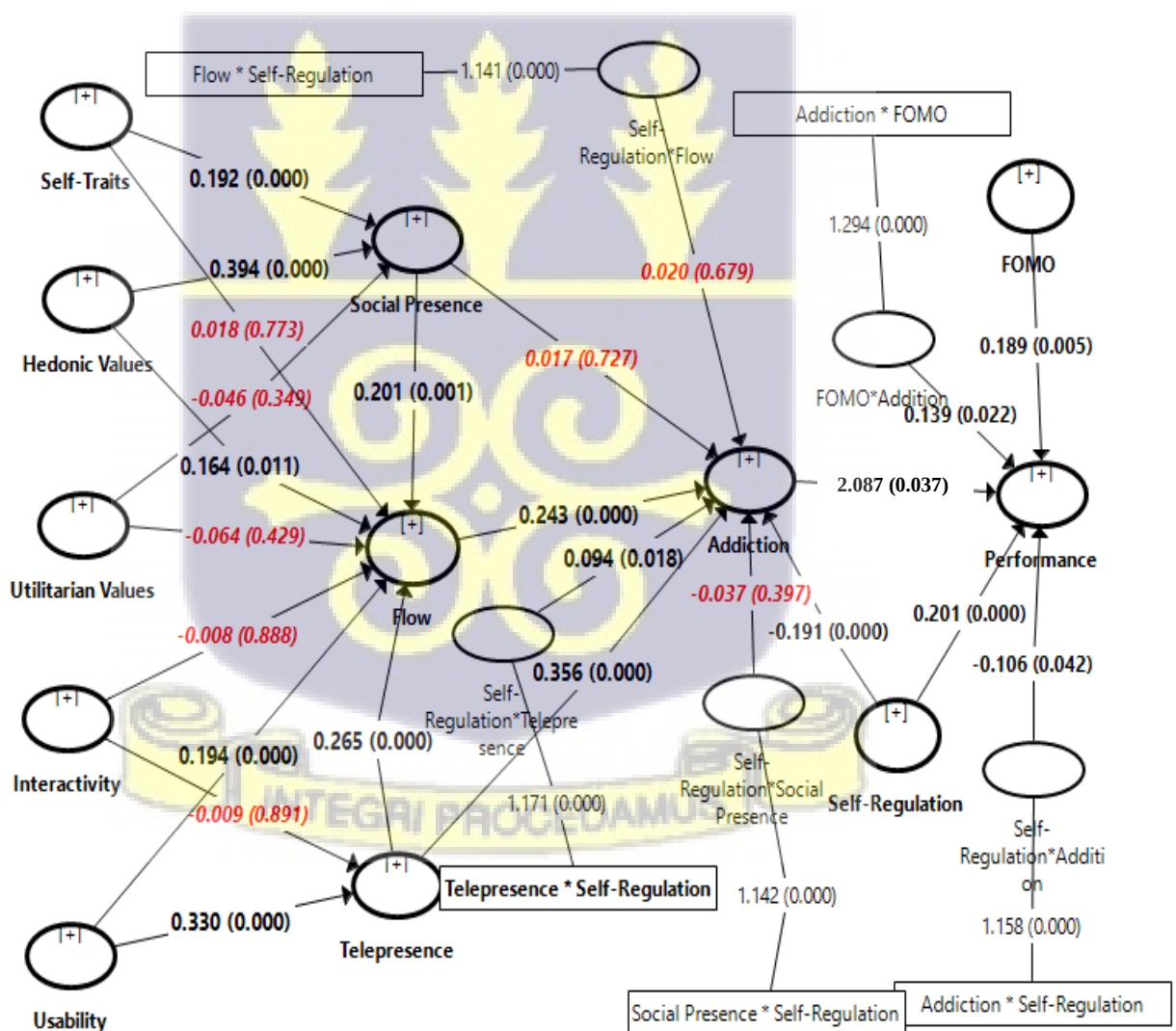
Table 6.15 Moderating effects of Self-Regulation and Fear of Missing Out

Hypotheses	Path	β	SE	T-Statistics	P-Values	Decision
H_{12}	Self-Regulation*Social Presence $\rightarrow$ Addiction	-0.037	0.044	0.847	0.397	Not supported
H_{13}	Self-Regulation*Flow $\rightarrow$ Addiction	0.020	0.049	0.413	0.679	Not supported
H_{14}	Self-Regulation*Telepresence $\rightarrow$ Addiction	0.094	0.040	2.357	0.018	Supported
H_{15}	Self-Regulation*Addition $\rightarrow$ Performance	-0.106	0.052	2.037	0.042	Supported
H_{16}	FoMO*Addition $\rightarrow$ Performance	0.139	0.061	2.287	0.022	Supported

Source: Constructed from analysis of survey data (Estimated by SmartPLS 3.2.8)

From Table 6.15 and Figure 6.2, self-regulation significantly moderated the effect of telepresence on mobile technology addiction ($\beta = 0.094$; $t = 2.357$; $p = 0.018$), as well as the effect of MTA on academic performance ($\beta = -0.106$; $t = 2.037$; $p = 0.042$), hence supporting hypotheses H₁₄ and H₁₅. It suggests that self-regulation strengthens the effect of telepresence on MTA while it weakens the effect of MTA on academic performance. Thus, self-regulation mitigates the negative effect of mobile technology addiction on academic performance. Further, as expected, the moderating effect of the FoMO on MTA and academic performance was significantly positive ($\beta = 0.139$; $t = 2.287$; $p = 0.022$), supporting hypothesis H₁₆.

Fig. 6. 2 Full structural model with moderators



6.13 Chapter Summary

The chapter presents the quantitative data analysis by considering the demographic characteristics, general mobile technology characteristics, construct descriptive analysis, tests of normality, measurement model assessment, measurement of reflective constructs, measurement of formative constructs, results of the structural model, collinearity assessment, model fit, predictive relevance of the model, hypotheses assessment, and moderation analysis.



CHAPTER SEVEN

QUALITATIVE RESULTS AND ANALYSIS

7.1 Chapter Overview

This chapter presents and analyses the qualitative results, findings, and data analysis based on the research questions. It provides details of the findings and analysis of the qualitative data collected among multi-stakeholders and multidisciplinary dimensions to understand technology addiction in a developing country context. This chapter analyses the data collected from experts, technology addicts, addicts' relatives, and friends.

7.2 Summary of Participants' Profiles

Respondents found to be addicts were first subjected to the Internet Addiction Test (IAT) (Young, 2009). *The full scale is in Appendix E.* All the participants except one (1) were found to be in the range of 80 to 100, which means they were in severe forms of addiction. One respondent scored 21, meaning his addiction was mild because he was recovering. Therefore, three out of the seven were even going through some form of treatment or recovery at the time of this interview.

The details of the seven (7) addicted users identified after the initial test are discussed below. The 1st participant was a lady found by the researcher during a church service on the University of Ghana campus. During the entire church service, she was glued to her phone. And so did not participate in any way. After the service, the researcher approached her and she agreed to be part of this study. Later she was made to fill out the IAT scale, and she was found addicted and therefore interviewed for this work. The 2nd participant was a female Master of Business Administration Student who was found on several occasions glued to her phone during lunch at a restaurant on the University of Ghana campus. She was tested and found to be addicted

and therefore added as a research participant. The 3rd participant is a male addicted to substances and technologies such as mobile applications, online gambling and betting, and cybercrime. He was brought to the prayer centre for deliverance and was contacted to participate in this study. The 4th participant, a male student addicted to mobile technology, online gambling, and betting, was undergoing treatment at Korle Bu Addiction Center during this research. The 5th participant is a male student addicted to substances and mobile technology and undergoing treatment at Korle Bu Addiction. The Clinical Psychologist in charge of the Addiction Center contacted the two addicts who voluntarily decided to be part of this research. The 6th participant called into the Joy FM discussion on mobile technology addiction and expressed interest in this research. The 7th participant is a male student and a long-time friend of the researcher. During the period of this research, he drove the researcher and was using the phone while driving. When tested on the IAT scale, he was found addicted and offered to be part of this research. Apart from the two who were undergoing treatment and were confirmed or identified by the in-charge as addicts, one tested mild because he was undergoing rehabilitation for more than six (6) months before the researcher contacted him for this research. He showed mild traces of addiction. All the other participants were severely addicted when tested on the addiction scales and used for this work. They were interviewed on their profiles, the nature and causes of their addictions, the process of addiction, the constructs used in the model, and the impact of addiction on their academic performance and well-being. The researcher also tried to determine if they lose control, crave, or feel compulsive to use mobile technology and its adverse negative effect (Shaffer, Hall & Bilt, 1999).

7.3 The Profiles of Participants

The detailed profiles of the participants used for this work are summarised in the table below.

Table 7. 16 The Profiles of Participants Interviewed for the Qualitative Data

Interviewees (Participants (Addicts, Relations, and Experts))	Codes	Profile
Participant 1	P1	<i>Female Law Student at the University of Ghana (She was into an Online Relationship)</i>
Relation 1	P1a	The younger sister of P1
Relation 2	P1b	The mother of P1
Participant 2	P2	<i>Female Master of Business Administration Student at the University of Ghana (She was also into online gaming)</i>
Relation 1	P2a	Co-worker of P2
Relation 2	P2b	The brother of P2
Participant 3	P3	<i>Male Undergraduate Dropout at a Prayer Center (He was also into drugs and cyber fraud)</i>
Relation 1	P3a	A friend of the P3
Relation 2	P3b	The father of P3
Participant 4	P4	<i>Male Undergraduate Dropout at the Addiction Center (He was also into online betting and gambling)</i>
Relation 1	P4a	A cousin of P4
Relation 2	P4b	The father of P4
Participant 5	5	<i>Second Male Undergraduate Dropout at the Addiction Center (Also addicted to drugs and online gaming)</i>
Relation 1	P5a	A brother of P5
Relation 2	P5b	The father of P5
Participant 6	P6	<i>A Male Postgraduate Student who worked at Joy FM. (He was also into Politics, Pornography, and online dating)</i>
Relation 1	P6a	A sister of P6
Relation 2	P6b	A classmate of P6
Participant 7	P7	<i>A Male Postgraduate Student who is an Entrepreneur (He was into online auctioning and dating)</i>
Relation 1	P7a	A classmate of P7
Relation 2	P7b	A teacher of P7
Expert 1	Exp1	A Clinical Psychologist (Addiction Center Manager) with 25years of experience
Expert 2	Exp2	A Professional Cyber Counsellor and a Senior Lecturer at the University of Ghana.

Expert 3	Exp3	Mental Health Nurse who rose through the ranks to become one of the Deputies at the Mental Health Authority of the Republic of Ghana.
Expert 4	Exp4	A Consultant Psychiatrist and Head Department of Psychological Medicine and Mental Health School of Medicine at the University of Health and Allied Sciences (UHAS) in Ghana and a Humphrey Fellow in Drug Abuse.
Expert 5	Exp5	An Elder and Prayer Center Leader
Expert 6	Exp6	A Lecturer of one of the addicts and a Mobile Apps Developer
Expert 7	Exp7	A Neuro Scientist who is also into Information Systems

Source: Author's Construct

7.4 Qualitative Second-Order Constructs and Representative Data

This section provides the first-order codes, second-order constructs, and representative data for the qualitative data. It presents how the data is coded at the outset to the abstracted constructs that explain the main constructs deduced from the theories.

Table 7. 17 Qualitative Evidence: Dimensions, Constructs, Codes, and Data

Second-Order Constructs		Representative Data
First - Order Codes		
Digital Self-Image		
1. <i>Uncontrollable Digital Nature</i>		
a. Digital Nature	I just act on my impulse and use the platforms without thinking about the consequences (<i>Par P2</i>)	
b. Uncontrolled Urge	During the time I was addicted, I could not control my urge for mobile technology (<i>Participant P3</i>)	
c. Perpetual Craving	I'm helpless; I always crave to use mobile technology to make money (<i>Participant P4</i>)	
2. <i>Digital Emotions</i>		

- a. Relative Happiness I am more excited online than in the physical world (*Participant P6*)
- b. Digital Desires My thought was to always be on mobile betting and gambling platforms (*Participant P4*)
- c. Online Emotions Sometimes, I get too emotional online (*Participant P1*)
She is unable to control her emotions online (*Participant P1a*)

3. Digital Status

- a. Online Status Young people use the platforms to post their nice and glamorous pictures online, which may not depict their physical conditions (*Expert 2*)
- b. Digitally Active My cousin does not have friends, and he's very dull. However, he's very active on mobile technology (*Participant P4a*)

Digital Self-Esteem

1. Digital Personality

- a. online bravery My friend is very secretive in the physical world but daring online (*Participant P6b*)
- b. online boldness I am shy in real life but bold and able to open up online (*Participant P6*)

2. Digital Ethos

- a. Online Reputation I perceived I could influence others online and enhance my reputation or status (*Participant P6*)
- b. Digital Values I try to project myself before my boyfriend; this sometimes leads to disregard for my Christian values (*Participant P1*)

My sister does not exhibit any values or ethics when it comes to online interaction with her boyfriend. They do so many nasty things online (*Participant P1a*)

- c. Online Influence I seek to influence most decisions and react to postings in the groups that I belong to (*Participant P7*)

3. Digital Interest

- a. Online Relationship Building
There is life online; we try to build relationships and maintain them (*Participant P7*)
- b. Online Relationship Maintenance
Some students use mobile applications to boost their confidence, release stress and tension (*Expert 4*)
I use mobile applications to keep my relationships with family and friends alive and to release tension (*Participant P7*)
I try to maintain my relationship by succumbing to online romance to give confidence to my boyfriend (*Participant P1*)
- c. Monetary Benefit Seeking
Anyone who is greedy, selfish, despondent and tries to make quick secret monies through mobile online platforms to live a glamorous life may easily become addicted (*Participant P4*)
My son has these traits of always looking for quick money, which influenced his online behaviours (*Participant P4b*)
I use online mobile platforms to enable me to make money to enhance my status (*Participant P3*)
I play online betting and gambling to make money, build houses, buy cars, and do other glamorous things to enhance my standard of living (*Participant P4*)

Digital Self-efficacy

1. Online Effectiveness

- a. Online Confidence
I build confidence in my clients by controlling my emotions and always trying to be nice to them online (*Participant P3*)
- b. Digital Image Building
I try to build a good image of myself on my social media handles and all mobile social media platforms that I belong to (*Participant P3*)

2. Online Efficiency

- a. Online Reputation
I am the daring type who wants to respond to issues and state my position clearly to preserve my reputation (*Participant P7*)
- b. Online Availability
Due to COVID-19 restrictions, I used mobile social games and was always available online (*Participant P6*)
- c. Task Completing
Since I'm fast at typing, I easily complete tasks on mobile applications (*Participant P7*)

3. Social Identity Seeking

- a. Presenting Culture Online
I present the culture of my people online (*Participant P3*)

- b. Online Social Identity My cousin believes in himself so much that he likes commenting or reacting to almost every post from others trying to seek identity. Hmm! I don't even know how he's able to do that
(Participant P4a)
- c. Projecting Beliefs Online I dare to project my values and beliefs online forcefully
(Participant P3)

Utilitarian Value

1. Educational Value

- a. Reading Novels Online I read novels and storybooks online during COVID-19 restrictions (Participant P2)
Yes, she reads her novels and all that, but I think she's just fond of always being on mobile applications (Participant P2a)
- b. Online Studies I use mobile devices for online studies during COVID-19
(Participant P7)
His parents complained that during COVID-19, he locked himself indoors, and when I engaged him, he said he's been learning on the mobile technology (Expert 6)
- c. Develop Specialised Skills I use YouTube on my mobile device to learn and develop my cooking skills (Participant P2)

2. Religious Value

- a. Reading Quran Online I am a Muslim, so I read my Quran and other religious books on my mobile devices (Participant P6)
- b. Reading Bible Online We have a program in our church for the year which is entitled "Read Your Bible Challenge," so I use my mobile device to read the Bible every day (Participant P1)
- c. Evangelise Online I use my mobile technology to evangelise and win souls to our fold (Participant P1)

3. Business Value

- a. Promoting Businesses I use mobile devices to promote my car business (Participant P7)
I use mobile technology to share images of beautiful ladies to attract rich men to my cyber business (Participant P3)
- b. Marketing Goods and Services I use mobile technology platforms for marketing my cyber business (Participant P3)

Generally, mobile technologies are used for marketing my goods and services (*Expert 2*)

- c. Developing and Maintaining Customers I develop and maintain the customer base of my business on these apps, so it's not that I want to always be on the apps, but I need to respond to the needs of my customers online (*Participant P7*)

- d. Ecommerce Activities My son has been buying and shopping online for COVID-19 (*Participant P3b*)
During COVID-19, we shopped among several goods and services online to compare prices and decide before purchase (*Participant P3b*)

4. Political Value

- a. For Politics I use my mobile device to promote my political ambition (*Participant P6*)

He uses the mobile device to comment, respond and share his thoughts on political issues (*Participant P6b*)

- b. Checking Headline News Every day, when I wake up, the first thing I do is check headlines and news updates (*Participant P6*)
I am very particular and mostly glued to what others share online (*Participant P2*)

- c. Receive Current News Update I have an alert on news portals, so I try to update myself on current news (*Participant P6*)

5. Communicative Values

- a. Connecting to Family and Friends I use mobile platforms to connect to family and friends (*Expert 6*)

- b. For Communication I use mobile platforms to share and send text messages (*Participant P6*)
Mobile applications like WhatsApp, Facebook Messenger, and so are used to make voice and video calls (*Expert 4*)

Since my boyfriend sometimes travels outside Ghana, social media platforms allow us to connect and sometimes even make love online (*Participant P1*)

My sister is very fast at sending text messages on mobile platforms (*Participant P1a*)

6. Entertainment Values

- | | |
|-----------------------------|---|
| a. Checking Profile Updates | Sometimes, if I want to relax, then I try to go through the profile updates of family and friends (<i>Participant P1</i>) |
| b. Online Dating | I use dating platforms to get friends online and try to engage them in real-life conversation (<i>Participant P6</i>)

My brother is always on the platform and has several lady friends on social media platforms (<i>Participant P6a</i>) |
| c. Playing Online Games | I use the mobile device to play online games (<i>Participant P2</i>)

I can create nice avatars on the game console, but sometimes you need to pay to get very good ones (<i>Participant P2</i>) |

7. Multimedia Values

- | | |
|--|--|
| a. Uploads and Downloads | I use the platforms to download and upload images, videos, and audios (<i>Participants 7</i>) |
| b. Creating Images, Audios, and Videos | My son sometimes creates and comes out with great images and videos using mobile applications (<i>Participant P5a</i>)

There are several easy ways of creating images on these platforms. Generally, audio and videos are created faster using mobile applications platforms than using other devices and gadgets (<i>Expert 6</i>) |
| c. Sharing Images, Audios, and Videos | I use mobile social media platforms to easily share images, videos, and audio (<i>Expert 6</i>)

I use nice images and share them on mobile applications to lure rich and wealthy clients (<i>Participant 3</i>)

These platforms provide interfaces for easy and quick audio, video and image creation (<i>Expert 6</i>) |

Hedonic Value

1. Social Value

- | | |
|--------------------------------|---|
| a. Online Excitement Seeking | I seek online excitement (<i>Participant P2</i>) |
| b. Online Satisfaction Seeking | I am satisfied when using mobile technology (<i>Participant P6</i>) |
| c. Online Fulfilment Seeking | I am fulfilled using mobile technology to interact with family and friends easily (<i>Participant P7</i>) |
| d. Online Pleasures and Joy | Interacting with others on mobile technology gives me online pleasures and joy (<i>Participant 1</i>) |

I easily have more fun on mobile platforms (*Participant 6*)

e. For Fun and Enjoyment

I easily use mobile technologies to enjoy myself (*Participant 7*)

2. Emotional Value

a. Mood Swing

My son is happy and joyous on these platforms. Anytime you want him to do other things, then he gets angry (*Participant P3b*)

I feel lonely and therefore use mobile technology (*Participant P1*)

b. Good Feeling

I feel good about mobile technology (*Participant P5*)

My brother is happy using his mobile technology (*Participant P5a*)

c. Emotional Attachment

Sometimes, I have to shout at my sister for her to realise that she is being too emotionally attached and is not acting in a physical sense (*Participant P2b*)

3. Psychological Value

a. Sense of Belongingness

Mobile technology helps me to belong (*Participant P2*)

b. Forgetting Immediate Problems

I use mobile technology to forget about my predicaments (*Participant P4*)

Sir, I used mobile technology during COVID-19 to belong and forget about my problems (*Participant P5*)

When I get hooked on mobile technology, I forget about my immediate environment (*Participant P2*)

c. Sense of Relief

I use the apps for relief when I have tension (*Participant P6*)

The mobile technology keeps me busy and helps me to release tension (*Participant P2*)

When I'm bored, I get myself busy with my mobile device (*Participant P6*)

Immediately after I start using it; I get interested in other things, which makes me busy and I keep using it for long hours (*Participant P6*)

I use mobile technology to relax (*Participant P6*)

Normally when I am tense after work, I use mobile technology to release tension (*Participant P7*)

4. Self- Actualisation Values

- a. *Accomplishment Seeking* I look for accomplishment, so I continue to search for platforms that will help me to make quick monies (*Participant P4*)
I thought I could make money and accomplish myself, but it never came (*Participant P4*)
- b. *Luxurious Living* I thought I could make a lot of money from these platforms and live a luxurious life (*Participant P4*)
- c. *Generate Interest and Influence* The issues on these mobile platforms generate interest and influence young people to always be on them (*Expert 3*)

Usability

1. *Communicative Nature*

- a. *Easy for Communication* Users are normally glued to mobile technologies that are used for communication (*Expert 6*)
These mobile applications interfaces should be easy to use for communication, like making video and audio calls (*Expert 4*)
- b. *Easy Studies and Research* It is easy to use these platforms for research and learning compared to using books (*Participant P2*)
- c. *Effective for Online Conferences and Virtual Learning* Since I access the applications on my mobile device, it's easy to use them effectively for online conferences and virtual learning (*Participant P6*)

2. *Ubiquitous Nature*

- a. *Ubiquitous for Ecommerce Activities* Due to the ubiquitous nature of smartphones, I use the apps to buy auction cars, track them and also sell them easily using these apps to make a profit (*Participant P7*)
The apps easily assist in shopping and ordering goods and services online, which is easier and faster than in physical life (*Expert 4*)
- b. *Easy for Cyber Business* These platforms are easy to use in running my cyber business to make a profit (*Participant P4*)

Effective for Gambling and Betting I started by using slot machines and graduated to online betting and gambling. These mobile applications platforms are easy to use since they're ubiquitous (*Participant 4*)

A lot of these young people are involved in gambling, betting, and other cyber activities online (*Expert 4*)

- c. Easy for Playing Online Games
 - I easily play games on mobile applications due to their ubiquitous nature (*Participant 2*)
 - I play games more easily on mobile applications than on other platforms (*Participant 5*)

1. Misappropriative Nature

- a. Spying on Others
 - These mobile technologies cause users to spy on other users (*Expert 4*)
- b. Watching Pornographic Movies and Pictures
 - Watching pornographic movies and pictures (*Expert2*)
- c. Online Romance
 - I easily use these apps to connect to my boyfriend for romance and other activities, which may be difficult sitting by a computer and other stationary devices (*Participant 1*)
 - These apps are designed to assist the users in socialising, so even the original intention was to get people connected, and so those who relate well with others through these platforms will tend to move to the dependent level of using these platforms (*Expert 6*)
- d. Occultic Sites
 - Sometimes, social media platforms like Facebook cause occultists to befriend me and lead me to visit occultic sites (*Participant 4*)

Interactivity

1. Responsive Nature

- a. Searchability
 - The mobile technology features enable users to use search options to seek help or assistance (*Expert 6*)
- b. Data transferability
 - The mobile apps are flexible to use in downloading and uploading videos, images and audio (*Expert 6*)
- c. Optionability
 - Most mobile apps have the delete, edit or manage and other relevant options for easy usage (*Expert 6*)
 - I can delete and upload or download pictures, videos, and audios (*Participant 7*)

- d. Communicative Ability

The designed features of these apps have flexible ways of communicating (*Expert 6*)

The user interface normally has a message or chatting options to enhance communication (*Expert 6*)

There are various means of sending and receiving videos, audios, and images (*Expert 6*)
2. Flexible Nature
 - a. Fast User Interface

These interfaces have quick and fast user alerts, which make it possible for me to receive alerts and work quickly on emergencies (*Participant 7*)
 - b. Easy Navigation

I easily navigate or move around the apps without any challenge (*Participant 1*)

I have easy means of navigating apps without any challenge (*Participant 2*)
 - c. Freedom of Choice

The interface responds quickly to my instructions (*Participant 6*)

Users have the flexibility of deciding on what to do on these apps (*Exp 6*)
 - d. Shareability and Creativity

I have a very nice experience creating images on mobile applications on the user interface (*Participant 2*)

I create audios and videos with others using mobile applications (*Participant 3*)

I share audios and videos with others using mobile apps (*Participant 3*)
3. Attractive Multimedia Nature
 - a. Multimedia Functionality

I use the user interface to record, edit and share audios and videos without any difficulties (*Participant 5*)

I create and interact with avatars on mobile applications (*Participant 5*)
 - b. Attractive colour

Most applications are very attractive in colour and enable easy interactivity (*Participant 3*)

Since these apps are mostly for social events and interactions, the developers try to keep them colourful and attractive (*Expert 6*)

- c. Quality Graphics The quality of the graphics on the user interface of these apps is appealing (*Participant 6*)
- d. Great User Experience Apart from setting my security codes, these apps don't pose any restrictions to my user experiences or engagements (*Participant 3*)

Social Presence

1. Social Relationship Building

- a. Intimacy Building I get to familiarise myself and create intimacy with others using mobile technology (*Participant 6*)
My brother tends to build more intimacy with people on mobile social media apps than those not on social media (*Participant P6a*)
- b. Relationship Building I build an informal relationship as if we are together at the same place (*Participant 3*)
- c. Trust Building My clients trust our engagement and are ready to spend money when we engage them more and feel the sense of being together in one place (*Participant 3*)
Seeing the gestures of others make me trust our conversations and engagement with others on mobile applications (*Participant 7*)

2. Online Presence

- a. Sense of togetherness I feel a sense of being connected with my boyfriend and it looks as if we are together at the same place (*Participant 1*)
I feel as if I'm at the place with my online dates (*Participant 6*)
- b. Sense of closeness I feel close to my relations (family and friends) who are on mobile social media than those who are not (*Participant 7*)
I feel closer to those I interact with more often on social media platforms than those I don't (*Participant 6*)
I relax and express myself when on mobile devices as if we are together in one place (*Participant 3*)
- c. Sense of Belongingness I feel I belong when talking with my boyfriend on these platforms (*Participant 1*)
She thinks she enjoys more privacy and belongingness on mobile social platforms (*Participant 1a*)

Telepresence

1. Technology Design

- a. Virtual Presence Designs The interface of the apps enables individuals to experience a virtual presence on these technologies (*Expert 6*)
- b. Immersive Designs The graphic user interface enables me to move from one interface to the other and enables me sometimes to get deeply immersed in the app. (*Participant 4*)
- c. Interactive Designs Users normally relate or interact well with the quality of GUI and attain flow (*Expert 6*)

2. Multimedia Quality

- a. Sounds Quality I enjoy browsing through quality sounds on mobile technology (*Participant 7*)
- b. Video Quality I enjoy browsing through quality videos on mobile technology (*Participant 7*)
- c. Image Quality I like good and quality images on mobile technology (*Participant 6*)
When the images are real and are presented like the actuals, users are likely to experience telepresence (*Expert 6*)
- d. GUI Quality New mobile devices have enhanced graphic user interfaces (*Participant 6*)

3. Integrative Nature

- a. Hyperlink interfaces The hyperlinking or interconnection of one platform to others also enforces telepresence (*Expert 6*)
- b. Applications Integration I can move from one mobile application to the other on my mobile device because they are integrated or connected such that I can move from one platform to the other (*Participant 7*)
I am addicted to other people's statuses, so I like going from one status to another, from one profile to another, and from one platform to another (*Participant 2*)
- c. Platforms Integration Several mobile applications can be installed on one mobile device at the same time, which makes users browse these apps and navigate several of them on one phone, which can be addictive (*Expert 6*)

High-quality videos and pictures can lure wealthy men into accepting and wanting to date me on social media platforms, which generates a lot of presence on these apps (*Participant 4*)

Flow

1. Immersive Capabilities

- a. Total Immersion I get totally immersed when I have a grip on mobile technology (*Participant 2*)
Technologies that have immersive tendencies can cause users to get into the flow (*Expert 6*)
- b. Total absorption These platforms are designed to get users to be totally absorbed, so every user has to be careful when using these apps (*Expert 6*)
- c. Lost Control Hmm! At a point, he lost control of everything (*Participant 4a*)

2. Users Interest

- a. Intrinsic Interest Anytime we are counselling them; we realise that Cyber Addicts have a highly concentrated intrinsic interest in these apps (*Expert 2*)
When the apps are very interactive, users have more interest in using them (*Expert 1*)
The technologies may have some characteristics that will generate the need to always be on it (*Exp1*)
I can use the functions of the apps, which made me able to get into the flow easily
- b. Focus Attention Sometimes my friend focuses her attention to the point that she can focus and even react to others on social media as if they are with her without even realising it (*Participant 2a*)
- c. Skewed Thoughts I lost control and thought when using these mobile devices (*Participant 4*)
- d. High Concentration I have high concentration and sometimes can laugh out without knowing, even while at work (*Participant 2*)
I have a high concentration on mobile technology (*Participant 5*)
He has so much concentration on these mobile technologies (*Participant 5a*)

High concentration on mobile devices sometimes gets users into the flow (*Expert 6*)

3. *Abilities and Skills*

- a. Users Curiosity The addicts may become curious and will like to explore more of these apps (*Expert 6*)
I get curious when using mobile technology with my clients (*Participant 3*)
- b. Users Abilities The ability of users to easily use mobile technology may result in a flow
- c. Users' skillsets The skill sets of the users to freely use the functions on the apps can also result in flow

Fear of Missing Out (FoMO)

a. *FoMO Online Monetary Benefits*

- a. Fear of Losing Business I'm a businessman and always connect to auction sales, so I try to always be on several auctioning mobile platforms to bid and buy cars, so I fear that if I am not always online, I may lose business (*Participant 7*)
Using computers for my cyber business is ideal, but I always try to be online using mobile applications because I fear that I may lose my customers if I don't stay online so that I can react, reply and connect with my business partners in real-time and make good money (*Participant 3*)
- b. FoMO Online Betting and Gambling I like to stay on mobile applications to study online betting and gambling trends, which eventually assists me in winning and making more money (*Participant 4*)
Those who are involved in online betting and gaming fear that they are missing the opportunity to make money if they are not on those mobile apps, so it is normal to see them always glued to these apps (*Expert 1*)
- c. FoMO Online Games I fear that I may lose the opportunity to play and win against others on the mobile applications (*Participant 5*)

My son is always on his mobile device, trying to catch up with his playing time so that he will not miss out on online mobile games (*Participant 5b*)

b. FoMO Live Interactive Sessions

- a. FoMO Live Interactions I fear that when I leave mobile social media apps., I may miss out on some important conversations or the big deal of socialisation with my friends and colleagues (*Participant 6*)
I fear that if I'm not on mobile applications, I may not be able to catch up with others and interact with them (*Participant 6*)
I fear losing my constant relationship and interactions with my dates if I don't visit the mobile applications often (*Participant 7*)
- b. Fear of Broken Relationships I fear that my boyfriend will leave me and spend that time with others if I don't engage him online (*Participant 1*)
- c. FoMO Relationships I have counselled several students who, because of fear of missing out in their relationships, will always want to be online and eventually become addicted (*Expert 2*)
- c. *FoMO Online Updates*
- a. FoMO User Updates Sometimes because my sister stays up very late, I also stay awake to catch up with her in order not to miss out on important mobile applications updates and to discuss people's status and posts deep into the night (*Participant 1a*)
I fear missing out in action if I don't visit the mobile applications regularly and update myself with the current happenings, e.g. people's statuses, posts, etc., to keep online updates (*Participant 2*)
- b. FoMO News Updates I always want to contribute to discussions any day or time, so I fear missing out on important news updates and events on social media (*Participant 7*)
- c. FoMO Online Pleasures I fear that my friends will have fun and enjoy more on mobile applications without me, so I try always to be online (*Participant 6*)
I fear that my colleagues are having fun and enjoying themselves without me (*Participant P6*)

When an individual gets addicted to these apps, there's pressure on them such that any day that they don't use mobile applications, it's as if something is missing in their lives (*Participant P3*)

- d. Losing Track of Activities of P2. Anytime my data is off, or I'm offline, I fear that others may be posting or performing activities that I might be losing track of (*Participant P7*)

Self-Regulation

1. Online Time Regulation

- a. Time Regulation Addicts must regulate the amount of time on these devices to control their addictions (*Expert 1*)
I tried to set a time for myself and only use mobile technology when I was less busy, which helped my recovery (*Participant 3*)
- b. Less Time Online I always try to spend a few minutes on mobile applications but can't. I, therefore, spend more time on applications than expected (*Participant 4*)

2. Data Regulation

- a. Switch off Data During working days, I switch my data off and only use the apps during my lunch break (*Participant 2*)
I switch off my data anytime I'm busy to avoid disruptions (*Participant 7*)
- b. Keep Data Offline To limit my dependence, I was advised to keep my data offline and only put it on if I have something important to do or only if I am less busy and feel like using mobile technology (*Participant 3*)

3. Checking Alerts and Updates Regulation

- a. Alerts Regulation It's important for users only to leave very important alerts on their mobile applications (*Expert 1*)
The best thing to do is to switch off the alerts on these mobile applications so that you can only visit them at your time (*Expert 6*)
- b. Update Checking Regulation I have advised myself to avoid regular and frequent checking up of other users' statuses on all platforms (*Participant 2*)

- c. Avoiding Alerts I try to avoid all forms of alerts that may prompt me to use the betting and gambling apps (*Participant 4*)

4. Live Interactive Sessions

Regulations

- a. Limit Live Interactive Sessions I normally advise my students to limit the number of interactions with others on mobile applications to regulate their addictions (*Expert 2*)
- b. Unessential Interactions Avoidance To regulate mobile technology addictions, users must avoid unnecessary engagements and interactions on mobile applications (*Expert 4*)
- c. Important Messages Checking Currently, I am regulating myself by going through only important messages on mobile social platforms (*Participant 4*)

5. Uninstall Gambling and Betting Apps and Alert Tools

- a. Uninstall Alert Tools I uninstalled all alert tools that cause me to frequently and regularly use mobile technology (*Participant 5*)
- b. Uninstall Gambling and Betting Apps I uninstalled all gambling and betting apps immediately after I started treatment at the recovery centre (*Participant 4*)
After I started treatment, I tried to avoid going close to any forms of gambling or online betting platforms (*Participant 4*)
I try not to respond to online adverts on gambling and betting mobile apps and websites (*Participant 4*)
My cousin was advised to uninstall all the gambling and betting apps, which he did the very day I sent him to the addiction centre (*Participant 4a*)
- c. Online Betting and Gambling Avoidance Even if they are playing the betting or gambling adverts on TV, he now switches to other channels (*Participant 4b*)
Most of these online quick money-making adverts are to lure users to online gambling/betting or online cyber fraud, so they must be avoided (*Expert 1*)

Mobile Technology Addiction

Academic Performance

1. School Abandonment

- a. School Drop Outs I dropped out of school because of my addiction to these platforms (*Participant 5*)
If not for my addiction, I would have completed school with my other colleagues. At a point, I moved from mobile applications to gambling and betting. I used my school fees to gamble online and lost, so I dropped out of school without the knowledge of my parents (*Participant 4*)
- b. Stop Schooling Severe forms of addiction lead young people to leave their parents' care, stop schooling, and virtually land on the streets (*Expert 1*)

2. Playing Truancy

- a. Missing Lecturers Hmmm! My son started with this computer thing, and I realised he began smoking and refused to attend lectures regularly. I did all that I could, but he refused and left home (*Participant 4b*)
- b. Attending Lecturers Irregularly When I enjoy the mobile apps throughout the night, I feel sleepy during the day and sometimes it's difficult to attend lectures (*Participant 6*)

3. Phubbing

- a. Smartphone Snubbing I took delight in browsing during lectures (*Participant 7*)
She normally browses in the church (1b)
- b. Lack of Concentration in Classroom I cannot wake up early the next morning if I spend the whole night on mobile technology. Therefore, I have to sleep in the morning till at least 10 am or even more to regain my sleep time, or I wouldn't feel well the whole day. This makes me unable to concentrate in class (*Participant 2*)
I was unable to concentrate in class due to mobile applications (*Participant 5*), Lack of Concentration
- c. Occupied Thought My thoughts were occupied due to my regular use of mobile technology. Therefore, I wasn't able to focus in class (*Participant 4*)

4. Learning Time Table

Disruptions

- a. Unable to Follow Personal Timetable I'm unable to follow my timetable schedules for learning (Participant 1)
Anytime I'm learning and I get an alert from mobile applications, then I get distracted and divert my attention towards the phone (Participant 1)
- b. Distracted Attention My thought was always about mobile applications and not books, so I got distracted from my purpose in life and stopped school (Participant 4)

5. Academic Performance

Reduction

- a. Drop-in Academic Performance My brother would have been a first-class graduate had he given full attention to his books (Participant 6a)
I made good money from my cyber activities on mobile applications, so I got distracted from my original purpose and didn't see the need to continue schooling (Participant 3)
- b. Average Academic Performance Well! I think that I could have performed better if I didn't use mobile applications (Participant 1)
My sister is very good and may perform better if she is not always glued to the phone (Participant 1a)

General Effect of MTA

1. Mental Health

Disorders

- a. Skewed Thoughts My thoughts became skewed, and I couldn't think about anything else apart from mobile applications, online gambling, and online betting (Participant 4)
- b. Depression From mobile applications, I moved to gambling and betting. I left home, virtually slept on the streets, and became depressed (Participant 4)
I became depressed when I realised that all my friends were doing better than me; I got frustrated and couldn't help myself anymore (Participant 5)

The brain's reaction to these addictions may lead to depression and so on (*Expert 7*)

- c. Frustration He was hallucinating, got frustrated and lost control of his life, so he was brought to the hospital and then to the addiction centre (*Expert 3*)

2. *Health and Relationship complications*

- a. Unhealthy Lifestyle I used any money I found to play games online, and it became difficult even to eat well and maintain a healthy life, so I was falling sick frequently (*Participant 5*)
- b. Multiple Sexual Relationships I am very shy in normal life and find it very difficult to approach ladies physically, but I'm bold online and have about three (3) online girlfriends so far (*Participant 6*)

Some individuals engage in online sexual relationships, which is very disturbing, and these are gradually trickling into our societies (*Expert 2*)

3. *Emotional Instability and Impaired Social Life*

- a. Emotionally Unstable I became emotionally unstable in my relationships. I currently have uncountable online relationships, but I'm unable to actualise any of them physically, which may lead to marriage (*Participant 7*)
- My friend became unstable and unable to concentrate on his job and work effectively due to mobile applications (*Participant 7a*)
- My son became emotionally unstable and misbehaved towards our relatives and friends (*Participant 5b*)
- I always want to win and be a heroine. Therefore, anytime I win, I'm excited, but when I'm defeated, I feel so sad that I sometimes even cry (*Participant 2*)

- b. Impaired Social Life MTA leads to an impaired social function. Addicts are unable to complete their tasks at home, school, or work (*Expert 4*)

My sister has several friends on mobile applications who make her happy, and she loves to be with them online even more than her physical friends (*Participant 2b*)

I'm shy in normal life, so I don't have friends like that, but on mobile applications, I've got a lot of friends (*Participant 4*)

I have a lot of friends online who respond to my social needs and I often pick fights with others who try to disregard or look down on me (*Participant 6*)

I became emotionally unstable when I realised my friends were doing better than me. I got frustrated and couldn't help myself anymore (*Participant 4*)

4. *Psychological instability*

- a. Powerlessness I felt powerless and could not help myself anymore (*Participant 5*)
- b. Desperation I was in total despair when I realised that the thought of making huge monies through online betting and gambling was just a fantasy and not real. I even thought of killing myself to end it all (*Participant 4*)
I had a mood swing; I was happy online but sad in the physical world (*Participant 2*)
- c. Mood Swings Those addicted to these mobile applications may have mood swings based on their interactions online (*Expert 4*)

5. *Selectivity and Sociability*

- a. Selectivity One good thing about online social media friends is that you decide whether you are in control and decide who you want to interact with
- b. Sociability I am unable to make friends in my physical world because I already have millions of friends when playing mobile social games (*Participant 2*)

Authors' Construct

7.5 Chapter Summary

This chapter presents the qualitative results and findings. It provides details of the findings and analysis of the qualitative data collected among multi-stakeholders and multidisciplinary dimensions to understand technology addiction in a developing country context. The experts' profiles from diverse backgrounds who participated in this research have been summarised. It analyses the representative data collected from experts, technology addicts, addicts' relatives, and friends by providing first-order codes and second-order constructs. It presents how the data is coded at the outset to the abstracted constructs that explain the main constructs deduced from the theories.



CHAPTER EIGHT

DISCUSSIONS OF RESULTS

8.1 Chapter Overview

Chapters Six and Seven of this research presented quantitative and qualitative results, findings, and analyses. This chapter focuses on presenting the discussions of the findings and the results of the quantitative and qualitative data. This chapter discusses the representation of the quantitative and qualitative data and assists in answering the research questions and objectives. The discussions are largely based on the findings after the data analysis through a critical realism paradigm lens.

8.2 Discussion of Quantitative Results (Deductive)

This section discusses the quantitative results of this study. It first presents the demographics and then gives the theoretical implications of socio-technical interactions, the moderating effect of self-regulation, the fear of missing out, and the effects of addiction on academic performance.

8.2.1 Demographic Characteristics of Participants

a. Gender

The demographic characteristics of the quantitative data demonstrate that male participants are higher than females. The number of males was (62.1%), while the female participants were (37.9%). The difference in the ratio demonstrates that more males participated in responding to the quantitative data than females. Although this is from a developing country context, it is consistent with several other publications that have more male respondents than females, and some even recorded more males being addicted to technology platforms than females (Çelik & Odaci, 2013; Jiang, 2014; Whang, Lee, & Chang, 2003).

b. Age and Education

Most participants were between 21-25 years in terms of age range, representing 64.2%. This is because most participants were undergraduates (First Degree Students), representing 67.2% of this research's total population, and the postgraduate students (Masters/Ph.D.) students were 32.8% of the total sample. The literature suggests that generation Y, aged 20 - 35, has a higher significant level of addiction than generation X (Zhitomirsky-Geffet & Blau, 2016). However, it was evident in another research conducted among high school students that users of technologies who may likely fall within generation Z and are within the range of 13 - 19 consume more social games and SNSs than university students who may likely be within generation X and Y (Eric, Hyunji, Sang, Han, & Oh, 2016). This research is conducted among university students in Ghana. The data sampled for this research supports the statistics that the age range of university students, even in developing countries, is largely among generation Y, which is in tandem with the global statistical figures.

8.2.2 Discussing Theoretical Implications of Socio-technical Interactions

Objective two (2) of this study is to develop a model that describes how the socio-technical interaction between users (university students) and mobile technology results in MTA that are missing in extant literature. To fill this gap, this study developed the MTA model and tested it empirically by collecting quantitative data from 528 university students who are mobile technology users from three (3) universities in Ghana. Twenty-one (21) hypotheses were tested; eight (8) were not supported, and thirteen (13) were supported. To clarify the socio-technical interactions, users' self-traits and hedonic values positively and directly predicted social presence. Also, technology's usability positively and directly predicted telepresence.

Furthermore, social presence and telepresence positively and directly predicted flow. Social presence, telepresence, and flow positively predicted mobile technology addictions. To get the details of the outcome of the hypotheses supported (see Table 6.8).

To explain further, human beings who use these technologies may be motivated by some traits to start and continue using these technologies. Therefore, this research uses self-traits to examine the attributes of mobile technology users. Self-trait is an antecedent to social presence and flow leading to technology addiction. This study sought to examine the influence of self-traits on social presence and flow. The first hypothesis supports the findings that self-traits significantly predicted social presence (H_{1a} ; $\beta = 0.192$; $t = 4.222$; $p = 0.000$), but the second hypothesis is not supported. Self-traits rather insignificantly predicted flow. This implies that users' self-traits must lead to social presence then to flow and not directly to flow; this finding is novel and does not support the previous literature that sought to suggest that self-traits directly influence mobile flow and video game flow and are associated with addiction for various media types like mobile and game (Khang et al., 2012). More specifically, existing literature suggests that self-control is the most significant construct that affects users' flow and addiction concerning their use of mobile phones, the internet, and video games (Khang et al., 2012). Also, by considering only self-control, scholars argued that inadequate self-control is highly correlated with a negative state of mind, leading to impulsive deviation, alienation, self-depression, avoidance, etc. These negative habits result in the users' heavy reliance on technologies and mobile applications. Considering the positive impact of self-control, a user may, through "controlled motivation," decide not to engage in an activity, for example, accessing mobile applications beyond a certain point. A user may use mobile technology for only some specific activities that may be productive, and their usage behaviours may be carried

out from the point of efficiency (Vaghefi, 2015, p.55). This study found that the users' self-traits (i.e., self-control) must go through social presence to flow before technology addiction.

The second hypothesis not supported is the direct influence of utilitarian values on social presence and flow, leading to mobile technology addiction. Utilitarian value is a consumer's overall assessment of the functional benefits and costs of using these technologies to achieve their goals or benefits (Hoffman & Novak, 1996). They result in the technologies' functional, instrumental, and practical benefits (Najjar & Ngoc Bui, 2012). This research hypothesised that utilitarian value directly impacts social presence and flow, leading to mobile technology addiction. Thus, this study sought to examine the influence of utilitarian value on social presence and flow leading to mobile technology addiction; however, these two hypotheses in H_{3a} and H_{3b} are not supported by the data. This implies that mobile technology platforms may be useful and beneficial to the users; they may even have some extrinsic attributes or characteristics that may force users to start using them but that will not lead to social presence to flow and result in mobile technology addiction. Furthermore, it implies that mobile technologies designed for utilitarian purposes (service or work) may not have the inherent potential or motivation to result in social presence and flow, leading to mobile technology addiction. Chang, Shu, and King focused on utilitarian values as the value of purchasing (stimuli). They posited that the greater these values, the greater the behavioural intentions (response) to revisit after use (Chang, Shu, & King, 2014). This study is consistent with the previous literature that shows no relationship between utilitarian value and social presence (Etemad-Sajadi, 2014; Etemad-Sajadi & Ghachem, 2015; Weiwei Li et al., 2015). It implies that the inherited stimuli that cause user response and revisit are insufficient to lead to social presence and flow. Therefore, this study posits that mobile technology designed for utilitarian purposes will not result in MTA.

The third hypothesis not supported is the influence of interactivity on telepresence and flow resulting in technology addiction. To explain further, this research found that interactivity negatively predicted flow and telepresence. Hypotheses H_{4a} and H_{4b} are, therefore, not supported. Mobile technology may be interactive but does not positively impact flow and telepresence. This is inconsistent with previous studies that interactivity positively impacts telepresence and enhances flow (Coyle & Thorson, 2001; Novak & Hoffman, 2000).

Nevertheless, this study supports the extant literature that did not support the conceptualisation of the relationship between interactivity and telepresence (Novak et al., 1998). For a detailed explanation of the interactivity construct (see Section 4.4.6). The interactivity is even perceived by how attractive the technology is. Theoretically, this implies that the interactive nature of the technology alone will not necessarily lead to flow or telepresence and result in technology addiction.

The last hypothesis not supported is that social presence directly predicted addiction. The three main virtual constructs, telepresence, social presence, and flow, have been conceptualised as virtual presence and theorised to positively influence mobile technology addiction. Specifically, flow (H₉; $\beta = 0.243$; $t = 5.208$; $p = 0.000$); and telepresence at (H₁₀; $\beta = 0.356$; $t = 7.201$; $p = 0.000$) significantly predicted addiction. However, the significant influence of social presence was not supported. Theoretically, this implies that to become addicted to mobile technology, there should be some specific or peculiar service that the technology provides (e.g., betting or gambling) that lures or influences users to be addicted (Joel Billieux, 2012; Gainsbury et al., 2017). Social presence concerns users' connectedness to the extent that some have developed personal relationships with other users online or in a virtual world (Biocca et al., 2003). Thus, such users are more likely to frequently visit the platform, not for the platform's sake but to enable them to connect with others and therefore feel a greater sense of

social presence (Animesh et al., 2011; Nyamadi et al., 2020). It means that users connecting to their families and friends on mobile social platforms are strongly correlated and may influence them to reach flow, so the higher the social presence, the higher the flow (Zhang, Lu, et al., 2014). The implication is that users who experience social presence must necessarily get into the flow before addiction.

8.2.3 Moderating Effect of Self- Regulation, and Fear of Missing Out (FoMO)

Objective three (3) of this study (see section 1.4) is to explore the moderating effects of Fear of Missing Out (FoMO) and Self-Regulation. These two (2) constructs, namely self-regulation and FoMO are moderators of the model. This research investigated that self-regulation significantly moderates the relationship between MTA and its predictors (i.e., social presence, flow, and telepresence) on the one hand and MTA and academic performance on the other hand. Similarly, the Fear of Missing Out (FoMO) significantly moderates the relationship between mobile technology addiction and academic performance. The self-regulation moderation construct is how users can control themselves when using mobile technology; self-regulation is expected to reduce mobile technology addiction. The FoMO is also about how users try not to lose track of all events on the mobile applications, which may influence them to be always on the mobile apps and may cause users to be more addicted. Therefore, these two constructs have opposing effects.

The findings of this study revealed that self-regulation significantly moderated the effect of telepresence on MTA ($\beta = 0.094$; $t = 2.357$; $p = 0.018$), as well as the effect of MTA on academic performance ($\beta = -0.106$; $t = 2.037$; $p = 0.042$), hence supporting hypotheses H₁₄ and H₁₅. The findings suggest that self-regulation strengthens telepresence's effect on MTA while it weakens the effect of MTA on academic performance. Thus, self-regulation mitigates the

negative effect of MTA on academic performance. Further, as expected, the moderating effect of the FoMO on MTA and academic performance was significantly positive ($\beta = 0.139$; $t = 2.287$; $p = 0.022$), supporting hypothesis H₁₆. Previous literature on FoMO is consistent with this study's findings that the fear of missing out has a significantly positive relationship with technology addictions. It enhances the users' compulsive and addictive behaviours like frequent checking of phones and constant checking of social media platforms. (Elhai et al., 2016; Hoetjes, 2013; Wegmann et al., 2017).

The above findings are consistent with previous literature suggesting that users can reduce their MTA and general behavioural addictions if they self-regulate. Therefore self-regulation is theorised as the main construct which is an intrinsic element of users and can help users mitigate all forms of technology addictions, and it has been found that deficient self-regulation leads to higher addictive usage of technologies and technology platforms (Gámez-Guadix, Calvete, Orue, & Las Hayas, 2015; Lee, Cheung, & Chan, 2014; Thadani & Cheung, 2011; Wang & Lee, 2014). This study has combined self-regulation and FoMO to produce a novel construct to regulate the use of information systems known as *IS Use Regulation* (see Fig. 9.2)

8.2.4 Addiction and Academic Performance

Objective four (4) of this study is to investigate and explain the effect of MTA on university students' academic performance (see Section 1.4). This research hypothesised that MTA would negatively affect academic performance. This hypothesis is supported and not rejected. According to these research findings, MTA negatively affects academic performance. This finding contradicts previous literature, suggesting no significant relationship between internet addiction and students' academic performance (Dhir et al., 2015; Usman et al., 2014). This contradicts Toker and Baturay's (2016) study, which established no relationship between game

addiction and academic performance. Also, in a related study, where it was hypothesised that higher smartphone dependency symptoms would reduce Grade Point Average (GPA), the hypothesis was rejected (Lin & Chiang, 2017). This means that addiction to MTA has a significant negative relationship with students' academic performance. Other findings supported this outcome and revealed a negative effect of these platforms on students' academic performance (Braun, Peus, Weisweiler, & Frey, 2013; Zhao, Lu, Huang, & Wang, 2010).

8.7 Discussion of Qualitative Results (Inductive)

This section discusses the qualitative findings and presents the nature and causes of technology addictions and the nature of addictive technologies, and the moderating effect of fear of missing out and self-regulation. It finally presents the effect of MTA on academic performance and well-being. The qualitative results explain the constructs hypothesised by the quantitative studies and draw inferences based on the studies' objective.

8.7.1 Stimulus: Nature and Causes of Technology Addictions

The S-O-R theoretical framework is used to discuss the qualitative findings of this research. The stimulus part focuses on the factors that enable technologies, on one side, and users, on the other, to be addictive. Therefore, the nature and characteristics of both technologies that enable users to be addicted are known in this research as stimuli. While the nature of technologies may aid technology addiction, the users' attributes and characteristics may also result in technology addiction. The nature of technologies was coded using the two constructs of interest derived from literature considering adopting technologies beyond UTAUT3 and TAM3. These two constructs are usability and interactivity. These constructs were examined from their subcodes, and the findings are put forward in the following sub-headings.

The nature and characteristics of technology users resulting in addiction were considered based on their hedonic values, utilitarian values, and self-traits. These constructs were also carefully

positioned under the stimulus constructs in the S-O-R framework. These three constructs are also sub-coded and interrogated regarding their characteristics and platforms that support users' addiction. The qualitative findings are discussed in the subsequent sections.

8.7.2 Nature of Addictive Technologies: Usability and Interactivity

The nature of addictive technologies examined in the model was based on usability and interactivity. Usability is an attribute of technologies that help users achieve their purpose and goals after a series of tasks. It is how purposeful mobile technologies are to users. This research revealed that the mobile technologies that are an addictive must by nature be (1) *Communicative*, (2) *Ubiquitous*, and (3) *Misappropriative*. For the interactivity construct, mobile technologies must by nature, be: (1) *Responsive*, (2) *Flexible*, and (3) *Have an Attractive Multimedia Interface* for them to be addictive. Additionally, this study has found that mobile technologies must-have applications that enable activities like gambling, betting, cyber business or cybercrime, playing online games, watching pornographies, online romance, occult, spying on others, and other social activities for it to be addictive, which is consistent with literature that mobile technology may not be addictive, but the activities on these platforms enable and intensify their addiction (Joel Billieux, 2012; Ko, Yen, Liu, Huang, & Yen, 2009; LaPlante et al., 2008; Yang, Liu, & Wei, 2016b). Furthermore, categories of mobile applications rated most addictive in literature are applications used for communication (Ding et al., 2016). This study again found that for mobile technology to be addictive, it must have functionalities in its design, such as data transferability, communicative ability, searchability, optionability, and enhanced multimedia interface. This is also consistent with the literature that mobile devices must-have features and functionalities for user satisfaction and addiction (Das, 2013; Glasscock & Wogalter, 2006; Han, Geng, Jou, Gao, & Yang, 2017; Han et al., 2004). For further clarification, the Mobile Developer (Expert 6) interviewed for this work suggested,

"Most mobile application platforms that are addictive have the delete, edit or manage and other relevant options for easy usage." This was captured under the first-order construct as "optionability." All these details are shown in Table 7.2 and Fig 8.1. respectively. The findings of the nature of the technologies that result in addiction are summarised below:

Finding 1: The nature in terms of the features of mobile technologies that enable addiction to revolve around usability and interactivity.

Finding 1a: From a stakeholder and multidisciplinary perspective, mobile technology must be communicative, ubiquitous, and misappropriative in nature in terms of its usability to be addictive.

Finding 1b: From a multistakeholder and multidisciplinary perspective, mobile technology, in terms of its interactivity, must be responsive, flexible, and have attractive multimedia interfaces by nature to be addictive.

The details of the above findings, from the first-order codes to second-order codes and the aggregated constructs, are shown below:

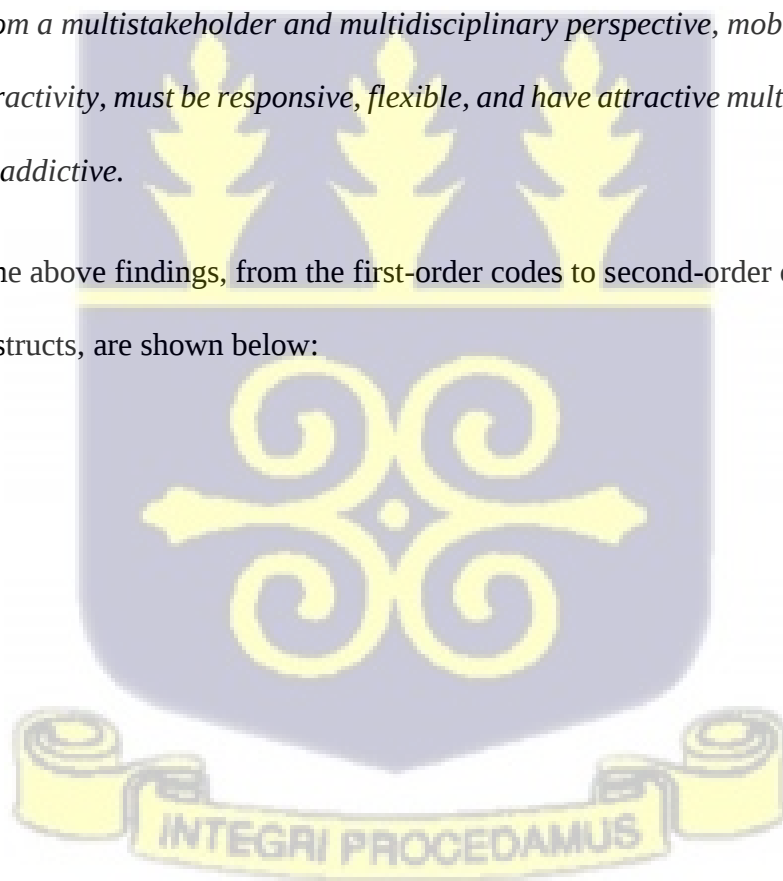
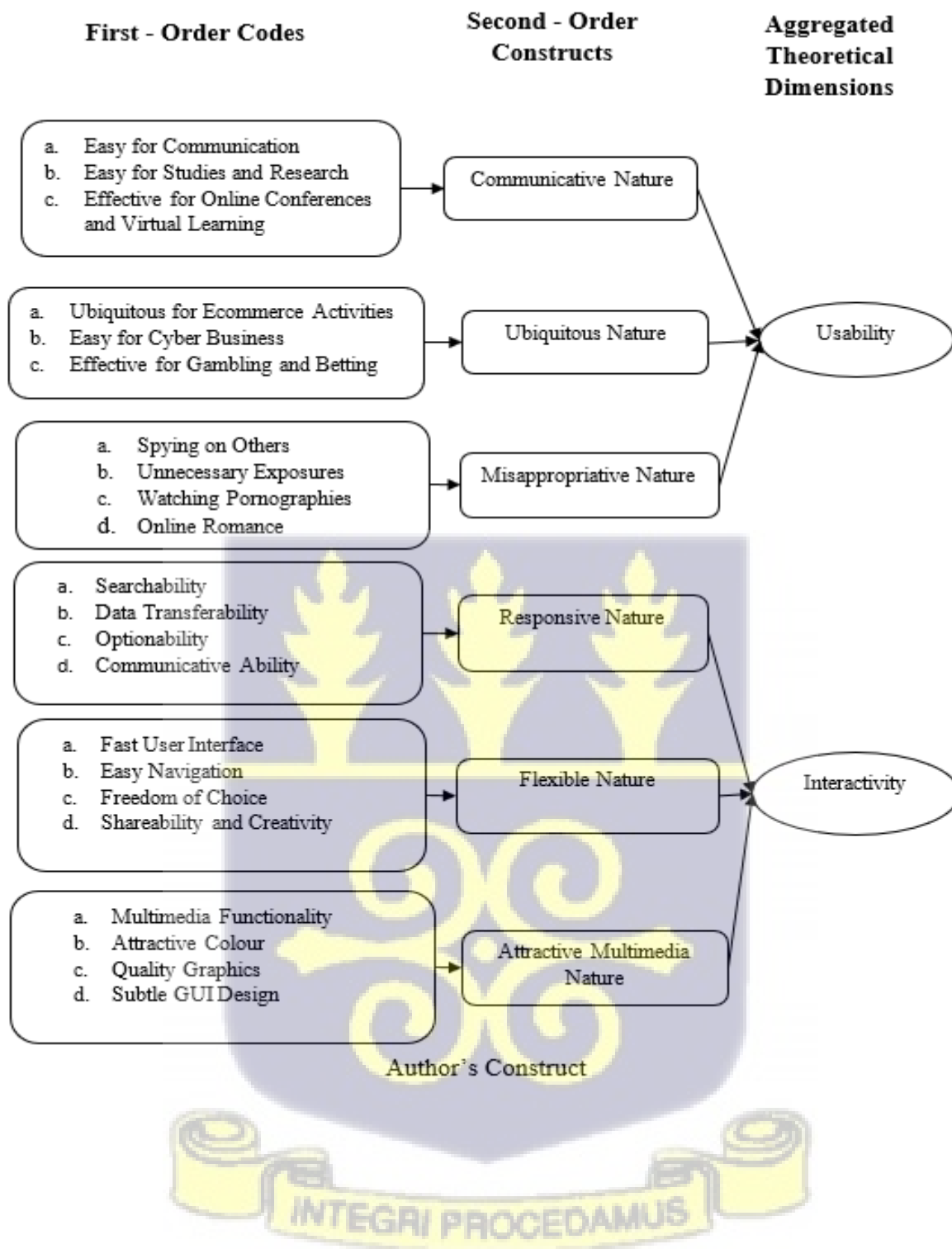


Fig.8. 1 The Structure of Data Related to the Nature of Addictive Technologies



8.7.3 Nature of Mobile Technology Users: Self-Traits, Hedonic and Utilitarian Values

The constructs (i.e., *self-trait*, *hedonic value*, and *utilitarian value*) as in the research model have been analysed qualitatively in this part of the study to understand the nature and characteristics of prone and vulnerable users to mobile technology addiction (Etemad-Sajadi & Ghachem, 2015; Khang et al., 2013; Van Der Heijden, 2004). Although these constructs were analysed quantitatively for their cause and effect in the model, the qualitative analysis looked at the three levels that lead mobile technology users to addiction. Self-trait was looked at as a multidimensional construct. Thus, users and mobile technologies must have some traits or characteristics to aid their addiction tendencies. The rest of this subsection discusses the results of each construct's qualitative findings.

a. Self - Traits

This study found that addictive users may establish their online digital self-image through their nature's digital self-efficacy and digital self-esteem. Therefore self-trait as a multidimensional construct was looked at in terms of digital self-image, digital self-efficacy, and digital self-esteem, consistent with the literature (Baumeister, 1999; Caplan, 2010; Khang, Woo, & Kim, 2012; Kim & Davis, 2009). For digital self-image: (1) *the addictive user must have uncontrollable digital nature exhibited through perpetual craving and the uncontrolled urge to be on the mobile technology*, (2) *digital emotions expressed through relative happiness, digital desires, and online emotions*, and (3) *digital status seen through being digitally active to establish or create an online status which may not be a true representation of user physical conditions and status*.

b. Digital Self-Image

Mobile technology users who continually use the application(s) would have a digital image to protect or enhance. This study found that addictive users have uncontrolled nature expressed through *digital nature*, *uncontrolled urges*, and *perpetual cravings* (Chan et al., 2014; Dong et al., 2017).

c. Digital Self-Esteem

This study found that the *digital self-esteem* of addicts was enhanced through (1) *digital personality*, (2) *digital ethos*, and (3) *digital interest*. Digital personality was achieved through online bravery and boldness. *Digital ethos* was realised through *online reputation*, *digital values*, and *online influence*. Low digital self-esteem has a greater tendency to influence an intense MTA (Khang et al., 2013; Kim & Davis, 2009).

d. Digital Interest

Every mobile technology user has some particular interest in being in the digital space; this research found these three digital interest subthemes that mobile technology addicts associated themselves with: (1) *online relationship building*, (2) *online relationship maintenance*, and (3) *monetary benefit seeking*. Digital interests lead to unnecessary online disclosures and avoidable exposures online (Han et al., 2016; Kim & Song, 2016)

e. Digital Self-efficacy

Self-efficacy is "an individual's self-assessment of his/her capacity for accomplishing a given task" (Bandura, 1986, 1999; Khang et al., 2013, p2417). It is a cognitive process related to users selecting diverse tasks to complete or perform a task (Bandura, 1999). For *digital self-efficacy*, the addicts assessed themselves on their (1) *Online effectiveness*, (2) *Online efficiency*,

and (3) *Social identity seeking*. This study found that online effectiveness is about mobile users' confidence in building their digital image. Online efficiency comes with three first-order codes such as (1) *online reputation*, (2) *online availability*, and (3) *task completion*. Social identity seeking came out with three (3) first-order codes such as (1) *presenting culture online*, (2) *online social identity*, and (3) *projecting beliefs online*. Therefore, when users are effective, efficient, and seek social identity online, they are likely to use mobile technologies, resulting in addiction, as shown in Table 7.3 and Fig. 8.2.

Finding 2: From a multidisciplinary and multidimensional perspective, mobile technology addicts are those who, by their uncontrollable nature, concentrate on building their digital self-image on mobile technology to enhance their digital self-esteem and digital self-efficacy.

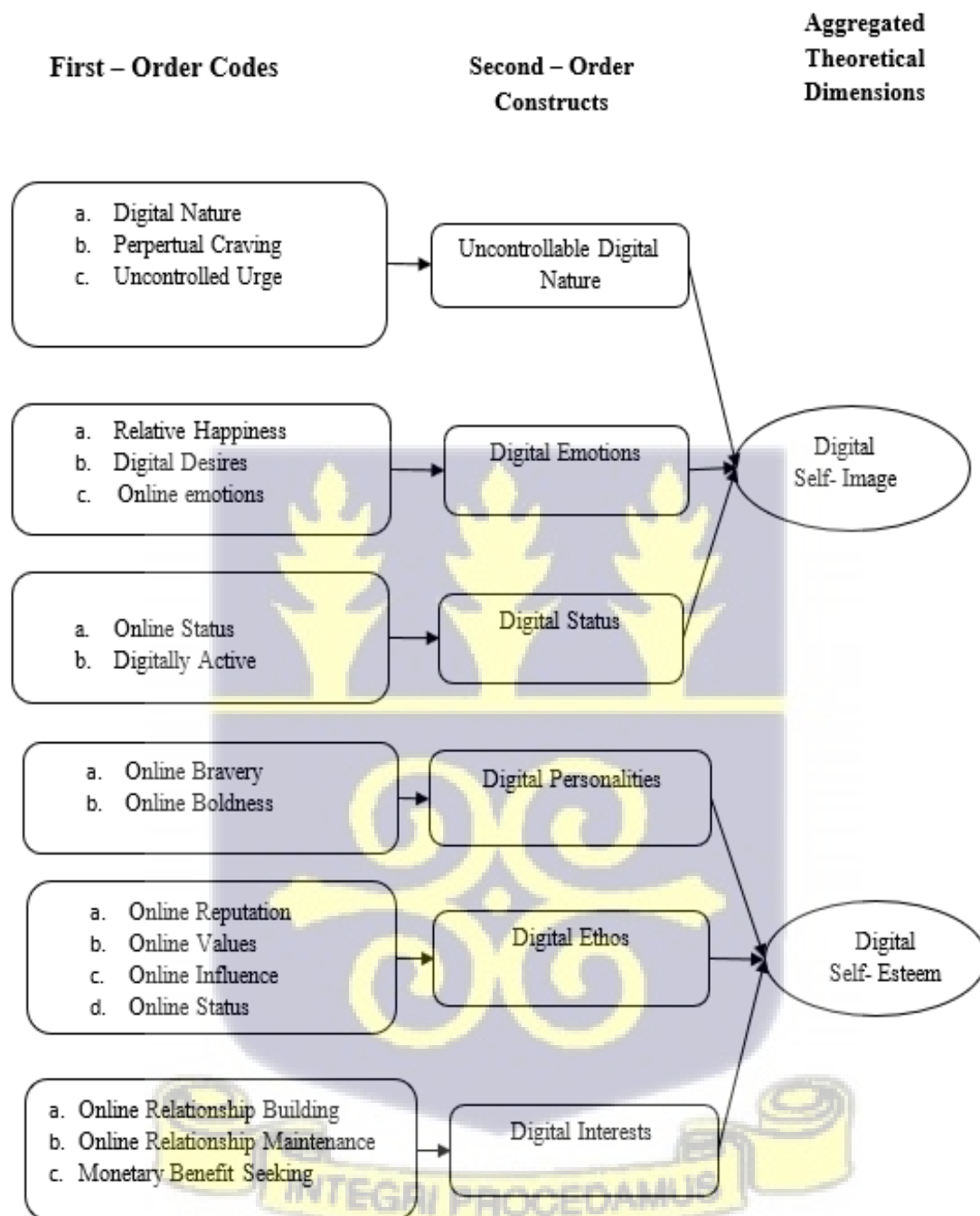
Finding 2a: Mobile technology addicts enhance their digital self-image by regularly updating their digital status and exhibiting their uncontrolled nature through their digital emotions.

Finding 2b: Mobile technology addicts, by their nature, are always online to enhance their digital self-esteem through their digital personalities, digital ethos, and digital interests.

Finding 2c: Mobile technology addicts enhance their digital self-efficacy by seeking to achieve online effectiveness, online efficacy and establish their online social-identity.



Fig.8. 2 The Structure of Data Related to Nature of Users' Self-Traits



Source: Author's Construct

f. Hedonic Value

Hedonic value is simply the enjoyment-related benefits of mobile technology (Chitturi, Raghunathan, & Mahajan, 2008). The qualitative part of this study found the following hedonic values derived by mobile addicts: (1) social values, (2) emotional values, (3) physical values, and (4) self-actualisation values. The social value was based on (a) online excitement seeking, (b) online satisfaction seeking, (c) online fulfilment seeking, (d) online pleasures and joy, and (e) fun and enjoyment. Psychological value is more about the users' cognitive or mental state benefits when on mobile technology (Bragazzi, Re, & Zerbetto, 2019; Van Der Heijden, 2004). This was stated in the first-order codes as; (a) a sense of belongingness, (b) forgetting immediate problems, and (c) a sense of relief. Self-Actualisation Values are the highest level of psychological development. Mobile technology users seek to achieve their highest potential in terms of basic body and ego needs; the addicts, therefore, seek to achieve the highest level of accomplishment and influence on these mobile technologies. These were categorised into (a) accomplishment seeking, (b) luxurious living, and (c) generating interests and influence.

g. Utilitarian Values

The utilitarian values are the tangible benefits users derive from mobile technology; thus, what the technologies are developed to achieve and what they are being used to do (Babin, Darden, & Griffin, 1994; Lin & Lu, 2015; Wu, 2009). It was found that the practical benefits known as utilitarian values derived were categorised into (1) educational values, (2) religious values, (3) business values, (4) political values, (5) communicative values, (6) entertainment values, and (7) multimedia values. Under educational values, there are sub-second-order constructs. It means the apps helped users in (a) reading novels online, (b) online studies, and (c) developing specialised skills. For Business Value, the mobile applications are for (a) promoting businesses, (b) marketing goods and services, (c) developing and maintaining customers and

(d) eCommerce activities. Mobile applications such as WhatsApp, Facebook, and Instagram have high *multimedia values* and are generally used for entertainment. These platforms allow users to create, download, upload, and share images, videos, and audios. Apart from the self-traits, users also seek some other values in these mobile applications, which this study found to be hedonic and utilitarian values (Cheung et al., 2013; Wegmann et al., 2017). The details of users' nature in terms of hedonic, utilitarian, and self-traits, second-order constructs, and first-order codes are shown in Fig. 8.3.

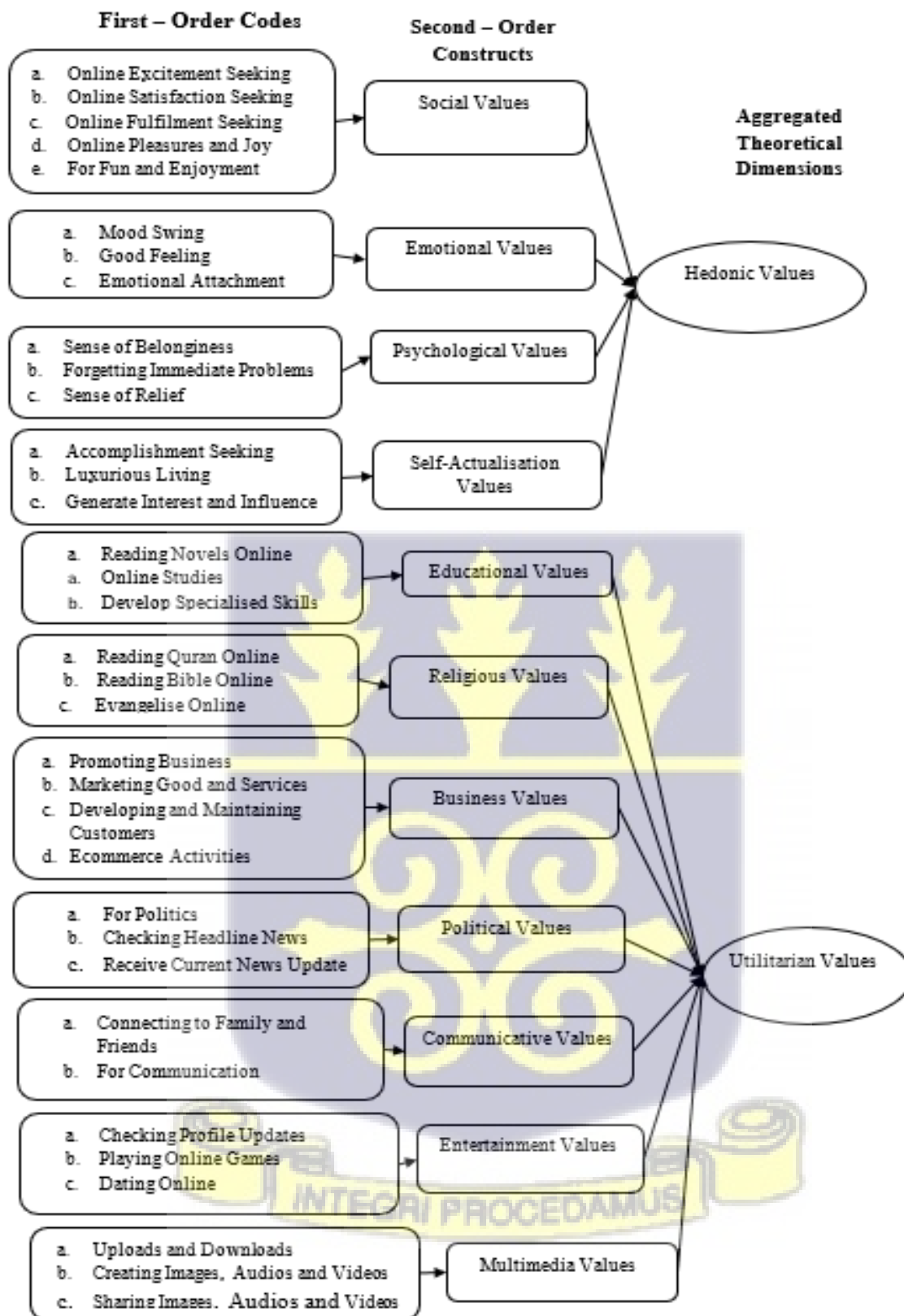
Finding 3: From a multistakeholder and multi-dimension perspective, it was found that mobile addicts, by their nature, sought to derive hedonic and utilitarian values from these applications.

Finding 3a: This study found that the hedonic values derived by the users (addicts) were social, emotional, psychological, and self-actualisation values.

Finding 3b: In terms of utilitarian values, the benefits derived by the users (addicts) were; educational, religious, business, political, communicative, entertainment, and multimedia values.



Fig. 8. 3 The Structure of Data Related to Hedonic and Utilitarian Values



Source: Author's Constructs

8.8 Organism: Social Presence, Telepresence, and Flow

According to the S - O - R Framework used to guide this discussion, while the *stimulus* is centred on the nature of user attributes and technology attributes that enable addiction, the *organism* refers to the *presence* experienced through human-computer interactions (Fu et al., 2020; Lin et al., 2020; Vieira, 2013). The phenomenon of concern for examination is *presence*. The presence was examined in terms of the socio-technical interaction between social and technological presence, leading to flow and addiction (Biocca et al., 2003; Morley et al., 2016). Therefore, the organism is centred on three constructs: social presence, telepresence, and flow. The findings of these constructs will be briefly discussed under these subheadings.

8.8.1 Social Presence

Social presence is concerned about the connectedness of users to the extent that some have developed personal relationships with other users online or in a virtual world such that they are more likely to visit the platform, not for the platform's sake frequently but to enable them to connect others and therefore feel a greater sense of social presence (Animesh et al., 2011; Gao et al., 2017; Han et al., 2016). According to the model, the social presence has self-traits, hedonic and utilitarian values as antecedents, and technology addiction and flow as outcomes or effects (Ho et al., 2012; Khang et al., 2013). The construct itself was interrogated with users' mindsets being influenced by the antecedent constructs to generate presence on mobile technology (Khang et al., 2013; Zhou, Yin, & Gao, 2020). This presence was stimulated by intimacy, relationship, and trust-building. Online presence was centred on three (3) cardinal points as having (a) a sense of togetherness, (b) a sense of closeness, and (c) a sense of belongingness (Almeida, Menezes, & Dias, 2022; Tzeng, 2018; Zhou et al., 2020).

8.8.2 Telepresence

Telepresence is the second construct that represents the organism of the model. The antecedents of telepresence were the usability and interactivity of mobile technology, and the outcomes were flow and technology addiction (Stavropoulos et al., 2013; Zollet, 2014). Telepresence helped examine how the users feel, whether they are more in the “technological world” or the “real world.” It tests whether technology users forget their immediate surroundings when using the technologies or whether they pay more attention to their physical world than the technological world (Almeida et al., 2022; Zhou et al., 2020). For the telepresence, the construct was interrogated with the mindset of mobile technology designs and their features that enable users to accept, adapt, and continue using technologies that may lead to flow and addiction (Pelet, Ettis, & Cowart, 2017; Stavropoulos et al., 2013).

Technology designs, multimedia quality, and integrative nature are the three (3) main second-order constructs that enable telepresence. Technologies with immersive designs, virtual presence designs, and interactive designs lead to interwoven quality interfaces to keep users online and enable telepresence (Fiore & Kim, 2007; Morin, Gonzalez-Sosa, Perez, & Villegas, 2022; Ying, Ghadiyaram, & Bovik, 2022). Mobile applications that are integrative (i.e., hyperlink interfaces, application integration, and platforms integration) easily enable and aid telepresence.

8.8.3 Flow

The flow, which is the result of total absorption and high concentration of the users, was interrogated with the view that when social presence, which represents the skills of the users, and telepresence, the drive or the demand from the mobile applications interact well, the user may likely get into a high concentration which is referred to as flow in this research (Chong,

Ng, & Basha, 2023; Thatcher et al., 2008). The findings showed that at flow, the following are likely to take place: (1) *Loss of self-control while having high focused attention*, (2) *High concentration leading to total absorption*, and (3) *Curious and having a high intrinsic interest to explore more through human interactions*. The flow, telepresence, and social presence are integrated to form the organism component of this model (Animesh et al., 2011; Chong et al., 2023; Engeser, 2014).

Finding 4: Mobile technology addiction is explained as a chronic condition where users (social/human beings) feel preoccupied with an uncoerced compulsion to repeat or continue to use mobile technologies with flow capabilities that result in severe negative consequences or outcomes.

Finding 4a: For social presence, this study found that users(addicts) are present online for social relationship building. This enhances intimacy, relationship, and trust-building among users and achieves a sense of togetherness, a sense of closeness, and a sense of belongingness.

Finding 4b: For telepresence, addictive technologies must be virtual, immersive, and interactive in their designs, integrative in nature, and have a quality multimedia interface.

Findings 4c: This research found that flow is the result of users' interest, abilities, and skills to effectively use mobile technology that has immersive capabilities, which result in total immersion and total absorption to the extent that the user may even lose control of time and immediate environment.

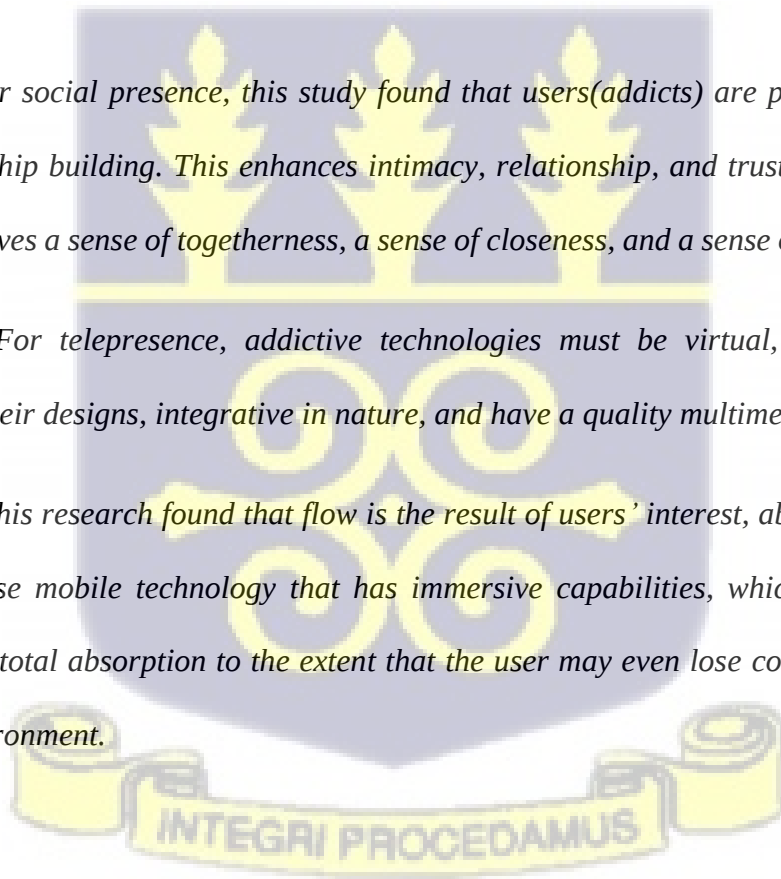
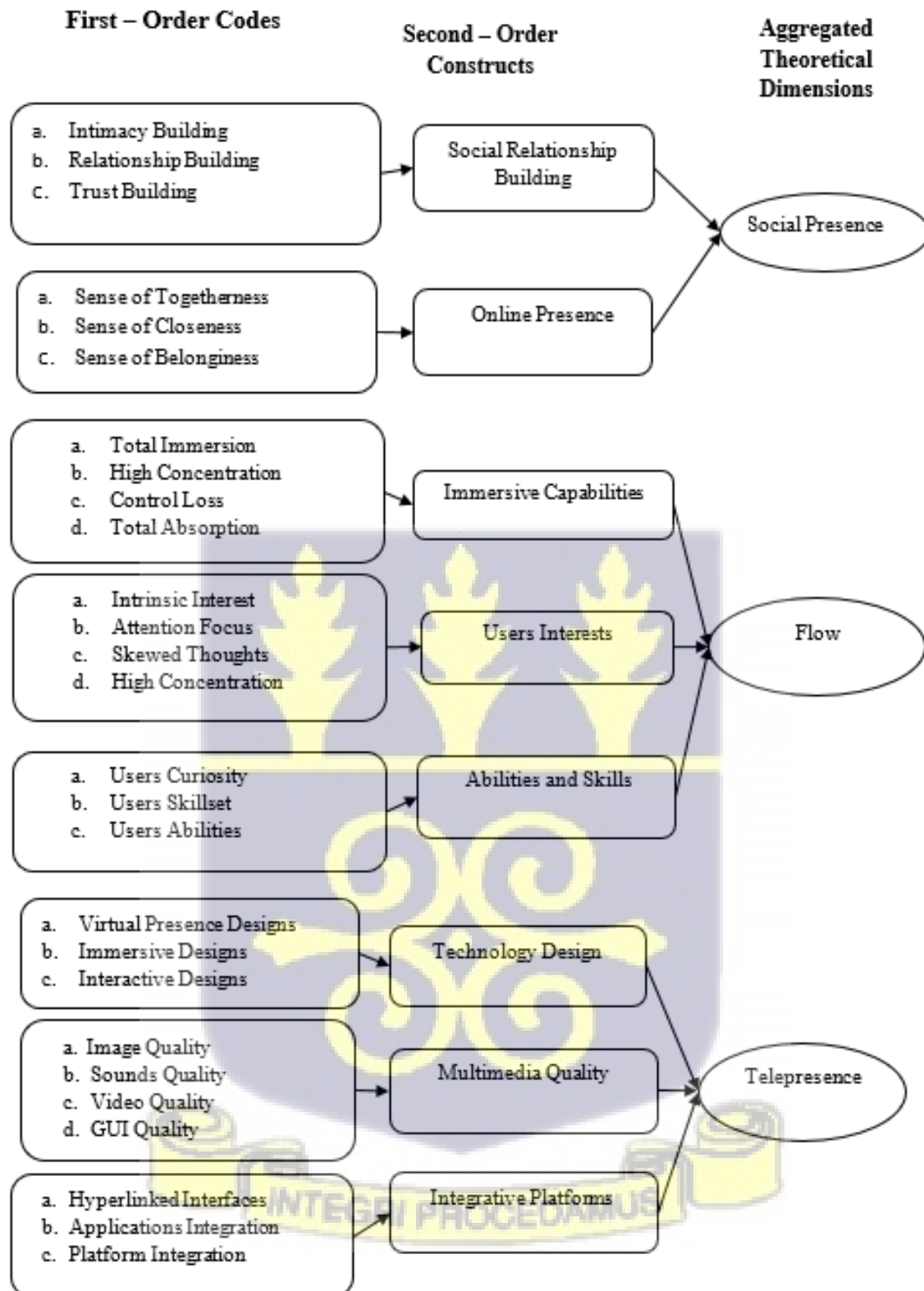


Fig.8. 4 The Structure of Data Related to the Multidimensional Nature of Presence



Source: Author's Construct

8.9 The Moderating Effect of Fear of Missing Out (FoMO) and Self-Regulation

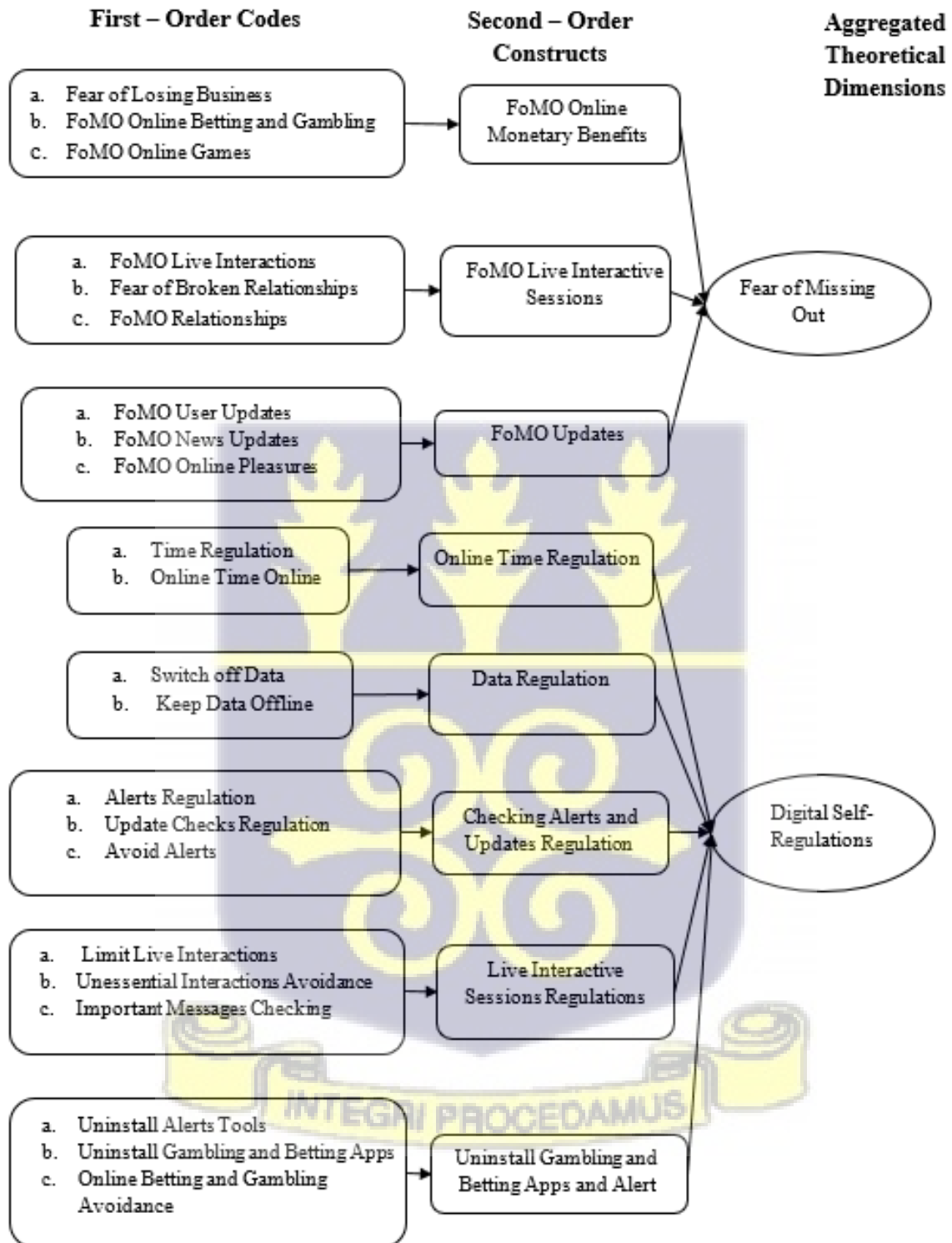
Two constructs, self-regulation and FoMO, are used to moderate the model. These two constructs are of opposing effects (Karg & Polat, 2020; Surya & Aulina, 2020). For FoMO, it was found that addicts fear of missing out on (a) online monetary benefits, (b) live interactive sessions, and (c) online updates. The monetary benefits revolved around losing business, online gambling and betting, and online game. The Fear of Missing Out on live interactive sessions and online updates (Liu & Chang, 2016; Wegmann et al., 2017). FoMO assists users to try and be present online, which, in effect, results in and intensifies addiction (Rozgonjuk, Elhai, Ryan, & Scott, 2019).

On the other hand, self-regulation is a reduction mechanism for intense addiction (LaRose et al., 2003; Osatuyi & Turel, 2020). This research found that users will be able to mitigate and reduce MTA if they observe the following; (a) Online Time Regulation, (b) Data Regulation, (c) Checking Alerts and Updates Regulation, (d) Live Interactive Sessions Regulation, and (e) Uninstall Gambling and Betting Apps and Alerts Tools. Self-regulation is one of the best methods advanced in literature for the treatment.

Findings 5: This study found that Fear of Missing Out on online monetary benefits, live interactive sessions and online updates are the reasons why users continue to use mobile technology leading to addiction.

Findings 6: This study also found that users will be able to mitigate and reduce mobile technology addiction if they exercise; (a) Online Time Regulation, (b) Data Regulation, (c) Checking Alerts and Updates Regulation, (d) Live Interactive Sessions Regulation, and (e) Uninstall Gambling and Betting Apps and Alerts Tools

Fig.8. 5 The Structure of Data Related to FoMO and Self-Regulation



Source: Author's Construct

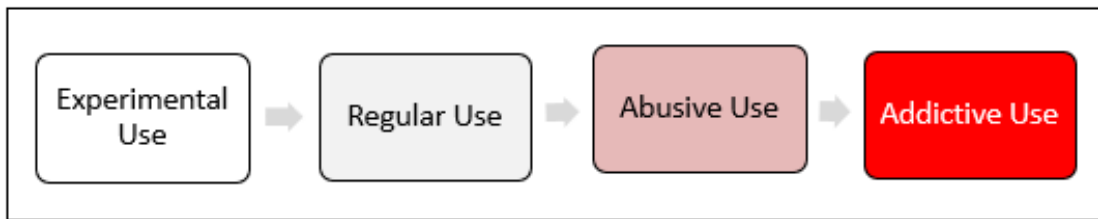
8.10 Process of Addiction

The mobile technology addicts were taken through a rigorous process to discover how they became addicted. After the examination, the findings showed that the addicts initially went through the experimental stage, where users tried to use mobile social media platforms; they then moved to the recreational stage, in which the addicts tried to entertain themselves and have fun, to the abusive stage and finally ended up having dependency traits with consequences to be referred to as addiction (Barnes et al., 2019; Charlton & Danforth, 2007; Dong et al., 2017; Han et al., 2017; Smith et al., 2014). According to the findings, although the participants were addicted to different mobile devices and mobile apps for diverse and varied reasons, the process of addiction was virtually the same.

For further explanation, the process is first to experience mobile technology through online gaming, betting, and online relationships. All seven participants started by experiencing mobile technology to solve their needs. After this, they started regular usage of the technology for recreational activities. The main problem occurred when the users frequented the mobile technology, abused them, and had dependency traits described as addictions. Participant three (3), who was addicted to online betting and gambling on mobile technology, informed the researcher that he was in Gambling Anonymous (GA) and Alcohol Anonymous (AA) groups. These groups supported the addicts during recovery. The groups helped them to unionise and share their stories and daily experiences. The Psychiatric Doctor summarised the process: *"Pleasure begets pleasure like all addictions."* As one begins to get followers and likes and general acceptability by people, they don't even know it gets them into the habit of doing more, which finally results in mental dependency." The Clinical Psychologist and Cyber Counselor also corroborated that addiction's main process is the same for all addiction types and that MTA may result in depressive symptoms, suicide-related outcomes and harmful effects (Joel Billieux, 2012; Charlton & Danforth, 2007; Twenge, Joiner, Rogers, & Martin, 2018).

The Clinical Psychologist explained, "At the recreational level, an individual may not suffer the negative consequences when he/she decides to stop. At that stage, it is just a psychological problem. But at the addictive stage, there is an additional dependency (psychological/physiological and physical dependence). The nature of addiction revolves around two features such as obsession and compulsion (Brooks et al., 2016; Shapira et al., 2000). This summarises the findings from the Clinical Psychology perspective of the process of all forms of addictions, including mobile applications addiction and, by extension, technology addiction. The Neuro Scientist also emphasised that *"Neurotransmitters are in the reward systems of the brain that transmit substances like dopamine, serotonin, endorphins, gaba, and so on, which are found in the limbic system, that may excite the user to influence continuous usage. Addiction results from the compelling force to satisfy the reward system, either substance or technology. The reward system may be for money or something else, so users are normally compelled to satisfy their gratifications"*. He further explained the process by stating that *"Addiction changes the brain systems, first by subverting the way it registers pleasure and then corrupting the normal drives such as learning and motivating."* All the above explanations are consistent with the literature, which states that addiction is caused by loss of control of impulses, craving, and continued involvement despite consequences and may be looked at as a cognitive-behavioural model of problematic internet use, and there are several motivational theories proposed for investigating all forms of addictions (Caplan, 2002, 2010; Davis, 2001; Lim, 1996). To summarise, MTA starts with *experimentation* to *regular use* and then to *abusive use*, which may aggravate and result in *addiction*. The detailed process is shown in the diagram below:

Fig. 8. 6 The Final Mobile Technology Addiction Process Model



Source: Author's Constructs

The Neuro Scientist stated that the process of addiction in connection with the brain vividly explains how any form of addiction occurs; the users' self-traits or characteristics are first impaired due to the abnormal related cues. Every technology user has moderators for affective and cognitive responses, which enforces biases and increases coping. Mobile technology users' brains react to the cues with strong urges and cause cravings for mobile applications (Chan et al., 2014; Dong et al., 2017; Turton et al., 2016). It may go with reduced inhibitory regulations or controls. At this stage, the user is the only one with the willpower and courage to reduce or increase usage. After increased usage, gratification begins the new reinforcement cycle that alters the affective and cognitive responses to these technologies' use. The reinforcement may increase the usage and cause higher reactions to the cues, leading to gratifications. After several reinforcements, the process moves from gratification to compensation and the development of tolerance. These processes may result in triggering mobile technology addiction. He stated that *"the continuous exposure to mobile technology or any behaviour would cause the nerve cells responsible for planning and executing, which are in the nucleus accumbens and prefrontal cortex, to communicate with users to drive them to crave the mobile technology."* Addiction alters how the addicts register pleasure and corrupt their normal driving system.

The nature of every form of addiction involves the brain sending a signal to the motivation system that leads to a great reward. Therefore, the various forms of technology addiction may

be equated to substance addiction. The brain reacts virtually the same to substance and technology addictions. This finding is consistent with literature that suggests that MTA has several commonalities and reactions similar to substance addiction. Therefore, most methods for treating substance addictions could also be used for treating behavioural addictions (Du et al., 2010). The brain's motivation system energises and directs our actions; this guides an individual's behaviour in instant situations. Therefore, studies around neuroimaging techniques have proven that reward, cognitive control, and motivation are directly connected to the brain's structure and functioning (Volkow et al., 2003).

8.11 Response: The Effect of Mobile Technology Addiction

This research explained the diverse negative consequences of MTA on academic performance and well-being. It was found that three (3) of the seven (7) participants interviewed for the qualitative part of this research were school dropouts. They had severe forms of addiction and were undergoing recovery. Four (4) others were average academic performers. In terms of academic performance, it was further deduced that MTA results in (1) school abandonment, (2) playing truancy, (3) phubbing, (4) learning timetable disruptions, and (5) poor academic performance. For clarity on school abandonment, the four (4) main severe mobile technology addicts were school dropouts or people who had stopped schooling.

The severe forms of addiction result in some deadly consequences, which are considered the general effect of addiction beyond the classroom or the academic space. It was found that those severe forms of addiction may result in (1) Mental Health Disorders, (2) Health and Relationship Complications, (3) Emotional Instability and Impaired Social Life, (4) Psychological Instability, and (5) Selectivity and Sociability. The mental health disorders identified were; skewed thoughts, depression, and frustrations. Participants (5) indicated, *"I became depressed when I realised that all my friends were doing better than me; I got*

frustrated and couldn't help myself anymore.” It was also realised that almost all the addicts were emotionally unstable and had impaired social life. The psychological instability of the addicts was centred on their powerlessness, desperation, and mood swings. Finally, mobile technology platforms also enable users to be selective and sociable. The details of the first-order constructs, the second-order constructs, and the aggregated constructs are shown in Fig. 8.7 below:

Finding 7: Concerning academic performance, mobile technology addiction effect results in (1) School Abandonment, (2) Playing Truancy, (3) Phubbing, (4) Learning Time Table Disruptions, and (5) Poor Academic Performance.

Finding 8: Beyond the effect on academic performance, this research found that mobile apps addiction also results in other consequences such as (1) Mental Health Disorders, (2) Health and Relationship Complications, (3) Emotional Instability and Impaired Social Life, (4) Psychological Instability, and (5) Selectivity and Sociability.

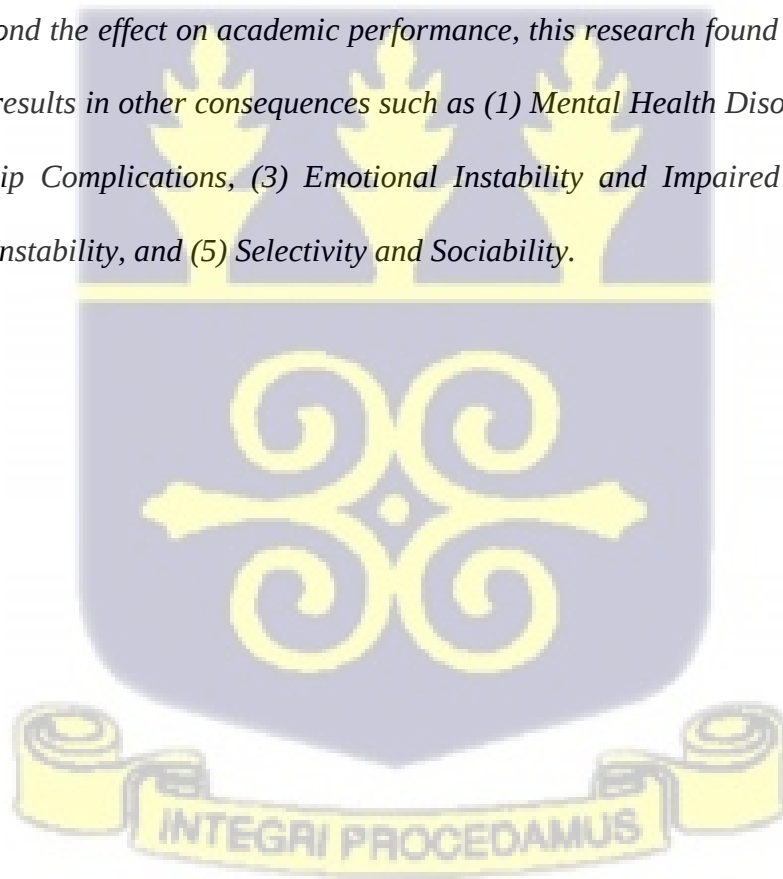
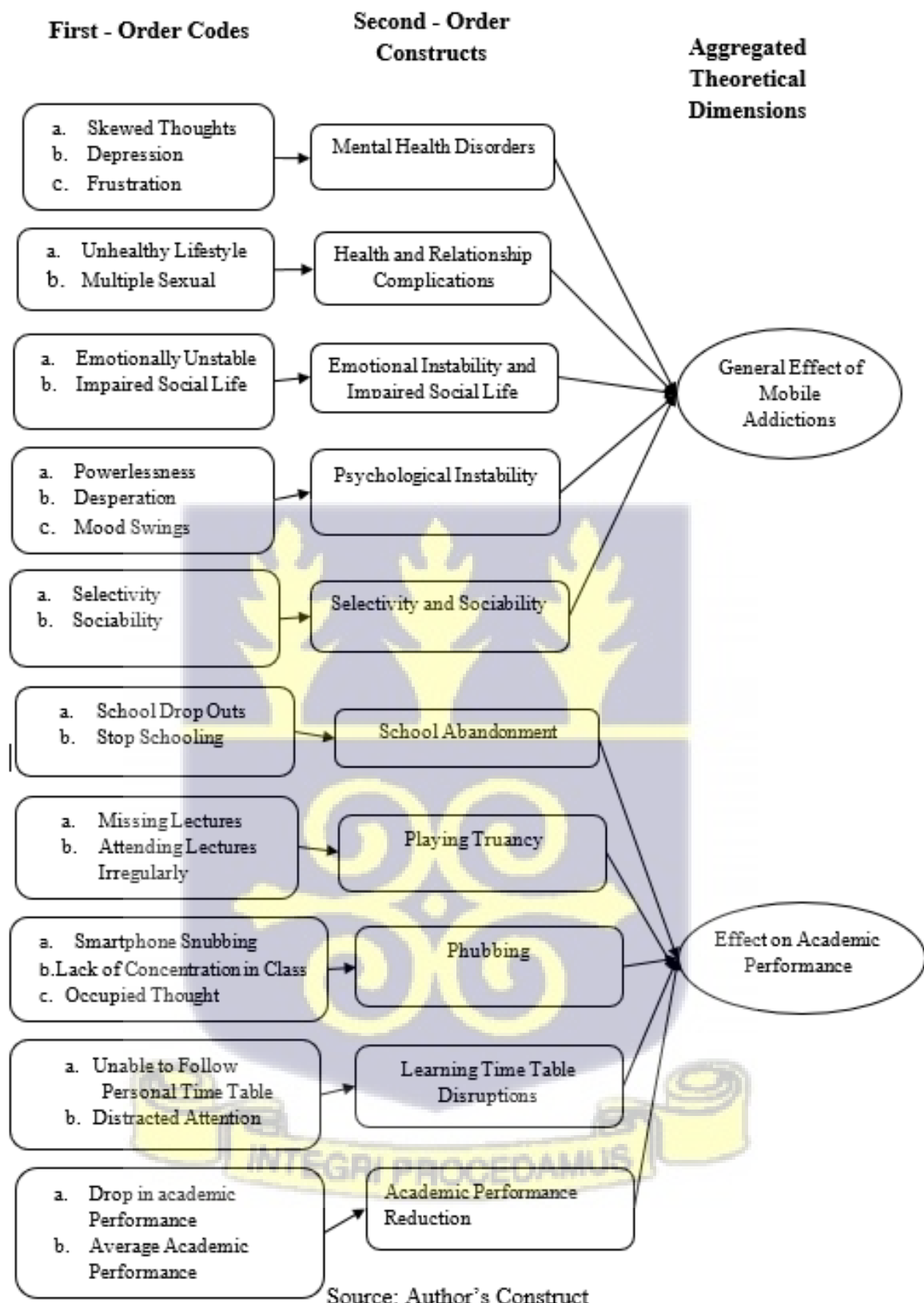


Fig. 8. 7 The Structure of Data Related to Consequences of MTA



8.12 Other Treatment / Recovery Methods from Developing Country Context

The recovery manual for addiction treatment at the centre has the quotation of *serenity prayer* by an American Theologian, Reinhold Niebuhr, entitled “Gambling Anonymous.”

*“God grant me the serenity to accept the things I cannot change, courage
to change the things I can, and the wisdom to know the difference.”*

The focus is to bring to the fore the various treatments available in the developing country context. This research has established the main treatment method for mobile technology addiction or reduction in IS use behaviour as self-regulation. This is consistent with technology addiction literature (Osatuyi & Turel, 2020; Polites, Serrano, & Thatcher, 2018; Wang & Lee, 2014). Since this research was conducted from a critical realism perspective, the researcher went beyond the empirical treatment method to look for the causal mechanisms influencing various treatment methods. Three of the addicts went through various treatment protocols. All the various treatment methods depended on these three cardinal principles: *willingness, honesty, and openminded* to stop. The *willpower* to stop or recover from addiction is the most powerful tool of the three that played a major role in all the addicts who were severely affected, later treated, and have recovered or are in the process of recovering. In contrast, the other four, made of two (2) females and two (2) males, have not sought any treatment and did not accept that they were addicted until the IAT scale proved them to be addicted.

The three severe cases used for this research were first introduced to spiritualism. Africans and, for that matter, Ghanaians are dominantly religious; therefore, it was not surprising that the addicts were either taken to shrines, mosques, or churches for deliverance. One of the addicts who was involved in occultism and cybercrime was healed through deliverance. He took a

personal decision to stop cybercrime, online gambling, and online betting. Initially, he did not find it easy; his fellow cybercriminals and their grand occultic master disciplined him and threatened to kill him, but that did not scare him, and he went through prayers and was delivered. He said, *“I told myself that if I did not get my deliverance at this Prayer Center, I would end it all because I was very tired. Addiction has ruined my life.”* He said the urge or the force that compelled him to meddle in those activities just left him after his deliverance. He felt so light, as if something had left him. He lamented, *“Hmmm! My brother, I no longer feel the urge to be involved in those things. I don’t even want to get close to online betting and gambling. I change my TV channel anytime they are advertising anything concerning online betting. Even on the internet, when I get an alert from these websites, I immediately turn them off. I think I am okay now.”* He felt good and was excited about his new life in the Lord. He joined the Prayer Center Media Team because he was a Computer Science student before his addiction.

The second addict, who was only addicted to mobile applications, online betting, and online gambling, also stated that he decided the addiction centre would be his last stop. He said, *“I was seriously struggling with everything; I wasn’t myself anymore, so I made up my mind that if this one did not work, I would give up.”* The third person addicted to both substances and mobile applications also stated that the father warned him that he would not allow him to enter his house again if he did not recover. He still remembered how his father brought him to the hospital and left him alone. That night, he could not sleep, and in the middle of the night, he decided to end it all, but some strong force encouraged him, and he then decided to stop and prove a point to the father and his other siblings. The two (second and third) addicts were being treated at the Korle Bu Addiction Center. They showed me the 12 steps and protocols that they were going through. These steps are the same for both substance addiction and behavioural

addictions. At the Addiction Center, they used the protocol established for gambling to treat the addicts since the two of them were also into online gambling.

The steps are listed below:

- 1) *We admitted we were powerless over gambling – that our lives had become unmanageable*
- 2) *Came to believe that a power greater than ourselves could restore us to a normal way of thinking and living*
- 3) *Decided to turn our will and our lives over to the care of this Power of our understanding.*
- 4) *Made a searching and fearless moral and financial inventory of ourselves*
- 5) *Admitted to ourselves and to another human being the exact nature of our wrongs*
- 6) *Were entirely ready to have these defects of character removed*
- 7) *Humbly asked God (of our understanding) to remove our shortcomings*
- 8) *Made a list of all persons we had harmed or became willing to make amends to them.*
- 9) *Made direct amends to such people wherever possible, except when doing so would injure them or others.*
- 10) *Continued to take personal inventory and promptly admitted when we were wrong.*
- 11) *Sought through prayer and meditation to improve our conscious contact with God as we understood Him, praying only for knowledge of His will for us and the power to carry that out.*
- 12) *Having made an effort to practice these principles in all our affairs, we tried to carry this message to other compulsive gamblers*

A unique perspective was introduced to the subject of recovery from the developing country context. One addict got recovered at the Prayer Center in Ghana. According to him, the cause of every form of addiction is the devil. He suggested that when the will of the addict is taken

and replaced by some strange spirits so that the addict does not have the *willingness, honesty, and open-mindedness* to stop performing the activities that lead to the addiction, the treatment will be difficult or impossible.

8.13 Chapter Summary

This chapter discusses both the quantitative and qualitative analysis by covering the following subtopics for the quantitative analysis; the discussion of quantitative results (deductive), the discussion of the demographic characteristics of participants, discussing theoretical implications of socio-technical interactions, moderating effect of self-regulation, and fear of missing out (FoMO), addiction and academic performance. For discussing qualitative results (inductive), the following subtopics are covered; stimulus: nature and causes of technology addictions, nature of addictive technologies: usability and interactivity, nature of mobile technology users: self-traits, hedonic and utilitarian values. Organism: social presence, telepresence, and flow, the moderating effect of fear of missing out (FoMO) and self-regulation, the process of addiction, response: the effect of mobile applications addiction and other treatment/recovery methods from developing country context. The qualitative discussions provide rich and detailed explanations of the quantitative data discussed.



CHAPTER NINE

CONCLUSIONS AND RECOMMENDATIONS

9.1 Chapter Overview

Chapter eight discussed both the qualitative and quantitative findings of this research. This chapter combines quantitative and qualitative discussions to draw conclusions and suggest future research directions. It summarises the study's major findings, triangulates, and presents the conclusions on the mobile application's nature from the multi-stakeholder and multidimensions perspective from the developing country context. It presents the final reviewed details of the model developed for technology addiction, which considers the antecedents and the consequences from a socio-technical perspective. This section concludes with the effect of MTA on students' academic performance and well-being. Finally, future research directions for MTA are proposed.

9.2 Summary of Major Activities

This research examined mobile technologies from a developing country context to develop a model for MTA. The model looked at MTA's antecedents (causes) to consequences (effects). This model predicted how socio-technical interaction between users (university students) and technologies (mobile technologies) results in a flow leading to MTA. It further explained how MTA impacted users' (university students') academic performance and other general consequences. This study combined the adoption theories (TAM3 and UTAUT2), Flow Theory, and S-O-R Framework. The combination of these theories addresses the weaknesses in the existing literature that sought to theorise MTA from either a social or technical perspective. Adoption theories (i.e., TAM3 and UTAUT3) present the relevant constructs for investigating the technological dimension of MTA. The Flow Theory looked at the psychosocial state of the mind of users when they are totally engrossed in interacting with

mobile technology to the extent that they lose control of time and their immediate environment and how that results in MTA. Finally, the S-O-R framework helped to situate the model into how a stimulus (users and technology attributes) influences an organism (virtual presence = social presence + flow + telepresence) and triggers a response (MTA and negative consequences). This study is conducted from a critical realism perspective using a mixed methodology. It uses a survey for the quantitative and a multi-case study approach for the qualitative. The constructs used for this research were validated quantitatively by monitoring the indicator loadings (Hair et al., 2019). The hypotheses were tested by examining the path coefficient for significance (Hair et al., 2019; Urbach & Ahlemann, 2010). The data were collected using purposeful sampling (Creswell & Clark, 2007). The technology addicts were interviewed using direct observations and semi-structured open-ended questionnaires (Benbasat et al., 1987; Cook & Campbell, 1979; Webb, Campbell, Schwartz, & Sechrest, 1966). Structure Equation Modelling (Smart Partial Least Square) is used for the quantitative and thematic content analyses for the qualitative. The above approaches and methods present a comprehensive view of MTA, enabling qualitative data and results to provide rich explanations for the quantitative findings.

9.3 Responses to Research Questions and Objectives

The results of this research were presented based on the research objectives. The four main research objectives and questions were framed from the main purpose. The first objective was to understand the nature and causes of technology addictions in a developing country context from diverse multidisciplinary and stakeholders' perspectives. The second objective was to explain how the socio-technical interaction between users (university students) and mobile technology results in MTA. The third was to explore the moderating effect of FoMO and Self-Regulation and finally to investigate the effect of MTA on university students' academic performance and well-being. The details of the responses are summarised in Table 10.1 below:

Table 10. 1 Summary of Research Objectives, Findings, Gaps Addressed, and Core Contributions

Research Objectives	Findings	Gaps Addressed	Core Contributions
1. To understand from diverse multidisciplinary and stakeholders' perspectives the nature and causes of technology addictions from a developing country context.	The nature and causes of technology addiction were theorised from technical and social perspectives. 1. This study found from a technical perspective that mobile applications that enable addiction are <i>usability</i> and <i>interactivity</i>. From a social perspective, self-traits, hedonic and utilitarian values were found to be users' attributes that may influence addiction. Quantitative Findings This study found that usability positively predicted telepresence (H5b; $\beta = 0.330$; $t = 6.754$; $p = 0.000$) and flow (H5b; $\beta = 0.194$; $t = 3.895$; $p = 0.000$). It is consistent with previous research suggesting that "good usability persistently leads to flow experiences" (Pilke, 2004). According to this research, mobile applications' usability should be considered more when designing mobile applications than their interactivity. This research found that interactivity insignificantly predicted flow and telepresence. Hypotheses H4a and H4b are therefore not supported. The first hypothesis supports that self-trait significantly predicted social presence (H1a; $\beta = 0.192$; $t = 4.222$; $p = 0.000$), but the second hypothesis is insignificant. Self-traits rather than predicted flow and leads to addiction. Hypotheses H2a and H2b, which sought to examine the influence of hedonic values on social presence and flow, are supported by the data. The hedonic values significantly predicted social presence (H2a; $\beta = 0.394$; t	The first gap identified was an issue gap, which addressed the first objective by understanding the nature and causes of mobile applications addiction from multidisciplinary and stakeholders from developing countries using Ghana as a case study. The second gap addressed in this study is the methodology gap. While the literature review revealed that TA was examined mainly using quantitative methods,	This part of the study contributed to addiction literature by defining and explaining MTA from a multidisciplinary and multistakeholder perspective, the nature and causes of mobile applications addiction from a developing country context MTA DEFINITION The definition deduced and agreed by all stakeholders for MTA is that it is <i>a chronic brain condition where one feels preoccupied with an uncoerced compulsion to repeat or continue using mobile technology with severe negative consequences or outcomes.</i> STAGES OF ADDICTION The process of addiction is in four stages, experimental use, regular use, abusive use and addictive/dependence use (see Fig 8.6). DESCRIPTIONS Professionals from health-related disciplines (i.e., psychiatry, psychology, nursing and medicine) describe MTA as a mental health disease which involves users' over-dependence on mobile technology despite harmful consequences. In Neuroscientist, MTA is described as an altered brain condition which occurs when the brain activities are induced by cues with several

	= 7.896; $p = 0.000$) and flow (H2b; $\beta = 0.164$; $t = 2.535$; $p = 0.011$). Thus, this study sought to examine the influence of utilitarian value on social presence and flow leading to mobile applications addiction; however, the data does not support these two hypotheses in H3a and H3b. It means that mobile technologies may be useful and beneficial to the users; they may even have some extrinsic attributes or characteristics that may force users to start using them. Still, it is not statistically supported to directly impact the social presence and flow, leading to mobile app addiction. Qualitative Findings <i>Finding 1a: From a stakeholder and multidisciplinary perspective, the usability constructs, as we have in the model, explained that mobile technology must be communicative, ubiquitous, and misappropriative in nature to be addictive.</i> <i>Finding 1b: From a multistakeholder and multidisciplinary perspective, mobile application technologies must, in terms of their interactivity, be responsive, flexible, and have an attractive multimedia interface to be addictive.</i> <i>Finding 2: Also, mobile technology addicts were described as those who, by their uncontrollable nature, concentrate on building their digital self-image on mobile applications to enhance their digital self-esteem and digital self-efficacy.</i> <i>Finding 2a: This study explained that addicts enhanced their digital self-image by regularly updating their digital status and exhibiting their uncontrolled nature through digital emotions.</i> <i>Finding 2b: Mobile technology addicts, by their nature, are always online to enhance their digital self-esteem</i>	this research presented mixed methods approaches to studying technology addiction. The third gap is the level of analysis gap. The literature review shows limited research at Meso, Meta, and Macro levels. This research addressed this gap by looking at the data from three universities in Ghana. The fourth gap identified and addressed by this research was the geographical gap. The literature review revealed that Africa was the least contributor to technology addiction literature.	commonalities that alter the <i>limbic system</i>, which is the reward circuitry in the brain that takes care of the emotional and behavioural responses and causes the user to crave for the mobile technology regardless of the negative effects. In Religious, MTA is described as a sickness caused by strange spirits. Technology Developers described MTA as a disorder caused by ubiquitous, communicative, responsive, flexible, and attractive multimedia interfaces of the technology, which enable users to engage in online social behaviours that lead to addiction. The nature and causes of mobile technology addiction from the technical dimension were clearly defined as <i>usability</i> and <i>interactivity</i>. While usability was supported, interactivity was not supported. Therefore, this research concludes that technologies' usability attribute leads more to TA. FURTHER EXPLANATIONS The nature and causes of technology addiction (i.e., mobile applications addiction) from a social perspective were deduced by research as self-traits and hedonic and utilitarian values. These findings helped explain the natures of both technologies and users, which stimulate interaction leading to addiction.
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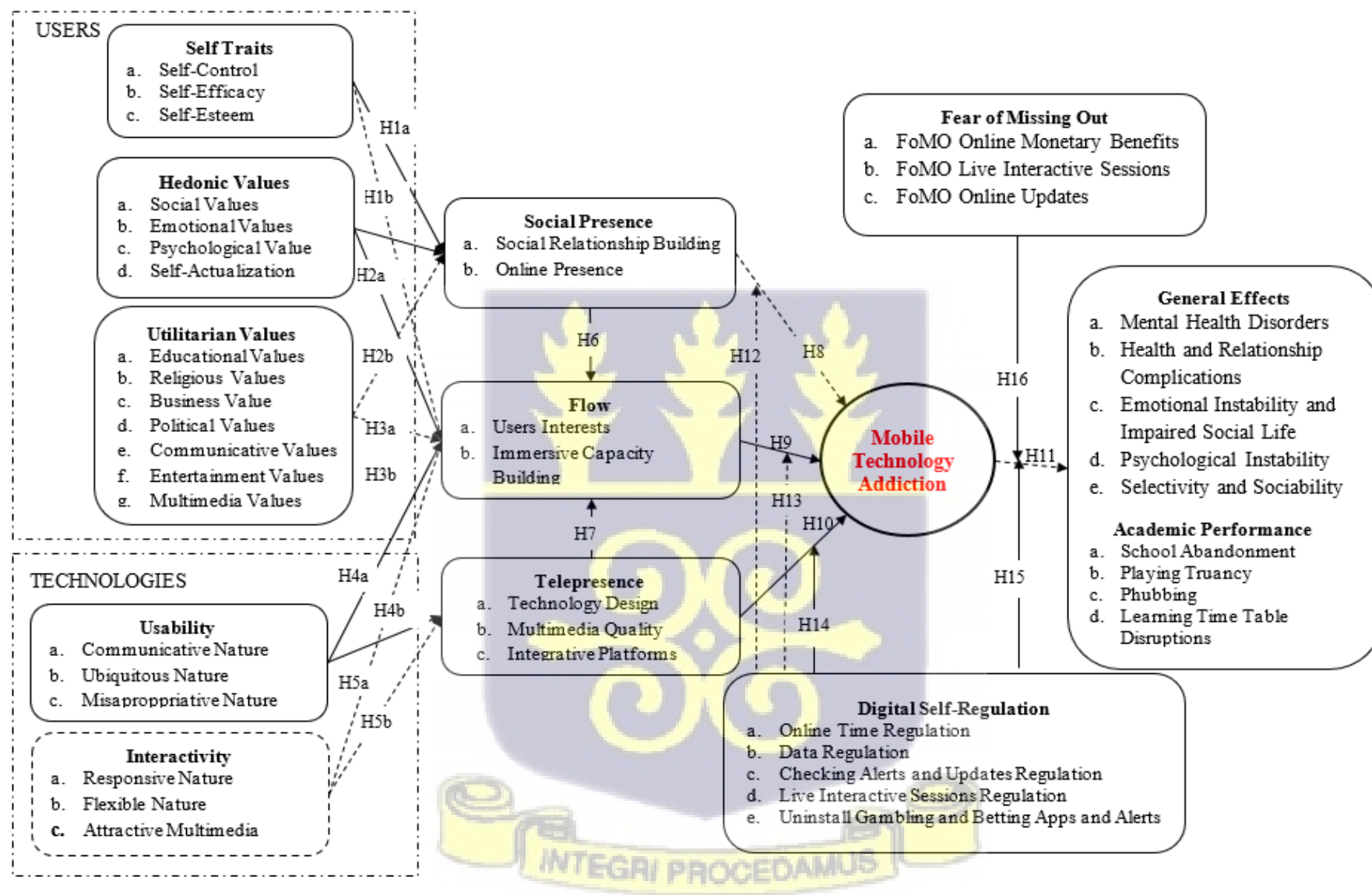
	through their digital personalities, digital ethos, and digital interests. <i>Finding 2c: Mobile technology addicts enhance their digital self-efficacy through seeking to achieve online effectiveness, online efficacy and establish their online social identity.</i> <i>Finding 3: From a multistakeholder and multidimensional perspective, it was found that mobile application addicts, by their nature, sought to derive hedonic and utilitarian values from these apps.</i> <i>Finding 3a: This study found that the hedonic values derived by the users (addicts) were social, emotional, psychological, and self-actualisation values.</i> <i>Finding 3b: In terms of utilitarian values, the benefits derived by the users (addicts) were; educational, religious, business, political, communicative, entertainment and multimedia values.</i>		These findings formed the foundation for the final technology addiction model developed from the information system (IS) perspective. This research's methodology gap is a huge contribution to the literature because it helped to reveal beyond the figures the structure and causal mechanisms by stating the details of each construct used in the model. The quantitative data was collected from three universities in Ghana, putting this research at the Meso Level. Although the data were not analysed by comparing three different universities, it clearly demonstrates the prevalence of addiction in Ghana. This research contributes to technology addiction literature from Ghana in Sub-Saharan Africa. It is one of the first doctoral IS studies that contribute to technology addiction literature from a developing country context
2. To describe how the socio-technical interaction between users (university students) and technologies (mobile applications) results in	This study further describes the socio-technical interaction between users and mobile technologies and how that results in MTA. 2. This study found that the nature and causes of both mobile technologies and users lead to the main organism (presence), which was researched from social determinism (social presence) and technical determinism (telepresence), and the interaction between the two known as flow, which predicts addiction.	The fifth gap was the theoretical gap. This objective addressed the lack of theorisation of the technology addiction phenomenon by considering the socio-technical interaction between users and technologies	This part of the research contributed to the theoretical gap identified in the literature. The theories, models, and frameworks identified and used in Information Systems (IS) literature focused on users (social) or technologies (technical). While previous literature was sharply divided between looking at the technology addiction phenomenon from social and technical dimensions, this study contributed to the literature by presenting its socio-technical dimension. It combined the

technology addictions.	Quantitative Findings a. This research found that social presence (H6; $\beta = 0.201$; $t = 3.465$; $p = 0.001$) and telepresence (H7; $\beta = 0.265$; $t = 5.585$; $p = 0.000$) significantly predicted flow. b. Specifically, flow (H9; $\beta = 0.243$; $t = 5.208$; $p = 0.000$); and telepresence at (H10; $\beta = 0.356$; $t = 7.201$; $p = 0.000$) significantly predicted addiction. However, the influence of social presence was insignificant and therefore not supported. Qualitative Findings <i>Finding 4: MTA is explained as a chronic condition where users (social/human beings) feel preoccupied with an uncoerced compulsion to repeat or use mobile technologies with flow capabilities, resulting in severe negative consequences or outcomes.</i> <i>Finding 4a: For social presence, this study found that users(addicts) are present online for social relationship building. This enhances intimacy, relationship, and trust-building among users and achieves a sense of togetherness, a sense of closeness, and a sense of belongingness.</i> <i>Finding 4b: For telepresence, addictive technologies must be virtual, immersive, and interactive in their designs, integrative in nature, and have a quality multimedia interface.</i> <i>Findings 4c: This research found that flow is the result of users' interest, abilities, and skills to effectively use mobile technologies that have immersive capabilities, which result in total immersion and total absorption to the extent that the user may eventually lose control of time and immediate environment.</i>		technical and social aspects and presented the MTA's socio-technical perspective to develop the model. This research also contributed by clearly presenting the process of addiction from users and technologies to socio-technical interactions between social presence and telepresence, leading to flow and eventually resulting in technology addiction. This is a dimension of the process of addiction that is not in the literature.
3. To explore the moderating effect	The literature review brought to the fore two main constructs of opposing effects on technology addiction.	The objective further addressed the	This part of the study contributes to IS literature by explaining how FoMO intensifies technology

<i>of Fear of Missing Out (FoMO) and Self-Regulation</i>	The constructs used to moderate the model are Fear of Missing Out (FoMO) and self-regulation. 3. This research found that FoMO intensifies technology addiction while Self-Regulation is an IS use behaviour for reducing mobile applications addiction. Quantitative Findings a. The findings of this study revealed that self-regulation significantly moderates the effect of telepresence on MTA ($\beta = 0.094$; $t = 2.357$; $p = 0.018$), as well as the effect of MTA on academic performance ($\beta = -0.106$; $t = 2.037$; $p = 0.042$), hence supporting hypotheses H14 and H15. It suggests that self-regulation strengthens the effect of telepresence on MTA while it weakens the effect of MTA on academic performance. Thus, self-regulation mitigates the negative effect of mobile technology addiction on academic performance. b. Further, as expected, the moderating effect of the FoMO on MTA and academic performance was significant ($\beta = 0.139$; $t = 2.287$; $p = 0.022$), supporting hypothesis H16. Qualitative Findings <i>Findings 5: This study found that Fear of Missing online monetary benefits, live interactive sessions and online updates are the reasons why users continue to use mobile technology leading to addiction.</i> <i>Findings 6: This study also found that users will be able to mitigate and reduce mobile applications addiction if they exercise; (a) Online Time Regulation, (b) Data</i>	theoretical gap. It addressed the moderating effect of FoMO and Self-Regulation. This part of the theoretical gap identified in the literature is very important to IS research, where scholars are trying to find the IS principles to mitigate or reduce the effect of MTA	addiction. Self-regulation is one of the main IS principles identified or revealed by this research to help mitigate or reduce the addiction effect. This study further shows how self-regulation weakens MTA, positively affects academic performance and enhances well-being. The various reasons users fear missing out (i.e., monetary benefits, live interactive sessions, and online updates) were identified. Also, the various means by which users can self-regulate to mitigate and reduce technology addiction (i.e., (a) Online Time Regulation, (b) Data Regulation, (c) Checking Alerts and Updates Regulation, (d) Live Interactive Sessions Regulation, and (e) Uninstall Gambling and Betting Apps and Alerts Tools) were all identified and explained in this study.
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	Regulation, (c) Checking Alerts and Updates Regulation, (d) Live Interactive Sessions Regulation, and (e) Uninstall Gambling and Betting Apps and Alerts Tools		
4. To investigate the effect of mobile applications addictions on university students' academic performance and well-being	The effect of mobile technology addiction was investigated on academic performance and well-being. 4. This study found the consequences or effects of addiction on well-being and the effects of addiction on the academic performance of users Quantitative Findings a. Addiction to mobile technology significantly predicted poor academic performance at ($\beta = 0.139$; $t = 2.284$; $p = 0.022$), supporting hypothesis H11. Qualitative Findings <i>Finding 8: With respect to academic performance, mobile technology addiction effect results in (1) School Abandonment, (2) Playing Truancy, (3) Phubbing, (4) Learning Time Table Disruptions, and (5) Poor Academic Performance.</i> <i>Finding 9: Beyond the effect on academic performance, this research found that mobile apps addiction also results in other consequences such as; (1) Mental Health Disorders, (2) Health and Relationship Complications, (3) Emotional Instability and Impaired Social Life, (4) Psychological Instability, and (5) Selectivity and Sociability.</i>	This objective addressed the final part of the theoretical gap. It addressed the effect of technology addiction. Theories of models for technology addiction research concentrated either on the causes or effects of technology addictions; this objective addressed this by developing a model that looks at the cause and effect of technology addiction and clearly explains the effect of technology addiction on the academic performance and well-being of university students.	This research contributes to addiction literature by developing a model that looks at technology addiction from cause to effect. This research establishes how addiction affects academic performance and well-being. It further stipulated the various addiction effects in relation to academic performance, such as (1) School Abandonment, (2) Playing Truancy, (3) Phubbing, (4) Learning Time Table Disruptions, and (5) Poor Academic Performance) and finally, clearly revealed all other forms of effects beyond the classroom such as (1) Mental Health Disorders (2) Health and Relationship Complications (3) Emotional Instability and Impaired Social Life, (4) Psychological Instability, and (5) Selectivity and Sociability) that affect the well-being of addicts.

Fig. 9. 1 The Final Integrated MTA with Construct Descriptions



9.4 Post Study Evaluation of the Model

Two separate workshops were organised for two distinct stakeholders to discuss the findings and evaluate the model in Fig. 9.1. The first workshop was for mobile application developers at the Institute of ICT Professionals, Ghana (IIPGH). The second one was organised for addiction experts from health-related disciplines and was facilitated by Korle Bu Teaching Hospital Addiction Unit in Ghana. These workshops helped evaluate the model, subject the findings to experts' analyses, and suggested practical implications. The developers agreed that MTA is an emerging phenomenon post-COVID-19 pandemic. Therefore, more education is needed to create awareness about the concept and educate users about the consequences. Second, Developers should be encouraged to develop applications integrated with pop-ups to alert users when they exceed some threshold time frame. An example is the time restrictions that force Uber Drivers to go offline for 6 hours after spending 12 hours online (Jamil & Noiseux, 2018)

Third, there was a collective view that the scales used for addiction cannot be generic when it comes to the use of mobile technology and that the time frame for determining the MTA for each mobile technology and individuals will have to vary, so the developers must create space for setting the threshold based on the users' usage. The developers agreed on varied measurement settings for different mobile applications. Fourth, the difficulty expressed by the developers is that their clients have feature sets and therefore are ready to pay for their applications based on meeting their feature sets. Therefore, adding the settings and having external stimuli and rules to regulate the applications apart from the original settings will only be easy if the mobile technology is regulated at an organisational or institutional level. The final point is that there is a need for more research and state policy to guide the operation and usage of mobile technology. For example, similar control settings like parental controls feature settings on DSTV should be inserted into the configuration and settings of these mobile

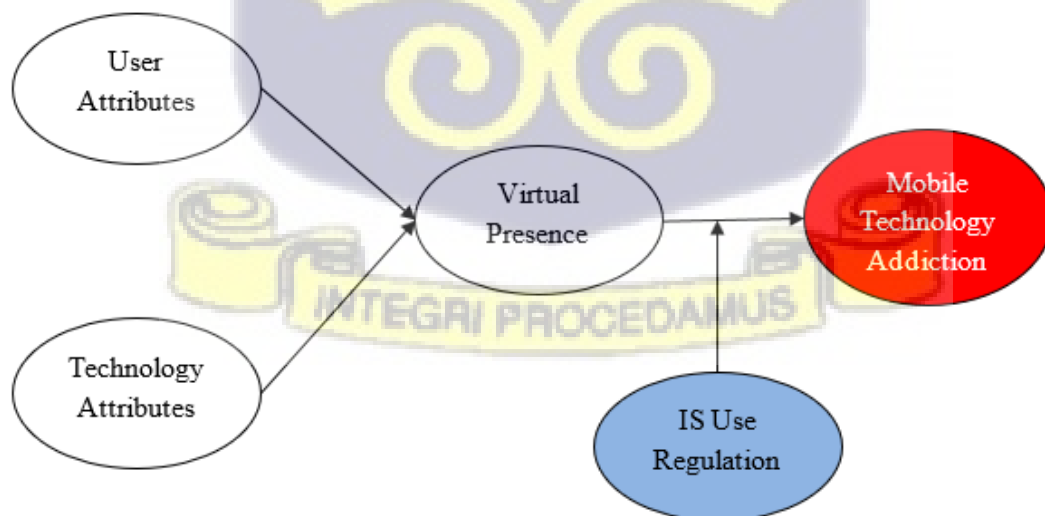
technologies. This will enable parental control features to help parents regulate their kids. The major manufacturers of current mobile devices, such as Samsung and Apple, have *digital well-being and parental controls* settings already integrated; therefore, practical implementation of the digital self-regulation findings of this study may be useful to enhance the regulatory mechanisms and digital well-being features to include pop-ups that can alert users when they exceed their threshold limits (LaRose et al., 2003; Osatuyi & Turel, 2020)

The health professionals also evaluated the model and agreed that addiction is a mental health disease which involves users' over-dependence on mobile technology despite harmful consequences. The Neuroscientist describes MTA as an altered brain condition which occurs when the brain activities are induced by cues with several commonalities that alter the *limbic system* and that the pleasure derived from mobile technology is similar to substance addiction. This finding agrees with neuroscience literature that the brain's reaction to technology addiction is similar to substance addiction (Spitzer, 2014; Weinstein et al., 2017; Wilson et al., 2004). Furthermore, it was emphasised that preoccupation and reward are from the *limbic system*, which is the reward circuitry in the brain that takes care of the emotional and behavioural responses. The second is that MTA consequences may be classified as psychosomatic disorders; usually, they are mental health challenges relating to depression, stress, anxiety, fear, etc. The third finding reiterates the process of addiction, as already stipulated in the diagram above (see Figure 8.6)

However, it was further explained that at the abusive stage, the user normally starts experiencing physiological consequences such as weight loss due to lack of sleep, loss of appetite, etc. There will be an intense physiological disorder coupled with psychosomatic disorders such as delusions, auditory hallucinations, and paranoia at the dependence or addiction stage. The psychosomatic disorders affect the addicts' well-being. This causes those

affected to decline to make rightful decisions and may go into the realms of signs and hallucinations (Taheri, 2011). The fourth is that Health Professionals have agreed that self-regulation might apply only to experimental and regular use. When the addicts get to the abusive stage, there should be some settings or forms of digital restrictions to intermittently stop or regulate the user from using the mobile technology; this may include the mobile applications going off at a point. At the dependence or addictive stage, the only treatment measure is to take the addicts off the device completely and move them to treatment or rehabilitation. They also suggested the need to develop an addiction testing device or a measuring tool like a thermometer that can be used to test addiction. Lastly, the two main consequences among addicts are managing *conflicts at home* and *parental neglect*. The developers and the addiction experts called for more research to create awareness of the problem. Further, they suggested developing and implementing state policy as a matter of urgency to curb or manage the situation before it becomes uncontrollable. The final MTA model deduced after the evaluation by mobile developers and addiction experts are shown in Fig. 9.2 below:

Fig. 9. 2 The Mobile Technology Addiction Model



Source: Author's Construct

9.5 Research Contributions and Implications

This study categorises the contributions into research, practice, and policy. The study-specific details are discussed in the subsequent sections.

9.5.1 Contributions to Research

This research first contributes to the literature by presenting to the research fraternity the nature and causes of mobile technology addiction from the multidisciplinary and stakeholder perspective from a developing country context. The findings from Ghana suggest a multiplicity of perspectives by professional practice or experiential knowledge from health-related disciplines (i.e., psychiatry, psychology, nursing and medicine). They describe MTA as a mental health disease which involves users' over-dependence on mobile technology despite harmful consequences. Even among healthcare professionals, differences exist per their practice. Neuroscientists describe MTA as an altered brain condition where the brain can get into a state of uncontrollability toward external stimuli like mobile phones and their contents. Religious leaders in Ghana Pentecostal and Charismatic Council (GPCC) describe MTA as a sickness caused by strange spirits. Technology developers described MTA as a technological disorder caused by ubiquitous, communicative, responsive, flexible, and attractive multimedia interfaces of mobiles, which enable users to engage in online social behaviours that lead to addiction. Finally, the definition deduced and agreed by all stakeholders for MTA is that it is *a chronic brain condition where one feels preoccupied with an uncoerced compulsion to repeat or continue using mobile technology with severe negative consequences or outcomes*. The process of addiction is divided into four stages, experimental use, regular use, abusive use and addictive/dependence use (see Fig 8.6).

The second contribution is that this study explains the nature and causes of mobile technology addiction, which is unique in IS literature. While Information Systems (IS) literature is skewed towards users (social) and technologies (technical) perspectives, this study contributes to research by looking at the nature and causes of technology addiction from a socio-technical perspective. This study derived technology attributes for the technical dimension as *usability* and *interactivity* (Zollet, 2014). While usability was supported, interactivity was not supported. This agrees with the assertion that the services or activities on these applications mainly influence their adoption leading to addiction (Joel Billieux, 2012). From a social perspective, the attributes that influence users' adoption of mobile technologies are self-traits, hedonic and utilitarian values (Etemad-Sajadi & Ghachem, 2015; Khang et al., 2013; Van Der Heijden, 2004; Wu, 2009). This research is arguably the first in IS to bring out these attributes.

Furthermore, the structure from social traits of users and technology attributes to the virtual presence (interaction of social presence, telepresence, and flow) and then to addiction and its consequences are well explained. Each construct was explained with individual items. For the interactivity construct, it was explained that mobile technology's interactivity is due to its *responsive nature, flexible nature, and attractive multimedia nature*. This study unearthed the nature of mobile technology usability features, which influence their usage and lead to MTA's *communicative, ubiquitous, and misappropriative* social behaviour. This research further posits that users' nature and causes from a social perspective should be their self-traits, hedonic and utilitarian values. The self-traits of technology addicts are unearthed to be their *digital self-control, digital self-efficacy and digital self-esteem*. For hedonic value, mobile technologies are used for *social, emotional, psychological, and self-actualisation benefits*. Regarding utilitarian values, mobile technologies are used for *educational, religious, business, political,*

communicative, entertainment and multimedia benefits. While the process structure is such that users' attributes lead to social presence and flow, the technology features lead to telepresence and flow. This study explains the social presence realities as *social relationship building and online presence*. The telepresence experienced by users is based on mobile technology *design, multimedia quality and integrative platforms*. The concept is that when the telepresence demands are equal to the skills needed to experience social presence, the user gets to flow, which is explained to be the result of the *immersive capacity-building* nature of the technologies and the *user's interests*. This study contributes to research by presenting the nature and causes of MTA from multistakeholder and socio-technical perspectives.

The third contribution is by addressing the theoretical gap identified in the literature. The theories, models, and frameworks identified and used in Information Systems (IS) literature focused on users (social) or technologies (technical). This study contributes to the flow theory by conceptualising that if users' nature and abilities meet the demands of mobile technologies, the resultant effect is MTA. This study positions *flow* as the central mechanism that controls MTA. It theorised flow as a multidimensional and proposed *presence* as the fifth dimension of flow theory. This study also contributes to the S-O-R framework literature by suggesting user stimulus as *self-traits, hedonic values, utilitarian values*, and technology stimulus as *interactivity and usability*. This study theorises *virtual presence* as the main organism for MTA, constituted from a multidimensional perspective through *social presence, flow, and telepresence*. The new constructs for response are *MTA and their outcomes*. Finally, this study posits that MTA could be moderated through IS use of a regulation mechanism such as *self-regulation* and *FoMO*. The FoMO intensifies MTA while self-regulation mitigates MTA. For the adoption theories, although this study theorised the *interactivity and usability* constructs to lead to MTA, it was found that the usability of mobile technology significantly influences

telepresence and flow, leading to MTA. Therefore, this thesis is arguably the first to combine three theories and contribute to each of the three theories, and altogether use the three theories to develop a framework and a concise model for MTA. This is a huge novelty and perhaps the first doctoral thesis to make such contributions to these theories and IS literature.

To explore the effect of MTA on academic performance, this research further discloses that self-regulation weakens the MTA effect on academic performance and enhances well-being. As identified, the users' FoMO is their quest for *monetary benefits, live interactive sessions, and check online updates*. The various ways users can self-regulate are; *online time regulation, data regulation, checking alerts and updates regulation, live interactive sessions regulation, uninstalling gambling and betting apps, and turning off alerts tools*. These have been put together to develop a new construct known as *IS Use Regulation*, a combination of FoMO and self-regulation (see Fig. 9.2).

The fourth contribution of this study is the methodology gap identified in the literature. While the literature review revealed that MTA was examined mainly using quantitative methods, this research contributes to research by adopting a mixed methodology, which assists in going beyond the calculations to unearth the structures and causal mechanisms that influence users to become addicted to mobile technologies.

In conclusion, this study is arguably the first IS doctoral thesis contributing to the literature by developing an MTA framework and a model from the socio-technical and developing country context. The quantitative data was collected from three universities in Ghana, putting this research at the Meso Level. Although the data were not analysed by comparing the three different universities, it clearly demonstrates the emergence of MTA in Ghana and Africa. This

study explores MTA from cause (pre-addiction) to effect (post-addiction), the least research subtheme found in MTA literature.

9.5.2 Contributions and Implications to Practice

This research makes contributions to practice by clearly explaining the process of addiction. From a design perspective, mobile technology manufacturers and developers are now aware of these technologies' addictive features and how technology addiction occurs. This study has revealed that usability explained in terms of mobile technologies' communicative, ubiquitous, and misappropriative nature causes users to be addicted. Therefore, companies producing mobile technology devices and applications may increase their market shares by concentrating more on mobile technology usability capacities and benefits. When there are complaints about addiction to these mobile technologies, developers and manufacturers are now aware of the regulatory mechanisms to reduce the intensity of the addiction.

From the practitioners' perspective, this model becomes the base that enables the IS community to start thinking about developing design principles to regulate, block and mitigate mobile technology addiction. By observing the elaborated principles, the practitioners believe users cannot self-regulate at the abusive stage. Therefore, the IS community should consider integrating the various self-regulation mechanisms into their designs to give alerts and raise red flags early to avoid addiction. For kids, these alerts should be added to the parental control settings. This is because mobile TA is dominant among young people, which affects their academic performance (Kuss & Griffiths, 2011).

This study has made users aware of mobile technology's nature, causes, and effects. It has further described the process of addiction, explained what causes users to be more addicted, and presented how to self-regulate; therefore, users are now aware and can decide to discontinue or regulate themselves when using these technologies. Parents can also use the

principles this research presents to regulate their kids. For further details, contributions, and implications of this study to practitioners (see Fig. 9.1 The Final Integrated Mobile Technology Addiction Model with Construct Descriptions).

9.5.3 Contributions and Implications to Policy

This thesis contributes to policy by establishing how MTA affects academic performance and well-being. It further clarified the various MTA effects in relation to academic performance, such as (1) School Abandonment, (2) Playing Truancy, (3) Phubbing, (4) Learning Time Table Disruptions, and (5) Poor Academic Performance. Finally, this study revealed all other forms of effects beyond the classroom, such as (1) Mental Health Disorders, (2) Health and Relationship Complications, (3) Emotional Instability and Impaired Social Life, (4) Psychological Instability, and (5) Selectivity and Sociability that affect the well-being of addicts. Therefore, governments, policy developers, and implementors must enact laws and other regulatory measures to guide and direct the procurement and use of these mobile devices and mobile applications. For example, the Gaming Commission of Ghana can put in necessary measures to regulate online gaming, betting, and gambling. Interaction with the staff of the Gaming Commission revealed no clear policy to guide online gaming and gambling in Ghana. Currently, the regulation is on casino and gaming centres, whose compliance or enforcement has been a challenge for the commission. A clear policy should guide mobile technology activities such as online gaming, betting, and gambling. This work is expected to generate interest among stakeholders, most especially regulating bodies and authorities, to put in measures to investigate further and properly regulate this emerging phenomenon to mitigate negative technology addiction consequences eventually. The main work is advocacy for self-regulation. The researcher has already started the advocacy work on Joy FM and Volta Premier FM. The use of social media platforms such as Facebook, Twitter, WhatsApp, Instagram,

LinkedIn, Snapchat, Google+, Hi5, and so on during productive times can be regulated as in some developed countries (Akdeniz, 2001; Jing & Hock, 2012; Lee, Kim, & Hong, 2017).

This study should kick-start a debate on the effects of mobile technology addiction on productivity, students' academic performance and well-being. Since this research is from a developing country context, other developing nations should consider developing a clear-cut policy to guide the use of some mobile applications, if not all. Only two technology addiction centres in Africa are located in Tunisia and South Africa. There is no technology addiction centre in the whole of West Africa. Therefore, this research must also inform policymakers about building research and treatment centres to assist in education, research and treatment of technology addiction in Ghana and West Africa.

9.7 Limitations and Future Research Directions

This research is, first and foremost, limited to mobile technology. Some technologies are not restricted to mobile devices but are addictive. For example, many multiplayer games like FIFA MMORPGs, among others, are not mobile but very addictive. Therefore, future research should focus on some of these applications on non-mobile devices. Additionally, individual applications such as Facebook, WhatsApp, YouTube, and Flitxter on mobile devices should be explored rather than lumping everything together. It is easier for researchers to focus on devices rather than applications and vice versa. This research recommends that the two are inseparable; therefore, studying smartphone addiction is like perceiving "food addiction" as "kitchen addiction." This research is restrained to considering both the devices and the applications as one entity which may not always be acceptable in all circumstances.

This research was done by considering three different university students from Ghana. Future research may compare and contrast the data from each of these universities to find out the

university with a more prevalent rate of students with mobile technology addiction. Other tertiary schools such as Colleges of Education, Nurses Training Colleges, and Agric Colleges may also be examined in future research to determine the population with dominant mobile technology addiction. Future research may also compare and contrast the data from the universities with the ones from the colleges to find out which of the two institutions have mobile technology addicts. In future research, special attention should also be given to kids' technology addiction. Therefore, it will be useful for future research to be conducted at the basic and high school levels.

Future research can also explore the relationship between mobile technology addiction and cybernetic behaviours such as cybercrime, cyberbullying, cyberwarfare, cyberterrorism, cyberloafing, etc. There is a need for future research to explore the addictive tendencies of new and emerging digital platforms, technologies, and services such as sharing economy, smart devices and services, social media platforms, Artificial Intelligence (AI) platforms, fake news, internet of things (IoT), virtual realities among others post COVID-19 pandemic. Finally, the direct impact of MTA on the productivity of organisations, institutions, nations and the African continent can also be explored.

Stakeholders from diverse backgrounds, such as policymakers, regulators, manufacturers, researchers, and users, must accept that MTA is a multidisciplinary issue; therefore, there is a need to work together to guide future research direction, develop the right policies and implementation strategies from regulatory, market-based and voluntary perspectives in finding an antidote to mobile technology addiction.

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APPENDICES

Appendix A

Resulting Publications

Publication Type	Full Bibliographic Information
Scholarly Book Chapter	1. Nyamadi, M. (2020). Technology Addictions, Model Development, Measurement, and Effect on Performance from a Developing Country Context: A Viewpoint for Future Research. In Handbook of Research on Managing Information Systems in Developing Economies (pp. 471-479). IGI Global.
	2. Nyamadi, M. & Tsibolane, P. (2020). Exploring the Problematic Consumption of Digital Platforms During COVID-19 Pandemic Among University Students in Africa. In a Handbook of Digital Innovations, Business and Society in Africa
Conference Publications	3. Nyamadi, M., & Boateng, R. (2018). The Influence of IT Artifacts on Players Leading to Internet Gaming Addiction among University Students in Africa. <i>Americas Conference on Information Systems</i> , 1–10. New Orleans.
	4. Nyamadi, M., & Boateng, R. (2018, December). Theorising Technology Addictions: Model Development, Measurement, and Effects on Productivity. <i>Proceedings of 39th International Conference on Information Systems (ICIS) TREO Session, San Francisco</i> .
	5. Nyamadi, M., Boateng, R., & Asamenu, I. (2020). Smartphone Addictions: A Review of Themes, Theories and Future Research Directions. <i>Proceedings of the 53rd Hawaii International Conference on System Sciences</i> , 6093–6102. https://doi.org/10.24251/hicss.2020.746



Appendix B

Ethical Clearance



UNIVERSITY OF GHANA

ETHICS COMMITTEE FOR THE HUMANITIES (ECH)

P. O. Box LG 74, Legon, Accra, Ghana

My Ref. No...ECH 050/ 20-21 ...

November 20, 2020

Makafui Nyamadi
Department of Operations and Management
Information Systems
University of Ghana
Legon

ETHICAL CLEARANCE (ECH 050/ 20-21)

The protocol title below has been reviewed and approved by the ECH Committee.

TITLE OF PROTOCOL: DEVELOPING A MODEL FOR TECHNOLOGY ADDICTIONS BY EXAMINING MOBILE SOCIAL APPS (SOCIAL NETWORKING SITES (SNS) AND SOCIAL GAMES).

PRINCIPAL INVESTIGATOR: MAKAFUI NYAMADI

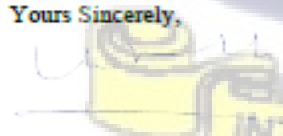
Please note that the final review report must be submitted to the Committee at the completion of the study. Your research records may be audited at any time during or after the implementation. Any modification of this research project must be submitted to ECH for review and approval prior to implementation.

Please report all serious adverse events related to this study to ECH within seven (7) days verbally and in writing within fourteen (14) days.

This certificate is valid till November 19, 2021. You are to submit annual reports for continuing review.

Please accept my congratulations.

Yours Sincerely,


Professor C. Charles Mate-Kole
ECH Chair

Cc: Prof. Richard Boateng, Dept. of Operations and Management Information Systems, UG

Tel: +233-303933866

Email: ech@ug.edu.gh

Appendix C

Quantitative Research Questionnaire

Theorising Mobile Technology Addiction: Evidence from a Developing Country

This questionnaire collects data on mobile technology addiction (MTA). This questionnaire focuses on mobile applications “apps” such as social networking sites and social games on mobile devices (smartphones or tablets). Your contribution to the completion of this questionnaire is highly appreciated. Please be assured that your information will be used only for academic purposes and given the utmost confidentiality needed.

NB: **Mobile technologies** allow you to work from anywhere, and they let you get things done with a simple touch on your smartphone or tablet without returning to your desk every time. In this work, mobile technology refers to mobile devices with installed applications and Mobile devices = Smartphones or Tablets

Filling out this questionnaire is voluntary. However, your participation will be highly appreciated as it contributes to knowledge. Kindly select YES if you are willing to participate; otherwise, select NO and exit

YES ☐

NO ☐

Demographic information (Please tick [✓])

1. Gender: Male ☐ Female ☐
2. Age: < 15yrs ☐ 16-20 ☐ 21-25 ☐ 26-30 ☐ 31-35 ☐ > 35yrs ☐
3. What is your highest qualification?
First Degree ☐
Masters / PhD ☐
4. Which type of mobile device do you use?
Smartphones ☐ Tablets ☐
5. Which platform on your mobile device allows you to access mobile technology?
a) Android ☐ Apple iOS ☐ Windows ☐ Others ☐
6. Do you use your mobile device to access social apps and voice calls?

YES ☐

NO ☐

7. Which of these do you mostly access on your mobile devices?

a) Social Media ☐

Social Games ☐

8. By your estimation, what do you think you are addicted to on your mobile device?

YES ☐

NO ☐

9. Which of the following social media platforms do you use? (Tick [✓] all that apply)

Facebook ☐

LinkedIn ☐

Twitter ☐

YouTube ☐

Instagram ☐

Google + ☐

Blogs ☐

WhatsApp ☐

SMS text ☐

Snapchat ☐

Others ☐

10. Rank the following social media platforms based on the frequency of use

With one (1) being NOT USE and five (5) being VERY OFTEN used, rank the following social media platforms based on how you often access them on your smartphones (Where 1=Not Use, 2=Rarely Use, 3=Sometimes Use, 4=Often Use, 5=Very Often Use).

	1	2	3	4	5
a. Facebook					
b. LinkedIn					
c. Twitter					
d. YouTube					
e. Instagram					
f. Google+					
g. Blogs					
h. WhatsApp					
i. SMS text					
j. Snapchat					

Others (If you use any other social media platform, kindly write the name below)

If you list any other site in the preceding question, kindly rank it here; otherwise, move to the next page

(1) Not Use ☐

(2) Rarely Use ☐

(3) Sometimes Use ☐

(4) Often Use ☐

(5) Very Often Use ☐

11. Estimate the total number of hours you spend on mobile applications in a day.

Less than 1hour ☐

1hour ☐

2hours ☐

3hours ☐ 4hours ☐ 5 hours ☐ 6hours ☐ More than ☐ hours

12. Estimate how often or frequently you access mobile applications in a day.

1 to 10 times ☐ 11 to 20 times ☐ 21 to 30 times ☐ Uncountable ☐

13. a) c) Do you think you are addicted to mobile applications (SNS or games)?

Yes ☐ No ☐

14. Between males and females, who are likely to become addicted to mobile apps?

Male ☐ Female ☐

15. What exactly do you often use your mobile applications for? Tick only the most frequent use

Communication ☐ Learn ☐ Socialise ☐ Play ☐

16. What is the most significant time that you check your mobile applications?

First Thing in the Morning ☐ During Lunch Break ☐ Just Before Sleep in the Evening ☐

None of the above ☐ All the above ☐

17. Which of these will automatically influence you to check your mobile applications?

Voice calls ☐ Text Message Alerts ☐ Social Media Alerts ☐ All the above ☐

Please tick ✓ or cross ⊗ to indicate your level of agreement or disagreement with the following statement. SD = strongly disagree | D = Disagree | N = Neutral | A = Agree | SA = Strongly Agree

These Questions are on Mobile Applications Addictions					
FLOW (Huang, 2003; Cheng, 2000; Novak et al.,2000; Csikszentmihalyi,1975)					
Control	SD	D	N	A	SA
When navigating mobile applications, I feel in control	☐	☐	☐	☐	☐
I feel that I have no control over my interactions with mobile applications	☐	☐	☐	☐	☐
Using mobile applications allows me to control my technology interactions	☐	☐	☐	☐	☐
Using mobile application allow me to control my social interactions	☐	☐	☐	☐	☐
Attention Focus	SD	D	N	A	SA
When using mobile applications, I think about others	☐	☐	☐	☐	☐
When using mobile applications, I'm aware of distractions	☐	☐	☐	☐	☐
When using mobile applications, I get absorbed	☐	☐	☐	☐	☐
When using mobile applications, I lose track of time	☐	☐	☐	☐	☐
Curiosity	SD	D	N	A	SA

I'm curious to know more when using mobile applications	☐	☐	☐	☐	☐
I'm eager to learn more about mobile applications	☐	☐	☐	☐	☐
I'm rapt with varied imaginations when on mobile applications	☐	☐	☐	☐	☐
I'm interested in navigating more on mobile applications	☐	☐	☐	☐	☐
Intrinsic Interest	SD	D	N	A	SA
Navigating mobile applications is boring	☐	☐	☐	☐	☐
Using mobile applications is intrinsically interesting	☐	☐	☐	☐	☐
I have an inherent interest in enjoying mobile technology	☐	☐	☐	☐	☐
Using mobile applications provides a challenge, which I easily surmount	☐	☐	☐	☐	☐
Presence (When using social media on smartphones)	SD	D	N	A	SA
<i>When using mobile applications;</i>					
I have the feeling of being connected to others as if we are in one place	☐	☐	☐	☐	☐
I feel a sense of 'being there' in the technology-generated world	☐	☐	☐	☐	☐
I feel absorbed in the virtual world and forget the real world outside.	☐	☐	☐	☐	☐
I feel a sense of both social and technology presence	☐	☐	☐	☐	☐
Utilitarian Value / Perceived Usefulness (Gefen et al., 2003)	SD	D	N	A	SA
Using mobile applications is useful to me	☐	☐	☐	☐	☐
Using mobile applications improves my effectiveness and efficiency (performance)	☐	☐	☐	☐	☐
Using mobile applications helps me to keep a relationship with family and friends	☐	☐	☐	☐	☐
Using mobile applications gives me the needed skills to be productive	☐	☐	☐	☐	☐
Using mobile applications helps me to be up-to-date (current)					
Hedonic Value (Cheung et al. 2000; Igbaria et al. 1995; Davis et al., 1992)	SD	D	N	A	SA
I have fun when using mobile applications	☐	☐	☐	☐	☐
Using mobile applications is pleasurable or pleasant	☐	☐	☐	☐	☐
Using mobile applications is interesting	☐	☐	☐	☐	☐
Using mobile applications is exciting	☐	☐	☐	☐	☐
I enjoy playing on mobile applications	☐	☐	☐	☐	☐
SELF-TRAITS (Tangney, Baumeister, & Boone, 2004; Scholz, Doña, Sud, & Schwarzer, 2002; Rosenberg, 1965)	SD	D	N	A	SA
I am capable and competent in using mobile applications without difficulties (Self-efficacy)	☐	☐	☐	☐	☐
I can deal efficiently and effectively with unexpected events on mobile applications (SE)	☐	☐	☐	☐	☐
I earn a lot of respect among my peers while using mobile applications (Self-esteem)	☐	☐	☐	☐	☐

I can exercise self-regulation when using mobile applications (Self-control)	☐	☐	☐	☐	☐
I cannot resist being on mobile applications even if I'm negatively affected (Self-control)	☐	☐	☐	☐	☐
INTERACTIVITY (Skadberg & Kimmel, 2004)	SD	D	N	A	SA
Using mobile applications gives me the freedom to choose what I want and where to go	☐	☐	☐	☐	☐
Interacting with mobile technology images is easy for me	☐	☐	☐	☐	☐
Loading, downloading, and playing videos on mobile applications is effortless for me***	☐	☐	☐	☐	☐
Loading, downloading, and playing audios on mobile applications is very easy for me****	☐	☐	☐	☐	☐
Mobile application platforms respond to my actions (messaging, posting, etc.) very fast	☐	☐	☐	☐	☐
USABILITY (Nielsen, 1994; Agarwal & Venkatesh, 2002; Teo et al., 2003; Flavian et al., 2006)	SD	D	N	A	SA
Everything seems easy to accomplish when using mobile technology	☐	☐	☐	☐	☐
Mobile applications are simple to use, even when using them for the first time	☐	☐	☐	☐	☐
It is easy to find the information I need when using mobile technology	☐	☐	☐	☐	☐
It is easy to send and receive text messages on mobile applications	☐	☐	☐	☐	☐
It is easy to navigate within mobile apps environments on my mobile device	☐	☐	☐	☐	☐
SOCIAL PRESENCE (Gefen et al., 2003b)	SD	D	N	A	SA
I feel a sense of human contact when using mobile technology	☐	☐	☐	☐	☐
I feel a sense of sociability when using mobile technology	☐	☐	☐	☐	☐
I feel a sense of human warmth when using mobile technology	☐	☐	☐	☐	☐
I feel a sense of human sensitivity when using mobile technology	☐	☐	☐	☐	☐
I feel a sense of being connected to others when using mobile technology	☐	☐	☐	☐	☐
TELEPRESENCE (Bouchard & Robillard, 2006)	SD	D	N	A	SA
Mobile technology provides an interface that seems natural	☐	☐	☐	☐	☐
Mobile technology provides the platform for us to react as if we are physically in one place	☐	☐	☐	☐	☐
Mobile technology provides the platform for virtual presence, which disappears when the session ends, and I feel like returning to the "real world."	☐	☐	☐	☐	☐
Mobile technology sites provide the interface that allows others (s) to react to my presence	☐	☐	☐	☐	☐
I lost track of time when present on mobile technology	☐	☐	☐	☐	☐
Students' Academic Performance (Kubey et al. 2001)	SD	D	N	A	SA
My academic is hurt because of the time I spend using mobile technology	☐	☐	☐	☐	☐
I spend too much time using mobile technology instead of my books	☐	☐	☐	☐	☐
Mobile social media apps usage sometimes prevents me from attending lectures	☐	☐	☐	☐	☐
Using mobile technology has influenced my academic performance negatively	☐	☐	☐	☐	☐

Using mobile technology has influenced my academic performance positively	☐	☐	☐	☐	☐
FEAR OF MISSING OUT (FoMO) (Przybylski et al., 2013)	SD	D	N	A	SA
I fear my friends have more rewarding experiences than me on mobile technology	☐	☐	☐	☐	☐
I get worried when I find out that my friends are having fun without me on mobile technology	☐	☐	☐	☐	☐
I get anxious when I don't know what my friends are up to on mobile technology	☐	☐	☐	☐	☐
I get anxious when I don't know what my friends are up to on their mobile technology	☐	☐	☐	☐	☐
It bothers me when I miss an opportunity to meet up with friends on mobile technology	☐	☐	☐	☐	☐
SELF REGULATION (Haagsma et al., 2013; Turel, 2005a)	SD	D	N	A	SA
I can't resist the urge to use mobile technology	☐	☐	☐	☐	☐
I can resist the urge to use mobile technology	☐	☐	☐	☐	☐
I can control myself when using mobile technology	☐	☐	☐	☐	☐
I predict I would regulate(reduce) the amount of time on mobile technology	☐	☐	☐	☐	☐
I plan to regulate (reduce) the amount of time I spend using mobile technology	☐	☐	☐	☐	☐
Mobile Technology Addiction (MTA) (Turel and Serenko, 2012)	SD	D	N	A	SA
I sometimes neglect important academic work because of my interest in mobile technology	☐	☐	☐	☐	☐
I have made unsuccessful attempts to reduce the time I interact with mobile technology	☐	☐	☐	☐	☐
Using mobile technology has interfered seriously with my academic work	☐	☐	☐	☐	☐
When I am not using mobile technology, I often feel agitated	☐	☐	☐	☐	☐
I crave too often or frequently use mobile technology	☐	☐	☐	☐	☐



Appendix D

Qualitative Questions

Theorising Mobile Technology Addiction:

Evidence from a Developing Country

This questionnaire collects data on mobile technology addiction (MTA). This questionnaire focuses on mobile applications “apps” such as social networking sites and social games on mobile devices (smartphones or tablets). Your contribution to the completion of this questionnaire is highly appreciated. Please be assured that your information will be used only for academic purposes and given the utmost confidentiality needed.

NB: Mobile technologies allow you to work from anywhere, and they let you get things done with a simple touch on your smartphone or tablet without returning to your desk every time. In this work, mobile technology refers to mobile devices with installed applications. Social Networking Site (SNS) = Social Media and Mobile Device = Smartphones or Tablets

Filling out this questionnaire is voluntary. However, your participation will be highly appreciated as it contributes to knowledge. Kindly select YES if you are willing to participate; otherwise, select NO and exit

YES ☐

NO ☐

General Background Information

Users (Addicts)

1. What is your understanding of mobile technology addiction?
2. How long have you been using mobile technology?
3. Which mobile technologies are you addicted to?
4. Briefly describe what mobile applications addiction is to you.

Relatives

1. What is your understanding of mobile technology addiction, and do you think your "friend or relation" is addicted?

2. How long has your "friend or relative" been using mobile technology, and how frequently does he/she use them?
3. Briefly describe how your friend became addicted to mobile technology.

Experts

1. Briefly describe what mobile technology addiction is in your discipline.
2. What is the process of addiction to your discipline?

These questions are generic; they will be reworded and asked about the addicts, their relations, and the experts

Questions regarding the nature and causes of mobile technology addiction (stimulus)

3. Briefly describe what you understand of mobile technology users' self-traits in terms of self-control, self-efficacy and self-esteem
4. What are the hedonic values or pleasant indirect sensations such as fun & joy that you derive from mobile apps?
5. What are the direct practical benefits you derive from mobile technology?
6. What makes mobile technologies easy and convenient to use to accomplish a task?
7. What is the nature of the mobile technologies that make them interactive?

Question regarding nature and causes of technology addiction (organism)

8. Describe your experience of the social presence or connectedness with others on mobile application platforms.
9. Describe your experience of virtual or telepresence on mobile technology platforms.
10. Flow is total mental absorption. Have you experienced flow before, and what was the experience like?

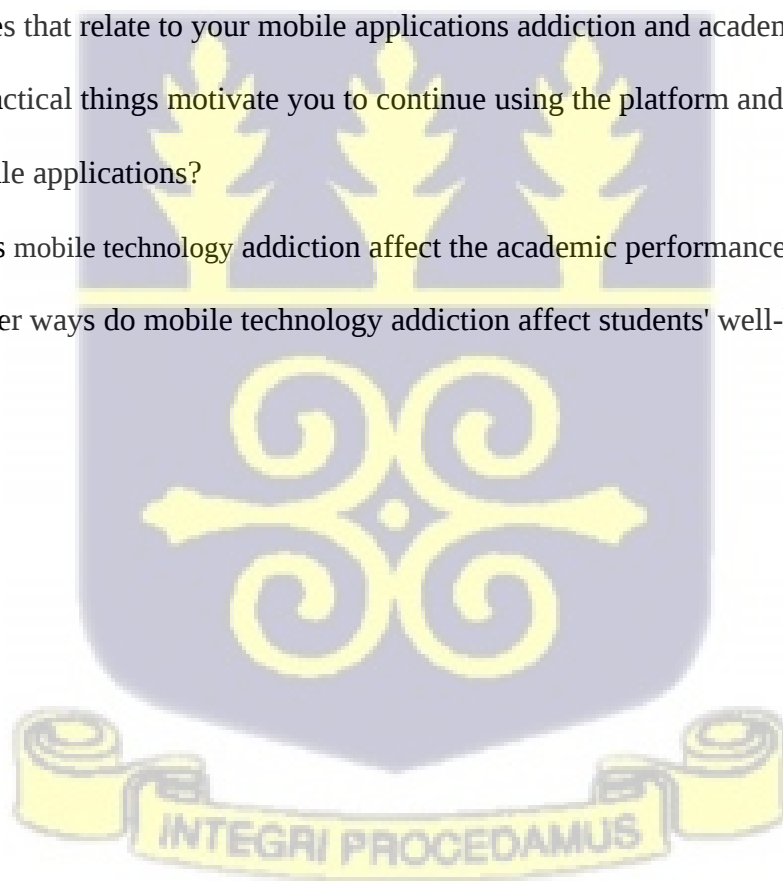
Questions on the moderating Effect of Self-Regulation and FoMO

11. What are the practical ways by which you can self-regulate as technology addiction treatment?
12. Which activities enable you always be on the mobile applications and do not want to miss out?
13. Could you please describe how self-regulation and fear of missing out relate to technology addiction and academic performance?
 - a. Do you think self-regulation can help in the treatment of addiction?
 - b. Do you think the fear of missing out on mobile applications will result in excessive usage and addiction?

Questions regarding the consequences of technology addiction (response)

14. a. What are the practical ways of regulating yourself on mobile applications?
 - b. How does that relate to your mobile applications addiction and academic performance?
15. a. What practical things motivate you to continue using the platform and not want to miss out on mobile applications?
16. a. How does mobile technology addiction affect the academic performance of students?
 - b. What other ways do mobile technology addiction affect students' well-being?

THANK YOU



Appendix E

Mobile Phone Addiction Scale Adapted from

Internet Addiction Test (AIT) By Kimberly Young

Mobile Phone Addiction Test (MPAT) is adapted from the Internet Addiction Test developed by Dr. Kimberly Young. The original scale is a reliable and valid measure of the addictive use of the Internet. It consists of 20 items that measure the mild, moderate, and severe levels of Internet Addiction. NB: The original scale is modified and used to test MTA in this study.

To begin, answer the following questions by using this scale: -

0	Does not apply
1	Rarely
2	Occasionally
3	Frequently
4	Often
5	Always

	Question	Scale					
		1	2	3	4	5	6
1	How often do you find that you stay mobile technology longer than you intended?						
2	How often do you neglect household chores to spend more time on mobile technology?						
3	How often do you prefer the excitement of mobile technology to intimacy with your partner?						
4	How often do you form new relationships with fellow mobile technology users?						
5	How often do others in your life complain to you about the amount of time you spend on mobile technology?						
6	How often do your grades or school work suffer because of the amount of time you spend on mobile technology?						
7	How often do you check your phone before something else that you need to do?						
8	How often does your job performance or productivity suffer because of mobile technology?						
9	How often do you become defensive or secretive when anyone asks you what you do with mobile technology?						
10	How often do you block out disturbing thoughts about your life with soothing thoughts on mobile technology?						
11	How often do you find yourself anticipating when you will check your mobile technology again?						
12	How often do you fear that life without mobile technology would be boring, empty, and joyless?						
13	How often do you snap, yell, or act annoyed if someone bothers you while you are on your mobile technology?						

14	How often do you lose sleep due to late-night log-ins?							
15	How often do you feel preoccupied with mobile technology when off-line, or fantasise about being online?							
16	When on mobile technology, how often do you find yourself saying, “just a few more minutes”?							
17	How often do you try to cut down the amount of time you spend on mobile technology and fail?							
18	How often do you try to hide how long you’ve been on mobile technology?							
19	How often do you choose to spend more time on mobile technology over going out with others?							
20	How often do you feel depressed, moody, or nervous when off-line, which goes away once you return to mobile technology?							

Total up the scores for each item. The higher your score, the greater your level of addiction is.

20 – 49 points: You are an average online user. You may surf the Web a bit too long at times, but you have control over your usage.

50 – 79 points: You are experiencing occasional or frequent problems because of the Internet. You should consider their full impact on your life.

80 – 100 points: Your Internet usage is causing significant problems in your life. You should elevate the Internet’s impact on your life and address the problems directly caused by your Internet usage.

