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Exploring the dimensions of nomophobia: Developing and validating a questionnaire using mixed methods research

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Exploring the dimensions of nomophobia: Developing and validating a questionnaire using mixed methods research

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DEDICATION

To my mom, my dad and my brother…

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ABSTRACT

Nomophobia is defined as the fear of being out of mobile phone contact and is considered a modern age phobia introduced to our lives as a byproduct of the interaction between people and mobile information and communication technologies, especially smartphones. This research study sought to contribute to the nomophobia research literature by identifying and describing the dimensions of nomophobia and developing a questionnaire to measure nomophobia. Consequently, this study adopted a two-phase, exploratory sequential mixed methods design. The first phase was a qualitative exploration of nomophobia through semi-structured interviews conducted with nine undergraduate students at a large Midwestern university in the U.S. The qualitative findings from this initial exploration were then developed into a questionnaire measuring nomophobia. In the second phase of the study, the nomophobia questionnaire (NMP-Q) was tested with a large sample of 301 undergraduate students.

As a result of the first, qualitative phase of the study, four dimensions of nomophobia were identified, namely *not being able to communicate*, *losing connectedness*, *not being able to access information* and *giving up convenience*. Using the findings from this phase, a 20-item NMP-Q was created. The results of the second, quantitative phase showed that the four dimensions were connected to the theoretical construct of nomophobia and that the NMP-Q produced valid and reliable scores.

Utilizing both qualitative and quantitative approaches, this study provided greater insight into nomophobia as a theoretical construct. In addition, the methodology employed in this study - exploratory sequential mixed methods design – offers a guide in the development of new measures to investigate the impact of technology on people's lives.

CHAPTER 1

INTRODUCTION

Information and communication technologies (ICT) have become an indispensable part of our lives (Salehan & Negahban, 2013). With the proliferation of inexpensive mobile devices, we are now living in a mobile age in which mobile ICTs are vigorously and quickly adopted (Oulasvirta, Rattenbury, Ma, & Raita, 2012). In this mobile age, smartphones are considered the latest evolution of mobile ICTs (Oulasvirta et al., 2012).

The advances in mobile ICTs have paved the way for the worldwide adoption of mobile phones. Mobile phones have become so pervasive that the number of mobile-cellular subscriptions is expected to reach almost 7 billion by the end of 2014, approaching the world population with a penetration rate of 96% (International Telecommunications Union, 2014).

According to Pew Research Center's Mobile Technology Fact Sheet (2014), as of January 2014, 90% of the American adult population have some kind of a cell phone and 58% of American adults own a smartphone. Among adults who own a smartphone, 83% are aged 18-29, 74% are aged 30-49, 49% are aged 50-64, and 19% are aged 65 or older. Thus, smartphones are particularly popular among young adults. In fact, college students are regarded as the early adopters of smartphones (Lee, 2014).

The popularity of smartphones among college students is ascribable to the numerous features and functionalities they provide. Smartphones make it possible to perform a variety of daily tasks in one device, including, but not limited to, calling and texting people, checking and sending email messages, scheduling appointments, surfing the Internet, shopping, social networking, searching for information on the Internet, gaming, entertainment, etc. (Park, Kim,

Shon, & Shim, 2013). Because smartphones are ubiquitous and provide numerous capabilities, Kang and Jung (2014) propose that smartphones go beyond serving communication, information and entertainment purposes. They state that smartphones enable people to "fulfill needs such as learning, individual capability, safety, and human relationships" (Kang & Jung, 2014, p. 377), which is attributed to the mobility of smartphones.

While the mobility of smartphones provides apparent benefits and help people satisfy their basic needs (Kang & Jung, 2014), it may also induce some problems associated with smartphone use. Studies have shown that smartphones may cause compulsive checking habits (Oulasvirta et al., 2012), that smartphones may lead to compulsive usage and increased distress (Lee, Chang, Lin, & Cheng, 2014; Matusik & Mickel, 2011) and that smartphones can be addictive (Chiu, 2014; Lee et al., 2014; Salehan & Negahban, 2013).

Another problem exacerbated by smartphones is nomophobia. Nomophobia, or no mobile phone phobia, is "the fear of being out of mobile phone contact" (SecurEnvoy, 2012, para. 1). Although there has been an increasing academic interest in investigating the problems emanating from smartphone use, research into nomophobia has been scarce (King et al., 2013; King et al., 2014).

Purpose of the Study

The purpose of this two-phase, exploratory mixed methods study was to explore the dimensions of nomophobia with the intent of using these findings to develop and validate a questionnaire to measure nomophobia among U.S. college students. The first phase of the study was a qualitative exploration of nomophobia by interviewing undergraduate students at a large Midwestern university. The qualitative findings from this initial exploration were then developed

into a questionnaire aimed at measuring nomophobia. In the second phase of the study, the questionnaire, referred to as Nomophobia Questionnaire (NMP-Q), was validated with a large sample of undergraduate students.

Research Questions

In line with the purpose of the study, the following research questions were addressed**:**

1. What are the dimensions of nomophobia as described by college students?
2. Does the NMP-Q generate reliable scores?
3. Does the NMP-Q generate valid scores?
4. To what extent do the dimensions of nomophobia identified as a result of the first, qualitative phase of the study inform the design and development of the NMP-Q in the second, quantitative phase of the study?

Assumptions

The following assumptions are made throughout this study:

1. Nomophobia can be measured using a self-reported questionnaire.
2. The students are representatives of U.S. college student population at the university where this study is conducted.

Significance of the Study

Given the dearth of research into nomophobia, this study aims at contributing to nomophobia research literature by revealing the dimensions of nomophobia that may be further investigated. Moreover, the development of a new nomophobia measure will be useful for researchers interested in investigating nomophobia. In addition, through the use of a mixed

methods research design, this study will help provide guidance to other researchers in the development of new measures to investigate the impact of technology on people's lives.

Definition of Terms

The following are the definitions of the terms commonly used throughout the thesis.

Validity

Validity refers to "whether an instrument measures what it was designed to measure" (Field, 2009, p.11).

Construct validity

Construct validity refers to the extent to which an instrument measures what it purports to measure. In other words, it is "the extent to which a measure behaves the way that the construct it purports to measure should behave with regard to established measures of other constructs" (DeVellis, 2003, p. 53).

Content validity

Content validity is "the degree to which individual items represent the construct being measured, and cover the full range of the construct" (Field, 2009, p. 12).

Reliability

Reliability refers to "whether an instrument can be interpreted consistently across different situations" (Field, 2009, p. 11).

Factor loading

Factor loading "can be thought of as the Pearson correlation between a factor and a variable" (Field, 2009, p. 631).

Internal consistency

Internal consistency refers to "the homogeneity of the items within a scale" (DeVellis, 2003, p. 27).

Problematic mobile phone use

Problematic mobile phone use is defined as "an inability to regulate one's use of the mobile phone, which eventually involves negative consequences in daily life" (Billieux, 2012, p. 299).

Questionnaire

A questionnaire "is a means of eliciting the feelings, beliefs, experiences, perceptions, or attitudes of some sample of individuals. It is a very concise, preplanned set of questions designed to yield specific information to meet a particular need for research information about a pertinent topic" (Key, 1997, para. 1).

Thesis Outline

The rest of the thesis is organized as follows: Chapter 2 provides a review of the relevant literature by presenting the definitions of nomophobia available and discussing previous research on nomophobia. It also provides an overview of currently available measures of problematic mobile phone use. Chapter 3 details the methodological approach guiding this study, focusing on exploratory sequential mixed methods design. Chapter 4 presents the findings from the first, qualitative phase of the study. Chapter 5 presents the quantitative results from the second phase of the study. Lastly, Chapter 6 closes the thesis with the discussion of findings and results from the two phases of the study, conclusions drawn from the study, limitations and directions for future research.

CHAPTER 2

REVIEW OF RELEVANT LITERATURE

This chapter discusses the literature related to nomophobia and mobile phone use research. The first section reviews the definitions of nomophobia available in the literature while touching upon the previous studies into nomophobia. The second section reviews the available measures of problematic mobile phone use.

Nomophobia

Defining Nomophobia

Nomophobia is defined as "the fear of being out of mobile phone contact" (SecurEnvoy, 2012, para. 1). The term, nomophobia, is an abbreviation for no-mobile-phone phobia and it was first coined during a study conducted in 2008 by the UK Post Office to investigate anxieties mobile phone users suffer (SecurEnvoy, 2012). In order to refer to people with nomophobia, two other terms were introduced and colloquially used: *nomophobe* and *nomophobic*. A nomophobe is a noun and refers to someone who is afflicted with nomophobia. The term, nomophobic, on the other hand, is an adjective and is used to describe the characteristics of nomophobes and/or behaviors related to nomophobia.

The 2008 study in the UK, conducted with over 2,100 people, demonstrated that some 53% of mobile phone users suffered from nomophobia (Mail Online, 2008). The study also revealed that men were more prone to nomophobia than were women, with 58% of male participants and 48% of female participants indicating feelings of anxiety when unable to use their phone.

Another study conducted by SecurEnvoy (2012), a security company in the UK, surveyed 1,000 employees and showed that the number of people suffering from nomophobia increased from 53% to 66%. Unlike the 2008 study, the 2012 study found out that women were more susceptible to nomophobia, with 70% of the women compared to 61% of the men expressing feelings of anxiety about losing their phone or not being able to use their phone (SecurEnvoy, 2012). In terms of the relationship between age and nomophobia, the study found that young adults, aged 18-24 were most prone to nomophobia with 77% of them identified as nomophobic, followed by users aged 25-34 at 68%. Moreover, mobile phone users in the 55 and over group were found to be the third most nomophobic users.

One of the very first research studies into nomophobia is a case report by King, Valença and Nardi (2010). In their study, they consider nomophobia as a 21st century disorder resulting from new technologies. In their definition, nomophobia "denotes discomfort or anxiety when out of mobile phone (MP) or computer contact. It is the fear of becoming technologically incommunicable, distant from the MP or not connected to the Web" (King et al., 2010, p. 52). Their definition seems to encompass not only mobile phones but computers, as well.

In another study, King, Valença, Silva, Baczynski, Carvalho and Nardi (2013) define nomophobia as follows:

> Nomophobia is considered a disorder of the modern world, and has only recently been used to describe the discomfort or anxiety caused by the non-availability of an MP, PC or any other virtual communication device in individuals who use them habitually (p. 141).

Although their definition includes the unavailability of computers, they argue that computers are replaced by mobile phones, which presumably have smartphone capabilities, and tablets. Therefore, they state that their research focus is less on computers and more on the virtual communication environments, including mobile phones (King et al., 2010, p. 142). Their definition implies a dependency on virtual environments for communication.

In a recent study by King, Valença, Silva, Sancassiani, Machado and Nardi (2014), nomophobia is defined as follows:

> Nomophobia is the modern fear of being unable to communicate through a mobile phone (MP) or the Internet. … Nomophobia is a term that refers to a collection of behaviors or symptoms related to MP use. Nomophobia is a situational phobia related to agoraphobia and includes the fear of becoming ill and not receiving immediate assistance (p. 28).

In this updated definition, they seem to emphasize the inability to communicate through a mobile phone. Another point that is worth mentioning is the description of nomophobia as a situational phobia related to agoraphobia. While the previous definitions appear to embrace the feelings of anxiety resulting from the unavailability of such devices as computers or virtual communication devices, this recent definition is more related to mobile phones and denotes nomophobia as a situational phobia.

Similarly, *International Business Times'* definition (2013) seems to put an emphasis on the feelings of anxiety caused by the unavailability or inaccessibility of mobile phones:

> Nomophobia or no-mobile-phone-phobia is an anxiety which people face when they feel they could not get signal from a mobile tower, run out of

> battery, forget to take the phone with them or simply do not receive calls, texts or email notifications for a certain period of time. In short, it is a psychological fear of losing mobile or cell phone contact (para. 2).

This definition provides a deeper insight into nomophobic behaviors by listing some of the situations in which people get anxious.

Within the scope of this thesis, nomophobia will be discussed in relation to smartphones. As King et al. (2010) propose, nomophobia is considered a modern age phobia and a byproduct of the interaction between people and new technologies. As discussed in the previous chapter, smartphones have taken over the mobile phone market and have almost replaced the phrase "mobile phone" or "cell phone." With their numerous capabilities, smartphones facilitate instant communication, help people stay connected anywhere anytime, and provide people with constant access to information. Thus, people have become dependent on their mobile phones more than ever (Park et al., 2013), which, in turn, supposedly exacerbates the feelings of anxiety caused by being out of mobile phone contact. That connection is why nomophobia should be considered in relation to smartphones, which have the standard capabilities of a cell phone, (e.g., phone calls, texting, etc.) and have more advanced capabilities like internet access, applications, or sensors (Park et al., 2013).

Previous studies on Nomophobia

After the term was coined, nomophobia received a great deal of attention by media, especially online media (CNW, 2012; Merz, 2013; *The Telegraph*, 2012). Research into nomophobia, however, has been scarce as evidenced by the results of searches on academic

research databases, such as Web of Science, EBSCOHOST, PsychInfo, and ProQuest. Therefore, a few research studies will be discussed in this section.

As mentioned in the previous section, one of the very first and few research studies on nomophobia was conducted by King et al. (2010), in which they reported the case of a patient with panic disorder and agoraphobia and examined the relationship between nomophobia and panic disorder. The patient, who was reported to demonstrate total dependence on his mobile phone, received a combination of psychiatric treatment, medication, and cognitive behavioral therapy (CBT). In addition to addressing panic disorder and agoraphobia, the CBT also addressed nomophobia. They reported that the patient's condition improved after the treatment, that his symptoms had not appeared for the last four years and that he demonstrated considerable improvement in his phobia. Despite the focus on nomophobia in the CBT, the patient's dependence on his mobile phone was unchanged. They proposed that nomophobia should be considered and addressed in the treatment of patients with panic disorders on the grounds that the dependence on mobile phones for instant communication to reduce anxiety in case of panic attack may preclude the patients from becoming autonomous and independent. They stated this practice may even increase patients' dependence on mobile phones and result in static dependent behavior. They noted, however, that no pathophysiological explanation could be made for the development of nomophobia in patients with panic disorder. Because mobile phones are associated with autonomy and freedom of action and people with agoraphobia demonstrated limited mobility and autonomy, they propose the inclusion of nomophobia in the situational phobias group, specifically related to agoraphobia.

In an attempt to draw attention to how individuals' interaction with new technologies result in behavioral changes, King et al. (2013) reported a single-case study of a person with

social phobia who showed the symptoms of nomophobia. They examined nomophobia as a manifest behavior that might be an indicator of a potential anxiety disorder. The patient, who was diagnosed with social phobia disorder (SPD), was reported to have developed a dependency on virtual environments to communicate with his contacts and thus to avoid direct social interactions with people. After receiving the treatment, which was a combination of medication and cognitive-behavioral therapy (CBT), the patient was reported to reduce his dependence on virtual environments for communication and show an improvement in engaging in real-life situations. While the authors acknowledge the impact of nomophobia on individuals, they assert that nomophobia might also be a mask for other problematic behaviors and even mental disorders.

Dependence, Addiction, and Nomophobia

Nomophobia has been generally referred to as dependence on mobile phones (Dixit et al., 2010) or addiction to mobile phones (Forgays, Hyman, & Schreiber, 2014). Although Forgays et al. (2014) argue against the notion of mobile phone addiction, they seem to regard nomophobia as a term used to refer to mobile phone addiction. Nonetheless, the colloquial use of the term addiction seems to obscure the meaning of nomophobia. Rather, as its name implies, nomophobia, or no-mobile-phone phobia, may be better suited for classification as a phobia in general, and as a situational phobia in particular (King et al., 2010; King et al., 2014).

According to Choy, Fyer and Lipsitz (2007), situational phobias are one of the four types of specific phobia recognized in the fourth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV) and was not changed in the most recent, fifth edition of the manual (DSM-5) (Grohol, 2013). Choy et al. (2007) explain that “specific phobia is characterized by an

excessive, irrational fear of a specific object or situation, which is avoided at all cost or endured with great distress" (p. 267). Situational phobias are experienced when a specific situation evokes an intense, irrational fear that leads to an intense reaction that can be both physical and emotional. For instance, fear of flying, which is called aviophobia, is one of the most common situational phobias (Skolnick, Schare, Wyatt, & Tillman, 2012). People with aviophobia would strive to avoid flying as much as possible. If they had to fly for some reason, they would endure the experience with great anxiety and stress. Similarly, in the case of nomophobia, people with nomophobia or nomophobes would have an irrational fear of being out of smartphone contact or not being able to use their smartphones and try to eliminate the chances of not being able to use their smartphone. Had they been unable to use their smartphones, they would have intense feelings of anxiety and distress.

Although nomophobia is not considered a mobile phone dependence or mobile phone addiction, it may be comorbid with problematic uses of mobile phones. Therefore, in the next section, research into problematic mobile phone use is discussed, focusing on the available measures of problematic mobile phone use.

Measures of Problematic Mobile Phone Use

Although the need for thoroughly understanding what constitutes the problematic use of mobile phone is apparent, the measures developed thus far seem to have focused on the substance use and addiction literature, as seen in Table 2.1.

Table 2.1. Measures of Problematic Mobile Phone Use

Measure	Authors	Basis
Mobile Phone Use Questionnaire (MP-UQ)	King et al. (2014)	Mobile Phone Use Literature
Problematic Use of Mobile Phones (PUMP) Scale	Merlo, Stone, & Bibbey (2013)	Informal Interviews and DSM-IV-TR and DSM-5 Criteria for Substance Use Disorder
Test of Mobile Phone Dependence (TMD)	Chóliz (2012)	DSM-IV-TR Criteria for Dependence Disorder
Mobile Phone Involvement Questionnaire (MPIQ)	Walsh, White, & McD Young (2010)	Brown's Behavioral Addiction Components and Interviews
Problem Cellular Phone Use Questionnaire (PCPU-Q)	Yen et al. (2009)	DSM-IV-TR Criteria for Substance Use
Problematic Mobile Phone Use Questionnaire (PMPUQ)	Billieux, Van der Linden, & Rochat (2008)	Problem Mobile Phone Use Literature
Text-Message Dependency Scale (TMDS)	Igarashi, Motoyoshi, Takai, & Yoshida (2008)	Text-Message Use Literature and DSM-IV-TR for Alcoholic and Drug Dependencies
SMS Problem Use Diagnostic Questionnaire (SMS-PUDQ)	Rutland, Sheets, & Young (2007)	Young's Criteria for Internet Addiction
Mobile Phone Dependence Questionnaire (MPDQ)	Toda, Monden, Kubo, & Morimoto (2006)	Excessive Mobile Phone Use Literature
Mobile Phone Problem Use Scale (MPPUS)	Bianchi & Phillips (2005)	Mobile Phone Use Literature and Addiction Literature

Mobile Phone Use Questionnaire (MP-UQ) by King et al. (2014)

King et al. (2014) investigated the emotional alterations resulting from nomophobia in patients with panic disorder and agoraphobia. For this purpose, they compared the emotional alterations of the patients with volunteer healthy individuals in the control group. Because of the lack of a validated measure for nomophobia in the current literature (King et al., 2014, p. 29), they set out to develop a structured questionnaire to measure nomophobia. They stated that the

questionnaire was based on the nomophobia literature and mobile phone use literature. Having drafted the questionnaire, they had it reviewed by two clinicians and consulted a third clinician who was unfamiliar with the questionnaire. Also, they piloted the questionnaire with seven patients. In the end, they devised a 29-item nomophobia questionnaire. They found out that compared to healthy individuals, patients with panic disorder and agoraphobia expressed significantly more intense feelings of anxiety and distress when they did not have their mobile phone or could not use it.

To the researcher's best knowledge, the present study is the first and only attempt to devise a nomophobia measure. With this questionnaire, this study contributes a great deal to the literature by addressing the need for a nomophobia measure and sounds promising for the development of the nomophobia research literature. That being said, the questionnaire was developed by the authors based on their review of the literature and preconceptions about the phenomenon of nomophobia. Given that the nomophobia literature is currently limited, a more comprehensive investigation of nomophobia through interviews would have strengthened the validity of the items included in the questionnaire.

Problematic Use of Mobile Phones (PUMP) Scale by Merlo et al. (2013)

Merlo et al. (2013) developed and validated a measure of problematic mobile phone use. The items in the questionnaire were created based on informal interviews with several mobile phone users who described themselves as addicted to their phones, DSM-IV criteria for substance use disorders, and a review of existing measures concerned with the excessive use of the Internet. As a consequence, a list of 69 items was constructed, 20 of which were retained after the revision of the items according to DSM-5. Then, the 20-item questionnaire with a 5-

point rating scale was administered to a sample of 244. Afterwards, they performed factor analysis and reliability analysis to assess the psychometric properties of the questionnaire. The results of the analysis indicated a unidimensional factor structure for the questionnaire, and the questionnaire had excellent internal consistency (α = .94). Furthermore, the authors examined the relationship between the scores on PUMP Scale and the scores on another questionnaire that was previously validated, Cellular Phone Dependency Tendency Questionnaire (Toda, Monden, Kubo, & Morimoto, 2004). They found a strong correlation between the scores (r = .76, p < .01). An analysis of their results support their conclusion that the PUMP Scale is a valid and reliable instrument that can be used to measure the problematic use of mobile phones.

Test of Mobile Phone Dependence (TMD) by Chóliz (2012)

Chóliz (2012) sought to develop a questionnaire to assess mobile phone dependence among adolescents. Taking the DSM-IV-TR criteria for dependence as the basis, the author created a 101-item dependence questionnaire. This initial questionnaire was piloted with 542 students, which resulted in a 46-item penultimate questionnaire for mobile phone dependence. This 46-item questionnaire was administered to a sample of 1,944 adolescents. After this study, the final version of the questionnaire contained 22 items. The final version of the 22-item (5-point rating scale) questionnaire was administered to a sample of 347 adolescents to check for its construct validity by examining its relationship with MPDQ (Toda et al., 2006). The results of the exploratory factor analysis with principal components extraction revealed a three-factor solution. These factors were named abstinence, lack of control and problems derived from use, and tolerance and interference with other activities. The questionnaire had excellent internal consistency (α = .94). Also, the scores on TMD were strongly correlated with the scores on

MPDQ, $r = .857$, $p < .01$. The results of the statistical analyses showed that TMD produced valid and reliable scores.

Mobile Phone Involvement Questionnaire (MPIQ) by Walsh et al. (2010)

Walsh et al. (2010) investigated the relationship between frequency of mobile phone use and mobile phone involvement. They argued that the frequency of use and involvement were not identical concepts by conceptualizing involvement as people's cognitive and behavioral interaction with their mobile phone. Initially, they came up with a list of 25 items obtained from the results of a previous qualitative study (Walsh, White, & Young, 2008), using Brown's (1993, 1997) behavioral addiction components as basis for the interviews in that study. The questionnaire was administered to a sample of 946 young Australian people. After an initial analysis of the results, they eliminated several items and ended up with a questionnaire of 8 items (using a 7-point rating scale) measuring a unitary construct, as revealed by the principal component analysis. The questionnaire had moderate reliability ($\alpha = .78$). They found a weak relationship between mobile phone involvement and frequency of daily use, leading them to the conclusion that highly involved mobile phone users used their phone more frequently than did those who were not highly involved. In addition to investigating the relationship between the two types of mobile phone behavior, they explored the psychological predictors of each. Self-identity and validation from others were investigated as the predictors in the study. Both self-identity and validation from others were found to be predictors of mobile phone involvement, even though frequency of mobile phone use was predicted only by self-identity. Hence, they drew the conclusion that frequency of use and involvement conceptualized by cognitive and behavioral interactions with mobile phones should be distinguished. Employing a rigorous methodology,

this study shows that the MPIQ is a valid and reliable questionnaire and that self-identity and validation from others are factors affecting people's mobile phone involvement.

Problem Cellular Phone Use Questionnaire (PCPU-Q) by Yen et al. (2009)

Yen et al. (2009) sought to investigate whether adolescents had the symptoms of problematic cellular phone use and to examine the relationship among the symptoms of problematic cellular phone use, functional impairment caused by cellular phone use and depression. They used the taxonomies of substance use dependence on the DSM-IV-TR to develop the 12 items included in the PCPU-Q. The questionnaire was administered to a sample of 76 adolescents and their parents. The 12-items questionnaire had very good internal consistency (α = .854). They used the Kappa coefficient of agreement to examine the test-retest reliability of the self-reported scores on PCPU-Q by adolescents and by their parents. The results indicated that the PCPU-Q was a reliable instrument to measure problematic cell phone use.

After they ensured the reliability of the PCPU-Q, they administered the questionnaire, along with Center for Epidemiological Studies' Depression Scale (CES-D), to a sample of 10,191 adolescents in Southern Taiwan. They found that 48.9% of the adolescents showed signs of problematic cellular phone use. Their results also indicated that those adolescents who indicated any one of the symptoms of problematic cellular phone use as demonstrated by the PCPU-Q were more susceptible to having at least one functional impairment resulting from cellular phone use. Moreover, the study revealed that having four or more symptoms of problematic cellular phone use would differentiate the adolescents with functional impairment resulting from cellular phone use from those without any functional impairments. Finally, they found out that it was more likely for those adolescents suffering from significant depression to

demonstrate four or more symptoms of problematic cellular phone use and thus to have functional impairment caused by cellular phone use.

Different from many of the other relevant studies, the present study used test-retest reliability to ensure the reliability of the questionnaire. Also, the study provided greater insight into adolescents' problematic cell phone use, its relationship with functional impairment, and depression.

Problematic Mobile Phone Use Questionnaire (PMPUQ) by Billieux et al. (2008)

Billieux et al. (2008) explored the relationship between problematic mobile phone use and impulsivity. For this purpose, they developed the PMPUQ. Although the authors did not explain how the items were constructed in sufficient detail, they appeared to rely on the existing studies related to problematic mobile phone use. They devised a questionnaire consisting of two parts: actual mobile phone use and problematic mobile phone use. To assess the problematic uses of mobile phones, they included 30 items (4-point rating scale) in the questionnaire. The PMPUQ was constructed to have four subscales, namely prohibited use, dangerous use, dependence, and financial problems. The study was conducted with 339 participants who completed the PMPUQ and UPPS Impulsive Behavior Scale, assessing four facets of impulsivity (e.g., urgency, lack of premeditation, lack of perseverance, and sensation seeking). The results of the exploratory factor analysis and confirmatory factor analysis showed that the PMPUQ was a valid questionnaire with an acceptable fit, measuring the previously mentioned four dimensions of problematic mobile phone use. Reliability analysis of the PMPUQ revealed that each subscale (prohibited use, dangerous use, dependence, and financial problems) had good internal consistency (for prohibited use: $\alpha = .65$, for dangerous use: $\alpha = .73$, for dependence: $\alpha = .84$, and

for financial problems: α = .85). The results of the factor analyses performed in the study and reliability analysis show that the PMPUQ is a valid and reliable questionnaire to assess the problematic uses of mobile phones.

As for the relationship between PMPUQ and impulsivity, the study found that increased mobile phone use was primarily related to two facets of impulsivity: urgency and lack of perseverance. Billieux et al. (2008) also found that mobile phone dependence was predicted by high urgency and low perseverance.

Self-perception of Text-message Dependency Scale (STDS) by Igarashi et al. (2008)

Igarashi et al. investigated the relationship between self-perception of text-message dependency and psychological/behavioral symptoms of heavy use of text-messaging in relation to two personality factors, namely extroversion and neuroticism. Using the items constructed in a previous study (Igarashi, Motoyoshi, Takai, & Yoshida, 2005), they devised a concise version of the same questionnaire composed of 15 items by taking the five items with the highest factor loadings on each factor. The factors in the original scale were emotional reaction, perception of excessive use, and relationship maintenance.

The exploratory factor analysis of the concise questionnaire revealed a three-factor structure consistent with the factor structure of the original scale. The same factors, emotional reaction, perception of excessive use, and relationship maintenance, were retained. The confirmatory factor analysis of the scale also confirmed a good fit for the model. The reliability analysis showed that the factors had good internal consistency (for emotional reaction: α = .81, for perception of excessive use: α = .85, and for relationship maintenance: α = .78). The results

of the statistical analyses revealed that the concise version of the STDS was a valid and reliable scale.

To measure psychological/behavioral symptoms of heavy text-message use, they developed a five-item questionnaire based on the DSM-IV-TR criteria for alcoholic and drug dependencies. They found that personality factors, that is, extroversion and neuroticism, had a significant impact on self-perception of text-message dependency. Furthermore, the study revealed that the self-perception of text-message dependency was one of the integral predictors of psychological/behavioral symptoms. The personality factors, however, were not direct predictors of psychological/behavioral symptoms.

SMS Problem Use Diagnostic Questionnaire (SMS-PUDQ) by Rutland et al. (2007)

Rutland et al. (2007) investigated the problematic uses of text-messaging (SMS messaging). For this purpose, they developed the SMS-PUDQ based on Young's (2004) criteria for Internet addiction. The 8-item questionnaire was administered to a total of 115 undergraduate students, 78 of which met the criteria for inclusion in the study and thus could be used for the analysis. The exploratory factor analysis revealed a two-factor structure. Reliability analysis showed that the factors had good internal consistency, with Cronbach's alpha values .84 and .87, respectively. Moreover, they investigated the relationship between SMS-PUDQ scores and self-reported time spent using SMS and the relationship between SMS-PUDQ scores and the scores on a previously validated scale, Mobile Phone Problem Use Scale (Bianchi et al., 2005). The correlation analysis revealed a significant, moderate correlation, $r(76) = 0.477$, $p < .01$, between SMS-PUDQ scores and self-reports of time spent texting. The analysis also showed that there was a significant, moderate correlation, $r(76) = 0.741$, $p < .01$, between the SMS-PUDQ scores

and the MPPUS scores, leading the authors to the conclusion that the SMS-PUDQ was a valid and reliable questionnaire to measure problematic uses of SMS messages.

Mobile Phone Dependence Questionnaire (MPDQ) by Toda et al. (2004)

Toda et al. (2004) developed the MPDQ to investigate mobile phone dependence (as cited in Toda et al., 2006). Since the original study in which the questionnaire was created and validated was published in Japanese, the questionnaire development procedures are cited from other sources. The items in the questionnaire were created based on the excessive mobile phone use literature (Billieux, 2012). The 20-item questionnaire (4-point rating scale) was validated by the authors, and the reliability of the questionnaire was proved. This study was one of the first attempts to identify mobile phone use as dependence.

Mobile Phone Problem Use Scale (MPPUS) by Bianchi & Phillips (2005)

Bianchi and Phillips (2005) developed and validated a mobile phone problem use scale based on addiction literature. The MPPUS contained 27 items (10-point rating scale), covering common issues in behavioral addiction literature, such as tolerance, escape from other problems, withdrawal, craving, and negative life consequences on daily life. There were 195 participants in the study. To assess the reliability of the scale, they computed Cronbach's alpha for all items in the scale and found that the scale had a high level of internal consistency ($\alpha = .93$). To assess the construct validity of the scale, they explored the relationship between the MPPUS and self-reported time spent using the mobile phone during the week and the relationship between the MPPUS and the previously validated Addiction Potential Scale (APS). The correlation analysis showed that the correlation between the MPPUS scores and the self-reported time spent using the mobile phone, $r = .45$, $p < .01$, was moderate. The analysis also revealed that there was a

moderate correlation between the MPPUS scores and the APS scores, $r = .34$, $p < .01$, which the authors accepted as the evidence of the construct validity of the MPPUS. The authors also explored the predictors of problematic mobile phone use from such personality factors as extraversion, self-esteem, neuroticism, gender, and age. They found that extraversion, self-esteem, and age predicted mobile phone problematic use.

Unlike the other studies, the present study only reported the results of reliability analysis and correlation analysis. The authors did not report the factor structure of the scale. Considering the high internal consistency of the scale, the items appear to be homogenous and related to the construct. However, given the lack of the factor structure, no further interpretation could be made regarding the interrelations between the items. In addition, the low correlation between the Addiction Potential Scale and the MPPUS could be attributed to the lack of evidence to support the construct of mobile phone addiction, which may in fact justify the weak relation between the two constructs.

Summary

This chapter provided a review of the selected, relevant nomophobia research literature. The chapter presented currently available definitions of nomophobia and discussed previous research studies on nomophobia. The review of relevant studies showed that little has been done to investigate nomophobia as a theoretical construct, except for a handful studies (King et al., 2010; King et al., 2013; King et al., 2014).

To investigate how measures of problematic mobile phone use have been developed, the chapter reviewed currently available measures of problematic mobile phone use. The majority of measures have been developed on the basis of substance use and addiction literature (Bianchi &

Phillips, 2005; Billieux et al., 2008; Rutland et al., 2007; Toda et al., 2006; Walsh et al., 2010). Specifically, DSM criteria have been extensively adopted to develop measures for problematic mobile phone use (Chóliz, 2012; Igarashi et al., 2008; Merlo et al., 2013; Yen et al., 2009). The majority of these studies devised the items in the measures so that the items would reflect the criteria for the diagnosis of substance use or addiction as described in DSM-IV-TR or DSM-5. In other words, these criteria were taken as the basis for writing the items. The measures were then tested with a sample to examine the psychometric properties of the measures. When investigating the psychometric properties of newly developed measures, currently available studies generally used factor analysis, both exploratory factor analysis and confirmatory factor analysis, reliability analysis, and correlation analysis.

Of all the selected studies, only one study sought to develop a measure of nomophobia (King et al., 2014). When developing the questionnaire, the authors relied on nomophobia research literature and their preconceptions about the nomophobia. Because the current nomophobia literature is limited, the questionnaire developed by the authors may not comprehensively measure nomophobia.

The review of the relevant literature revealed that more research is warranted to investigate nomophobia as a theoretical construct (King et al., 2013; King et al., 2014). Given that the majority of measures have been developed based on some substance use and addiction criteria, the need for qualitatively exploring the problematic mobile phone use in general and nomophobia in particular is apparent on the grounds that such an exploration through interviews can strengthen the validity of items included in measures.

Thus, this study aims to address the need to investigate nomophobia as a theoretical construct. Different from currently available measures, this study adopts an exploratory,

sequential mixed methods design to qualitatively explore and elucidate the dimensions of nomophobia and devise a measure of nomophobia based on these qualitative findings, which is explained in greater detail in the following chapter.

CHAPTER 3

METHODOLOGY

This chapter presents the methodology that guided the research study. Specifically, this chapter explains the exploratory sequential mixed methods research design used to explore the dimensions of nomophobia and to design and develop the NMP-Q. This chapter expounds the procedures undertaken in each phase of the study and discusses participant and sample selection, data collection, and analysis.

Research Design

To address the research questions presented in Chapter 1, this study adopted a mixed methods research design with its focus on "collecting, analyzing, and mixing both quantitative and qualitative data in a single study" (Creswell & Plano Clark, 2007, p. 5). From a methodological standpoint, the basic tenet of mixed methods is that the combination of both qualitative and quantitative approaches results in a more thorough understanding of research problems than can be attained by using either approach alone (Creswell & Plano Clark, 2007).

Of all the various mixed methods designs, this study utilized the two-phase, exploratory sequential design (qual → QUAN). The basic premise of this design is that the findings of the first, qualitative phase inform the development of the second, quantitative phase (Creswell & Plano Clark, 2011). This design is especially useful when developing and testing an instrument that helps explore a phenomenon about which little is known or there is no instrument available (Creswell & Plano Clark, 2011). Therefore, this design is also known as the instrument development design (Creswell, Fetters, & Ivankova, 2004), which is illustrated in Figure 3.1.

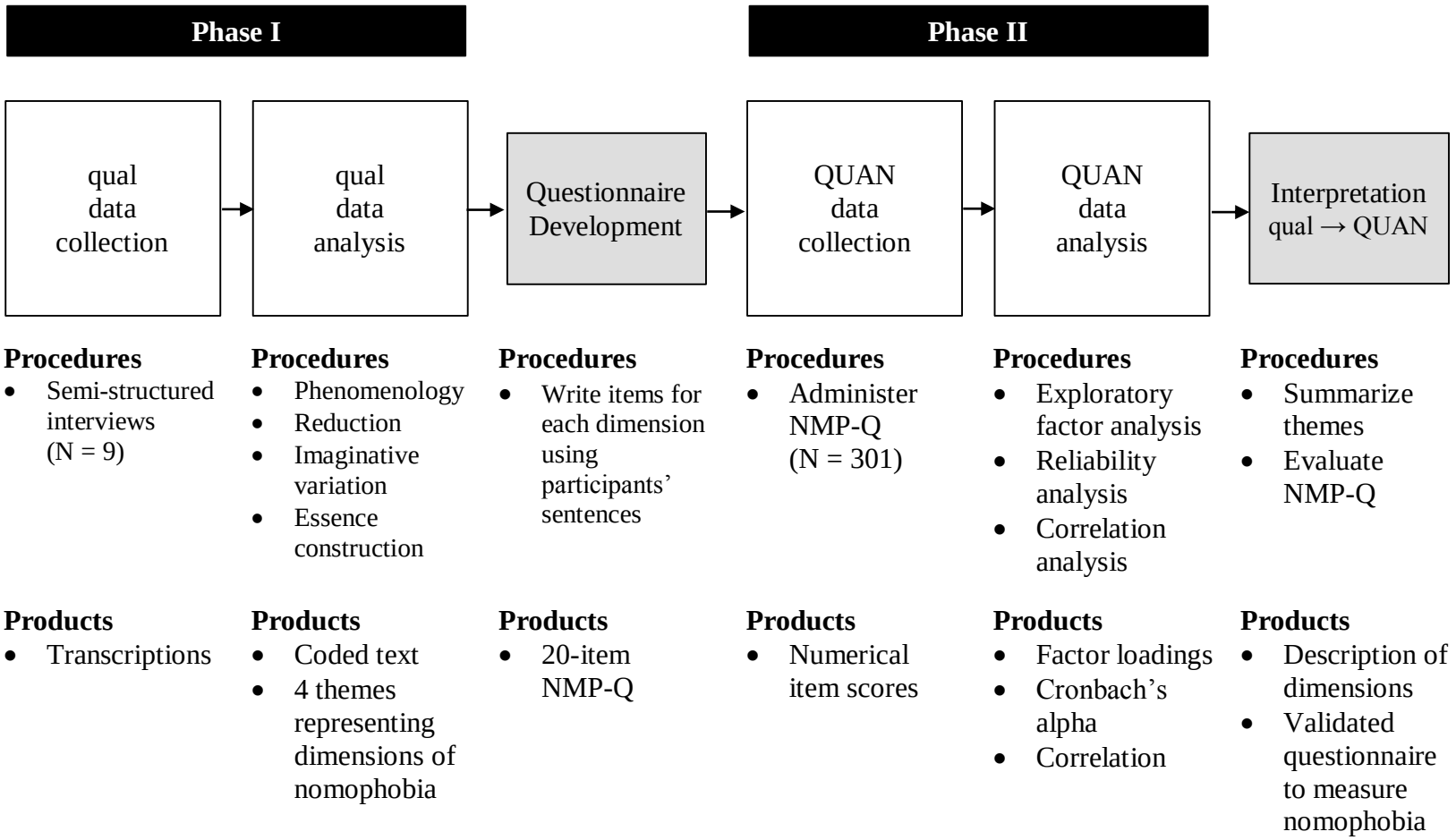

Figure 3.1. Visual Diagram of the Procedures Undertaken in the Exploratory Sequential Design

In this study, the first phase of this model began with the qualitative exploration of nomophobia through focused interviews. Then the findings from this qualitative phase guided the development of the items to be used in the Nomophobia Questionnaire (NMP-Q), which was tested in the second, quantitative phase. All the steps taken in each phase are explained in their respective sections as follows.

Phase One: Qualitative

The first, qualitative phase of the study was aimed at exploring the dimensions of nomophobia as described by college students. To this end, a phenomenological approach to qualitative exploration was undertaken because the purpose was to explore the dimensions of nomophobia by describing "the lived experiences for several individuals about the phenomenon" (Creswell, 2012, p. 51). Phenomenology, as a qualitative inquiry approach, involves the exploration of a phenomenon through individuals' narrative descriptions of their own lived experience pertaining to that specific phenomenon (Moustakas, 1994; Sokolowski, 2000). Hence, semi-structured interviews were conducted with a sample from the population to gain a thorough understanding of the dimensions of nomophobia based on the lived experiences of the interviewees.

Participants

To recruit participants for the interviews, purposive sampling strategy was used because the aim was to identify the participants who had experienced the phenomenon and thus who could provide the most accurate narrative description of the phenomenon. Therefore, a criterion sampling strategy was used for purposive sampling to ensure that the participants "experienced the phenomenon being studied" (Creswell, 2012, p. 118). For this purpose, a screening

questionnaire, attached to Appendix A, was distributed through email messages, using snowballing strategies.

The screening questionnaire included questions about smartphone ownership, duration of ownership, and smartphone use. Moreover, the questionnaire adapted eight items from a previously developed and validated questionnaire, Test of Mobile Phone Dependence (TMD) (Chóliz, 2012). This questionnaire was used to identify the respondents who heavily depended on their smartphones by calculating a dependence score for all respondents using their responses to the TMD items. The selection of the respondents was based upon the following criteria:

1. the respondent owned a smartphone for a year or more
2. the respondent had a mobile data plan providing access to the Internet via the smartphone
3. the respondent spent more than an hour using his or her smartphone
4. the respondent had a dependence score, calculated using the responses to the TMD items, greater than the mean of the scores of all respondents.

Respondents who met these criteria were contacted through email and were invited for an interview. As a result, nine undergraduate students (four males, five females), aged 19-24, were recruited as participants for the interviews.

Procedures

Semi-structured interviews were conducted with the participants. All the interviews took place in a university office on campus. Each interview lasted approximately 10-15 minutes. When the interviewees arrived at the designated location, they were introduced to the study and then asked to read and sign the Informed Consent Form, attached to Appendix B, if they agreed

to be interviewed and audio-recorded. After the interviews' permission was granted, all the interviews were audio-recorded and the interviewees were assured that their identity would be kept confidential and that no associations between their identity and audio recording would be made.

During the interviews, an interview guide was followed to make sure that all the interviewees were given the same information about the study and were asked the questions. The interview guide is appended to Appendix C.

Data Analysis

Phenomenological data analysis steps as described by Moustakas (1994) were followed to analyze the transcriptions. Phenomenological data analysis involves phenomenological reduction, imaginative variation, and construction of the essence of the experience (Creswell, 2012; Moustakas, 1994).

Phenomenological reduction begins with the horizonalization of the data, through which significant statements about the interviewees' experience are identified while treating all the statements as equal in terms of their contribution to understanding the interviewees' experience (Creswell, 2012; Moustakas, 1994). Then, statements that are repetitive and overlapping are eliminated, leading to "a list of nonrepetitive, nonoverlapping statements" (Creswell, 2012, p. 147) about the interviewees' narrative description of their lived experience, which are also referred to as invariant constituents (Moustakas, 1994). Afterwards, these invariant constituents are clustered into themes that represent meaning units (Creswell, 2012). Using these themes and interviewees' statements, a textural description of their experience is written (Creswell, 2012).

Imaginative variation refers to constructing a structural description of participants' experience with the phenomenon (Creswell, 2012), incorporating the textural descriptions from the phenomenological reduction (Moustakas, 1994). Synthesizing the textural descriptions and the structural description, an overall description of the experience, or the essence of experience, is constructed (Creswell, 2012; Moustakas, 1994). All interview recordings were transcribed verbatim and pseudonyms were used to protect the identity of the participants. For the analysis of the transcriptions, NVivo 10, a qualitative data analysis software package, was used.

After exhaustively reading the transcriptions of all the interviews, horizons (significant statements about the interviewees' experience) were extracted from each interviewee's transcription. Through thematic clustering, these horizons were grouped into meaning units (Creswell, 2012), which resulted in the textural description of the experience for interviewees. Next, a structural description of the interviewees' experience was written, which was then used to construct the essence of the phenomenon, nomophobia, through the narrative descriptions of the interviewees (Miles & Huberman, 1994).

Trustworthiness

To ensure that the findings of the phenomenological analysis reflected accurately the interviewees' experience (Creswell & Plano Clark, 2011), member-checking was conducted. In qualitative research, member-checking is used to verify the accuracy and trustworthiness of the findings by requesting input from participants (Rager, 2005). All interviewees were contacted through an email message explaining the purpose of member checking with a description of what they were requested to do. They were asked to read the descriptions of their experience and assess whether the descriptions reflected their experience. The interviewees were requested to

respond within two days. Also, they were asked to propose changes or corrections if anything was not accurate enough. Three out of nine interviewees were able to check the descriptions of their experience. They did not make any changes on the descriptions. They confirmed that the descriptions were accurate and valid, alluding to the credibility of the interpretations.

My Role as a Researcher

As a mixed methods researcher, my role and involvement in the data collection process, especially in the first, qualitative phase should be taken into consideration when interpreting the findings and results of this study. Personally, I believe that people can become attached to inanimate objects like smartphones. With technology, the feeling of attachment can be almost inevitable for some people because of the advanced features such technological innovations as smartphones provide. This attachment to and bonding with technology can be attributed to the fact that people can get what they think they want through technology as Turkle (2012) argues. The attachment users feel to technology then may be more related to what they are getting out of their interactions with technology.

One year prior to the onset of this study I would call myself a nomophobe. I had the fear of being out of the loop and getting off the grid. Upon realizing my attachment to my smartphone, I tried to reduce the number of times I checked my smartphone for calls, texts, emails, and notifications from my social media accounts among others. When I moved to the U.S. for my graduate studies, I did not have a smartphone for five months and was able to completely eliminate the desire to constantly check my smartphone and overcome the fear of being out of touch with my smartphone. When I started using a smartphone again, I was able to reduce significantly the amount of time I spent on my smartphone and number of times I checked

it. Also, I did not experience any feeling of anxiety or fear when I was away from my smartphone. My own experience led me to thinking that the intensity of nomophobia can change from time to time and that people can learn to cope with nomophobia by trying to control their use of smartphones.

Interim Phase: Questionnaire Development

The interim phase of the study was devoted to the development of the NMP-Q. Specifically, this phase of the study was aimed at building on the findings from the first, qualitative stage to design and develop the NMP-Q. Hence, it was the interim phase in which the first, qualitative phase was connected to the second, quantitative phase.

To devise the questionnaire, eight guidelines proposed by DeVellis (2003) were followed. These steps are elaborated below.

Step 1: Determine Clearly What It Is You Want to Measure

The findings of the first, qualitative phase of the study were invaluable in that they provided an in-depth description of the dimensions of nomophobia in the words of the participants interviewed. Thus, these findings defined the purpose of the questionnaire: measuring nomophobia.

Step 2: Generate an Item Pool

Within each dimension, there were several recurrent components mentioned by the interviewees. Taking into consideration the importance of each component, for each dimension, several items were carefully constructed using the statements of the interviewees from the transcriptions. This resulted in a list of 23 items, covering the four dimensions of nomophobia.

The list of the items is attached to Appendix D. Three items were paraphrased versions of other items.

Step 3: Determine the Format for Measurement

A 7-point Likert scale was chosen as the rating scale for the questionnaire because the items were presented as declarative statements and the intent was to have respondents indicate the degree of their agreement or disagreement with each statement. As a commonly used scaling format in "measuring opinions, beliefs, and attitudes" (DeVellis, 2003, p. 79), Likert scaling was deemed appropriate for the purposes of NMP-Q.

Step 4: Have the Initial Item Pool Reviewed by Experts

The questionnaire was reviewed by two experts for content validity. These experts were familiar with the phenomenon of nomophobia. One of the experts was a full professor of Instructional Technology with extensive experience and expertise in educational research and was investigating the effects of technology use, especially the Internet and smartphones, on adolescents. The other expert was the researcher's advisor, an associate professor of Curriculum and Instructional Technology and Human Computer Interaction. These experts evaluated the items for their clarity, importance, and relevance. The results of the expert review indicated that all 23 items were relevant to nomophobia and important for the questionnaire. Based on the experts' comments and feedback, three paraphrased items were removed from the questionnaire because the experts indicated that they were overlapping with the original items. Also, some minor changes were made in word choices and sentence structure to improve the clarity of the items.

After the expert review, the questionnaire was reviewed by an English language editor to make sure that there were no structural errors in the items and the wording of the items was appropriate. Based on the editor's feedback, some wording changes were made to improve the consistency among and clarity of the items. For instance, the language expert recommended the use of "email messages" instead of "emails."

Finally, representatives of the population (two undergraduate students who were naïve to the study) piloted the 20-item questionnaire to ensure that all the items were comprehensible. The two students indicated that the items were meaningful to them, and that they had no difficulty in reading and understanding the items.

As a result of this step, a penultimate questionnaire with 20 items was created.

Step 5: Consider Inclusion of Validation Items

DeVellis (2003) recommends that other relevant measures be administered to check for construct validity. For this purpose, the 8-item Mobile Phone Involvement Questionnaire (MPIQ) developed by Walsh et al. (2010) was administered together with the NMP-Q. The MPIQ was just used for purposes of analysis and is not part of the NMP-Q.

The remaining three steps, Step 6: Administer Items to a Development Sample, Step 7: Evaluate the Items and Step 8: Optimize Scale Length, are related to the second, quantitative phase of the study and encompass the procedures described in Phase Two.

Pilot Study

Before the main study, a pilot study of the penultimate NMP-Q was conducted with a convenience sample of 86 undergraduate students from the population, who were not included in the sample for the main study. The sample consisted of 11 male students (12.8%) and 75 female

students (87.2%) aged 18-24 with a mean age of 19. The NMP-Q was administered in a large undergraduate class. Rather than identifying the factor structure of the questionnaire, the purpose of the pilot study was to see whether the NMP-Q produced reliable scores because the sample size was relatively small to perform exploratory factor analysis and thus to make informed decisions about the factor structure of the questionnaire, which is explained in greater detail in the next section.

The pilot study demonstrated that the NMP-Q held good internal consistency, with a Cronbach's alpha value of .918. Therefore, it was concluded that the questionnaire was appropriate for use in the main study; and thus, the second phase of the study was initiated.

Phase Two: Quantitative

The purpose of the second, quantitative phase of the study was to test the penultimate NMP-Q with a large sample and investigate the extent to which the NMP-Q generated valid and reliable scores.

Sample

To improve the representativeness of the results, a stratified sample was selected for the main study. In particular, proportionate stratification was used and college/discipline was chosen as the strata. Since the university where this study was conducted had six colleges offering different undergraduate programs (see Table 3.1), the population was divided into six strata. The proportionate stratification was calculated on the basis of the enrollment statistics of the university for the last 4 years (Office of the Registrar, n.d.). This ascertained that the number of students selected for the sample from each stratum (i.e., college) was proportionate to the number of students in each college at the university level or in the population. Table 3.1 lists

both the number and the proportion of students in each college when compared to the population, that is, all undergraduate students at the university. A sample size of 300 students was chosen for statistical analysis purposes because it is commonly accepted as a sufficiently large sample to perform exploratory factor analysis for such a questionnaire as NMP-Q (Comrey & Lee, 1992; DeVellis, 2003; Tabachnick & Fidell, 2013). Hence, the sample in the main study consisted of 301 undergraduate students (135 male, 166 female) with mean age of 20.

Table 3.1. Demographic Characteristics of the Sample

Characteristics	***n***	**%**
Age		
18	55	18.3
19	91	30.2
20	54	17.9
21	49	16.3
22	32	10.6
23	12	4.0
≥ 24	8	2.7
Sex		
Male	135	44.9
Female	166	55.1
Year of Study		
Freshman	126	41.9
Sophomore	58	19.3
Junior	61	20.3
Senior	56	18.6
College		
Agriculture and Life Sciences	46	15.3
Business	41	13.6
Design	21	7.0
Engineering	74	24.6
Human Sciences	45	15.0
Liberal Arts and Sciences	74	24.6

Data Collection

For data collection, after getting instructors' approval, the principal researcher appeared in class meetings to explain the purpose of the study and to invite students to participate in the study. Both the researcher and instructors emphasized that the students' decision to participate was completely voluntary and had no effect on their relationship with the course instructor or on their course grade. After clearly explaining the purpose and procedures, the principal researcher asked the students to distribute the paper copies of the questionnaire among themselves. In the classes where the students were using laptop computers, the students were asked to complete the online version of the questionnaire using Qualtrics, a web-based questionnaire-delivery application. Those students who decided to complete the questionnaire took a copy and handed it to the principal researcher after they were done. Each data collection session took approximately 10-15 minutes.

Questionnaire Structure

The penultimate questionnaire is attached to Appendix E as it was used in the study. It contained three main sections: demographics, smartphone use, and nomophobia questionnaire. In addition to these three sections, the questionnaire included the 8-item Mobile Phone Involvement Questionnaire (MPIQ) developed by Walsh et al. (2010). As mentioned before, the MPIQ was used to check for construct validity.

Section I: Demographics

The Demographics section of the NMP-Q was specifically designed for undergraduate students because the population was the undergraduate students at a large Midwestern university in the U.S. This section included age, sex, year of study, major, and college.

Section II: Smartphone Use

The Smartphone Use section of the NMP-Q was constructed based on the findings from the interviews. It included duration of ownership, data plan ownership, average time spent daily using the smartphone, frequency of checking, number of phone calls made/received per day, number of text messages sent/received per day, number of email messages sent/received per day, number of applications on the smartphone, purposes for which the smartphone is used, and contexts in which the smartphone is used.

Section III: Nomophobia Questionnaire (NMP-Q)

The Nomophobia Questionnaire section included the 20 items developed as a result of the first, qualitative phase.

Data Analysis

All of the statistical analyses were performed using IBM Statistical Package for the Social Sciences (SPSS) 20. All data collected through the paper-based questionnaires were entered into SPSS and the data downloaded from Qualtrics were imported into SPSS.

Specific statistical analysis techniques employed to analyze the quantitative data collected in the second phase of the study are discussed below.

Exploratory Factor Analysis

To explore the underlying factor structure of the NMP-Q, exploratory factor analysis (EFA) was performed on the dataset. Factor analysis serves various purposes. It is used to reduce a relatively large number of variables into a parsimonious set of factors (DeVellis, 2003). It also helps to identify the underlying structure of a questionnaire by determining which items load on which factors or dimensions (Comrey & Lee, 1992). Thus, it is used to ensure the

construct validity of self-reported instruments (Thompson, 2004). EFA, as its name implies, is used to explore such psychometric properties of a measure, e.g., a questionnaire.

Reliability Analysis

Internal consistency reliability was examined to determine "the homogeneity of the items within" (DeVellis, 2003, p. 27) the NMP-Q. Since internal consistency of a questionnaire is demonstrated by the intercorrelations among the items in the questionnaire (DeVellis, 2003), Cronbach's alpha was used for reliability analysis.

Correlation Analysis

To examine the relationship between the NMP-Q and MPIQ, a parametric correlation coefficient (the Pearson product-moment correlation) was used. The degree of the correlation between the scores provided evidence of similarity between the NMP-Q and MPIQ (DeVellis, 2003).

Summary

This chapter presented the research design for addressing the research questions guiding this study. The two-phase, exploratory sequential mixed methods research design was explained and the steps undertaken in each phase of the study were described. The first phase described the procedures for the qualitative exploration of the dimensions of nomophobia through semi-structured interviews conducted with nine undergraduate students from the population. In the second phase, procedures for testing the NMP-Q with a proportionately stratified sample of 301 undergraduate students from the population were described. Moreover, the steps followed in the development of the NMP-Q after the first phase of the study were presented in the interim phase.

CHAPTER 4

FINDINGS OF PHASE ONE: QUALITATIVE

This chapter presents the qualitative findings based on the analysis of the interviews conducted with nine undergraduate students recruited during the first phase of the study as described in Chapter 3. The purpose of the qualitative data collection and subsequent qualitative data analysis was to explore the dimensions of nomophobia as described by the college students. The findings of the first phase of the study are derived from qualitative analysis of the verbatim transcriptions of the interview, following the procedure explained in the previous chapter.

The research question that guided this first, qualitative phase of the study was: What are the dimensions of nomophobia as described by college students? Therefore, this chapter details the emergent themes that reflected the dimensions of nomophobia through exemplar statements from verbatim transcriptions of the interviews.

Understanding the Dimensions of Nomophobia

Four themes emerged from the interviews as the dimensions of nomophobia. These dimensions are: (1) *not being able to communicate*, (2) *losing connectedness*, (3) *not being able to access information* and (4) *giving up convenience*.

Throughout the rest of this chapter, pseudonyms are used to protect the participants' identities.

Dimension I: Not being able to communicate

The first theme that emerged as a dimension of nomophobia is not being able to communicate. It refers to the feelings of losing instant communication with people and not being able to use the services that allow for instant communication. The items under this theme are related to the feelings of not being able to contact people and to be contacted.

The interviews showed that the participants heavily relied on their smartphones and respective features for communication purposes. When asked in what ways he thought his smartphone affected his daily routines, Peter, a 21-year-old junior in Computer Engineering, said:

> It lets me keep in touch with... like my parents who live out of the state. We can text or talk all the day without like setting time aside to devote. We can just message each other as needed. For work and stuff, if someone has a question for me I can respond to them wherever I am.

For the same question, Olivia, who is a 21-year-old junior in Agricultural Education, responded as follows:

> It lets me communicate with people more easily. So if my schedule needs to change or I need to ask someone a question, I can do that more easily.

Lily, a 20-year-old sophomore in Elementary Education, said:

> I think it enhances [my daily routines] actually. Obviously communication is so much easier. You can just text a group to tell them where to meet up…

Ted, a 24-year-old senior in Mechanical Engineering, explained the importance of his smartphone as a communication tool as follows:

> It is like a good friend to me. It can help me solve many problems. Also, it is a very important way to connect to other people. For example, I am in the US right now, but most of my friends are in China or somewhere. I have to use my phone to communicate with them. It helps me feel better, feel I am not alone. For example, when I first came to the US, I just felt homesick but my phone helped me communicate with my family so I could feel better. Also, every morning when I wake up, my first thing is to get my phone and check what I got during the night. Since there is a time difference with where my friends live, they may send me something during the night. So every time I wake up I check my phone.

These quotations demonstrate the importance of smartphones as a communication tool for young adults. Owing to the place of smartphones in their lives, the participants expressed that they would feel anxious when they could not use their smartphones as illustrated by the following quotations.

> The part that would be unfortunate is like I can't receive any messages or email. I can't contact people I need to contact. That's not like a nice feeling. (Peter)

Peter’s statement about not being able to contact people was recurrently pointed out by other participants, as well. When asked how she would feel if she had left her smartphone at home,

Lily said she had forgotten her smartphone at home the day before the interview. She described her experience as follows:

> It is funny I did that yesterday [laughing]. I left it at home. Umm it was kind of weird because I couldn't text my roommate and say "when are you riding the bus home?" I couldn't communicate. For that instant communication, I had to wait until I opened my computer on Wi-Fi and typed out a message. [] The communication one was the hardest for me. [] Not being able to get a hold of people…

Lily's experience provides insight into the importance of instant communication for young adults. To her, instant communication meant being able to get a hold of someone through text messaging.

Similarly, another problem was related to being out of contact. Tracy, a 22-year-old senior in Kinesiology, said that she would feel anxious if she could not use her smartphone based on a recent experience:

> [] I just blew through my first 300 minutes a couple of days ago. I was like "Now how are people gonna call me?" Even that makes me have a feeling of anxiety.

Tracy also explained how she felt when her smartphone was broken. She said she hated the fact that she depended on her smartphone too much and added:

> The losing of contacts, connection and the losing of information too. Pictures are not a big deal. But I don't have the contacts anywhere else so I was like "how am I gonna contact people to let them know my phone is dead."

Thus, Tracy's statements highlight the value and importance young adults put on both contacting and being contactable by their family and/or friends.

While calls and text messages were highlighted in the participants' statements, email messages were another medium of communication for Astrid, a 22-year-old senior in Microbiology:

> I think I am too attached to my email like I get back to emails really quickly, which is great for some things, but sometimes I feel too plugged in to the email. [] I think that not being able to check my email would probably make me a little anxious just because I know at the end of the day I probably would have a full inbox. I wouldn't be able to check it. If someone like needed me for something, I wouldn't be able to respond right away.

To Astrid, email messages were just as important as calls and text messages. Her statement also shows her desire to respond to people immediately when they try to contact her.

Dimension II: Losing Connectedness

The second theme is losing connectedness. The items grouped under this theme are related to the feelings of losing the ubiquitous connectivity smartphones provide, and being disconnected from one's online identity (especially on social media).

The interviews revealed that connectedness was a driving force for young adults to use a smartphone. Astrid stated that one of the benefits of her smartphone was that it helped her stay connected. She said:

> I think it allows me to stay up-to-date with my friends and all of that. I also have this app that allows me… I went abroad this past summer so I have a lot of friends in Africa that I can't text. So it helps me stay connected to them because there is like this free texting app so I can text them for free through that. And then I think it facilitates my ability to stay connected to my classes like I have a Blackboard app that I check for updates and lecture notes and all of that.

Another important point raised by the participants was related to how they ensured that they saw the notifications from their smartphones. For instance, Peter said:

> When I am on my computer or something, I would leave my phone like facing this way [showing his smartphone facing up so he can see the screen when it is on the desk] and then there is a light here [showing the place of the light]. It would change like if it is olivine, it is a text from my girlfriend. If it is like blue, it is like a friend. If it is purple, it is an email. That way if I notice it and I can decide. If it is purple, I don't care about email right now so I can just work on.

Astrid stated:

> I have my smartphone like next to me on my desk like at home. So if it buzzes because someone like Facebooked me or whatever, I will check that and go back to what it is I am doing. I guess I don't like seeking out to check it while doing something but if I see that someone is like contacting me I will check it.

Lily said:

> If it is just sitting here and I know nothing has happened with it, I don't need to check it. Or if I don't hear it ring, or if it is just in a bag somewhere but if I hear it go off then I had that need of "what is it? what is the notification?" If I could, I would check. I wouldn't if I am having a meeting with a professor. I wouldn't check it; I would just wait. But if I am just doing something on my own, I would check it.

Ted recurred:

> If there is a notification, I would check it as soon as possible. If it is nothing important, I would continue what I was doing.

These quotations illustrate the importance young adults attach to making sure that they notice the notifications they receive from their smartphones and their desire to check their smartphones for notifications. They appear to view notifications as a way of ensuring connectedness: if they have notifications, it means they stay connected to their online identity and networks.

Connectedness seems not only related to their online identity but also to the smartphone itself. Tracy's comment provides an exemplar of this point:

> [*My smartphone*] is very important because of that connectedness and I got used to it. So it is hard to go backwards.

It is worth noting that Tracy brought up a recurrent point - being used to having a smartphone. When asked how she would feel if she did not have her smartphone with her, Olivia said:

> Because you are used to having it in your pocket or in your hand and it is like you are always touching your pockets, looking for it and like situations like on the bus or if I am sitting outside the classroom, waiting for the class to start, I don't know what to do with myself cause in that situation I'd be probably on my phone.

Furthermore, Peter commented:

> Once you are used to having a smartphone, you don't want to go back to having like an old phone.

These statements suggest an interesting point: not only do young adults, via their smartphones, feel connected to their online connections and networks but they do feel connected to their smartphones, as well.

When asked how she would feel if she had left her phone at home, Olivia said:

> Umm I have done that before and I just feel kind of like naked.

For the same question, John said he would feel awful. He added:

> Pretty much for me it is just like it becomes twined with your everyday routine and everything. I mean it is just like it is not comfortable to have a day without it. If you went all day without, uhh..., get rid of your backpack and pencils and stuff. Imagine going to a class and it would be just weird, I guess. For me, I lost my cell phone in a classroom one day. I couldn't find for like four hours. In that four hours, I was like I just lost power instead of cost, you know. So I guess losing it versus forgetting it is different but yeah I mean going without it is a huge drawback ‘cause it is entwined with everything today. It is also kind of an expectation. I guess for the most part society just kind of expects everybody to have a smartphone. So it is like "yeah, I will send an email. Reply once you get it." You know it is not like five hours later when you get home. They want responses quick.

John’s portrayal of his smartphone as being entwined with his daily routine shows how important connectedness is in his life. He brings up a very important point that having a smartphone is an expectation in society. To further explain his point, he added:

> It pretty much is considered mandatory in society now. People will complain about people who are on their smartphones too much but if you look around at what everybody else is doing if you didn't have a smartphone or you weren't on your smartphone, that's a lot of less productivity. It is just away from the norm.

Thus, he views not having a smartphone as an aberration from the norm.

Dimension III: Not being able to access information

The third theme is not being able to access information. The items under this theme reflect the discomfort of losing pervasive access to information through smartphones, being unable to retrieve information through smartphones and search for information on smartphones.

The interviews showed that accessing information on smartphones was of great importance for young adults. As a benefit of having a smartphone, Peter said:

> I like the ability of… if you are walking around, and you are like "oh, what is this song?" you can pull out an app that figures out what song is playing. If you are thinking about "what did I just learn in the lecture today?" you just pull out and google what the lecture note was and like no matter where you are, if you have a question you don't have to set that question aside. You can just figure out the answer like immediately. Things there most of the Internet, I guess.

Robin, a 21-year-old junior in Elementary Education, described the benefits of her smartphone in terms of how it facilitates access to information as follows:

> Benefits would be like I check the weather and check like if I have a question like about I didn't know when the [football] game was, so I could check when that was or questions like someone says something and I am like "what does that mean?" so I check it on my phone. Or "what actor was in that movie?" So that's kind of how I use it for that.

Similarly, Lily said her smartphone was very beneficial for accessing information and added:

> I use it for my news. I use CNN and BBC apps to like get the world news. I am constantly googling things, looking things up. So instant gratification in a way. Like I can find things right away if I wanna find or know something.

Ted said:

> It benefits me a lot. Just like with a smartphone I can get as much information as I want. Because I am an international student, when I have trouble reading something or I don't know what a word means I can look it up on the Internet. It provides me with a lot of information. Also, it has many features. It has a camera. It can work like an iPod or something. I can listen to music. I can take pictures. It also has GPS or navigation. It is very useful.

Barney, a 22-year-old senior in Aerospace Engineering, described the benefits of his smartphone as follows:

> Especially with class projects and stuff like that, it is really nice because I like to be able to look things up. That has come in handy a couple times, as I have been talking about. School projects with other friends.

To further explain how he uses his smartphone to access information, Barney also added:

> It is especially nice if I have a test coming up. Sometimes I take my study notes on Evernote. From there I can pull out my notes and just look at them quick. Sometimes I make some study notes. If I don't wanna pull out a bunch

> of sheets, I can like quick search through them to find different things. So many of my classes have like online stuff. For a good example, I had a German test yesterday. When I was on my way to the class, I just pulled out my smartphone, loaded up the PowerPoint and just started reviewing it while I was walking.

These quotations exemplify the importance put on accessing information through smartphones. Since it is a very essential component of their smartphone use, young adults report problems when they cannot access information through their smartphones. The following statements by Olivia provide an insight into this issue:

> I like having information at my fingertips like if I don't know the answer of something, I wanna know it right away. So I'm gonna use my smartphone to look it up. [] And if I couldn't answer a question right away, without that access to the Internet I feel like that would make me uncomfortable.

The same concern was pointed out by Peter, too. He said:

> I would feel anxious if I can't google information.

Dimension IV: Giving up convenience

The fourth theme identified as a result of the qualitative analysis is giving up convenience. The items grouped under this theme are related to the feelings of giving up the convenience smartphones provide and reflect the desire to utilize the convenience of having a smartphone.

The interviews revealed that the participants found their smartphones convenient. When describing his use of his smartphone, John said:

> [My smartphone use] has probably been excessive. I mean just because it is so convenient, I mean you have literally everything you need in your pocket. If I didn't have to type papers or play Legal Legend, I probably wouldn't need a laptop. I mean there is research, I suppose too. It is just convenient; you always have everything you need right there. [] I mean having like a 4G LT like everywhere here and having the convenience is really nice to have. Especially being able to drive anywhere now. We don't have like dead spots for the most part. I mean besides like a few spots you have pretty much Internet anywhere, which three years ago even you drive out of a city and there is nothing.

Although John believed that he was using his smartphone excessively, he did not seem to be worried about it because of the convenience it provides. When asked how he would feel if he could not use his smartphone, John stated:

> I would say it is kind of situational. For the most part, I would definitely feel anxious. I mean if you are in the middle of the day and if it is 2 o'clock and your class is until 4 or something, you know. It is like snowing outside. You know there is always stuff that can happen. Just being out of the loop completely and not having that right here you know... It is almost like a comfort that you carry around with you. It is like a peace of mind, I guess.

John appeared to associate having a smartphone with relaxing or relieving the stress of ‘being out of the loop.” Barney was also pleased with the convenience his smartphone provided. He described it even further:

> It is kind of a freedom. It is the same thing as moving from a desktop to a laptop computer. With desktop, obviously you are stuck wherever that is but with laptop you can freely move about the house or move to a friend's location. The same thing with the smartphone is now suddenly you don't even need the Internet. You can kind of move wherever then and you get access to the Internet and get access to anything. So it is kind of the same way of freedom. If I wanted to, I could access anything at any time.

These quotations demonstrate that having access to the Internet through the smartphone is one of the most convenient commodities smartphones allow for. Both John and Barney touched upon the convenience of constant and instant access to the Internet anywhere and anytime. If this convenience of having constant access to the Internet is not provided, then the feelings of discomfort emerge, as demonstrated by the following statements. Robin said:

> It would be kind of annoying because it is just I am used to it again. If I don't have service for the Internet, then I would be like always keep trying to see if I do have service or something like that. If I am in a different state, it doesn't always work out and so that's really annoying. I am always like "oh, I wish I was back in Iowa so I could use my smartphone again." One time my smartphone broke, then I got a non-smartphone to use and then it wasn't as big of a deal because I knew it didn't have those capabilities. But I already

> knew that. If this one [showing her smartphone] wasn't working, again that would be annoying because I am paying for it and I know that I should be able to use it.

As Robin's statements show, when she knows she should be able to use her smartphone and utilize the convenience it offers, she expects to have it available all the time. If not, she feels annoyed. Based on her experience with the "non-smartphone", it might be that as the expectations from the smartphone increase, the feelings of annoyance and/or anxiety tend to be more severe.

Moreover, Ted stated:

> Sometimes I feel anxious but mostly if there is not internet connection, I would try to go somewhere else to get access to the Internet. If my battery goes dead, I would try to charge my phone. I would try to make it alive.

Likewise, Ted, who was an international student, said:

> Actually, when I am with my family and friends, I would not feel uncomfortable if my battery is low or dead. I think when I am lonely, I feel my phone is a very important thing. But when I am not alone, or I have something to do, I don't feel the same.

Ted's comment is an exemplar of the effect of loneliness and being with family and friends on the feelings attached to the smartphone.

The importance of having battery in the smartphone was pointed out by another participant, as well. John, who was previously reported to believe that his smartphone was a peace of mind for him, expressed his desire for having a charged battery in his smartphone as follows:

> [] If it does go dead, that's the sort of thing when it is like "I need to charge my phone right now". Especially, if I'm not at home and it dies, it is just an uncertainty of like what if I forgot my keys? [] If it does die, you lose a peace of mind.

This statement exemplifies how important it is for young adults to have a charged battery so that their smartphone will be “alive”. John appeared to attach the same value to having his smartphone with him as the value to having his keys with him.

Another important point was made by Tracy when asked to describe her smartphone use. She said:

> Ummm, I would probably say that I am addicted to my phone based on when my phone died a couple of weeks ago and I had to get a new one and I was like "Oh my Gosh what am I gonna do?". And then within 24 hours I had a new phone, just real quick. [] I felt like I was gonna get stranded somewhere [laughing]. [] Like "well, I don't have phone now. What do I do?" Like Dark Ages. Just kidding but yeah [laughing]”

Tracy described herself as being addicted to her smartphone. She appeared to count on her smartphone as a means of ensuring safety.

Summary

This chapter presented the findings of the first, qualitative phase of the study. As a result of the analysis of the interviews conducted with nine undergraduate students from the population, this chapter focused on identifying and describing the dimensions of nomophobia. Based on the findings from this phase, four dimensions of nomophobia were identified: *not being able to communicate, losing connectedness, not being able to access information and giving up convenience.* The first dimension of nomophobia, not being able to communicate, refers to the feelings of losing instant communication with people and not being able to use the services that allow for instant communication. The items under this theme are related to the feelings of not being able to contact people and to be contacted. The items grouped under the second dimension, losing connectedness, are germane to the feelings of losing the ubiquitous connectivity smartphones provide, and being disconnected from one's online identity. The items under the third dimension, not being able to access information, reflect the discomfort of losing pervasive access to information through smartphones, being unable to retrieve information through smartphones, and being unable to search for information on smartphones. Finally, the items in the fourth dimension of nomophobia, giving up convenience, are related to the feelings of giving up the convenience smartphones provide and reflect the desire to utilize the convenience of having a smartphone.

CHAPTER 5

RESULTS OF PHASE TWO: QUANTITATIVE

In this chapter, the results of the Phase Two, which is the quantitative phase of the study, are presented. The primary purpose of the quantitative phase was to assess the validity and reliability of the questionnaire developed as a result of the first, qualitative phase. For this purpose, this chapter presents the results of the statistical analyses of the quantitative data collected from both the pilot study and main study. The specific analyses performed include exploratory factor analysis with principal component extraction (and varimax rotation), reliability analysis with Cronbach's alpha, Bartlett's test of sphericity, Kaiser-Meyer-Olkin measure of sampling adequacy, the Pearson product-moment correlation, and other relevant descriptive analyses. This chapter first presents the results of the pilot study, and then it elaborates more on the results of the main study.

Results of the Pilot Study

Principal component extraction with varimax rotation and reliability analysis were performed on the 20 items in the questionnaire for a sample of 86 undergraduate students. As discussed in Chapter 3, the primary purpose of the pilot study was to test the internal consistency of the items rather than extracting the exact number of factors because of the small size of the sample to conduct exploratory factor analysis that could help to make a good decision about the adequacy of factors and rotation. Table 5.1 details the results of the EFA and reliability analysis of the items in the pilot study.

Table 5.1. Exploratory Factor Analysis and Reliability Analysis of All Items in Pilot Study

Items	Factor Loading					Communality after Extraction	Corrected Item-Total Correlation	Cronbach's Alpha If Item Deleted
	1	2	3	4	5			
1			**.784**			.655	.339	.918
2				**.783**		.760	.481	.916
3				**.632**		.698	.536	.915
4				**.658**	**.545**	.778	.441	.916
5		**.540**				.594	.623	.913
6			**.536**			.600	.594	.913
7			**.640**			.647	.658	.912
8			**.772**			.696	.559	.914
9					**.765**	.693	.396	.918
10	**.633**					.684	.729	.911
11	**.787**					.722	.574	.914
12	**.821**					.796	.674	.912
13	**.897**					.838	.603	.913
14	**.860**					.753	.495	.915
15	**.656**					.705	.726	.910
16		**.784**				.813	.681	.911
17		**.816**				.756	.647	.912
18		**.817**				.785	.649	.912
19	**.522**					.696	.529	.915
20		**.716**				.628	.571	.914
% of Variance	22.6	18.6	13.6	9.4	7.3	**Overall Cronbach's Alpha**		**.918**

As seen in Table 5.1, five factors were extracted and they accounted for approximately 71.5% of variance. Factor structure differed greatly, however, from what was expected after the qualitative phase of the study. Item 4 was a complex item because it loaded on both Factor 4 and Factor 5. While all the other factors had multiple items with salient loadings, Factor 5 had only two items: Item 4 and Item 5. Considering that Item 5 loaded on Factor 4 with a greater loading value, Factor 5 had only one item, Item 9. Such a factor structure did not make sense both statistically and conceptually. This complicated factor structure was ascribed to the small size of the sample and therefore the researcher decided to focus more on the internal consistency of the items. Table 5.1 also shows the results of the reliability analysis for the pilot study. Cronbach's alpha for all of the 20 items in the questionnaire was .918, indicating a good internal consistency.

Moreover, reliability analysis of the pilot study data revealed that intercorrelations among the items were good and no item needed to be deleted so that the internal consistency of the overall questionnaire would increase. Considering the total variance accounted for by the items (71.5%), high value of overall Cronbach's alpha, intercorrelations among the items, and the contribution of each item to the overall internal consistency, it was concluded that all items were important and needed to be included in the questionnaire.

Results of the Main Study

Data collected during the main study were analyzed following the same procedures as the pilot study. Principal component analysis (PCA) with varimax rotation was performed on the 20 items in the questionnaire for a sample of 301 undergraduate students. The results of the main study are presented in four sections: (1) item analysis, (2) exploratory factor analysis, (3) reliability analysis, and (4) correlation analysis.

Item Analysis

Table 5.2 provides an item-level summary of the descriptive statistics for each item, including the number and percentage of respondents for each response level (from 1 to 7), and the mean and standard deviation for each item. As seen in the table, item means generally tend to be close to the center of the range; they are not too near to the extremes, which is regarded as "desirable" by DeVellis (2003, p. 94).

Table 5.2. Nomophobia Questionnaire Item-Level Summary Statistics (N=301)

Items	Responses														Mean	SD
	1		2		3		4		5		6		7			
	n	%	n	%	n	%	n	%	n	%	n	%	n	%		
Item 1	19	6.3	20	6.6	41	13.6	54	17.9	84	27.9	51	16.9	32	10.6	4.48	1.632
Item 2	8	2.7	16	5.3	19	6.3	29	9.6	81	26.9	93	30.9	55	18.3	5.19	1.505
Item 3	33	11.0	45	15.0	51	16.9	65	21.6	57	18.9	36	12.0	14	4.7	3.77	1.673
Item 4	6	2.0	13	4.3	17	5.6	35	11.6	86	28.6	76	25.2	68	22.6	5.27	1.464
Item 5	33	11.0	48	15.9	53	17.6	51	16.9	45	15.0	44	14.6	27	9.0	3.89	1.828
Item 6	63	20.9	49	16.3	56	18.6	54	17.9	29	9.6	31	10.3	19	6.3	3.35	1.841
Item 7	32	10.6	53	17.6	42	14.0	48	15.9	53	17.6	51	16.9	22	7.3	3.92	1.821
Item 8	34	11.3	46	15.3	47	15.6	51	16.9	53	17.6	40	13.3	30	10.0	3.94	1.843
Item 9	7	2.3	12	4.0	24	8.0	46	15.3	87	28.9	66	21.9	59	19.6	5.09	1.485
Item 10	11	3.7	25	8.3	45	15.0	54	17.9	74	24.6	63	20.9	29	9.6	4.53	1.578
Item 11	8	2.7	19	6.3	39	13.0	40	13.3	84	27.9	70	23.3	41	13.6	4.82	1.548
Item 12	10	3.3	23	7.6	35	11.6	54	17.9	82	27.2	62	20.6	35	11.6	4.66	1.559
Item 13	12	4.0	21	7.0	37	12.3	48	15.9	82	27.2	68	22.6	33	11.0	4.67	1.575
Item 14	7	2.3	22	7.3	33	11.0	48	15.9	77	25.6	71	23.6	43	14.3	4.83	1.554
Item 15	31	10.3	41	13.6	45	15.0	63	20.9	62	20.6	34	11.3	25	8.3	3.95	1.742
Item 16	89	89.6	67	22.3	48	15.9	50	16.6	21	7.0	12	4.0	14	4.7	2.80	1.709
Item 17	91	30.2	52	17.3	53	17.6	31	10.3	37	12.3	21	7.0	16	5.3	2.99	1.862
Item 18	78	25.9	57	18.9	52	17.3	43	14.3	37	12.3	16	5.3	18	6.0	3.08	1.817
Item 19	54	17.9	51	16.9	64	21.3	50	16.6	39	13.0	24	8.0	19	6.3	3.39	1.777
Item 20	73	24.3	52	17.3	52	17.3	55	18.3	25	8.3	27	9.0	17	5.6	3.19	1.829

For all items N=301. Responses rated from 1 to 7, with "1" being strongly disagree and "7" strongly agree.

Exploratory Factor Analysis

As an initial solution, PCA was performed on the 20 items in the questionnaire before rotating the factors to estimate the factorability of the correlation matrix and the likely number of factors.

Initially, the correlation matrix, shown in Table 5.3, was examined for correlations among the items. Since there were numerous correlations among the items exceeding .30, it was concluded that the use of PCA was appropriate for the matrix (Tabachnick & Fidell, 2013). To further investigate the factorability of the matrix, Bartlett's test of sphericity was used to examine partial correlations in addition to bivariate correlations. Moreover, the Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy was examined to assess the sampling adequacy during the analysis. Barlett's test of sphericity was significant ($\chi^2(190) = 4266.807$, $p<.01$), which rejected the null hypothesis that the correlations in the correlation matrix were zero and that the matrix was an identity matrix. As for the adequacy of sampling, the KMO index was .941, which is greater than the minimum acceptable value of .60 (Tabachnick & Fidell, 2013). In fact, a KMO value of .90 or greater would be considered "marvelous," as suggested by Kaiser (1974). Thus, the results of these tests indicate that the factor analysis can be considered appropriate.

Table 5.3. Correlation Matrix for the 20 Items in the Questionnaire

Items	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
1	.538	.568	.475	.386	.398	.353	.322	.400	.457	.379	.455	.491	.407	.439	.383	.463	.445	.508	.450
2		.525	.739	.394	.356	.396	.335	.470	.521	.357	.494	.460	.405	.317	.305	.350	.376	.398	.409
3			.451	.398	.446	.344	.368	.317	.479	.450	.492	.491	.443	.473	.437	.404	.406	.469	.372
4				.446	.424	.405	.353	.514	.516	.370	.486	.482	.423	.354	.352	.406	.433	.434	.415
5					.603	.562	.470	.431	.424	.406	.491	.418	.457	.375	.475	.471	.489	.417	.452
6						.577	.391	.422	.429	.377	.458	.461	.419	.379	.498	.503	.484	.455	.446
7							.395	.504	.425	.375	.421	.406	.437	.356	.510	.538	.562	.444	.433
8								.400	.417	.382	.382	.368	.403	.297	.256	.241	.309	.423	.312
9									.532	.469	.509	.535	.538	.323	.435	.492	.501	.503	.482
10										.741	.759	.797	.640	.448	.435	.462	.434	.678	.494
11											.734	.794	.717	.414	.405	.412	.366	.648	.316
12												.805	.762	.494	.470	.478	.440	.642	.463
13													.753	.485	.458	.516	.459	.742	.459
14														.496	.444	.429	.431	.629	.368
15															.556	.453	.483	.451	.367
16																.800	.742	.531	.506
17																	.799	.571	.551
18																		.575	.553
19																			.561

As a result of the initial solution, four factors explaining 69.6% of variance were extracted with initial eigenvalues larger than 1 (see Table 5.4). Eigenvalues can be used to determine the likely number of factors to be extracted. Factors with eigenvalues greater than 1 are considered important and therefore retained because they account for a significant amount of variance (Field, 2009; Kaiser, 1960; Tabachnick & Fidell, 2013).

Table 5.4. Eigenvalues and Total Variance Explained by Factors Before and After Rotation

	Initial Eigenvalues			Rotation Sums of Squared Loadings		
	Total	**% of Variance**	**Cumulative %**	**Total**	**% of Variance**	**Cumulative %**
Factor I	9.979	49.894	49.894	4.575	22.877	22.877
Factor II	1.653	8.264	58.158	3.695	18.477	41.354
Factor III	1.264	6.318	64.476	2.863	14.317	55.671
Factor IV	1.022	5.110	69.586	2.783	13.915	69.586

The scree plot of the eigenvalues and factors visually supports that a four-factor structure is a reasonable estimate because the eigenvalues start descending below 1 after that point.

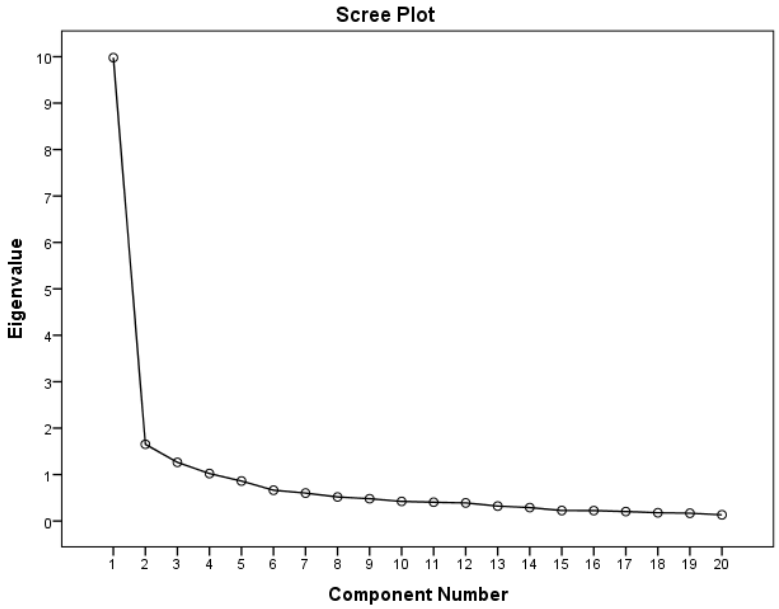

Figure 5.1. Scree Plot of Eigenvalues and Factors

Having determined the estimated number of factors, a second run of PCA with varimax rotation was performed to enhance the interpretability of the factors. Varimax rotation, which is the most commonly used orthogonal technique, minimizes factor complexity with maximized variance of factor loadings (Tabachnick & Fidell, 2013). The reason for the use of an orthogonal rotation technique emanated from the need for orthogonal factors in other analyses (e.g., correlation test). As can be seen from Table 5.4, after rotation Factor I - *not being able to communicate*- accounts for 22.9% of item variance, Factor II - *losing connectedness*- accounts for 18.5% of item variance, Factor III - *not being able to access information*- accounts for 14.3% of item variance, and Factor IV - *giving up convenience*- accounts for 13.9% of item variance. Considering the substantial proportion of variance accounted for by each factor, it was concluded that the factors were important for the questionnaire (Tabachnick & Fidell, 2013).

Loadings of the items on each factor are shown in Table 5.5. To facilitate interpretation of the table, items are ordered and grouped by factor loadings. For the interpretation of factor loadings, Comrey and Lee (1992) propose that loadings ≥ .71 (50% overlapping variance) can be considered "excellent", loadings ≥ .63 (40% overlapping variance) "very good", loadings ≥ .55 (30% overlapping variance) "good", loadings ≥ .45 (20% overlapping variance) "fair", and loadings ≥ .32 (10% overlapping variance) "poor." Tabachnick & Fidell (2013) recommend that only variables with factor loadings ≥ .32 should be interpreted, and they assert that "the greater the loading, the more the variable is a pure measure of the factor" (p. 654). Therefore, a factor loading of .45 was used as a cutoff value. In the table, the loadings ≥ .45 are written in boldface.

Table 5.5. Factor Loadings from Rotated Component Matrix: PCA with Varimax

Items	Factor			
	1	**2**	**3**	**4**
11. If I did not have my smartphone with me, I would be worried because my family and/or friends could not reach me.	**.861**	.148	.119	.200
13. If I did not have my smartphone with me, I would be anxious because I could not keep in touch with my family and/or friends.	**.836**	.258	.262	.172
12. If I did not have my smartphone with me, I would feel nervous because I would not be able to receive text messages and calls.	**.782**	.228	.276	.238
14. If I did not have my smartphone with me, I would be nervous because I could not know if someone had tried to get a hold of me.	**.778**	.206	.162	.278
10. If I did not have my smartphone with me, I would feel anxious because I could not instantly communicate with my family and/or friends.	**.753**	.197	.331	.234
15. If I did not have my smartphone with me, I would feel anxious because my constant connection to my family and friends would be broken.	**.646**	.425	.228	.213
16. If I did not have my smartphone with me, I would be nervous because I would be disconnected from my online identity.	.242	**.838**	.110	.206
17. If I did not have my smartphone with me, I would be uncomfortable because I could not stay up-to-date with social media and online networks.	.235	**.835**	.169	.220
18. If I did not have my smartphone with me, I would feel awkward because I could not check my notifications for updates from my connections and online networks.	.180	**.800**	.202	.287
19. If I did not have my smartphone with me, I would feel anxious because I could not check my email messages.	.390	**.512**	.272	.046
20. If I did not have my smartphone with me, I would feel weird because I would not know what to do.	.214	**.523**	.326	.295
2. I would be annoyed if I could not look information up on my smartphone when I wanted to do so.	.208	.084	**.830**	.259
4. I would be annoyed if I could not use my smartphone and/or its capabilities when I wanted to do so.	.211	.142	**.734**	.340
1. I would feel uncomfortable without constant access to information through my smartphone.	.254	.342	**.668**	.088
3. Being unable to get the news (e.g., happenings, weather, etc.) on my smartphone would make me nervous.	.324	.288	**.605**	.119
5. Running out of battery in my smartphone would scare me.	.204	.304	.197	**.708**
8. If I could not use my smartphone, I would be afraid of getting stranded somewhere.	.294	-.027	.200	**.672**
7. If I did not have a data signal or could not connect to Wi-Fi, then I would constantly check to see if I had a signal or could find a Wi-Fi network.	.165	.421	.134	**.669**
6. If I were to run out of credits or hit my monthly data limit, I would panic.	.197	.384	.195	**.623**
9. If I could not check my smartphone for a while, I would feel a desire to check it.	.375	.272	.284	**.473**

Factor loadings > .45 are in bold.

As can be seen from Table 5.5, each item loaded on a single factor and the loadings on other factors were generally very low, except for Item 7 and Item 15. Item 7 had a loading value of .669 on Factor IV - giving up convenience- and of .421 on Factor II – losing connectedness. Similarly, Item 15 had a loading value of .646 on Factor I – not being able to communicate- and of .425 on Factor II – losing connectedness. Due to the fact that their loadings on the primary factors were more salient and thus explained more variance, and that with a cutoff value of .45, their loadings on the secondary factors would not be considered, these items were considered to load on their primary factors.

When Table 5.5 is closely examined, it can be seen that the majority of the items had excellent or very good loadings on a single factor and some had good loadings. This factor structure, which has several variables correlating with each factor and only one factor correlating highly with each variable, is referred to as "simple structure" (Thurstone, 1947). The presence of simple structure supports the adequacy of rotation (Tabachnick & Fidell, 2013).

Table 5.6 shows the factor loading of each item under each factor, communality values after extraction, corrected item-total correlation for each item, Cronbach's alpha if item deleted, and the internal consistency of each factor (α). Communality of a variable refers to the amount of variance that can be predicted by the factor(s) on which it loads (Tabachnick & Fidell, 2013). With PCA, the initial communality for all items is 1, and the decision as to whether the variance is predictable by the underlying factor is made by examining the communalities after factor extraction. As seen in Table 5.6, the extract communality values are reasonably high for all items, suggesting that the items loading on each factor can be well predicted by the respective factors.

Table 5.6. Exploratory Factor Analysis and Reliability Analysis of All Items

Items	Factor Loading	Communality after Extraction	Corrected Item-Total Correlation	Cronbach's Alpha If Item Deleted	Alpha
Factor I – Not being able to communicate					**.939**
Item 11	.861	.818	.675	.942	
Item 13	.836	.864	.774	.941	
Item 12	.782	.797	.764	.941	
Item 14	.778	.751	.714	.942	
Item 10	.753	.770	.751	.941	
Item 15	.646	.694	.756	.941	
Factor II – Losing Connectedness					**.874**
Item 16	.838	.815	.682	.942	
Item 17	.835	.829	.706	.942	
Item 18	.800	.795	.703	.942	
Item 19	.512	.490	.592	.944	
Item 20	.523	.512	.629	.943	
Factor III – Not being able to access information					**.827**
Item 2	.830	.807	.600	.943	
Item 4	.734	.719	.628	.943	
Item 1	.668	.635	.618	.943	
Item 3	.605	.569	.619	.943	
Factor IV – Giving up convenience					**.819**
Item 5	.708	.674	.643	.943	
Item 8	.672	.578	.503	.945	
Item 7	.669	.671	.634	.943	
Item 6	.623	.612	.641	.943	
Item 9	.473	.520	.654	.943	
				Overall Cronbach's Alpha	**.945**

Reliability Analysis

As can be seen from Table 5.6, reliability analysis of the questionnaire shows that Cronbach's alpha reliability coefficient for internal consistency of the questionnaire is .945, indicating that the questionnaire has good internal consistency (DeVellis, 2003; Field, 2009; Nunnally, 1978). In fact, an alpha value of .945 is considered "excellent," according to George and Mallery (2011). In order to assess the internal consistency of each factor, Cronbach's alpha was computed separately for each factor. The alpha coefficients of Factor I – not being able to communicate- (6 items), Factor II – losing connectedness- (5 items),

Factor III – not being able to access information- (4 items) and Factor IV – giving up convenience- (5 items) were .939, .874, .827, and .814, respectively. They were all above the commonly accepted minimum value of .7 (Nunnally, 1978), suggesting that they have good reliability.

To assess the reliability of each item, corrected item-total correlation and Cronbach's alpha if item deleted values were taken into consideration. Corrected item-total correlation is a measure of the extent to which an item correlates with all the other items in a questionnaire, excluding the item itself (DeVellis, 2003). All corrected item-total correlations were greater than .40, showing that all items correlate with the total. Cronbach's alpha if item deleted refers to the Cronbach's alpha value of the total items if a given item were to be excluded from the questionnaire. The comparison of the Cronbach's alpha if item deleted to Cronbach's alpha reliability coefficient for internal consistency of the questionnaire (.945) reveals that there is no item whose deletion will result in an increase in the Cronbach's alpha of all items. Based on these two analyses, it was concluded that no item needed to be deleted from the questionnaire, as suggested by Field (2009).

Correlation Analysis

For correlation analysis, a nomophobia score was computed for each case in the dataset using the four factor scores estimated by the statistical software using the Anderson-Rubin method to generate factor scores. To create a Mobile Phone Involvement score for each case, a PCA with varimax rotation was performed on the items in the Mobile Phone Involvement Questionnaire (MPIQ). With this PCA on MPIQ, a single factor solution was requested because the eight items on MPIQ were reported to "assess a unitary construct"

(Walsh et al., 2010, p. 198). The Mobile Phone Involvement score was computed in the same way as Nomophobia score.

A Pearson product-moment correlation coefficient was computed to assess the relationship between the scores of the participants on the Nomophobia Questionnaire and Mobile Phone Involvement Questionnaire. Nomophobia scores and Mobile Phone Involvement scores were strongly and directly correlated, $r(299) = .710$, $p < .01$. The strong correlation between the two scores provided evidence of similarity between the two questionnaires (DeVellis, 2003).

Summary

This chapter presented the results of the data analyses undertaken to investigate the validity and reliability of the NMP-Q The results of the pilot study conducted with 86 undergraduate students provided evidence for the internal consistency of all 20 items in the questionnaire (Cronbach's alpha = .918). Because of the small size of the sample in the pilot study, the exploratory factor analysis did not produce a reasonable factor structure. After the pilot study, all the 20 items in the questionnaire were retained and administered to a large sample of 301 undergraduate students in the main study. The data collected from the main study were subjected to item analysis, exploratory factor analysis, reliability analysis, and correlation analysis. First, item analysis of the main study showed that the items had desirable mean values, not too near to the extreme values of the rating scale (1 and 7). Second, for exploratory factor analysis, a principal component analysis with varimax rotation was conducted on the 20 items in the questionnaire. Four factors explaining 69.6% of variance were extracted. With a cutoff value of .45, all the items loaded on only a single factor, indicating that the factor structure was a simple structure. Third, the reliability

analysis of the items revealed that all the items correlated well with each other, and that no item needed to be deleted from the questionnaire so that the internal consistency of the questionnaire would increase. The overall internal consistency of the questionnaire was very good (Cronbach's alpha = .945). Last, the correlation analysis demonstrated that the scores on the NMP-Q and the Mobile Phone Involvement Questionnaire were strongly correlated, which indicated that two questionnaires measured similar constructs and ensured the construct validity of the NMP-Q.

CHAPTER 6

CONCLUSIONS

Nomophobia has received scarce attention from researchers as a theoretical construct with the exception of a few studies (King et al., 2010; King et al., 2013; King et al., 2014). Following a systematic mixed methods research design, this study attempted to investigate nomophobia as a theoretical construct by exploring the dimensions of nomophobia and devising a valid and reliable questionnaire to measure nomophobia.

This chapter presents the discussion of the findings and results of this study and the conclusions drawn from this study. For this purpose, this chapter summarizes the study by addressing the research questions that guided the research undertaken within the scope of this thesis. Then, the conclusions of the study are presented. The chapter concludes by addressing the limitations of the study and providing some directions for future research.

Research Questions Addressed

The findings and results of this study are discussed in terms of the research questions addressed within the scope of this study:

Research Question 1: What are the dimensions of nomophobia as described by students?

This research question guided the first, qualitative phase of the study, which explored the dimensions of nomophobia through semi-structured interviews with nine undergraduate students from the population. As a result of the qualitative data analysis, four themes

emerged as the dimensions of nomophobia. The four dimensions of nomophobia are summarized below:

Dimension I: Not being able to communicate

This dimension refers to the feelings of losing instant communication with people and not being able to use the services that allow for instant communication. It also encompasses the feelings of not being able to contact people and to be contacted.

Dimension II: Losing connectedness

This dimension is related to the feelings of losing the ubiquitous connectivity that smartphones provide, and being disconnected from one's online identity (especially on social media).

Dimension III: Not being able to access information

The dimension of not being able to access information reflects the discomfort of losing pervasive access to information through smartphones, being unable to retrieve information through smartphones, and being unable to search for information on smartphones.

Dimension IV: Giving up convenience

This dimension is pertinent to the feelings of giving up the convenience smartphones provide and reflects the desire to utilize the convenience of having a smartphone.

Research Question 2: Does the Nomophobia Questionnaire (NMP-Q) generate reliable scores?

Based on the results of the reliability analysis, the internal consistency coefficient, Cronbach's alpha, for all the items in the NMP-Q was .945. Cronbach's alpha values for the four dimensions were .939, .874, .827, and .814, respectively. Given that all values exceed the commonly accepted minimum value of .7 (Nunnally, 1978), it is concluded that the NMP-Q demonstrates good internal consistency (DeVellis, 2003; Field, 2009; Nunnally, 1978), and therefore it generates reliable scores.

Research Question 3: Does the NMP-Q generate valid scores?

The four-factor solution obtained as a result of the exploratory factor analysis corroborates the connection of the four dimensions to the theoretical construct of nomophobia, and thus ensures the construct validity of the NMP-Q (DeVellis, 2003). The comparison of the scores obtained from the NMP-Q with those of Mobile Phone Involvement Questionnaire (MPIQ) indicates that there is a significantly strong correlation between the scores, $r(299) = .710$, $p < .01$. The MPIQ has been previously proved to produce valid scores (Walsh et al., 2010). Also, the strong correlation between the scores of NMP-Q and MPIQ provides evidence for the similarity between the questionnaires and suggests that they should behave in similar ways (DeVellis, 2003). Hence, the NMP-Q generates valid scores.

Research Question 4: To what extent do the dimensions of nomophobia identified as a result of the first, qualitative phase inform the design and development of the NMP-Q in the second, quantitative phase?

The first, qualitative phase allowed for the exploration of the dimensions of nomophobia. During the interim phase, the findings of the first phase were utilized to

construct the items for each dimension, using the interviewees' sentences. This process resulted in the development of the NMP-Q. Thus, the NMP-Q was devised in the second, quantitative phase, building on the findings of the first, qualitative phase.

Conclusions

This two-phase, exploratory sequential mixed methods study sought to explore the dimensions of nomophobia and to design and develop a questionnaire to measure nomophobia. In doing so, this study extended nomophobia research by exploring the dimensions of nomophobia and devising a validated nomophobia questionnaire.

In line with King et al. (2010), this study purports that nomophobia, or no mobile phone phobia, can be considered a modern age phobia introduced to our lives with the rapid proliferation and adoption of smartphones. Within the scope of this study, nomophobia is defined as the fear of not being able to use a smartphone or a mobile phone and/or the services it offers. It refers to the fear of not being able to communicate, losing the connectedness that smartphones allow, not being able to access information through smartphones, and giving up the convenience that smartphones provide.

King et al. (2010) and King et al. (2014) suggest that nomophobia be regarded as a situational phobia. Based on the description of specific situational phobias (Choy et al., 2007), this study also confirms that nomophobia can be considered a situational phobia evoked by the unavailability of a smartphone or the thought of not having it, not being able to use it and losing it. Considering the DSM-5 Criteria for Specific Phobia (American Psychiatric Association, 2013), it is plausible that nomophobia may be listed as a situational phobia under specific phobia identified in DSM-5.

The use of mixed methods research, specifically exploratory sequential design, made it possible to explore qualitatively the dimensions of nomophobia through the experiences of individuals from the population. Then, a questionnaire to measure nomophobia (NMP-Q) was created based on the dimensions identified as a result of the qualitative exploration. Subsequently, the NMP-Q was also tested quantitatively, and the extent to which it reflected the dimensions of nomophobia was determined. Thus, by utilizing both qualitative and quantitative approaches, this study provided greater insight into nomophobia as a theoretical construct than could be obtained using either qualitative methods or quantitative methods. In that manner, this study has contributed to the nomophobia research literature by revealing the dimensions of nomophobia, and by devising and testing the NMP-Q, which was proven to yield valid and reliable scores. Moreover, the specific methodology employed in this study provided an exemplar of how an exploratory sequential mixed methods design could guide the development of new measures to investigate the impact of technology on people's lives.

Limitations

With its novel approach to investigating nomophobia as a theoretical construct, this study provides a better understanding of the dimensions of nomophobia. However, there are certain limitations that should be addressed.

One limitation is pertinent to the sample used in the study. Although the population of this study is undergraduate students in the U.S., selecting the entire sample from a large Midwestern university may be a limitation to the generalizability of the study's findings and results: this limitation should be considered when interpreting these findings and results. This study would benefit from diversifying the sample by recruiting undergraduate students from other universities across the U.S.

Another limitation is again related to sampling. In the second, quantitative phase of the study the NMP-Q was administered to a sample of 301 undergraduate students (135 men, 166 women). In this sample, women were overrepresented (55.1%) because the actual representation of women in the population used in this study was 43%.

Yet another limitation may be related to the scope of this study. The purpose of this study was to investigate the phenomenon of nomophobia among college students. Nonetheless, since nomophobia is presumably prevalent in other demographic groups using smartphones, this study could benefit from extending the generational scope and including other age groups, such as adolescents, graduate students, professional students and a broader spectrum of adults, not limited to young adults. Lastly, as with any other self-reported questionnaire, the self-reported structure of the NMP-Q may be a limitation because of social desirability bias.

Directions for Future Research

Through the exploration of the dimensions of nomophobia and development of the NMP-Q, this study provides various possible directions for research in the following areas.

As an initial step, the factor structure of the NMP-Q can be further investigated through confirmatory factor analysis and structural equation modeling to assess the model fit of the dimensions of nomophobia. Also, future research can examine the relationship between nomophobia and other psychological characteristics, such as personality traits, social anxiety, and self-efficacy, among others. Moreover, the predictors of nomophobia could be identified. Furthermore, the NMP-Q can be administered to a large and more diverse sample to examine the differences among individuals in terms of such demographic characteristics as age, gender, education level, and socio-economic status. Additionally,

another possible direction can be to examine the relationship between nomophobia and academic motivation and success because of the widespread adoption of smartphones by college students.

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APPENDIX A

SCREENING QUESTIONNAIRE FOR INTERVIEWS

1. Your age: _____

2. Your sex: a) Male b) Female

3. Year of study: a) Freshman b) Sophomore c) Junior d) Senior

4. Your major (e.g., Education): _____

5. Your college (e.g., Human Sciences): _____

6. For how long have you been using a smartphone?
   a. Less than a year
   b. 1 year to less than 2 years
   c. 2 years to less than 3 years
   d. 3 years to less than 4 years
   e. 4 years to less than 5 years
   f. 5 years or more

7. Do you have a mobile data plan that allows you to access the Internet via your smartphone?
   a) Yes b) No

8. Approximately how much time do you think you spend a day using your smartphone?
   _____ minutes or hours

For the following questions (9-12), please indicate how frequently the statements below apply to you.

Scale 0: Never, 1: Rarely, 2: Sometimes, 3: Often, 4: Frequently

9. I have been warned about using my smartphone too much.	0	1	2	3	4
10. I have put a limit on my smartphone use and I couldn't stick to it.	0	1	2	3	4
11. I have gone to bed later or slept less because I was using my smartphone.	0	1	2	3	4
12. When I am bored, I use my smartphone.	0	1	2	3	4

For the following questions (13-16), please indicate the extent to which you agree or disagree with the statements presented below.

Scale 0: Completely disagree, 1: Disagree somewhat, 2: Neutral, 3: Agree somewhat, 4: Completely agree

13. If I don't have my smartphone, I feel bad.	0	1	2	3	4
14. As soon as I get up in the morning, the first thing I do is to check my smartphone.	0	1	2	3	4
15. I don't think I could stand spending a week without my smartphone.	0	1	2	3	4
16. When I feel lonely, I use my smartphone.	0	1	2	3	4

APPENDIX B

INFORMED CONSENT FORM FOR INTERVIEWS

Title of Study: Exploring the Dimensions of Nomophobia: Developing and Validating a Questionnaire Using Mixed Methods

Principal Investigator: Caglar Yildirim

Introduction

This form describes a research project. It has information to help you decide whether or not you wish to participate. Research studies include only people who choose to take part—**your participation is completely voluntary**. Please discuss any questions you have about the study or about this form with the principal investigator before deciding to participate.

You are being invited to participate in this interview because you have filled out a screening questionnaire and indicated that you are at least 18 or older and that you have a smartphone. You should not participate if you are under age 18.

Description of Procedures

If you agree to participate, you will be interviewed and asked several questions about your smartphone use habits and its place in your life. The interview will approximately take 15-20 minutes. The interviews will be recorded with an audio recorder. The recording and its content will be kept confidential to the extent permitted by applicable laws and regulations and will not be made publicly available.

Compensation

You will be compensated for participating in this study. If you decide to participate in the study, you will receive a **$5 ISU Dining Gift Card**.

Participant Rights

Participating in this study is completely voluntary. You may choose not to take part in the study or to stop participating at any time, for any reason, without penalty or negative consequences. You can skip any questions that you do not wish to answer.

Consent and Authorization Provisions

Your signature indicates that you voluntarily agree to participate in this study, that the study has been explained to you, that you have been given the time to read the document, and that your questions have been satisfactorily answered.

Participant's Name (printed) _____

_____ _____

Participant's Signature Date

APPENDIX C

INTERVIEW GUIDE

Warm-up

1. [*Ask the interviewee to read and sign the informed consent.*]

   "Before we start I would like you to read this informed consent form and sign it if you agree to participate in this interview. This is a typical requirement by the ISU Institutional Review Board to ensure that interviewees are informed of the scope of the study. Please take your time to review the form and feel free to ask any questions about the study"

2. [*Introduce the interviewee to the study and procedures.*]

   "Thank you so much for coming to this interview. I am a Master's student in the Human Computer Interaction graduate program and I am conducting this study for my thesis. For this interview, I have a couple of questions to ask you to better understand how you use your smartphone and explore the place of your smartphone in your life. If any question makes you feel uncomfortable or if you decide not to answer it, please feel free to say that you want to skip the question. Also, please feel free to ask for further clarification at any time. For analysis purposes, I will record the interview. The recording will be kept confidential and will not be associated with you whatsoever. I will start recording now if that is fine with you."

Focus Questions

3. [*Ask the following questions and use the probes when needed.*]

   "I would like to begin with your experience using a smartphone."

   - How long have you being using your smartphone?
   - How often do you think you check your smartphone a day?
   - In what contexts do you usually use your smartphone?
     - Probe Question

       Do you use your smartphone in places like a lecture, a bus or at dinner table while eating or while hanging out with your friends?

- For what purposes do you use your smartphone?
- How would you describe your use of your smartphone?
- How would your family and friends describe your use of your smartphone?
  - Probe Question

    Has any of your friends or family members expressed concerns or comments about your smartphone use?
- In what ways do you think your smartphone affects your daily routines?
- How would you describe the benefits of your smartphone to your everyday life?
  - Probe Question

    In what ways do you think your smartphone contributes to your everyday life?
- How would you describe the downsides of your smartphone?
  - Probe Question

    In what ways do you think your smartphone affects your life negatively?
- How would you describe your mobile experience?
- How would you feel if you left your smartphone at home and had to spend your day without it?
- Do you ever feel a strong desire to check your phone when you need to focus on something else?
- Would you feel anxious if you could not use your smartphone for some reason when you wanted to do so? Why? Why not?
- What does your smartphone mean to you?
  - Probe Question

    What is the place of your smartphone in your life?

Closing

4. [*Ask the closing question and thank the interviewee for his/ her time and sharing*.]
   - Is there anything else you would like to share?

   "That brings us to the end of our interview today. This has been a very fruitful interview and it would provide greater insight into my research. Please accept this $5 ISU Dining Gift Card as a token of my appreciation."

APPENDIX D

LIST OF ITEMS FROM PHASE ONE

1. I would be annoyed if I couldn't look things up on my smartphone when necessary.
2. I would be annoyed if I couldn't use my smartphone and/or its capabilities when I wanted to do so.
3. I would feel uncomfortable if I didn't have constant access to information through my smartphone.
4. Being unable to get the news (e.g., happenings, weather, etc.) on my smartphone would make me nervous.
5. Running out of battery scares me.
6. I like the ability of having information at my fingertips all the time.
7. When I don't have data signal or cannot connect to a Wi-Fi, I will constantly check to see if I have signal or can find a Wi-Fi network.
8. When I run out of credits or hit my monthly limit, I would panic.
9. When I have my smartphone with me, I can always stay connected to my contacts and online social networks.
10. When I haven't checked my smartphone for a while, I feel a desire to check it.
11. When I have my smartphone with me, I feel relaxed because I know my family and friends can contact me.
12. If I couldn't use my smartphone, I would feel anxious because I couldn't instantly communicate with my family and/or friends.
13. If I couldn't use my smartphone, I would be afraid of getting stranded somewhere.

14. If I didn't have my smartphone with me, I would be anxious because I couldn't keep in touch with my contacts.
15. If I didn't have my smartphone with me, I would be nervous because I would be disconnected from my online identity.
16. If I didn't have my smartphone with me, I would be uncomfortable because I couldn't stay up-to-date with social media and online networks.
17. If I didn't have my smartphone with me, I would be worried because my contacts couldn't reach me.
18. If I didn't have my smartphone with me, I would feel anxious because I couldn’t check my emails.
19. If I didn't have my smartphone with me, I would be nervous as I couldn't know if someone had tried to get a hold of me.
20. If I didn't have my smartphone with me, I would feel anxious because my constant connection to my family and friends would be broken.
21. If I didn't have my smartphone with me, I would feel awkward because I couldn't check my notifications for updates from my connections and online networks.
22. If I didn't have my smartphone with me, I would feel nervous because I wouldn't be able to receive text messages and calls.
23. If I didn't have my smartphone with me, I would feel weird because I wouldn't know what to do.

APPENDIX E

MAIN STUDY QUESTIONNAIRE

Section I: Demographics

1. Your age: _____
2. Your sex: a. Male b. Female
3. Year of study: a. Freshman b. Sophomore c. Junior d. Senior
4. Your major (e.g., Elementary Education): _____
5. Your college:
    a. Agriculture and Life Sciences
    b. Business
    c. Design
    d. Engineering
    e. Human Sciences
    f. Liberal Arts and Sciences

Section II: Smartphone Use

6. For how long have you been using a smartphone?
    a. Less than a year
    b. 1 year to less than 2 years
    c. 2 years to less than 3 years
    d. 3 years to less than 4 years
    e. 4 years to less than 5 years
    f. 5 years or more
7. Do you have a mobile data plan that allows you to access the Internet through your smartphone?
    a) Yes b) No
8. Approximately how much time per day do you think you spend using your smartphone?
    _____ hours
9. On average how many times per day do you think you check your smartphone?
    _____ times

10. How often do you think you usually check your smartphone?

a. Every 5 minutes
b. Every 10 minutes
c. Every 20 minutes
d. Every 30 minutes
e) Every hour
f) Every 2 hours
g) Every 3 hours
h) Other (please specify): _____

11. Please indicate the average number of times per day you do the following on your smartphone.

a) Number of phone calls you make per day : _____
b) Number of phone calls you receive per day : _____
c) Number of text messages you send per day : _____
d) Number of text messages you receive per day : _____
e) Number of emails you send per day : _____
f) Number of emails you receive per day : _____

12. Approximately how many apps do you have on your smartphone? _____ apps

13. For which of the following purposes do you usually use your smartphone? (Please select all that apply.)

☐ Checking email
☐ Checking lecture notes
☐ Checking social media
☐ Gaming
☐ Getting news
☐ Killing time
☐ Looking information up on the Internet
☐ Listening to music
☐ Scheduling meetings and events
☐ Talking with family or friends
☐ Texting family or friends
☐ Other (please specify): _____

14. In which of the following contexts would you use your smartphone? (Please select all that apply.)

☐ At a dinner table
☐ Between classes
☐ During a class
☐ In the restroom
☐ On public transportation
☐ While driving
☐ When I'm alone
☐ When I'm bored
☐ While hanging out with friends
☐ While talking to somebody
☐ While waiting for someone or something
☐ While walking
☐ While watching TV or a movie
☐ Other (please specify): _____

Please indicate how much you agree or disagree with each statement in relation to your smartphone use.	**Strongly Disagree**						**Strongly Agree**
	1	**2**	**3**	**4**	**5**	**6**	**7**
15. I often think about my smartphone when I am not using it.	○	○	○	○	○	○	○
16. I often use my smartphone for no particular reason.	○	○	○	○	○	○	○
17. Arguments have arisen with others because of my smartphone use.	○	○	○	○	○	○	○
18. I interrupt whatever else I am doing when I am contacted on my smartphone.	○	○	○	○	○	○	○
19. I feel connected to others when I use my smartphone.	○	○	○	○	○	○	○
20. I lose track of how much I am using my smartphone.	○	○	○	○	○	○	○
21. The thought of being without my smartphone makes me feel distressed.	○	○	○	○	○	○	○
22. I have been unable to reduce my smartphone use.	○	○	○	○	○	○	○

Section III: Nomophobia Questionnaire (NMP-Q)

Please indicate how much you agree or disagree with each statement in relation to your smartphone.	**Strongly Disagree**						**Strongly Agree**
	1	**2**	**3**	**4**	**5**	**6**	**7**
1. I would feel uncomfortable without constant access to information through my smartphone.	○	○	○	○	○	○	○
2. I would be annoyed if I could not look information up on my smartphone when I wanted to do so.	○	○	○	○	○	○	○
3. Being unable to get the news (e.g., happenings, weather, etc.) on my smartphone would make me nervous.	○	○	○	○	○	○	○
4. I would be annoyed if I could not use my smartphone and/or its capabilities when I wanted to do so.	○	○	○	○	○	○	○
5. Running out of battery in my smartphone would scare me.	○	○	○	○	○	○	○
6. If I were to run out of credits or hit my monthly data limit, I would panic.	○	○	○	○	○	○	○
7. If I did not have a data signal or could not connect to Wi-Fi, then I would constantly check to see if I had a signal or could find a Wi-Fi network.	○	○	○	○	○	○	○
8. If I could not use my smartphone, I would be afraid of getting stranded somewhere.	○	○	○	○	○	○	○
9. If I could not check my smartphone for a while, I would feel a desire to check it.	○	○	○	○	○	○	○
If I did not have my smartphone with me,							
10. I would feel anxious because I could not instantly communicate with my family and/or friends.	○	○	○	○	○	○	○
11. I would be worried because my family and/or friends could not reach me.	○	○	○	○	○	○	○
12. I would feel nervous because I would not be able to receive text messages and calls.	○	○	○	○	○	○	○
13. I would be anxious because I could not keep in touch with my family and/or friends.	○	○	○	○	○	○	○
14. I would be nervous because I could not know if someone had tried to get a hold of me.	○	○	○	○	○	○	○
15. I would feel anxious because my constant connection to my family and friends would be broken.	○	○	○	○	○	○	○
16. I would be nervous because I would be disconnected from my online identity.	○	○	○	○	○	○	○
17. I would be uncomfortable because I could not stay up-to-date with social media and online networks.	○	○	○	○	○	○	○
18. I would feel awkward because I could not check my notifications for updates from my connections and online networks.	○	○	○	○	○	○	○
19. I would feel anxious because I could not check my email messages.	○	○	○	○	○	○	○
20. I would feel weird because I would not know what to do.	○	○	○	○	○	○	○

☺ Thank you for your participation! ☺

APPENDIX F

INSTITUIONAL REVIEW BOARD APPROVAL

IOWA STATE UNIVERSITY
OF SCIENCE AND TECHNOLOGY

Institutional Review Board
Office for Responsible Research
Vice President for Research
1138 Pearson Hall
Ames, Iowa 50011-2207
515 294-4566
FAX 515 294-4267

Date: 2/24/2014

To: Caglar Yildirim
N 057 Lagomarcino Hall
Ames, IA 50011

CC: Dr. Ana-Paula Correia
N165B Lagomarcino Hall

From: Office for Responsible Research

Title: Exploring the Dimensions of Nomophobia: Developing and Validating a Questionnaire Using Mixed Methods

IRB ID: 14-092

Study Review Date: 2/24/2014

The project referenced above has been declared exempt from the requirements of the human subject protections regulations as described in 45 CFR 46.101(b) because it meets the following federal requirements for exemption:

- (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey or interview procedures with adults or observation of public behavior where
  - Information obtained is recorded in such a manner that human subjects cannot be identified directly or through identifiers linked to the subjects; or
  - Any disclosure of the human subjects' responses outside the research could not reasonably place the subject at risk of criminal or civil liability or be damaging to their financial standing, employability, or reputation.

The determination of exemption means that:

- **You do not need to submit an application for annual continuing review.**
- **You must carry out the research as described in the IRB application.** Review by IRB staff is required prior to implementing modifications that may change the exempt status of the research. In general, review is required for any modifications to the research procedures (e.g., method of data collection, nature or scope of information to be collected, changes in confidentiality measures, etc.), modifications that result in the inclusion of participants from vulnerable populations, and/or any change that may increase the risk or discomfort to participants. Changes to key personnel must also be approved. The purpose of review is to determine if the project still meets the federal criteria for exemption.

  Non-exempt research is subject to many regulatory requirements that must be addressed prior to implementation of the study. Conducting non-exempt research without IRB review and approval may constitute non-compliance with federal regulations and/or academic misconduct according to ISU policy.

  Detailed information about requirements for submission of modifications can be found on the Exempt Study Modification Form. A Personnel Change Form may be submitted when the only modification involves changes in study staff. If it is determined that exemption is no longer warranted, then an Application for Approval of Research Involving Humans Form will need to be submitted and approved before proceeding with data collection.

Please note that you must submit all research involving human participants for review. **Only the IRB or designees may make the determination of exemption**, even if you conduct a study in the future that is exactly like this study.

Please be aware that **approval from other entities may also be needed.** For example, access to data from private records (e.g. student, medical, or employment records, etc.) that are protected by FERPA, HIPAA, or other confidentiality policies requires permission from the holders of those records. Similarly, for research conducted in institutions other than ISU (e.g., schools, other colleges or universities, medical facilities, companies, etc.), investigators must obtain permission from the institution(s) as required by their policies. **An IRB determination of exemption in no way implies or guarantees that permission from these other entities will be granted.**