An Exploration of Problematic Smartphone Use among Chinese and British University Students

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Abstract

This body of research aimed to explore the prevalence and correlates of problematic smartphone use (PSU) among Chinese and UK university students. The studies presented in the thesis tested a hypothesised model of relationships between PSU and factors including academic anxiety, procrastination, self-regulation and life satisfaction. A cross-cultural comparison of PSU among Chinese and British undergraduates was also undertaken. The studies presented used self-reported questionnaire data and semi-structured interview data to address a series of research questions about the prevalence and correlates of PSU. Data were gathered from 475 undergraduates studying in a Chinese university, and 303 British undergraduates. Path analysis and framework analysis were used to analyse the data. A good model fit was found for the Chinese, but not the UK sample, in which PSU predicted academic procrastination and academic anxiety; and self-regulation predicted PSU, academic anxiety, academic procrastination and life satisfaction. Chinese undergraduates reported significantly higher levels of PSU than British students, with a medium to large effect size. In both China and the UK, females scored significantly higher for PSU than males. In both samples similar explanations were given for PSU. However, only the Chinese students cited difficulties in adapting to a freer college life after the sharp transition from a strictly managed high school life as an explanation. This thesis aims to enhance our understanding of the PSU, mental health and well-being of college students, and to explore some of the possible mechanisms underpinning it. This research indicates the importance of considering cultural factors and educational/contextual backgrounds when conducting studies on problematic smartphone use.

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Declaration

I declare that this thesis is a presentation of original work and I am the sole author. This work has not previously been presented for an award at this, or any other, University. All sources are acknowledged as References.

Some results of the main study presented in this thesis has been published in a journal article as: Yang, Z., Asbury, K., & Griffiths, M. D. (2018). An Exploration of Problematic Smartphone Use among Chinese University Students: Associations with Academic Anxiety, Academic Procrastination, Self-Regulation and Subjective Wellbeing. *International Journal of Mental Health and Addiction*, 1-19. https://doi.org/10.1007/s11469-018-9961-1. Dr Kathryn Asbury (my supervisor) and Professor Mark D. Griffiths in Nottingham Trent university are the coauthors of this paper.

The results of the cross cultural study in this thesis has been published in a journal article as: Yang, Z., Asbury, K., & Griffiths, M. D. (2018). Do Chinese and British university students use smartphones differently? A cross-cultural mixed methods study. *International Journal of Mental Health and Addiction*, 1-14. https://doi.org/10.1007/s11469-018-0024-4. Dr Kathryn Asbury (my supervisor) and Professor Mark D. Griffiths in Nottingham Trent university are the coauthors of this paper.

Chapter 1 Introduction

1.1 Research background and aims

Mobile phones and smartphones (phones that have Internet-based functions and applications besides calls and text messages) are widely used by people around the world. Those devices have become increasingly popular in recent years. The global penetration rate of smartphone use has grown sharply from 10% in 2011 to 36% in 2018 (Statista, 2018a). China has been reported as leading the global smartphone industry since 2012 (Statista, 2018b). The number of smartphone users in China is predicted to reach 675 million by 2019 (Statista, 2018a). The prevalence of smartphone ownership in China was found to have already exceeded half of the country's population (58%) in 2015 (Poushter, 2016).

. Despite the convenience offered by smartphones in daily life, the usage of smartphones/mobile phones/Internet/social networking has been negatively described as dysfunctional, pathological, problematic or even addictive (Andreassen et al., 2016; Bianchi & Phillips, 2005; Billieux, Maurage et al., 2015; Billieux Philippot, et al., 2015; Davis, 2001; Kuss & Griffiths, 2017; Young, 1998a; 1998b). Since the concept of technology addiction was proposed by Griffiths (1995), Internet addiction (Griffiths, 1996; Young, 1998a; 1998b) has been widely investigated (Davis, 2001). As Internet-based devices, mobile phones and smartphones have also been subjects of study since the last decade of twentieth century (e.g. Bianchi & Phillips, 2005; Leung, 2008). A number of studies have labelled problematic mobile phone/smartphone use as additive

(e.g. Hong, Chiu, & Huang, 2012; Huang, Zhou, & Yu, 2013). However, there is an ongoing debate regarding use of the term "Smartphone/mobile phone addiction" (Panova & Carbonell, 2018), since no diagnostic criteria of phone addiction has yet been included in either the Diagnostic and Statistical Manual (DSM)-5 or the International Classification of Disease (ICD)-11 (Grant & Chamberlain, 2016). Therefore, the term "smartphone addiction" or "addictive smartphone use" is not used in the current thesis. Instead, as a neutral choice, "problematic smartphone use (PSU)" is used in in line with a theoretical model of problematic mobile phone use presented by by Billieux, Maurage et al. (2015).

However, whether smartphone use can be described as addictive or not, empirical studies show that problematic smartphone use can have negative consequences including mental health issues (e.g. anxiety) (Carbonell, Chamarro, Oberst, Rodrigo, & Prades, 2018; Ha, Chin, Park, Ryu, & Yu, 2008; Hussain, Griffiths & Sheffield, 2017; Lepp, Barkley, & Karpinski, 2014). It seems that smartphones can be problematic and they can have negative effects. Thus, it is necessary and meaningful to further investigate problematic smartphone use (PSU) and its correlates.

Furthermore, the factors associated with PSU can be complex. Several empirical studies have found PSU to be associated with anxiety and stress in different contexts (Hussain, Griffiths, & Sheffield, 2017; Jenaro, Flores, Gómez-Vela, González-Gil, & Caballo, 2007; Lepp, Barkley, & Karpinski, 2014; Vahedi & Saiphoo, 2018). Problematic Internet use has also been found to be linked with anxiety and procrastination (Caplan, 2007; Sahin, 2014). Self-regulation and life satisfaction have

also been found to correlate with PSU (Samaha & Hawi, 2016; Van Deursen, Bolle, Hegner, & Kommers, 2015; Wei, Wang, & Klausner, 2012). Besides the quantitative studies in this area, several qualitative studies have investigated PSU using inductive methods (e.g. Aoki & Downes, 2003; Walsh, White, & Young, 2008) and identified different associated factors of PSU (e.g. personal safety; financial incentive). It seems that the potential correlates of PSU are complex and wide ranging, including mental illness, well-being, self-regulation, etc. Also, there are likely to be other, unknown factors associated with PSU as well. It is therefore necessary to investigate the factors related to PSU and potential linked issues.

In the Chinese context, PSU seems to be a particular issue among university students who have very high rates of smartphone ownership (99.2% in Long et al., 2016). Among 1062 undergraduates, Long et al. (2016) found that the prevalence of PSU among Chinese undergraduates was higher than in other Asian countries or regions (e.g. South Korea and Taiwan), and the reasons for that were unclear. In a cross cultural study, Lachman et al. (2018) found that the level of PSU was higher among Chinese university students than German students. It remains unknown why Chinese students reported higher levels of PSU than German students. Thus, it seems necessary to further investigate the PSU in Chinese university students.

However, though many studies have explored PSU or Internet addiction among university students, few of them have investigated PSU in relation to academically relevant variables such as academic anxiety or academic procrastination. It seems necessary to focus on context-specific factors in academic contexts. Although a number

of studies have focused on PSU from a cross cultural perspective (e.g. Lopez-Fernandez et al., 2017; Lopez-Fernandez, Männikkö, Kääriäinen, Griffiths, & Kuss, 2018), a limited number of studies have focused on PSU across Chinese and European samples. It therefore seems interesting to explore whether Chinese students use smartphones differently to students from Western countries. Furthermore, to our knowledge, no study has systematically investigated PSU among Chinese undergraduate students using both quantitative and qualitative methods, and no study has compared Chinese and European samples' PSU using a mixed-methods design. Thus, it seems important to explore PSU among Chinese students using both quantitative hypothesis tests and qualitative studies, and comparing with a sample from a different cultural background.

In summary, as a widely used device around the world, smartphones might be used in a problematic way. It might be necessary to investigate the levels of PSU, especially among Chinese undergraduate students. It also seems necessary to explore the prevalence and correlates of PSU among Chinese undergraduates using both mixed-methods and cross-cultural designs. Therefore, the aims of the research presented in this thesis were:

(1) To explore the prevalence of PSU among Chinese undergraduate students

(2) To test a hypothesised model of associations (based on theoretical and empirical evidence) between PSU and possible academic correlates

(3) To explain those relationships (if observed) and explore other potential antecedents and consequences of PSU

(4) To compare the Chinese undergraduates' PSU with another sample (British undergraduate students) from a different cultural background

In order to fulfill the research aims, several research questions and hypotheses were proposed as below. The details are discussed in the following chapters.

Hypotheses (details are in Chapter 2):

H1: problematic smartphone use positively predicts academic anxiety.

H2: academic anxiety positively predicts academic procrastination

H3: problematic smartphone use positively predicts academic procrastination.

H4: problematic smartphone use positively predicts academic procrastination mediated through academic anxiety.

H5: self-regulation negatively predicts problematic smartphone use.

H6: problematic smartphone use negatively predicts life satisfaction.

Research questions (details are in Chapter 6 & 7):

RQ1: How much do Chinese undergraduates report using their smartphones (both quantitative and qualitative responses)?

RQ2: What are the reasons given for participants' smartphone use and PSU?

RQ3: What do participants see as the consequences of how much they use their smartphones?

RQ4: Do Chinese and British undergraduates report their use of smartphone differently?

(based on both quantitative and qualitative data)

1.2 Structure of the thesis

This thesis includes nine chapters. Chapter 1 (this chapter) briefly introduces the main topic of this thesis (i.e. PSU) and the general research background. It has presented the research aims and the relevant research questions and hypotheses. The structure of this thesis is also included in this chapter.

Chapter 2 (literature review) reviews theoretical and empirical literatures in five areas including problematic smartphone use (PSU), academic anxiety, academic procrastination, self-regulation and life satisfaction. PSU is the main focus of the literature review chapter. Research contexts and theoretical models of PSU, problematic Internet use and behavioural addiction are reviewed at the beginning of chapter 2. In terms of the correlates of PSU, theoretical and empirical evidence linking PSU and academic anxiety, academic procrastination, self-regulation and life satisfaction are also reviewed in this chapter. At the end of chapter 2, six hypotheses are proposed based on theoretical and empirical evidence. A hypothesised model containing all the six hypotheses is presented at the end of the chapter.

Chapter 3 (general methodology) discusses the methods applied in this thesis. It presents the published and validated scales used in the questionnaire survey. Details of the translation and modification process of the measurements are introduced. Chapter 3 also describes the participants, research design, ethical concerns, data collection and

data analysis of the studies in this thesis. However, since this thesis includes several separate studies in different times, more details of the participants and data collection are explained in the relevant results chapters.

Chapter 4 presents a pilot study conducted in May 2016. It includes an introduction, research methods (participants, measurements, data collection procedure and data analysis), results and a brief discussion. The pilot study tested the measurements of the questionnaire survey. It also tested the mediation relationship between PSU, academic anxiety and academic procrastination, one element of the hypothesised model.

Chapter 5 presents the results of the quantitative part of the main study. A first wave of data collection was conducted in November 2016 with 102 participants. The main wave of data collection of the main study was conducted in May 2017 with 373 participants. The two waves of data were combined for analysis. Chapter 5 describes the results of the combined sample of 475. It includes a short introduction, methods (participants, measurements, data collection procedure and data analysis), results and a brief discussion of the quantitative findings.

Chapter 6 presents the results of the qualitative part of the main study. It describes the research questions, participant details, participant recruitment, interview schedule, data analysis approach, findings and a brief discussion of the qualitative findings.

Chapter 7 presents the cross cultural study between Chinese and British undergraduate students. It includes an introduction, methods, results of the British sample, cross cultural comparison and a brief discussion. In this chapter, both

quantitative data and qualitative data from China and the UK are compared.

Chapter 8 is a General Discussion chapter and discusses the main findings of this thesis and compares them with previous studies and existing theories. At the beginning of this chapter, the main findings are briefly presented in a short summary. Then the theoretical, empirical, methodological and practical implications of the findings are discussed. The implications are discussed in terms of the areas of behavioural addiction, psychology in education and other topics in educational studies. Limitations of this thesis are discussed around the research design, measure and data collections. Chapter 8 also includes recommendation for studies in the future.

Chapter 9 is the conclusion of the thesis. It summarises the main findings and implications of the body of research presented in this thesis.

Chapter 2 Literature review

2.1 Problematic smartphone use

2.1.1 Contexts of problematic mobile phone and Internet use

According to a report by the Ministry of Industry and Information Technology of the People's Republic of China (2015, 2018), the number of mobile phone users in China reached 1.304 billion in November 2015 and went up to 1.42 billion in 2017. The popularity of mobile phones in China has grown sharply and reached 94.03% of the population in 2014, while the number was only 30.26 per 100 in 2005 (The National Bureau of Statistics of China, n.d.). Smartphone (wifi enabled mobile phones) ownership in China reached 58% in 2015 (Poushter, 2016). It is therefore important to understand the implications of high levels of smartphone use. Billieux (2012) has reviewed a range of studies which view problematic mobile phone use as an addiction. In a large scale study of 1062 Chinese undergraduates, Long et al. (2016) found that the prevalence of problematic smartphone use (PSU) in China (21.3%) was higher than in similar samples in other countries or regions of East Asia, including Korea (11.4%) and Taiwan (16.4% to 16.7%). These studies used the same measurement (Problematic Cellular Phone Use Questionnaire, PCPUQ, Yen et al., 2009) to test PSU and the same criteria. Other empirical studies of Chinese university students (Bian & Leung 2015; Huang, Zhou, & Yu, 2013) also suggest that mobile phone use could be problematic or become a type of addiction associated with psychological problems such as anxiety and loneliness. Thus, it seems that dysfunctional or addictive mobile phone or smartphone

use could be a problem, especially in China.

Addiction is defined as dependency in dictionaries (*Longman dictionary of English language and culture*, 1998; Collins dictionary: 175 years of dictionary publishing, 2007). As pointed out by Bianchi and Phillips (2005), addiction was originally understood as a medical reliance on substances including alcohol or drugs. The understanding of addiction has become broader as Griffiths (1996) defined the term technological addictions as "non-chemical (behavioural) addictions which involve human-machine interaction" (p. 471). Bianchi and Phillips (2005) argued that those behavioural understandings of addiction could be conducive to studies of problematical behaviours including problematical use of mobile phone though it is still unclear whether the problematical behaviours are addictions in the strict medical sense.

However, in the fourth and fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-IV and DSM-5) of the American Psychiatric Association (2000; 2013), there is no specific diagnostic criteria for mobile phone addiction. Only Internet gaming disorder was included in DSM-5 as an emerging disorder. It therefore remains unclear whether problematic or excessive mobile phone use should be considered as 'addictive' behaviour. Billieux Philippot, et al (2015) challenged the frequently applied medical "addiction model" for investigating mobile phone use, an approach in which problematic or excessive mobile phone use is assumed to represent addictive behaviour. Instead, they argued that diagnosing problematic mobile phone use as an addiction with existing diagnostic criteria is unsupported.

The Ministry of Industry and Information Technology of the People's Republic of China (2015) reported that 3G and 4G mobile Internet users reached 0.76 billion by 2015. It seems that Internet use cannot be ignored when discussing mobile phone use in China. Griffiths (1996) and Young (1998a, 1998b) used the term "addiction" to describe problematic Internet use and adapted the criteria of pathological gambling in the DSM-IV to develop specific measures for Internet addiction. A number of studies (Chen, Weng, Su, Wu & Yang, 2003; Chotpitayasunondh & Douglas, 2016; Fu et al., 2010; Jang, Hwang & Choi, 2008; Kee, Byun, Jung, & Choi, 2016; Liu & Kuo, 2007; Zboralski et al., 2009 etc.) have also viewed problematic or excessive Internet use as addictive. However, as with problematic mobile phone use, no diagnostic criteria for Internet addiction have been included in the DSM-5. Thus it remains unknown whether problematic mobile phone and Internet use should be seen and treated as an addiction, or whether mobile phone or Internet addiction really exists as a disorder.

2.1.2 Problematic mobile phone use

2.1.2.1 Introduction

In general society, alongside the advantages of mobile phones, there are several problems related to mobile phone use including using phones while driving, privacy violations and bullying, all of which are suggested to be associated with self-control or personality traits (Bianchi & Phillips, 2005). As discussed earlier, a trend has developed in the literature in this area of labelling problematic mobile phone use as an addiction

(Billieux Philippot, et al., 2015). However, as Bianchi & Phillips (2005) have argued, mobile phone use can be problematic and it is important to investigate problematic behaviour regardless of whether it is defined as an addiction.

2.1.2.2 Billieux's models of problematic mobile phone use

Based on empirical evidence, as shown in Figure 2.1, Billieux (2012) proposed a model of problematic mobile phone use which included four pathways: an impulsive pathway, a relationship maintenance pathway, an extraversion pathway and a cyber-addiction pathway. The impulsivity pathway indicates the correlation between problematic mobile phone use and self-control or emotion regulation. Another pathway, the relationship pathway, suggests that overuse of mobile phones may originate from problematic relationship maintenance predicted by poor self-esteem and neuroticism. Similarly, the extraversion pathway indicates that problematic mobile phone use is predicted by the personality trait of extraversion which is linked with relationship establishment. Finally, the cyber addiction pathway posits that problematic mobile phone use is predicted by problematic Internet use since current mobile phones provide applications or functions based on the Internet such as social networks.

As suggested by the four pathways in the model, problematic mobile phone use is seen as being related to self-control, positive and negative emotions, personality traits, relationship maintenance and addictive Internet behaviours. Those factors seem have overlapping features as they were mostly directly or indirectly linked in Billieux's model (2012). For example, dysfunctional social relationships and problematic social

media use might be associated with, and predictive of, negative emotions; and positive affect and social relationships seem to be associated with well-being. Overall, it seems that the predictors and consequences of problematic mobile phone use may cover a wide range of psychological attributes. If this pathway model is adapted to an educational context, the correlates might be either daily life related factors (e.g. self-regulation and well-being) or academic-specific factors (e.g. academic anxiety and academic procrastination).
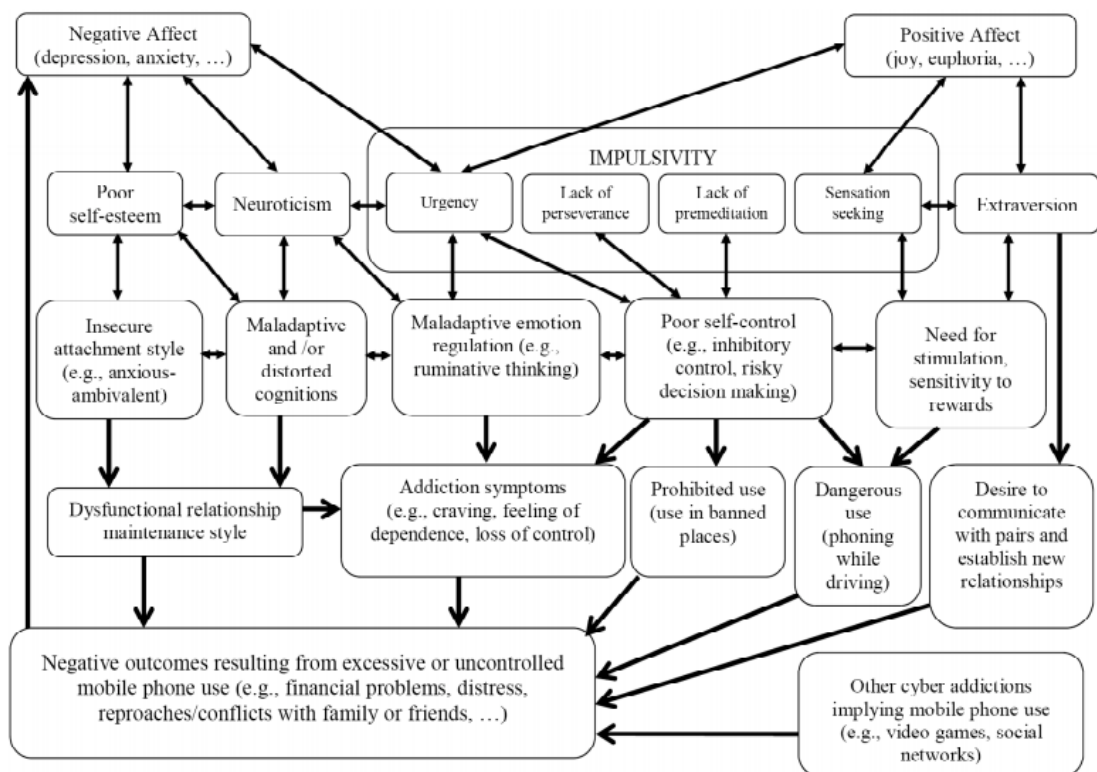
Fig. (1). Integrative model depicting four pathways to problematic mobile phone use: (1) the impulsive pathway; (2) the relationship maintenance pathway, (3) the extraversion pathway, and (4) the cyber addiction pathway.

Figure 2.1: A model of problematic mobile phone use (Billieux, 2012, p. 6)

Further to their 2012 model, Billieux and colleagues (Billieux, Maurage et al, 2015) proposed a pathway model which illustrates the complexity of problematic mobile phone use. Based on existing research evidence, this model includes three pathways

including an excessive reassurance pathway, an impulsive pathway and an extraversion pathway, as shown in Figure 2.2. The excessive reassurance pathway describes the problematic use of mobile phones in order to maintain interpersonal relationships and receive assurance from the others. The impulsive pathway describes the antisocial mobile phone use driven by poor impulse control. The extraversion pathway focus on individuals' strong desire to communicate and gain reward from mobile phone activities.

Across the three pathways, established risk factors, privileged applications, types of problematic use, and symptoms and behaviours are identified. First, a series of established risk factors was included in each of the three pathways, suggesting that the factors are potential antecedents for problematic mobile phone use. Mental health problems including anxiety symptoms, neuroticism, low self-esteem and emotional instability were included in the excessive reassurance pathway. The Impulsive pathway includes risk factors related to personality traits and self-control. The extraversion pathway includes risk factors such as sensation seeking and reward dependence. Second, privileged applications related to the risk factors were displayed, including calls, messages, emails, social networks, games and gambling. Third, three main types of problematic use were suggested in this model, including addictive patterns (e.g. reassurance behaviours), antisocial patterns (e.g. use in inappropriate situations) and risky patterns (e.g. use while driving). Related symptoms or behaviours were also presented. These usage patterns could provide a useful theoretical framework for deductive studies focusing on problematic mobile phone use.

PROBLEMATIC MOBILE PHONE USE

Excessive Reassurance Pathway	Impulsive Pathway	Extraversion Pathway
Established risk factors →		
• Low self-esteem • Neuroticism • Emotional instability • Insecure attachment • Social anxiety symptoms • General anxiety symptoms	• Emotion laden impulsivity • Lack of premeditation • Low self-control • Agressive traits • Antisocial personality • Psychopathic traits • ADHD symptoms	• Sensation seeking • Extraversion • Reward sensitivity • Reward dependence
Privileged applications →		
• Calls • SMS, instant messaging • Emails • Social Networks	• Calls • SMS, instant messaging • Emails • Social Networks • Video Games / Gambling	• Calls • SMS, MMS, instant messaging • Emails • Social Networks
Type of problematic use →		
Addictive pattern of use	Antisocial pattern of use	Risky pattern of use
Symptoms or behaviors →		
• Addiction symptoms • Reassurance behaviors	• Prohibited use • Use in inappropriate contexts • Mobile phone aggressions	• Phoning while driving • Unsafe/risky Sexting

Figure 2.2: A pathway model of problematic mobile phone use (Billieux, Maurage et al, 2015, p. 160)

2.1.3 Problematic internet use

2.1.3.1 Introduction

Since the terms "technology addiction" (Griffiths, 1995) and "Internet addiction" (Griffiths, 1996; Young, 1998a; 1998b) were proposed in the last decade of 20th century, a flow of studies have focused on problematic behaviours related to the use of the Internet and related technology using the term "addiction" (Griffiths, 2000; Hong et al., 2012; Liu & Kuo, 2007; Widyanto & Griffiths, 2006). Internet addiction can be

understood as a type of technological addiction which refers to "nonchemical (behavioural) addictions that involve human-machine interaction" (Griffiths, 1995, p. 15). Thus it seems necessary to consider Internet use when discussing the use of technological devices such as mobile phones. However, while this body of research has been building up there has been a parallel debate on whether Internet addiction really exists. Young (1998a) argued that Internet addiction, an impulse-control disorder, could be diagnosed using the pathological gambling criteria in the Diagnostic and Statistical Manual of Mental Disorders (4th edition) (DSM-IV; American Psychiatric Association, 1994). An 8-item Internet addiction questionnaire, based on these criteria (Young, 1998b) has been widely adopted and the term "Internet addiction" has frequently been used. However, Davis (2001) pointed out that the DSM-IV does not actually use the term "addiction" to explain substance dependence or pathological gambling. He therefore suggested that the term "Pathological Internet Use (PIU)" be used to describe problematical Internet use. In reaction, Widyanto & Griffiths (2006) argued that the terms "Internet addiction", "Pathological Internet Use" or "Problematic Internet Use" are explaining the same the fact that "an individual could be so involved in their online use as to neglect other area of their life" (p. 160). They made a case that excessive Internet users are not necessarily addicted to the Internet itself, but rather to the activities or functions provided by the Internet, for example keeping in touch with their friends online in order to make sure they keep pace with others (Widyanto & Griffiths, 2006). Although it remains unclear whether Internet addiction really exists, it seems necessary to discuss it when considering the topic of problematic smartphone use as

smartphones are one of the most common ways for people to access the internet.

2.1.3.2 A model for pathological Internet use

Davis (2001) coined the term Pathological Internet Use (PIU) and classified it into specific and generalised PIU. Specific PIU refers to online behaviours with the obvious purpose of using specific functions on the Internet such as online games or online trading. Generalised PIU refers to behaviours such as wasting time online using chat rooms or checking emails without a specific purpose because of social isolation or other issues in real life (Davis, 2001). Although this classification may be useful in some ways it is important to note that the two categories are unlikely to be mutually exclusive.

Based on the classification of PIU, as well as the cognitive-behavioural approach, Davis (2001) developed a cognitive-behavioural model of PIU which is shown in Figure 2.3. In this model, maladaptive cognition, its central aspect, can be affected by relevant reinforcements such as the sound of the Internet connection and the experience of psychopathological symptoms such as depression, social anxiety or substance dependence (alcohol, drugs etc.). There are two types of maladaptive cognition represented in the model: cognitive distortions about the self and cognitive distortions about the world. Both cognitions about the self and world can result in specific and generalised PIU which, the model proposes, then lead to associated behavioural symptoms including failure of impulse control. This, in turn, can be seen as a predictor of maladaptive cognitions, indicating a circularity of symptoms and behaviours.

Overall, this cognitive-behavioural model provides a useful theoretical framework

for studies on Internet use and the other Internet-related behavioural addictions including smartphone use. It seems necessary to consider the role of problematical behaviours and psychological issues such as depression and social anxiety when investigating addictive or pathological Internet use. Meanwhile, this model provides a good theoretical framework for considering Internet addiction from two aspects: general use and specific use.
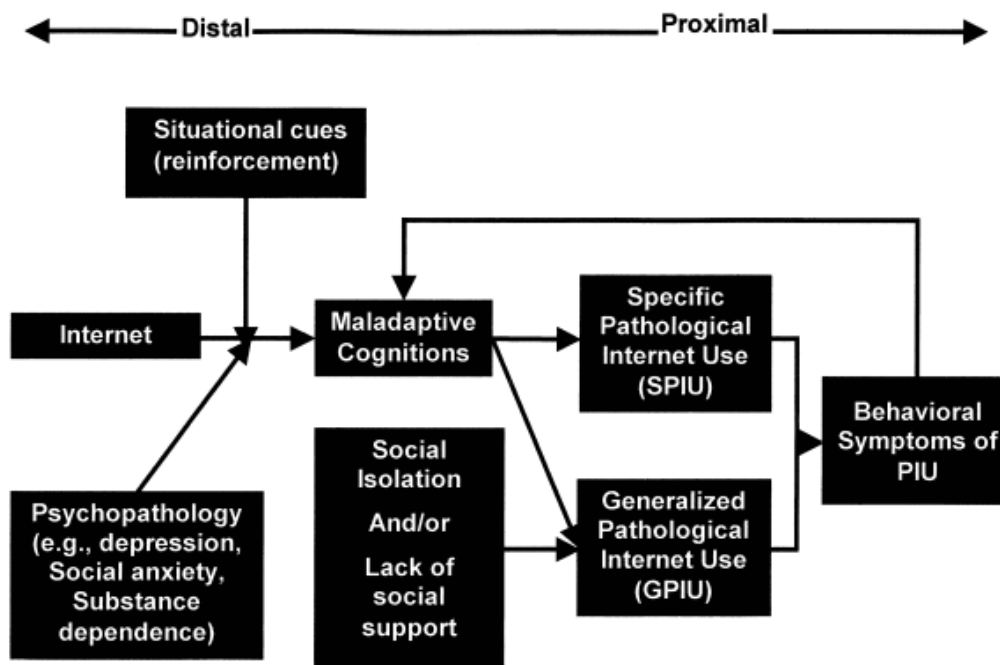
Figure 2.3: The Cognitive-Behavioural Model of Pathological Internet Use (PIU) (Davis, 2001, p. 190)

2.1.3.3 A model for Generalised Internet Addiction

On the basis of the model of PIU presented by Davis (2001), Brand, Laier and Young (2014) proposed a new model for Generalised Internet Addiction (GIA) and

validated it in a sample of 1019 German participants. This model seems to represent a more detailed explanation of Davis (2001)'s model. GIA was the term conceptualised in Davis (2001) as the multidimensional misuse of the Internet, without directed usage or specific functions (gaming or gambling), which could be linked to a lack of social support, social anxiety or stress. As shown in Figure 2.4, this more recent model describes mechanisms for GIA including individual characteristics, dysfunctional coping and Internet use expectancy. In this model symptoms of GIA are predicted by three aspects of personal characteristics including psychological aspects (depression, social anxiety), personality aspects (low self-esteem, low self-efficacy, stress vulnerability) and social cognitions (emotional loneliness, low social support). Furthermore, coping and expectancies for Internet use are presented as potential mediators of associations between GIA symptoms and personal characteristics. This model provides a detailed theoretical framework for studies in Internet addiction. It suggests the importance of considering individual characteristics, including mental health problems such as anxiety and depression, when investigating Internet addiction. Futhermore, Brand, Young, Laier, Wölfling, & Potenza (2016) proposed a model of specific Internet-use disorders, the Person-Affect-Cognition-Execution (I-PACE) model. It described the process of the development and maintenance of disordered use of specific online applications (e.g. gaming and shopping). Similar to the GIA model, the I-PACE model indicates the links between Internet-use disorders and personal characteristics such as anxiety and impulsivity.
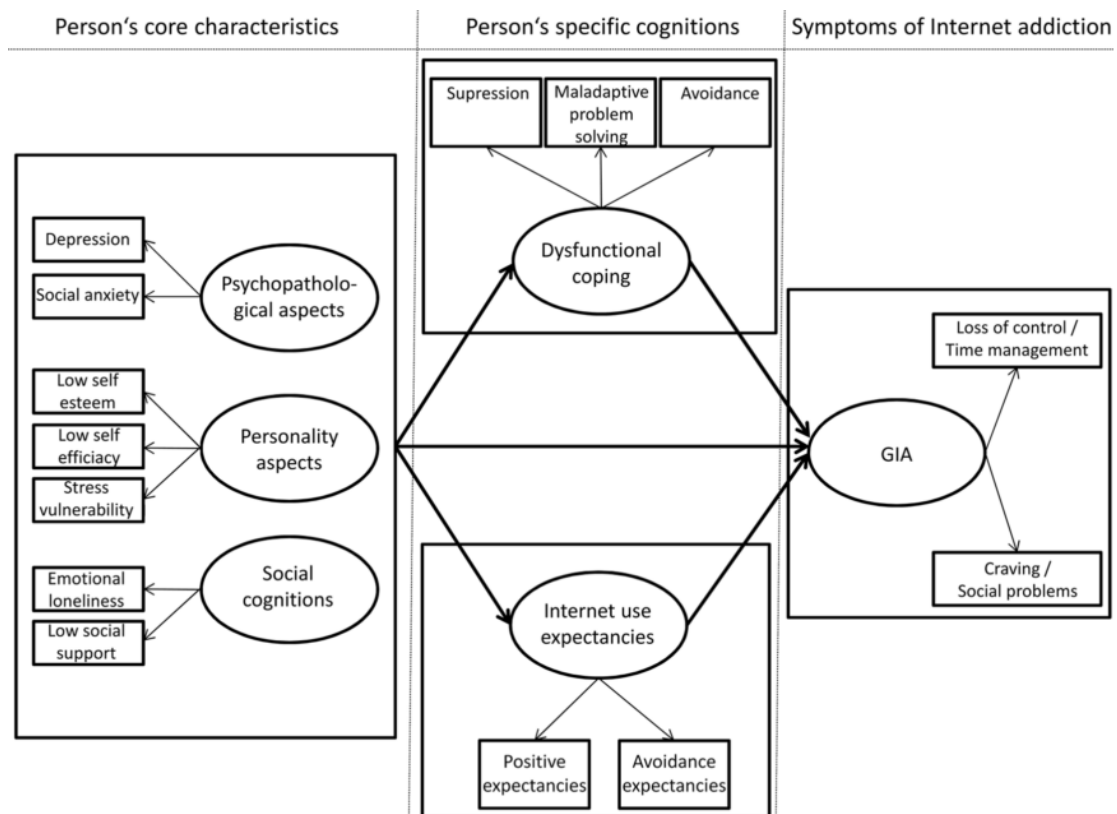
Figure 2.4: A model for Generalised Internet Addiction (GIA) (Brand et al., 2014, p. 3)

2.1.3.4 Current trends in studies of Internet addiction

Since the term Internet Addiction was introduced at the end of last century, a large number of empirical studies have focused on it. Several trends can be observed in this body of research. One focus is the difficulty of diagnosing Internet addiction without any criteria for Internet addiction either in DSM-IV or DSM-5. Second, it is becoming increasingly clear that the factors associated with Internet addiction are complex and in need of further study. Third, cultural factors/differences associated with Internet addiction have been, and continue to be, considered by researchers in the field. Fourth, social networking has become a key focus for researchers.

Kuss, Griffiths, Karila and Billieux (2014) reviewed 68 quantitative empirical studies on Internet addiction from 2000 to 2013. They searched for empirical studies using *Web of Science* based on five criteria: quantitative empirical study, published after 2000, had analysis of Internet addiction, a minimum of 1000 participants and full text article in English. They focused on three main aspects including the measurements used to test Internet addiction, the prevalence rates observed and the associated factors identified. The majority of those empirical studies used or modified Young (1998a, 1998b)'s Internet Addiction Test (IAT) and Internet Addiction Diagnostic Questionnaire (IADQ) to test Internet addiction. Another frequently used measurement was the Chinese Internet Addiction Scale (CIAS: Chen et al., 2003). However, the prevalence of 'Internet addiction' was found to differ across different contexts even when the same measures were used, raising important questions about social and cultural contexts (Kuss et al., 2014). For example, using the IAT and the same thresholds of 80 out of 100 for Internet addiction, the addicted rate was 0,8% in Italian high school students (Poli & Agrimi, 2012) but 20.3% in Korean adolescents (Ha et al., 2006). Such differences were found in both adolescent and adult samples.

Furthermore, as concluded by Kuss et al. (2014), the factors associated with Internet addiction appear to be complex, including sociodemographic factors (e.g. gender, family income), Internet use variables (e.g. frequency and length or Internet use), psychosocial factors (e.g. stress, emotion stability and personality) and comorbid symptoms (e.g. alcohol use, depression and social anxiety). Overall, this review makes clear the complexity of Internet addiction (or problematic internet use) and the

mechanisms underpinning the behaviour. Thus, it seems necessary to further investigate the potential factors associated with Internet addiction (or problematic levels of use).

In terms of cultural differences, Young (2017, online in 2015) claimed that the problem of Internet addiction was more serious in Eastern or Asian countries. The difference identified between Italian and Korean teens as discussed above seems to support this statement. However, Griffiths, Kuss, Billieux, & Pontes, (2016) have argued that there is no evidence to support that statement based on Kuss et al. (2014)'s systematic review. This is a question in need of further research.

In relation to the specific focus on social networking observed in the last two decades, Kuss & Griffiths (2011) reviewed empirical studies exploring social networking usage, motivation, negative consequences and potential social networking addiction. They found that social networking sites were mostly used for maintaining offline relationships. Personality traits, including extraversion, conscientiousness and narcissism, were found to be associated with social networking usage. Social networking use had negative consequences including social relationship problems and low academic achievement. Kuss & Griffiths (2011) concluded that social networking use could potentially be conceptualized as an addiction. Further to this review, Kuss & Griffiths, (2017) have more recently clarified their definition of social networking sites which focus on connecting people, seeing social media as a broader concept with various functions including web-blogs, collaborative projects (Wikipedia) and content communities (YouTube). They argue that addiction to social networking sites includes a wide range of behavioural addictions or addictive symptoms including smartphone

addiction, Facebook addiction and fear of missing out (Kuss & Griffiths, 2017). In all, social networking sites use has emerged as a complex topic which includes features of both Internet addiction and smartphone addiction (or problematic use).

2.1.4 Griffiths' component model of behavioural addiction

Beyond chemical addictions including drug-ingestion activities, Griffiths (2005) argues that non-chemical behaviours (e.g. Internet use, gambling and gaming) could be viewed as addictive and proposed a six-component model of behavioural addiction. Modified from the components of addiction in Brown (1993), Griffiths (2005, 2017) argued that a behaviour could be diagnosed as addiction when six specific components were identified, namely salience, mood modification, tolerance, withdrawal, conflict and relapse. This model provides a theoretical framework for the consideration of behavioural addictions.

First, salience refers to situations when an activity dominants/occupies the life of an individual (Griffiths, 2005). In other words, the activity becomes the most important thing in a person's life and the person thinks about it frequently. Griffiths (2005) used gambling as an example to explain this component. Addicted gamblers tend to spend a great deal of time actively gambling or craving further gambling activity. Furthermore, Griffiths (2005) noted the term "reverse salience" which refers to the situation in which an activity dominates one's life while it is prevented. Smoking could be an example of "reverse salience". Second, mood modification refers to the outcome of an activity that

can be arousing or lead to feelings of reassurance (Griffiths, 2005). One example could be the feeling offered by nicotine in cigarettes. Third, tolerance refers to a situation in which increasing amounts of an activity are needed in order to achieve the desired feeling (Griffiths, 2005). It can be explained by the example of gamblers who tend to need to spend more time and money to reach their previous mood modification feeling. Fourth, withdrawal symptoms refer to the negative mental and physical feelings experienced when the activity is reduced. Griffiths (2005) explained this component with the examples of pathological gamblers who tend to experience physical withdrawal symptoms including headaches. Fifth, conflict refers to interpersonal conflicts (addictive activity and social relationships) and intrapersonal conflicts (addictive activity and individual tasks) (Griffiths, 2005). In other words, this component indicates that an addictive activity negatively affects a person's social relationships with others and personal productivity and functioning. Finally, relapse refers to the reoccurrence of an addictive activity when it has been prevented for a long time. Griffiths (2005) used returning smokers as an example for this component. In all, Griffiths (2005)'s component model of behavioural addiction can be used as a theoretical framework for studies in this field, including mobile phone or smartphone use.

2.1.5 Summary

Widyanto & Griffiths (2006) argued that over-involved Internet users are not

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dependent on the Internet itself, but on the online functions offered by the Internet (e.g. social networking sites). It remains unknown whether Internet over-use always represents addiction, or whether the Internet in itself is addictive in the manner of drugs or cigarettes, since the Internet provides essential functions for daily life and can have benefits. Problematic Internet use might share similarities with problematic mobile phone use as they both depend on online functions. Bian & Leung (2015) point out that smartphones provide online services which enable people to communicate and to surf the Internet. Billieux's (2012) model indicates that Internet use should be considered when discussing problematic mobile phone use since smartphones provide Internet access and allow people to use Internet related functions such as social networks. Hence, it is necessary to consider the Internet when investigating problematic mobile phone use. As a result, the current study will focus on smartphones which provide not only the traditional functions of mobile phones but also flexible Internet access. Considering the complexity of mobile phone/Internet/social networking sites addiction, and the complexity of associated factors as reviewed above, it also seems necessary for this study to focus on the predictors or consequences of problematic mobile phone use rather than the debate about "addiction" which remains unresolved. The term problematic smartphone use (PSU) will therefore be used in this study.

2.2 Academic anxiety

2.2.1 Introduction to academic anxiety

Anxiety could be defined as "an uncomfortable feeling in mind caused by the fear

or expectation that something bad will happen" (*Longman dictionary of English language and culture*, 1998, p. 72) or "a state of uneasiness or tension caused by apprehension of possible future misfortune, danger, etc." (Collins dictionary: 175 years of dictionary publishing, 2007, p. 45). Spielberger (1966) explained that anxiety could be classified into trait anxiety and state anxiety, which will be described and discussed later. Thus, it seems that anxiety is usually conceptualized as a feeling resulting from within an individual, and from triggers in the external environment.

Academic anxiety seems to be an umbrella term for anxiety in educational settings which is suggested as a "unifying formulation" (Cassady, 2010, p. 1). It refers to "feelings of worry, nervousness, and uneasiness in achievement related situations in the school context" (Gogol et al., 2014, p. 189). Academic anxiety includes context-specific anxieties (e.g. test anxiety and classroom anxiety); content-specific anxieties (e.g. math anxiety and science anxiety) and anxiety in specific populations (e.g. anxiety in gifted students) (Cassady, 2010). Ottens (1991) believes that academic anxiety, compared to test anxiety or evaluative anxiety, is a better term to describe fearful feelings related to a range of academic situations that includes test taking, test preparation and assignment completion. Therefore, it seems that academic anxiety is a collection of different anxieties in educational contexts.

2.2.2 Pekrun's Control-value theory

The control-value theory of achievement emotions proposed by Pekrun (2006) explained the reciprocal relationship between achievement emotions, antecedents

(environment and appraisal) and effects (learning and achievement). Anxiety is one of the achievement emotions which is aroused by negative evaluation of prospective outcomes and a medium level of emotion control (Pekrun, 2006). This is considered by many to be a "state of the art" theory explaining achievement emotions including anxiety. As shown in Figure 2.5, achievement emotions are viewed in this model as being influenced by genes (emotion regulation) and appraisals (cognition regulation) including "control" (e.g. expectations for success) and "value" (e.g. perceived importance) of achievement activities and outcomes. Appraisals could also be affected by the environment and personal goal beliefs. The effects of achievement emotions include motivation, self-regulated learning and achievement. Pekrun (2006) also pointed out that it remains unclear how achievement emotions affect well-being and happiness although positive and negative emotions are key elements of well-being. Overall, this theory offers a useful theoretical framework for investigating anxiety, especially academic anxiety. It indicates that academic anxiety could be associated with a wide range of variables including regulation, well-being and other learning related strategies. For this study, it seems interesting to explore whether academic anxiety is associated with problematic smartphone use which might be seen as a failure of self-regulation or poor learning strategies.
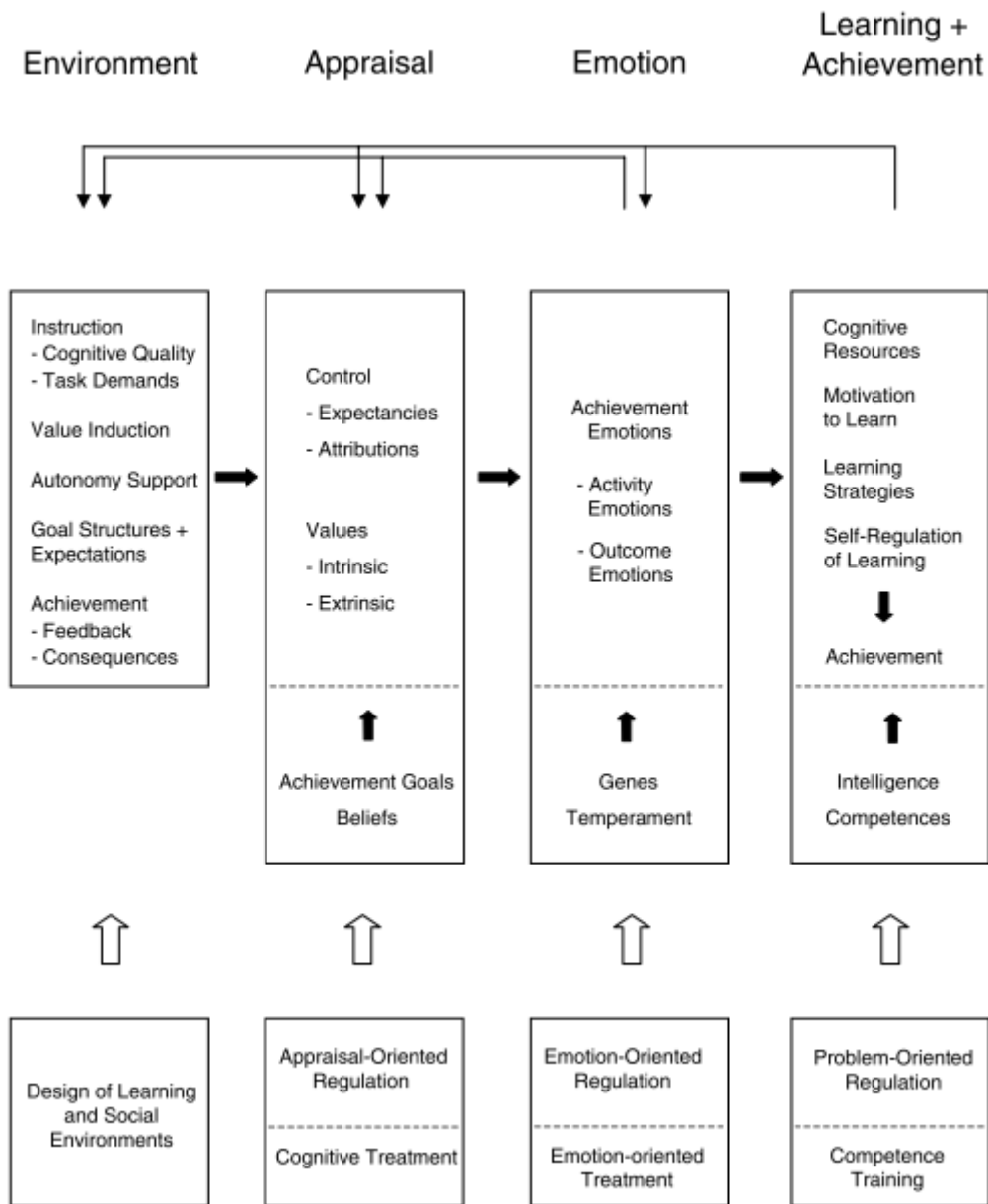
Figure 2.5: The control-value theory of achievement emotions: Reciprocal linkages between antecedents, emotions, and effects (Pekrun, 2006, p. 328).

2.2.3 Test anxiety

2.2.3.1 Concept and facets

As discussed in previous sections, test anxiety is one component of academic anxiety. In educational contexts, and for some students as a "constant companion" (Slavin, 2012, p. 299), anxiety has been found to limit learning and performance,

especially in test situations (Everson, Smodlaka, & Tobias, 1994; Wigfield & Eccles, 1990). Thus it seems necessary to explain the term "test anxiety". According to Sieber, O'Neil, & Tobias (1977), the concept of test anxiety was first introduced in a study that focused on the attitudes of a group of college students towards test situations (Mandler & Sarason, 1952). This early study found that anxiety in test situations had a negative association with students' performance.

Zeidner suggested that test anxiety could be defined as "the set of cognitive, affective and behavioural reactions that accompany concern over possible negative consequences contingent upon performance in a test or evaluative situation" (Zeidner, 1998, p. 25-26). Similarly, Sieber et al. defined the term test anxiety (sometimes also known as evaluative anxiety) from phenomenological, physiological and behavioural aspects and ended with the context of "testing or evaluative situation" (Sieber et al., 1977, p. 23). In a third definition, Rachman (2013) described test anxiety as the anxiety experienced by people under formal exam conditions or performing other evaluative tasks. Therefore, test anxiety may occur during exam situations or during the preparation process preceding deadlines for evaluative tasks such as essays.

Test anxiety can be analysed in three main aspects: cognitive, affective and behavioural (Zeidner, 1998). Similarly, but without considering the behavioural facet, Spielberger & Vagg (1995a) have suggested that test anxiety has two main elements, namely worry and emotionality, which are representative of Zeidner's cognitive and affective components respectively. From the cognitive perspective, a test anxious person worries about the test or evaluation, doubts their ability and has unrelated

thoughts during test situations (Zeidner, 1998). Affective symptoms of test anxiety include physiological arousal, like increased heart rate during tests, and emotionality which is the personal awareness or interpretation of physiological arousal (Zeidner, 1998). Rachman (2013) concluded that test-anxious people tend to experience a higher level of physiological arousal than people with low test anxiety.

However, every test taker or evaluated person might have some degree of physiological arousal and different individuals may have different views on their physical reactions, and also different levels of emotionality (Zeidner, 1998). Thus, the affective symptoms of test anxiety depend on individual differences. Furthermore, as explained by Sarason (1980a), from both cognitive and affective perspectives, people with higher levels of test anxiety focus too much on issues that are unrelated to the assessed tasks, worry about the consequences or have negative awareness of physiological arousal. Therefore, it seems that test anxiety is significantly related to personal perceptions of the test or evaluative situation.

Test anxiety could be reflected in behaviours including insufficient study, test skills and/or procrastination as concluded by Zeidner (1998). Culler & Holahan (1980) found that test-anxious people lack sufficient learning and that their test skills and performance can be blocked. Meanwhile, Rothblum, Solomon & Murakami (1986) revealed that heavy academic procrastinators reported higher levels of test anxiety. These studies will be discussed in details in the following sections. As a behaviour of avoidance and escaping, procrastination may result in serious test anxiety because procrastinators lack energy to learn, delay their study and have low self-efficacy

(Zeidner, 1998).

2.2.3.2 Transactional model of test anxiety--linking test anxiety and the Trait-State Anxiety Theory

Transactional model analysis explores the interaction between individual and context and seems to be an effective way of explaining and understanding test anxiety (Zeidner, 1998). The transactional model of test anxiety developed by Spielberger & Vagg (1995a) is grounded in the transactional theoretical framework by Lazarus (1966) which described stress as a process of transaction. According to Spielberger & Vagg (1995a, p. 11), through the transactional model, test anxiety is a "situation-specific anxiety trait" which is a type of specific anxiety associated with personality and specific testing or evaluative situations. It is derived from the Trait-State Anxiety Theory developed by Spielberger (1972a).

Spielberger (1972a) suggested two different anxiety constructs: trait anxiety and state anxiety. Trait anxiety is defined as a stable dispositional process of evaluating most situations as potential threats. State anxiety, by contrast, is a short-lived emotion experienced by an individual when confronted with a specific situation (Spielberger, 1972a). The Trait-State Anxiety Theory has been applied to relationships between relevant factors such as external stimuli, internal stimuli, trait anxiety, cognitive appraisal, state anxiety, defense mechanisms and behaviour. According to Spielberger (1972a), cognitive appraisal, the core part of the theory, is affected by external stimuli (stressors), internal stimuli (feelings or biological needs) and trait anxiety (individual

differences). As shown in Figure 2.6, once a person cognitively appraises a situation as threatening or dangerous, he/she will experience transitory state anxiety, build defense mechanisms and relevant behaviours will be evoked (Spielberger, 1972a). Meanwhile, this mechanism of anxiety is circulatory. It seems that problematic smartphone use and academic procrastination could be the behaviour described in this model, which could be either a consequence or a reinforcement of anxiety.
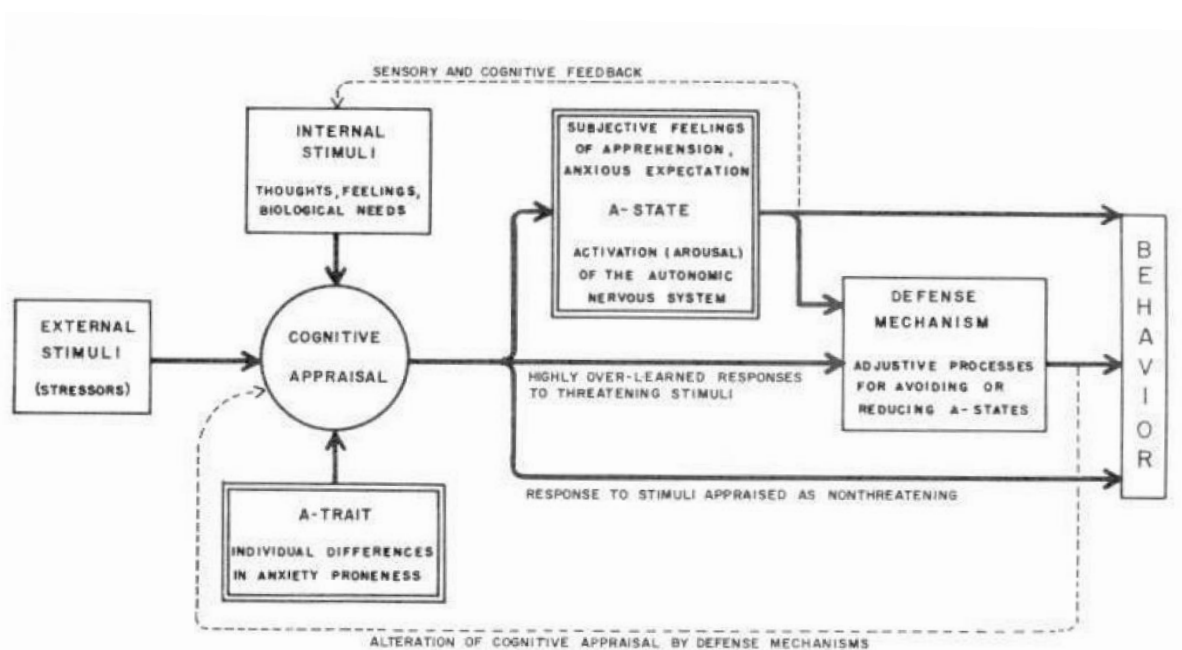
Figure 2.6: A schematic diagram of the Trait-State Anxiety Theory by Spielberger (1972a, p. 43)

Based on the Trait-State Anxiety Theory, Spielberger & Vagg (1995a) established the transactional process model for test anxiety as shown in Fig 2.7 which illustrates the intrapersonal dynamic process towards test situations and the correlating responses. A test situation is firstly perceived and evaluated by an individual depending on relatively stable personal traits (Spielberger & Vagg, 1995a). However, individuals with sufficient study skills and test taking skills (in testing situations) may regard the

situation as less threatening. The negatively appraised or reappraised test situation may in turn evoke state anxiety, cognitive and affective reactions including worry and emotionality which may result in irrelevant thoughts or behaviours to the task. Meanwhile, the storage and retrieval of knowledge which are critical to task-relevant behaviours can be affected by negative appraisals and worry or emotionality. It seems unclear whether problematic smartphone use and academic procrastination can be seen as task-irrelevant behaviours or poor study skills in this model.
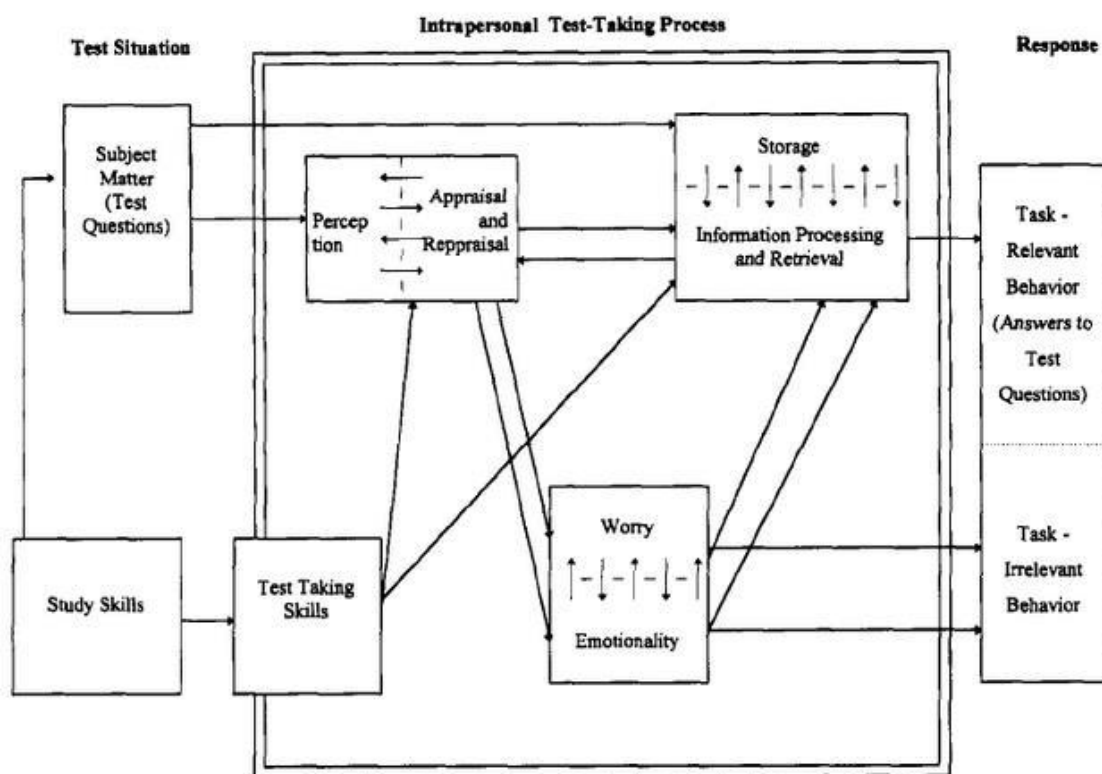
Figure 2.7: The graph presenting the transactional process model for test anxiety by Spielberger & Vagg (1995a, p. 12)

The core parts of the Trait-State Anxiety Theory and the transactional model for test anxiety both represent personal appraisals of a situation. The similar theoretical clue is from the stimulation and trait to personal appraisal and then the state of reaction. The level of trait anxiety determines a person's evaluation of a test situation. However,

the trait anxiety and the evaluation might be affected by personal experience and study skills. If the situation is negatively judged as a danger or a threat, state anxiety will be experienced by the person and cognitive, affective and behavioural symptoms of test anxiety will be evoked. Thus Spielberger & Vagg (1995a, p. 13) describe test anxiety as "a situation-specific personality trait" with worry and emotionality as main components. It seems that both the two theories indirectly indicate the possible links between anxiety and other relevant behaviours such as problematic smartphone use or academic procrastination. However, besides these theories, empirical studies explaining the relationships will be discussed in the following chapters.

2.2.3.4 Predictors and Consequences of test anxiety

Study skills and test anxiety

Test anxiety may be predicted by low levels of self-reported study skills, resulting in longer but not necessarily more effective study time. Culler & Holahan (1980) investigated test anxiety and study habits, attitudes and behaviours among 96 freshmen (65 high test-anxious students and 31 low test-anxious students) selected from 800 freshmen at the beginning of their first semester. Test anxiety was assessed with the Test Anxiety Scale (TAS) (Sarason, Pederson & Nyman, 1968). The Study Habits scale from the Survey of Study Habits and Attitudes (Brown & Holtzman,1967, as cited in Culler & Holahan, 1980, p. 17) was used to assess students' study behaviours. Meanwhile, study hours, cramming, missed classes and late exams were tested by questions designed by Culler & Holahan (1980). Group differences analyses showed

that students with high test anxiety had significantly lower levels of reported study skills and significantly more study hours. It seems that low level of study skills might be a predictor of test anxiety. More study time is not necessarily a good thing. However, it remains unknown whether the students efficiently spent time on study instead of procrastinating or playing with smartphones. It also seems unclear whether problematic smartphone use, procrastination study or self-regulation is associated with the level of study skills reported in Culler & Holahan (1980).

Time management could also be related to test anxiety. Sansgiry & Sail (2006) explored the relationship between time management and test anxiety among n=198 undergraduate students. A 10-item Test Anxiety inventory (Sarason, 1980b) was used to assess test anxiety while time management ability was assessed by a 0-100 scale. Results indicated that time management ability was negatively related to test anxiety, with a small effect size ($r = - 0.20$, $p < 0.001$). Students who were better at time management were a little less anxious about tests. However, it is not clear whether test anxiety was related to objective time management ability or only to the participants' self-beliefs about their ability to manage time.

However, a study conducted by Cassady (2004) focused not only on students' beliefs but also written notes for test preparation. Qualitative content analysis was used to assess the effectiveness of test preparation among 124 undergraduate students from whom test preparation notes were collected for analysis. The participants were invited to bring their preparation notes to the exams. Cassady (2004) found that students with high test anxiety reported lower level of study skills, perceived tests as more threatening

and had less effective preparation notes for the test. The relationship between test notes and test anxiety was analysed with a Mann-Whitney U test because the 'notes' data was not normally distributed. Results suggested the high test-anxious students prepared more copied definitions than low anxious students. It seems innovative that this study analysed the exam preparation notes to assess the participants' study skills. However, one possible shortcoming of this study might be the quality of the test preparation notes since it is unknown whether the participants prepared for the exams in different ways to cater to the research.

An early study by Wittmaier (1972) examined the relationship between study habits and facilitating and debilitating test anxiety. The Alpert-Haber Anxiety Test (AAT, Alpert & Haber, 1960) was adopted to test the facilitating test (AAT+) and debilitating test (AAT-) while the Survey of Study Habits and Attitudes (SSHA, Brown & Holtzman, 1967) was used to test study habits. In the study, of the 300 undergraduate participants, 52 were selected according to their scores on the AAT and allocated to four groups: (1) high AAT+, high AAT-; (2) high AAT+, low AAT-; (3) high AAT-, low AAT+; and (4) low AAT+, low AAT-. An Analysis of Variance (ANOVA) in study habits indicated that students with low debilitating test anxiety (AAT-) had more effective study habits ($F = 57.55$, $p < 0.001$).

Therefore, it seems that test anxiety could be predicted by study skills, habits or time management ability. However, it is not clear whether the self-reported study skills, habits or abilities are convincing reflections of the actual study skills of participants. Furthermore, it might be necessary to explore behaviours affecting study during the

whole process of test or evaluative situations.

Coping strategies and test anxiety

Stöber (2004) explored the relationship between test anxiety and ways of coping among a small sample of n=162 German university students. Test anxiety was evaluated using the German version of the Test Anxiety Inventory (TAI, Spielberger, 1980). Coping was tested with the Coping with Pre-Exam Anxiety and Uncertainty (COPEAU, Stöber, 2004). Four components of test anxiety were assessed: worry, emotionality, interference and lack of confidence, while the ways of coping for pre-exam anxiety were assessed in three dimensions: task orientation & preparation, seeking social support and avoidance. A zero-order correlation analysis found that overall test anxiety scores were only related to seeking for social support. However, partial correlations indicated that the four components of test anxiety were differentially associated with the three ways of coping. For example, avoidance was negatively associated with worry but positively associated with interference and lack of confidence.

Furthermore, Cohen, Ben-Zur & Rosenfeld (2008) investigated 216 freshmen and found coping strategies of emotion and avoidance predicted test anxiety. The worry and emotionality components of test anxiety were assessed, while coping strategies were assessed in three aspects: problem solving, emotion and avoidance. Hierarchical regression analysis found that only emotion-focused coping and avoidant coping strategies positively predicted test anxiety while problem solving coping was not associated with test anxiety. Similarly, Weiner & Carton (2012) focused on avoidant

coping, exploring this construct as a mediator of the relationship between perfectionism and test anxiety. In the mediation model, avoidant coping was found to be a positive predictor of test anxiety ($b = 0.34$, $F (1, 169) = 21.31$, $p < 0.001$).

Test anxiety appears to be predicted by coping strategies especially avoidance. Stöber (2004, p. 226) found that avoidant coping includes escaping and irrelevant behaviours: "I turn to other activities for diversion"; "I go to the movies or watch TV so I don't think about the exam so much". Thus, avoidant coping seems to be related to problem behaviours which may affect individuals in test or evaluative situations. It seems interesting to explore whether problematic smartphone use can be one of coping strategies which were associated with test anxiety as reported in the studies above.

Procrastination and test anxiety

Procrastination has been found to be associated with test anxiety. Rothblum, Solomon & Murakami (1986) conducted a study on the relationship between academic procrastination and academic-related traits among 126 university students. Academic procrastination was evaluated by the Procrastination Assessment Scale-Student (PASS) (Solomon & Rothblum, 1984). The Test Anxiety Scale TAS (Sarason et al., 1968) was adopted to assess test anxiety. Participants who were involved in weekly assessment sessions were asked to complete the study questionnaires three times in three weeks. Meanwhile, participants were identified as high procrastinators and low procrastinators by PASS. The study found that high procrastinators were more test-anxious. Thus procrastination might be a predictor or a consequence of test anxiety.

Milgram & Toubiana (1999) investigated academic anxiety and procrastination among children and parents. The study was based on the Appraisal Anxiety Avoidance (AAA) model of procrastination which suggests that high levels of anxiety are related to high levels of procrastination. Participants were 354 middle school and high school students from Israel. Academic anxiety was tested using the Academic Anxiety Scale, made up of the Test Anxiety Inventory (TAI) (Spielberger, 1980) and subscales regarding homework anxiety and paper writing anxiety that were created by the authors. The Academic Procrastination Form was used to test levels of academic procrastination. Although no significant correlation between overall academic anxiety and academic procrastination was found, academic procrastination was positively related to test anxiety ($r = 0.25$, $p < 0.05$) and paper writing anxiety ($r = 0.28$, $p < 0.05$), and negatively related to homework anxiety ($r = -0.21$, $p < 0.05$). It seems that Milgram & Toubiana (1999) interpreted test anxiety as a type of anxiety occurring only during exam situations and excluded paper writing anxiety and homework anxiety, which might also belong to test anxiety happened in evaluative situations. However, according to their study, academic procrastination presents as a consequence of test anxiety.

In line with this, Klassen et al. (2009) found that test anxiety predicted procrastination among adolescents both in Singapore and Canada. Test anxiety was assessed by the 5-item Test Anxiety Scale from the Motivated Strategies for learning questionnaire (Pintrich, Smith, Garcia, & McKeachie, 1993) while procrastination was assessed by the 16-item procrastination measure by Tuckman (as cited by Klassen et al., 2009, p. 802). Path analysis using structural equation modelling revealed that test

anxiety predicted procrastination in both a Singaporean sample ($\beta = 0.19$, $p < 0.001$) and a Canadian sample ($\beta = 0.10$, $p < 0.05$).

According to these studies, there might be a link between test anxiety and procrastination. Procrastination could be either a predictor or a consequence of test anxiety. Therefore, it is necessary to investigate whether procrastination or relevant negative behaviours such as problematic smartphone use are related to test anxiety.

2.2.4 Anxiety and problematic mobile phone and Internet use

2.2.4.1 Introduction

Recent studies of adolescents and university students have found that mobile phone use, including use frequency, overuse, dependence and addiction were associated with anxiety (Hong et al., 2012; Leung, 2008; Lu, Watanabe, Liu, Uji, Shono & Kitamura, 2011; Huang et al., 2013; Lepp, Barkley, & Karpinski, 2014; Yang & Lay, 2011; Ha et al., 2008; Wang, Huang, & Wu, 2014; Jenaro, Flores, Gómez-Vela, González-Gil, & Caballo, 2007). PSU has also been found to be associated with anxiety (Hussain, Griffiths, & Sheffield, 2017; Richardson, Hussain, & Griffiths, 2018). Slavin (2012) argued that anxiety may have a negative impact on students' learning and performance in tests. It seems important for psychologists and education researchers to seek to understand whether the increasingly widely used mobile phones are associated with anxiety and whether they negatively affect students learning outcomes, either directly or via a relationship with anxiety.

2.2.4.2 Mobile phone use frequency and anxiety

A study by Lepp et al. (2014) found that mobile phone use was positively associated with anxiety among a group of undergraduate college students in the USA. The mobile phone use of the participants was investigated with questions exploring two aspects of mobile phone use: the time spent on phones and texting. Level of anxiety was measured using the Beck Anxiety Inventory (BAI) (Beck, Epstein, Brown, & Steer, 1988 as cited by Lepp et al., 2014, p. 345) which tests common clinical symptoms of anxiety among adults. Based on path analysis, the standardised regression coefficient was 0.10 ($p< 0.05$) from cell phone use minutes per day to total BAI score and 0.09 ($p< 0.05$) from texts per day to total BAI score. Thus Lepp et al. (2014) concluded that participants with higher frequency of mobile phone use have higher levels of anxiety even though the effect sizes seem to be small. However, the self-reported amount of time spent on cell phones per day might be unreliable because it seems not easy for participants to estimate how long exactly they spent on mobile phones.

Furthermore, correlation does not imply causation and frequent use of mobile phones might not be the cause of anxiety symptoms. As Walsh, White, & Young (2008) point out, mobile phones have become a major tool of communication among young people and may offer wide-ranging benefits to users. In a qualitative study of 32 people aged between 16 and 24, Walsh et al, (2008) found the use of a mobile phone was beneficial to young people and that mobile phones have effectively replaced cameras and diaries in everyday life. The participants were divided into six groups randomly with four mixed gender groups and qualitative data were collected by focus group

discussions. It could be argued that qualitative data from a relatively small and not representative sample may not be convincing, and it is also important to note that the frequency of mobile phone use was not explored in this study. However, the participants did provide rich data and not only reported the benefits of mobile phone use but also the negative impacts, including addiction. Walsh et al, (2008) used the behavioural addiction criteria by Brown (1993, 1997, as cited in Walsh et al., 2008, p. 79) as a theoretical framework to investigate the participants' addictive symptoms of mobile phone use and results were inconclusive. They found that mobile phone use might be either advantageous or disadvantageous to young people.

Therefore, it remains difficult to understand the direct and/or indirect relationship between frequency of mobile phone use and student anxiety, and whether the relationship is context dependent. It remains unclear how much impact mobile phone use may have on students. Furthermore, it is still unknown whether frequent mobile phone use is more likely to be associated with situational specific anxiety such as academic anxiety.

2.2.4.3 Mobile phone overuse and anxiety

Based on empirical evidence, Billieux (2012) points out in his model that the overuse of mobile phones, which refers to uncontrolled or excessive mobile phone use, has negative consequences. Several studies have investigated the relationship between overuse of mobile phones and anxiety (Ha et al., 2008; Jenaro et al., 2007). The overuse here refers to self-reported scores on questionnaires measuring excessive mobile phone

use. Ha et al. (2008) focused on psychological problems and the overuse of mobile phones among 595 adolescents in Korea. They found that participants who could not control their use of mobile phones experienced more depression and higher levels of interpersonal anxiety. The over use of mobile phones was tested by the Excessive Cellular Phone Use Survey (ECPUS), while the level of interpersonal anxiety was tested through the Interactional Anxiousness Scale by Leary & Kowalski (as cited in Ha et al., 2008, p. 783). The ECPUS was a survey designed by Ha et al. (2008) based on the researchers' clinical experience covering control difficulty, need for communication and communication patterns. Different from the study by Lepp et al. (2014) which studied common symptoms of anxiety, Ha et al. (2008) evaluated participants' interpersonal anxiety which could be seen as a type of social anxiety rather than general anxiety. Thus it seems that the loss of control of mobile phone use might result in anxious feelings during interpersonal communication. However, among the students, Ha et al. (2008) only tested the interpersonal anxiety and ignored the other kinds of anxiety such as academic anxiety.

Similar to Ha et al. (2008), Jenaro et al. (2007) explored mobile phone overuse and anxiety. However, Jenaro et al. (2007) used the Cell-Phone Over-Use Scale (COS) to test the participants' excessive use of mobile phones and BAI as a measure to test common anxiety among 337 Spanish college students. Jenaro et al. (2007) identified high use of cell phones (scores above the 75th percentile) and low use of cell phone (scores below the 25th percentile) and compared clinical and normal anxiety scores, using a chi-squared test. Chi-square tests showed that high scorers in the COS tended

to score high in the BAI with significance ($\chi^2 = 15.50$; df = 1; p = 0.000). The results of a logistic regression suggested that overuse of mobile phones was predicted by high levels of anxiety ($\beta = 0.29$, p < 0.05). However, one shortcoming of this study might be the classification of heavy or light use of mobile phone while the criteria of distinguishing heavy or light mobile phone users was percentile 75 and 25 of the COS scores It seems problematic to say the participants of this sample with scores over 75 percentile are really heavy users without a clear criteria for over-use.

Therefore, according to Ha et al. (2008) and Jenaro et al. (2007), in some circumstances, anxiety is associated with excessive use of mobile phones although a causal relationship was not found as these were correlational studies. The anxiety tested in those studies were either social anxiety or general trait anxiety. It seems that the relationship between anxiety and overuse of mobile phone requires further understanding in different situations.

2.2.4.4 Dependence on mobile phones and anxiety

Yang & Lay (2011) investigated the usage rate of mobile phones, mobile phone dependence, habit and anxiety among 435 college students in Taiwan. Yang & Lay (2011) used a seven-point Likert scale including communication anxiety items modified from Brosan and Thorpe (as cited in Yang & Lay, 2011)'s scale with 10 items and mobile dependence items revised from Simpson, Rholes & Phillips (as cited in Yang & Lay, 2011)' scale with 9 items. Through regression analysis, they found that mobile phone usage rate and dependence was positively associated with mobile phone

communication anxiety. Mobile phone usage rate was also found to have a positive association with mobile phone dependence. According to Yang & Lay (2011), the mobile phone communication anxiety in their research refers to a specific type of state anxiety resulting from mobile phone usage rate and dependence. Therefore, excessive mobile phone use may result in mobile phone dependence and dependence on mobile phones might lead to anxiety about mobile phone communication among college students. However, this study explored communication anxiety which might be a type of social or state anxiety among college students. It remains unclear whether other types of anxiety such as academic anxiety among that group were affected by mobile phone dependence.

However, a study in Japan conducted by Lu et al. (2011) found that anxiety was negatively associated with dependence on text-messaging. The researchers found that high levels of text messaging were not associated with anxiety. Lu et al. (2011) also found no relationship between anxiety and Internet dependence. However, the shortcomings of this study cannot be ignored. The participants were 213 employees of an office aging from 22 to 59 and cannot be considered representative of either students or the general population. Also, text-messaging is only one aspect of a mobile phone's function. It is unlikely to represent the whole map of mobile phone use since people who text a lot might not talk a lot or use the Internet a lot on the phone.

The two studies (Lu et al., 2011; Yang & Lay, 2011) found contradictory results regarding the relationship between mobile phone dependence and anxiety. However, there were differences in sampling, measurements and contexts between the two studies.

Yang & Lay (2011) focused on college students while Lu et al. (2011) explored office staff aged from 22 to 59. People of different ages might have different habits of mobile phone use and the results of the two studies seem to be not comparable. Furthermore, Yang & Lay (2011) tested mobile phone dependence using a modified mobile dependence scale while Lu et al. (2011) used a scale only focused on text-message use dependence and internet dependence separately. Yang & Lay (2011) studied communication anxiety while Lu et al. (2011) examined anxiety using a clinically relevant scale. Thus it is difficulty to clarify the relationship between mobile phone dependence and anxiety by comparing the contradictory results of the two studies because of the different measurements and focuses. Considering the studies of Yang & Lay (2011) and Lu et al. (2011), it remains unclear whether mobile phone dependence is associated with anxiety.

2.2.4.5 Mobile phone addiction and anxiety

In the qualitative study mentioned earlier, by Walsh et al, (2008), participants noted that they were seriously attached to their mobile phone and that they may be suffering from mobile phone addiction. However, as discussed in previous sections, it seems unclear whether mobile phone addiction really exists. Regardless of that, a number of other studies (Hong et al., 2012; Huang et al., 2013; Leung, 2008; Wang et al., 2014) have explored mobile phone addiction and anxiety.

Leung (2008) aimed to investigate the addiction symptoms of mobile phone use and correlated psychological factors among adolescents in Hong Kong. On the basis of

the Mobile Phone Problematical Use Scale (MPPUS) developed by Bianchi and Phillips (2005) and the criteria of the DSM-IV, Leung (2008) created the Mobile Phone Addiction Index (MPAI). Leung (2008) revised 17 items from MPPUS which covered 8 items from the DSM-IV criteria for gambling problems. As noted by Leung (2008), addictive mobile phone use is a type of impulse control disorder and is related to pathological gambling in DSM-IV. However, the DSM-IV did not include criteria for mobile phone addiction but Leung (2008) suggests that the criteria for "substance dependence" in the DSM-IV were helpful when considering addictive mobile phone use. The criteria for "substance dependence" in the DSM-IV contains seven symptoms covering tolerance, withdrawal, longer period or amount taken than expected, persistent efforts to cut down the use, much time spent on obtaining, social activities reduced, physical or psychological problems (American Psychiatric Association, 2000). The results of Leung (2008)'s research suggest that anxiety may be usefully considered as a symptom of mobile phone addiction. In other words, mobile phone addiction might cause anxiety among adolescents. However, it remains unclear whether it is reasonable to use the diagnostic criteria of "substance dependence" in the DSM-IV to evaluate "mobile phone addiction".

Meanwhile, several studies (Hong et al., 2012; Huang et al., 2013) have found that anxiety can predict mobile phone addiction. In order to test the level of mobile phone addiction among 269 female undergraduate students, Hong et al (2012) modified the Internet Addiction Scale by Young (as cited in Hong et al., 2012, p. 2154) and created the Mobile Phone Addiction Scale (MPAS). According to Hong et al. (2012), regression

analysis shown that anxiety positively predicts mobile phone addiction. However, one limitation of this study might be the sampling because only female university students were included and the results cannot be generalized, for instance to male students. Similarly, through a study of 1172 undergraduate students, Huang et al. (2013) found that anxiety could predict mobile phone addiction also using regression analysis of their data. Therefore, the relationship between anxiety and mobile phone addiction seems unclear as they might have bidirectional impact. Whether mobile phone addiction is associated with academic-related anxiety among college students remains unknown.

2.2.4.6 Problematic Smartphone Use (PSU) and anxiety

PSU is a frequently used term when investigating the associated factors with smartphone use (e.g. anxiety). A recent meta-analysis (Vahedi & Saiphoo, 2018) reviewed empirical quantitative studies investigating the relationship between PSU/smartphone usage and anxiety/stress. Studies measuring smartphone usage time, text number or use frequency were coded as "non-problematic smartphone use studies", while studies measuring smartphone dependence/addiction were coded as "PSU studies". Among 37 quantitative studies in this area, 10 studies investigated the relationship between PSU and anxiety. The types of anxiety were general anxiety and social anxiety. PSU was measured by validated/published scales. Vahedi & Saiphoo (2018) found a summary effect size of $r = .22, p < .001$, indicating a small-to-medium association between smartphone use and stress/anxiety. Studies investigating stress and

anxiety were not separated, which would be interesting, but this meta-analysis indicates that there exists a relationship between PSU and anxiety. Two of the empirical studies on this relationship are presented below.

Hussain et al. (2017) investigated the relationship between PSU and anxiety in a multinational (mainly British) sample of 640 smartphone users ranging from age 13 to age 69. PSU was measured by the Problematic Smartphone Use Scale which was developed from the Internet Gaming Disorder Scale Short-Form (IGDS9-SF) by Pontes and Griffiths (2015). Anxiety was measured with the short form of the Spielberger State-Trait Anxiety Inventory (STAI) by Marteau & Bekker (1992). Anxiety was significantly correlated with PSU, $r = .22$, $p < .01$. However, regression analysis did not find anxiety to be a significant predictor of PSU. In line with this study, Richardson et al., (2018), with a similar but smaller sample ($n = 244$) and the same measurements, found a significant correlation between anxiety and PSU, $r = .305$, $p < .01$. Therefore, PSU and anxiety could be associated in some contexts. However, as discussed previously, besides general and social anxiety, academic anxiety has rarely been investigated when considering the issue of PSU. It seems important and interesting to investigate the specific relationship between academic-related anxiety and PSU.

2.2.4.7 Internet addiction and anxiety

Even though it remains unclear whether Internet overuse represents addiction, in the medical sense, recent studies on Internet addiction have paid attention to associated

psychological disorders, especially social anxiety, depression and even suicide. The majority of these studies have been conducted in Asia. For instance, a meta-analysis by Ho et al. (2014) indicates that Internet addiction is significantly associated with alcohol abuse, attention deficit and hyperactivity disorder (ADHD), depression and anxiety. According to the cognitive-behavioural model for PIU, those psychological disorders are likely to be predictors of maladaptive cognition which plays a key role in affecting PIU and associated behavioural symptoms.

Internet addiction and social anxiety

Caplan (2007) explored the relationship between loneliness, social anxiety and problematic Internet use among 343 undergraduates in the USA. The Social Avoidance and Distress (SAD) scale by Watson & Friend (1969) was adopted to assess social anxiety. Preference for online social interaction (POSI) and negative outcomes of Internet use were assessed with a three-item measure with response options ranging from 1 (strongly disagree) to 5 (strongly agree). Through regression analysis, Caplan (2007) found that social anxiety rather than loneliness significantly predicted POSI and POSI predicted negative outcomes of excessive Internt use. However, the negative outcomes of Internet use were assessed by just three self-designed statements including missing social activities and getting in trouble in schools or work places based on previous studies. It is doubtful whether the 3-item scale can adequately reflect the negative outcomes of Internet use. This problem might also exist in the 4-item scale for POSI which is also based on previous studies.

Furthermore, Liu & Kuo (2007) also investigated social anxiety, interpersonal relations and Internet addiction, testing Internet addiction with the IAT (Young, 1998a). Participants in this study were 555 students from five educational institutions in Taiwan. Structural equation modelling (SEM), found that parent-child relationships ($\beta = - 0.13$, $p < 0.01$), interpersonal relationships ($\beta = - 0.31$, $p < 0.01$) and social anxiety ($\beta = 0.15$, $p < 0.01$) significantly predicted Internet addiction.

The studies by Caplan (2007) and Liu & Kuo (2007) indicate that social anxiety may predict Internet addiction. In the cognitive-behavioural model, Davis (2001) also noted that social anxiety could be a predictive stressor for the symptoms of pathological Internet use. However, it is not clear whether general anxiety or other specific types of anxiety are associated with Internet addiction.

Internet addiction and general anxiety

Current studies suggest that general anxiety is associated with Internet addiction. Zboralski et al. (2009) explored Internet addiction and mental disorders including aggression and anxiety. Participants were 120 pupils from primary, middle and high schools in Poland. Anxiety was measured by the State-Trait Anxiety Inventory (STAI) by Spielberger, Gorsuch & Lushene (1970) and Internet addiction was assessed by a 45-item questionnaire created by the authors. However, the diagnostic criteria, reliability and validity of the questionnaire were not sufficiently clear. Zboralski et al. (2009) found a small to moderate positive correlation between anxiety and Internet addiction ($r = 0.28$). This study suggests that general or trait anxiety could be associated

with Internet addiction in spite of the shortcomings of the measure of Internet addiction. Furthermore, in a longitudinal study in Hong Kong, Fu et al. (2010) used the Depression Anxiety Stress Scale (DASS, Lovibond & Lovibond, 1995) and Young (1998b)'s 8-itme Diagnostic Questionnaire (YDQ) to investigate relationships between depression, anxiety and Internet addiction. Through correlation analysis, they found that Internet addiction was positively related to depressive symptoms including anxiety ($r = 0.37$, $p < 0.05$).

Furthermore, Internet addiction has been found to predict anxiety, albeit using regression in a correlational design. Akin & Iskender (2011) investigated Internet addiction, depression, anxiety and stress among 300 university students in Turkey. Internet addiction was measured by Davis, Flett & Besser (2002)'s Online Cognition Scale (OCS). Depression, anxiety and stress were assessed by the DASS. Standardised coefficients in path analysis using SEM suggest that Internet addiction positively predicted depression ($\beta = 0.67$), anxiety ($\beta = 0.63$) and stress ($\beta = 0.63$). The model fit was reported as good ($CFI = 1.00$, $RMSEA = 0.028$). However, the significance values of the path coefficients were not reported.

Similarly, in Taiwan, a study of 3662 junior and senior high school students conducted by Yen et al. (2008) focused on psychiatric symptoms, substance use (alcohol and drugs) and Internet addiction. Anxiety was measured by the Brief Symptom Inventory (BSI) including an anxiety subscale developed by Derogatis & Melisaratos (1983). The Chinese Internet Addiction Scale (CIAS) by Chen et al. (2003) was used to assess Internet addiction. Through multiple logistic regression analysis, the

authors found depressive symptoms, including anxiety, were positively predicted by Internet addiction.

There seems to be a relationship between anxiety and Internet addiction in which Internet addiction may correlate with anxiety in some contexts. However, general anxiety was not found to predict Internet addiction. Jang, Hwang & Choi (2008) found that depression rather than anxiety significantly predicted Internet addiction. Participants were 912 students from junior and senior high schools in South Korea. The IAT was used to assess Internet addiction and the Symptom Checklist-90-Revision (SCL-90-R) developed by Derogatis, Rickels & Rock (1976) was used to measure participants' psychological changes. Although results indicated that psychological symptoms including anxiety and depression were significantly associated with Internet addiction, multiple logistic regression analysis showed that depression was one of the significant predictors of Internet addiction (odds ratios = 1.145, $p < 0.05$) but that anxiety did not significantly predict Internet addiction (odds ratios = 0.993, $p > 0.05$).

Therefore, associations between general anxiety and Internet addiction have been found in some contexts and Internet addiction has been found to predict anxiety to some degree. As reviewed above, social anxiety as one type of anxiety was found to be a predictor of Internet addiction. It seems clear that anxiety is associated with Internet addiction in some contexts. However, it is still unclear whether Internet addiction can affect other types of anxiety such as academic anxiety, which is a type of anxiety disorder related to both individual dispositions and external situations.

Social media and anxiety

As reviewed previously, social media and social networking sites have been discussed within current studies focusing on Internet use. Wilson, Fornasier & White (2010) conducted a study to explore social networking sites (SNSs) use, addictive tendencies to SNSs use, self-esteem and personality among young adults in Australia. Participants were 201 university students aged between 17 and 24 years old. The Coopersmith Self-Esteem Inventory (SEI) (Coopersmith,1981) and the NEO Five-Factor Inventory (FFI) (Costa & McCrae, 1992) were used to measure self-esteem and personality respectively. Participants were asked about their time spent on social networking activity, and addictive tendencies in using social networking sites. Multiple regression analysis indicated that extraversion (β = - 0.18, p < 0.05) and conscientiousness (β = 0.27, p < 0.01) predicted SNSs use, and conscientiousness (β = 0.28, p < 0.01) predicted SNSs addictive tendencies. However, the measurement of addictive tendency was a self-designed 3-item scale based on previous research which needs to be validated before findings can be trusted. According to Wilson et al. (2010), self-esteem and several personality traits predict addictive use of social networking sites. However, it is necessary to explore whether anxiety as a personality trait can predict addictive social networking overuse or not.

It appears that social networking use is likely to be an aspect of Internet use because the Internet is the basis of social networking sites, but it is also necessary to consider the other aspects of Internet use such as news searching and gaming. Leon & Rotunda (2000) conducted two case studies of Internet use frequency and found contrasting

results. One participant marked as Neil was a 27-year-old white male senior college student in the USA. Neil reported that he spent too much time on an online computer game and missed social activities. More seriously, because of the online game he missed classes, reduced study time and had problems with laziness. Leon & Rotunda (2000) noted that Neil met the criteria for pathological gambling, sleep and anxiety disorders in the DSM-IV and diagnosed Neil as being dependent on the Internet. However, another case referred to a 25-year-old Chinese male exchange student identified as Wu who was studying in the graduate school in a university in the USA. The frequency of Internet use is also high as reported by Wu as he spent much time on social networking sites. Because of cultural differences, isolation and homesickness, Wu spent much time keeping in touch with his family through social media, and searching Chinese news online. Leon & Rotunda (2000) did not diagnose Wu as dependent user of Internet because he did not meet any diagnostic criteria in the DSM-IV. Wu reported that he felt happy and positive with his life and that Internet use stabilised his life.

The two cases in Leon & Rotunda (2000)'s study suggest that games and social networking are two possible reasons for Internet overuse and Internet overuse does not mean Internet addiction. They only judged Neil to be dependent on the Internet. Widyanto & Griffiths (2006) commented that Neil's problem was computer game addiction rather than Internet addiction. However, Neil's online behaviour still seems to be problematic since his study was affected because of gaming, while Wu's Internet overuse seems positive to his life. Therefore, it seems interesting to explore whether Internet overuse, including social media and the other functions, has to be problematic.

Smartphones, providing such online functions with flexible access to the Internet, seems necessary to be investigated.

2.2.5 Summary

Evidence suggests that levels of anxiety among college students might be higher if they use mobile phones more frequently, excessively, dependently or addictively in some contexts (Lepp et al., 2014; Ha et al., 2008; Yang & Lay, 2011; Leung, 2008), while in others mobile phones may not be associated with anxiety (Lu et al., 2011; Billieux, Van der Linden, & Rochat, 2008). Research evidence also suggests that anxiety is associated with PSU and Internet addiction. However, few studies have focused on mobile phone or Internet use and anxiety that is specific to academic life, such as academic anxiety, although university students have been asked about their mobile phone or Internet use and anxiety more generally. Therefore, there remains a need to investigate how smartphones are used by university students, and whether smartphones have negative implications such as academic anxiety for this group. Thus a hypothesis could be proposed as follows:

H1: problematic smartphone use positively predicts academic anxiety.

Furthermore, as suggested in the theories, anxiety is associated with self-regulation and coping behaviours. Empirical evidence suggests that test anxiety, as a component of academic anxiety, is associated with study skills (time management and habits), coping strategies and procrastination. Thus it seems interesting to explore whether academic anxiety is associated with self-regulation, coping behaviours or

procrastination, and whether problematic smartphone use is linked with those variables.

2.3 Academic procrastination

2.3.1 Introduction

Procrastination has been defined in a variety of ways, including "putting off acting on one's intentions" (Lay & Silverman, 1996, p. 61). Schraw, Wadkins & Olafson (2007) defined procrastination as "intentionally deferring or delaying work that must be completed" (p. 13). However, Steel (2007) suggest that "to procrastinate is to voluntarily delay an intended course of action despite expecting to be worse off for the delay" (p. 7). Meanwhile, according to Lay & Silverman (1996), procrastination often appears in academic contexts while students may procrastinate on assignments or exams. Milgram, Batori & Mowrer (1994) pointed out that academic procrastination is one specific form of procrastination.

2.3.2 A model of academic procrastination

According to Senécal, Koestner & Vallerand (1995) and Solomon & Rothblum (1984), procrastination is not simply about study skills or time management, but has behavioural, cognitive and affective elements. Schraw, Wadkins & Olafson (2007) conducted a grounded theory study of academic procrastination and built a paradigm model of academic procrastination as shown in Figure 2.8. The aim of their study was to construct a grounded theory of academic procrastination based on students' reports. Participants were sixty-seven undergraduate students from a university in the USA.

Data were collected in four stages of interviews during eight semesters including summer sessions. Phase 1 contained focus groups and individual interviews intended to find themes for further analysis. Phases 2 and 3, involving individual interviews, explored those themes in order to construct a model. Phase 4 with further individual interviews tested, validated and explained the paradigm model.

The paradigm model of academic procrastination provides a framework for understanding academic procrastination and indicates that procrastination can be either positive or negative for students. First, the causes or antecedents of procrastination in this model are personal interests and skills, teacher characteristics and expectations, and task characteristics. Second, the phenomenon of procrastination consists of both adaptive and maladaptive aspects which include positive aspects such as high efficiency in limited time and negative aspects including fear of failure and laziness. Third, in this model students use cognitive and affective coping strategies against procrastination including identifying clear goals, working in groups, underestimating task difficulty, self-talking to improve self-efficacy and physical exercise to reduce stress. Fourth and finally, procrastination may have limited impact on the students' quality of work and either positive or negative impact on their life quality. The model also suggests that contexts and conditions including deadlines may affect the phenomenon and coping strategies of procrastination. Overall, one of the strengths of this model might be that both positive and negative effects of procrastination were included. However, this model did not indicate reciprocal links or feedback loops of the aspects of procrastination. It is unknown whether the consequences such as improved or reduced

life quality have feedback impact on adaptive or maladaptive appraisals or the other antecedents.

Contexts and Conditions

*Unclear Directions

*Deadlines

*Lack of Incentives

Antecedents	Phenomenon	Coping Strategies	Consequences
*Self	*Adaptive	*Cognitive	*Quality of Life
*Teacher	*Maladaptive	*Affective	
*Task			*Quality of Work
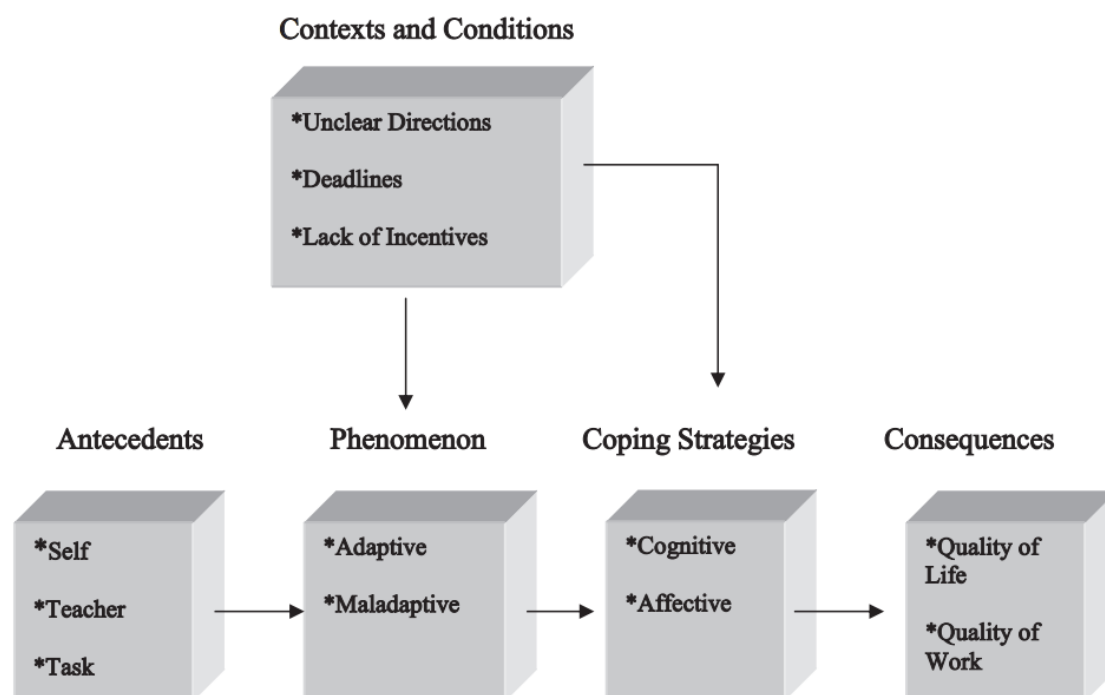
Figure 2.8: A paradigm model of academic procrastination (Schraw, Wadkins & Olafson, 2007, p. 18)

2.3.3 Academic procrastination and anxiety

Solomon & Rothblum (1984)'s factor analysis of the second part of the PASS, which is about the reasons for procrastination, finds that the dominant reasons for procrastination are fear of failure and the aversiveness of the task. They also found fear of failure to be significantly related to anxiety. According to the Collins dictionary (2007, p. 45), anxiety refers to "a state of uneasiness or tension caused by apprehension of possible future misfortune, danger, etc." Therefore, it seems that anxiety could be

associated with procrastination. Several studies have investigated the relationship between academic procrastination and anxiety.

2.3.3.1 General anxiety

Fritzsche et al. (2003) explored the relationship between academic procrastination, general anxiety, and writing success among 206 undergraduate students in the USA. Participants were asked to complete the PASS first. Then, after finishing their writing assignments, they were asked to complete the State-Trait Anxiety Inventory (STAI) by Spielberger, Gorsuch & Lushene (1970) and the Writing Behaviour Assessment (WBA), especially designed for the study assessing writing delay behaviours on the given task. Furthermore, participants' grades were collected, with their permission. Significant correlations were found between overall academic procrastination and trait anxiety ($r = 0.39, p < 0.05$) while procrastination on writing was significantly correlated with state anxiety ($r = 0.20, p < 0.05$) and trait anxiety ($r = 0.27, p < 0.05$) respectively. Procrastination on writing was also significantly correlated with typicality of delaying on the writing task ($r = 0.19, p < 0.05$) and actual behaviour ($r = 0.17, p < 0.05$). Thus it seems that academic procrastination on writing is correlated with trait and state anxiety according to this study. However, as reported by Fritzsche et al. (2003), the reliability of the WBA needs to be improved. Meanwhile, the validity of the WBA was not clearly explained, which might have affected the results.

Haycock, McCarthy & Skay (1998) investigated procrastination, anxiety, self-efficacy, gender and age. Participants were 141 university students including

undergraduates, postgraduates and adult extension students. The Self-Efficacy Inventory (SEI) was created in this study to assess participants' self-efficacy beliefs. The STAI was adopted to measure general anxiety and the modified Procrastination Inventory (PI) developed by Lay (1986) was used to measure procrastination. Procrastination was significantly correlated with state anxiety ($r = 0.31$, $p < 0.001$) and trait anxiety ($r = 0.23$, $p < 0.05$). Regression analysis found that only cumulative efficacy ($p = 0.04$) was a marginally significant predictor of procrastination.

Another small study, conducted by Lay & Silverman (1996), focused on trait procrastination and trait anxiety. Participants were 58 university students in Canada. Trait procrastination was measured by the PI by Lay (1986). Trait anxiety was tested by a 16-item scale from the Jackson Personality Inventory (Jackson, 1976). State anxiety and dejection were tested by an inventory of 24 emotion-labels designed by Higgins (1987). A 5-point scale including 6 behaviours based on previous studies were developed to assess dilatory behaviours. The study was conducted every two days during the exam period beginning at 5 days before the first exam. Multiple regression analyses indicated that trait procrastination predicted dejection rather than state anxiety. However, trait procrastination was found to be unrelated to trait anxiety. The small sample of participants in this study should be borne in mind.

The studies described above found different results and it remains unclear whether procrastination is associated with anxiety or not. However, it seems necessary to distinguish state and trait anxiety when investigating procrastination and general anxiety. Furthermore, the studies of Fritzsche et al. (2003) and Lay & Silverman (1996)

explored procrastination in relation to writing assignments or exam situations among university students which could be related to academic anxiety. Therefore, it seems necessary to consider whether academic anxiety is associated with academic procrastination among university students.

2.3.3.2 Test anxiety

There are studies exploring test anxiety and procrastination. As previously reviewed in the chapter about test anxiety, Klassen et al. (2009) investigated academic procrastination and motivational variables including test anxiety through a cross-cultural study in Canada and Singapore. Tuckman (1991)'s 16-item procrastination scale and a 5-item test anxiety scale by Pintrich et al. (1993) were adopted. According to multigroup path analysis, academic procrastination was significantly predicted by test anxiety in both Canadadian and Singaporean contexts.

A study by Cassady & Johnson (2002) aimed to establish a scale for cognitive test anxiety and to explore relationships between cognitive test anxiety, procrastination, gender, emotionality and performance. Participants were 168 undergraduate educational psychology majors in a university in the USA. Procrastination was measured by the 10-item Test Procrastination Questionnaire (TPQ) developed by Kalechstein et al. (1989). The 27-item Cognitive Test Anxiety scale developed from pilot tests was used to assess cognitive test anxiety. Correlational analysis indicates that test procrastination was significantly related to cognitive test anxiety ($r = 0.23$).

According to these studies, it seems that procrastination and test anxiety are likely

to be related among university students. However, as test anxiety seems to be one key components of academic anxiety as discussed previously, it seems necessary to explore if there are links between academic anxiety and academic procrastination.

2.3.4 Academic procrastination and Internet use

Sahin (2014) conducted a study to explore academic procrastination and the use of online social networks in Turkey. The Facebook Use Purpose scale and the Facebook Adoption Scale developed by (Mazman, 2009) were used to evaluate the Facebook use of the participants. Academic procrastination was assessed by the academic procrastination scale developed by Aitken (1982). The correlation between academic procrastination and Facebook use case was significant ($r = 0.204$, $p < 0.01$). Academic procrastination was significantly related to Facebook use for social relations ($r = 0.205$, $p < 0.01$) more than Facebook use for academic studies ($r = 0.075$, $p < 0.01$). Furthermore, ANOVA results show that moderate and high Facebook users were more likely to procrastinate. This study shows some links between Facebook use and academic procrastination. However, the validity and theoretical basis of the instruments in the study were not clarified while those instruments were adopted from an unpublished thesis.

A study by Odaci (2011) investigated whether self-efficacy and academic procrastination predicted problematic Internet use. Participants were 398 university students in Turkey. Problematic Internet use was measured by the Problematic Internet Use Scale (PIUS: Ceyhan, Ceyhan, and Gürcan, 2007) and academic procrastination

was measured by the Academic Procrastination Scale (APS: Çakıcı, 2003). Academic procrastination and problematic Internet use were not significantly correlated ($r = 0.09$, $p > 0.05$). Multiple linear regression indicated no predictive relationship between academic procrastination and problematic Internet use ($\beta = 0.03$, $p > 0.05$). This study indicates that there was no relationship between problematic Internet use and procrastination. It seems unclear whether similar results will be found in the other contexts such as China.

2.3.5 Summary

Several studies have found that procrastination is associated with general anxiety and test anxiety. The model by Schraw et al. (2007) indicates that fear of failure is a maladaptive aspect of procrastination and that task difficulty is an antecedent of procrastination. It remains unclear whether anxiety about the task is a predictor of procrastination. Thus, in an educational context, it seems necessary to explore whether there is a link between academic anxiety and academic procrastination. A hypothesis could be proposed as follows:

H2: academic anxiety positively predicts academic procrastination

Furthermore, empirical studies have found that academic procrastination might be related to problematic Internet use. To our knowledge, no study has yet investigated the relationship between mobile phone use and academic procrastination, while Schraw et al.'s (2007) model did not include mobile phone use or any similar factors. Nevertheless, since smartphones are providing Internet use and social network services with flexible

access, it is noteworthy to explore whether academic procrastination is associated with problematic smartphone use. Considering the previous hypothesis, it is also unknown whether academic anxiety mediates this relationship. Thus, we propose the following hypotheses:

H3: problematic smartphone use positively predicts academic procrastination.

H4: problematic smartphone use positively predicts academic procrastination mediated through academic anxiety.

2.4 Self-regulation and problematic smartphone use

2.4.1 General self-regulation and smartphone use

A number of studies have identified a relationship between self-regulation and smartphone addiction (Gökçearslan, Mumcu, Haşlaman, & Çevik, 2016; Van Deursen, Bolle, Hegner, & Kommers, 2015). They have tended to find that participants with higher levels of self-regulation show lower levels of problematic smartphone use.

Van Deursen, et al. (2015) found that self-regulation negatively influenced addictive smartphone behaviour among 386 participants ranging from age 15 to age 88 in the Netherlands. The Self-Regulation Scale (SRS) developed by Diehl, Segmon and Schwarzer (2006) was used to assess self-regulation in this sample and showed good internal reliability ($\alpha = 0.78$). It should be noted that the researchers deleted one item from the original 10-item four-point Likert scale after pre-test in order to improve internal reliability. Addictive smartphone behaviour was assessed using the Mobile

Phone Problem Use Scale (MPPUS, Bianchi and Phillips, 2005) which also showed good internal reliability ($\alpha = 0.93$). Self-regulation was significantly negatively correlated with smartphone addiction ($r = -0.37$, $p < 0.05$). That is, people who reported high levels of self-regulation were significantly less likely to report problematic mobile phone use. Path analysis revealed a significant negative direct effect ($\beta = -0.24$, $p < 0.001$) of self-regulation on addictive smartphone behaviour which supported one of the researchers' hypotheses. However, this study had some limitations in that the participants covered a large range of ages with 139 participants (36%) in the 15 to 25 age bracket, 92 (24%) in the 26 to 35 bracket, 49 (13%) in the 35-45 bracket, 60 (14%) in the 46 to 55 bracket and, finally, 46 participants (12%) who were older than 55. This study found that age significantly influenced both self-regulation ($\beta = 0.25$, $p < 0.001$) and smartphone addiction ($\beta = -0.18$, $p < 0.001$). There is therefore uncertainty regarding whether the relationship between self-regulation and smartphone addiction is the same at all ages.

Similarly, a recent study in Turkey found that self-regulation negatively predicts smartphone addiction (Gökçearslan et al., 2016). In this case the participants were 598 undergraduate students. The modified SRS developed by Diehl et al. (2006) was used to assess self-regulation and showed good internal consistency in this sample ($\alpha = 0.79$). However, three items of the original SRS were deleted in line with a Turkish validation study by Çevik, Has̨laman, Mumcu, and Gokçearslan (as cited in Gökçearslan et al., 2016, p. 642). The SAS-SV developed by Kwon et al. (2013) was adopted to assess smartphone addiction and showed an internal consistency coefficient of $\alpha = 0.76$. Once

again, smartphone addiction was significantly negatively correlated with self-regulation (r= -. 0.25, p < 0.01). Path analysis suggested that self-regulation had a negative effect on smartphone addiction with a standardised coefficient of -0.22 (p < 0.01).

These two studies set examples of using structural equation modelling to test a hypothesised relationship between self-regulation and smartphone addiction. The results indicate that there appear to be predictive relationships from self-regulation to smartphone addiction. However, as reported in both Van Deursen, et al. (2015) and Gökçearslan et al. (2016), it remains necessary to adapt other research methods collecting qualitative data besides self-reported surveys to gain deeper insight and knowledge of this topic. Thus it seems that mixed-methods research into smartphone addiction and self-regulation could enhance this body of literature. Furthermore, these studies both report data from European samples and it would be of interest to explore whether similar patterns of association are observed in non-European samples.

2.4.2 Deficient self-regulation specific to internet or mobile phone use

There have been several studies focused on the relationship between deficient self-regulation and Internet or mobile phone usage (LaRose & Eastin, 2004; LaRose, Lin, & Eastin, 2003; Soror, Steelman, & Limayem, 2012). However, deficient self-regulation in those studies was measured as specific self-regulation related to Internet or mobile phone use. An example of the items used is "I have a hard time keeping my Internet use under control" (LaRose & Eastin, 2004, p. 370). It seems unclear whether

the Internet self-regulation tested in these studies were the same variable as problematic Internet or mobile phone use.

LaRose et al. (2003) investigated deficient Internet self-regulation, Internet habit strength and Internet usage in a sample of 465 USA students. Deficient Internet self-regulation and Internet habit strength were measured using a series of items with 7-point Likert response scales designed by the researchers based on previous scales on Internet addiction. Internet usage was measured by the minutes of Internet use reported by participants. Deficient Internet self-regulation was significantly positively correlated with Internet use ($r = 0.45$, $p < 0.01$) and Internet habit strength ($r = 0.67$, $p < 0.01$). In the researchers' final model, deficient Internet self-regulation positively predicted Internet usage ($\beta = 0.13$) and Internet habit strength ($\beta = 0.55$), while Internet habit strength positively predicted Internet use ($\beta = 0.36$). However, the indirect effects and the significance of the estimates were not reported. There appears to be a mediating relationship between the three variables indicating that the participants spent more time on the Internet because they had developed a habit of using the Internet which was influenced by deficiencies in their self-regulation. It seems that the Internet self-regulation tested in this study was the similar variable as problematic Internet use.

Similarly, LaRose & Eastin (2004) explored deficient Internet self-regulation, habit and Internet usage in a sample of 167 internet users. The measurements in this study was similar to those in LaRose et al. (2003). In their path analysis model, deficient Internet self-regulation positively predicted Internet usage ($\beta = 0.15$, $p < 0.05$) and habit ($\beta = 0.39$, $p < 0.05$) while habit also predicted Internet usage ($\beta = 0.26$, $p < 0.05$). The

results in LaRose et al. (2003) and LaRose & Eastin (2004) suggest that low levels of self-regulation specific to internet use predicts higher levels of habitual internet use and frequency of Internet usage. However, the two studies focused on specific deficient Internet self-regulation rather than general self-regulation. But "deficient Internet self-regulation" seems to be too similar to problematic or addictive Internet use rather than self-regulation. Meanwhile, it seems too obvious to say that low levels of "Internet self-regulation" predict heavier Internet usage.

More recently, Soror et al. (2012) has explored associations between deficient mobile phone self-regulation, anxiety, boredom, mobile phone use, habit and negative consequences. Participants were 266 adults in the USA who responded with complete answers in an online survey. The research team gathered data using self-designed measures. Deficient mobile phone self-regulation was tested using a 6-item scale with a 7-point response scale. An example item is "I find it difficult to control my cell phone checking" (Soror et al., 2012, p. 857). Negative consequences were measured using items such as "I have often been in trouble because I checked my cell phone during a meeting" (Soror et al., 2012, p. 858). Mobile phone use was measure by the self-reported frequency and length of daily phone use. In the hypothetical structural model based on empirical evidence, anxiety and boredom were placed as antecedents and deficient self-regulation was located in the central part. The results of path analysis suggested that deficient mobile phone self-regulation positively predicted mobile phone use ($\beta = 0.47$, $p < 0.001$), habit ($\beta = 0.67$, $p < 0.001$) and negative consequences ($\beta = 0.59$, $p < 0.001$). Anxiety did not predict deficient mobile phone self-regulation

significantly and boredom positively predicted mobile phone self-regulation ($\beta = 0.50$, $p < 0.001$). Nevertheless, similar to LaRose et al. (2003) and LaRose & Eastin (2004), this study measured specific self-regulation specific to mobile phone use which possibly tested the same thing as mobile phone addiction or problematic smartphone use. Overall, the three studies discussed here indicate that there is likely to be a relationship between self-regulation and problematic smartphone use.

2.4.3 Self-regulated learning and text messaging

Another recent study investigated college students' self-regulated learning and text messaging during class using a sample of 190 undergraduate students in the USA (Wei, Wang, & Klausner, 2012). Self-regulation of learning was evaluated using the 9-item self-regulation subscale of the Motivated Strategies for Learning Questionnaire (MSLQ) developed by Pintrich & De Groot (1990). The numbers of the messages read and sent by participants during class was assessed by self-report in the same questionnaire. This study also assessed sustained attention and cognitive learning. The study found that self-regulation of learning negatively predicted text messaging during classes ($\beta = - 0.65$, $p < 0.001$). Also, it was found that text messaging during classes mediated the relationship between self-regulation and sustained attention as there was a significant indirect effect from self-regulation to sustained attention. One limitation of this might be the reliability of self-reported numbers of read and sent messages because the numbers of received messages might be different during the specific time and the chances of reading messages might be unequal. This study, which was

conducted within educational settings, suggests that the self-regulation of learning, besides the general self-regulation tested in Van Deursen, et al. (2015)'s study and the specific self-regulation tested in LaRose & Eastin (2004), may predict problematic smartphone use. Thus, considering all those studies, it seems that self-regulation (learning-related or general), can be a predictor of problematic smartphone use in certain contexts. It seems interesting to investigate whether self-regulation has impact on smartphone use among college students in China.

2.4.4 Summary

As reviewed above, self-regulation has been found to be negatively associated with problematic mobile phone and Internet use in some contexts. Specific self-regulation in relation to Internet use was found to be negatively associated with the amount of Internet usage. Self-regulated learning can also affect problematic mobile phone use. The model of problematic mobile phone use (Billieux, 2012) indicates that poor self-control could be a predictor of problematic mobile phone use. It seems interesting to explore whether the relationship exists in the Chinese college context. Thus a hypothesis is proposed as follows:

H5: self-regulation negatively predicts problematic smartphone use.

2.5 Life satisfaction and problematic smartphone use

2.5.1 Introduction

In dictionaries, well-being is defined as "the condition of being contented, healthy,

or successful; welfare" (*Collins dictionary: 175 years of dictionary publishing,* 2007, p. 1820); and "personal and physical comfort, especially good health and happiness" (*Longman dictionary of English language a*nd culture, 1998, p. 1514). Well-being is an abstract concept that includes both mental and physical components. However, commentators have argued that it is important to be clear about the type of well-being under study as subjective well-being or happiness, for instance, might represent something different to another definition of wellbeing, such as economic or physical comfort (e.g. Angner, 2010; Bartels, 2015). It will be important to be clear in the current study on the type of wellbeing that is measured.

Diener, Lucas, & Oishi (2002, p. 63) define "subjective well-being" (SWB) as "a person's cognitive and affective evaluations of his or her life". SWB therefore has three components: "pleasant emotions, low levels of negative moods and high life satisfaction". It is clear that the concept of subjective well-being does not incorporate any physical aspect of well-being. The Satisfaction With Life Scale (SWLS, Diener, Emmons, Larsen, & Griffin, 1985) was developed to measure just one component of subjective well-being, namely self-reported life satisfaction. When exploring relationships between mobile phone or Internet use and well-being, a number of studies adopted the SWLS as a measure of life satisfaction (Dayapoglu, Kavurmaci, & Karaman, 2016; Kross et al., 2013; Lepp, Barkley, & Karpinski, 2014; Li, Lepp, & Barkley, 2015; Samaha & Hawi, 2016). Other studies of mobile phone and Internet use have focused on "psychological well-being" regarding this as an umbrella concept operationalized as sub-variables such as loneliness, depression, compulsiveness and

self-esteem (Choi & Lim, 2016; Park & Lee, 2012; Whang, Lee, & Chang, 2003).

2.5.2 Subjective well-being and smartphone use

Samaha & Hawi (2016) explored the relationship between smartphone addiction and life satisfaction in a sample of 249 university students. The SWLS was used to test life satisfaction and the SAS-SV was used to assess smartphone addiction. They found no statistically significant correlation between smartphone addiction and life satisfaction. Through hierarchical multiple regression analysis, the researchers found that stress and academic performance (GPA) mediated the relationship from smartphone use to life satisfaction. However, they did not use Baron & Kenny's (1986) traditional methods or other methods (e.g. SEM) to test the mediation relationships. It seems that they only tested the correlations separately but claimed mediation relationships. Smartphone addiction negatively predicted GPA (β = -0.20, p < 0.001) and explained 3.9% of the variance after controlling for age and gender. In turn, GPA positively predicted life satisfaction (β = 0.16, p < 0.05) and explained 2.2% of the variance after controlling for age and gender. They confirmed the mediation relationship only based on these two separate links. A similar mediating relationship was found between smartphone addiction and life satisfaction via self-reported stress. Although no correlation was found between smartphone addiction and life satisfaction, stress and GPA were claimed to be mediators of that relationship. Thus, there seems a need to investigate whether smartphone addiction is associated with life satisfaction in different contexts such as Chinese colleges.

A study conducted with 536 undergraduates in the USA explored cell phone use and life satisfaction (Lepp et al., 2014). The researchers tested time spent on cell phones every day, except for listening to music, and the total number of text messages sent and received each day. Life satisfaction was evaluated using the SWLS. There were no significant correlations between life satisfaction and time spent on cell phones or text messaging. According to path analysis, time spent on cell phone significantly predicted GPA ($\beta = -0.20$, $p < 0.05$) and anxiety ($\beta = 0.10$, $p < 0.05$) while GPA and anxiety significantly predicted life satisfaction respectively ($\beta = 0.21$, $p < 0.05$; $\beta = -0.22$, $p < 0.05$). The model fit indexes show that the model including the four variables had a nearly perfect model fit (RMSEA = 0.04, GFI = 1.00, AGFI = 0.99). Although the effects were relatively small, it seems that GPA and anxiety were possible mediators of a relationship between cell phone use and life satisfaction. Similar relationships were found from texting to life satisfaction. However, Lepp et al. (2014) did not report the mediation relationship in full because there was no significant relationship between cell phone use and life satisfaction. The path coefficients in the models indicate that the possible relationship from cell phone use and life satisfaction through mediators such as academic performance and anxiety. Thus, considering this study and the study conducted by Samaha & Hawi (2016), it seems interesting to further explore whether the relationship between smartphone use and life satisfaction exists, and whether it is mediated by other variables.

Opposite to the study by Samaha & Hawi (2016), Dayapoglu et al. (2016) conducted a study with 353 undergraduates in Turkey and found problematic smartphone use to

be negatively correlated with life satisfaction ($r = -0.16$, $p < 0.01$) and positively correlated with loneliness ($r = 0.26$, $p < 0.001$). Life satisfaction was tested using the SWLS and problematic smartphone use was tested with the PMPUS. However, it is necessary to note that the participants were all nursing students. This study indicates that a relationship between problematic smartphone use and life satisfaction exists but further study on predictive relationship seems still necessary.

Kross et al. (2013) investigated Facebook use and subjective well-being among 82 participants in the USA through a three-step longitudinal study. In the first phase, the participants completed the SWLS and the other scales about self-esteem and depression. In the second phase, the participants were texted five times a day for 14 days. The text messages asked the participants about their feelings in the moment, their levels of worries, loneliness, Facebook usage frequency since the last text and direct contact with people. In the third phase, the participants completed the SWLS again and a loneliness scale. The researchers found that Facebook use appeared to affect participants' in-the-moment feelings (B = 0.08, p < 0.001) and life satisfaction ($\beta = -0.12$, p < 0.05). It shows that the more participants used Facebook, the more worries, and less life satisfaction, they had. However, one shortcoming of this study might be the 14-day text research phase in which the participants were asked for responses five times a day from 10am until midnight. It is unknown whether the questions interrupted the participants' daily life and affected their emotions. This study suggests that Facebook use, also a component of smartphone use, had a negative impact on subjective well-being indicating that the relationship between smartphone use and subjective well-being

needs to be further investigated.

Lachmann et al. (2018) investigated the relationship between life satisfaction and smartphone use disorder (SUD) among Chinese ($n = 612$) and German ($n = 304$) participants mainly university students. SUD was measured by the 10-item Smartphone Addiction Scale-Short Version (SAS-SV) by Kwon, Kim et al. (2013). Life satisfaction was measured by single item measures from the German Socio-Economic Panel (SOEP) (Siedler, Schupp, Spiess, & Wagner, 2009). They measured seven single items to test satisfaction with health, job, income, housing, leisure, family and overall life satisfaction. Lachmann et al. (2018) found significant correlations between SUD and overall life satisfaction only among the Chinese sample ($r = -.13, p < 0.001$). SUD was also significantly correlated with satisfaction with health ($r = -.11, p < 0.01$), income ($r = -.12, p < 0.01$) and leisure ($r = -.13, p < 0.001$). However, no significant correlations were found between SUD and life satisfaction among the German sample. This study suggests that life satisfaction was linked to SUD only among the Chinese participants. It indicates that PSU might be a unique issue in China and further studies are needed to explore the prevalence and associated factors. It is also necessary to explore whether the relationships found in Lachmann et al. (2018) are replicable.

2.5.3 Psychological well-being variables and smartphone use

A study conducted by Park & Lee (2012) investigated psychological well-being and motives for smartphone use. Psychological well-being was regarded as an umbrella

concept constituted by three variables: loneliness, depression and self-esteem. Participants were 279 university students in Korea. Loneliness was tested using the revised UCLA loneliness scale (Russell, 1996). Self-esteem was tested by Rosenberg (1965)'s ten statements about self-worth and self-acceptance. Depression was tested through seven items from the depression scale in Radloff (1977). Motives for smartphone use was assessed using a 21-item scale combined with items from Leung & Wei's mobile phone motives scale and Kim & Haridakis' Internet motive scale. The smartphone motivation scale was divided into six factors: caring for others, following trends, communication, information, accessibility and passing time. Regression analysis indicated that several motives for smartphone use significantly predicted the psychological well-being variables. Caring for others significantly predicted self-esteem ($\beta = 0.22$, $p < 0.01$) and loneliness ($\beta = -0.18$, $p < 0.01$). Accessibility significantly predicted self-esteem ($\beta = 0.15$, $p < 0.05$) and loneliness ($\beta = -0.17$, $p < 0.01$). They did not find significant predictive association form the other motives to the psychological well-being variables. However, it is important to note that this study did not investigate the smartphone use directly but the motives for smartphone use. It seems unclear whether problematic smartphone use is related to the psychological well-being variables.

Similarly, Whang et al. (2003) explored the relationship between Internet overuse and three psychological well-being variables including loneliness, depressive mood and compulsiveness in a large sample of 13588 Korean Internet users. The Internet use was assessed by self-designed questions asking about the Internet activities and duration of

use. Internet dependence was also tested using a scale adopted from Young (1998)'s study. Three psychological well-being variables were evaluated through 44 items selected from 142 items in the "The Diagnostic Scale of Excessive Internet Use" provided by the Korean Youth Counselling Institute (Whang et al., 2003, p. 145). According to Young (1998)'s criteria, the participants were identified as three groups: Internet Addicts (IA: scored higher than 60), Possibly Internet Addicts (PA: scored from 50 to 60) and Non-Addicts (NA: scored below 40). Participants with scores between 40 and 49 were excluded. ANOVA revealed that the IA group reported higher degree of loneliness, depressive moods and compulsiveness than PA or NA groups. Also, the NA group reported higher levels of depressive moods and compulsiveness than the PA group. This indicates that participants who overused the Internet tended to be in worse psychological condition but that moderate users were better off than the lightest users. However, the participants were divided into groups (IA, PA and NA) and a group with scores between 40 and 49 which was not in the three groups were excluded from data analysis. It is unknown if the deletion of data affected the results of the study. This study exploring the Internet use and psychological well-being might indicate the potential relationship between smartphone use and psychological well-being.

A study conducted by Choi & Lim (2016) focused on social and technological overload, social network addiction and psychological well-being but only used self-esteem as a single variable to represent well-being. Participants were 419 university students and employees who were all social network users in Korea. Social overload was tested using a six-item scale developed by Maier, Laumer, Eckhardt, & Weitzel

(2012) with an example item of "I feel irritated, because I pay too much attention to posts of my Facebook-friends in Facebook". Technology overload were examined using the five-item scale in Tarafdar, Tu, & Ragu-Nathan (2010) with an example item of "I am forced by this technology to work much faster". Social media addiction was assessed by the Facebook addiction scale developed by Koc & Gulyagci (2013). Self-esteem was tested as a representative variable of psychological well-being using the seven items from Rosenberg (1965)'s self-esteem scale. Path analysis revealed that social network addiction fully mediated social or technology overload and self-esteem. While social network addiction had a significant direct effect on self-esteem, which was reported as psychological well-being ($\beta = -0.30$, $p < 0.01$). However, it seems possible that participants may have misunderstood understand the technology overload questions since they might misunderstand the term "this technology". It is also unknown whether the social overload scale was testing one aspects of social network addiction. Nevertheless, this study indicates that social media use, as one component of smartphone use, predicted one aspect of well-being. Considering with the other studies conducted in Korean context, it seems interesting to investigate if similar patterns will be observed in China. It suggests the possibility of further studies on smartphone use and well-being among Chinese college students.

2.5.4 Summary

From the studies reviewed above, well-being can be measured using a wide variety of scales that measure constructs including life satisfaction, loneliness, depression and

happiness. In the current study, anxiety will be included as a negative emotion and we will supplement this with a measure of life satisfaction. The limited empirical evidence so far suggests that we can predict small associations between smartphone use and well-being (life satisfaction) and that this relationship may be mediated by other factors. We can explore this in a Chinese sample. Thus, a hypothesis could be proposed:

H6: problematic smartphone use negatively predicts life satisfaction.

2.6 Aims and hypothesised model

According to the reviews above, there are a number of issues that still need to be explored empirically. Therefore, the aims of the current study are as follows: 1. to investigate the prevalence of problematic smartphone use in a sample of Chinese students; 2. to investigate whether academic anxiety mediates a relationship (if observed) between problematic smartphone use and academic procrastination; 3. to investigate whether problematic smartphone use is associated with academic anxiety, academic procrastination, self-regulation and life satisfaction; 3. to explain those relationships (if observed).

As discussed in the reviews, six hypotheses including a mediation hypothesis have been proposed based on extant theoretical and empirical evidence:

H1: problematic smartphone use positively predicts academic anxiety.

H2: academic anxiety positively predicts academic procrastination

H3: problematic smartphone use positively predicts academic procrastination.

H4: problematic smartphone use positively predicts academic procrastination mediated through academic anxiety.

H5: self-regulation negatively predicts problematic smartphone use.

H6: problematic smartphone use negatively predicts life satisfaction.

Therefore, a hypothesised model including the mediation hypothesis is proposed as shown in Figure 2.9. This model will be tested in the studies presented in this thesis.
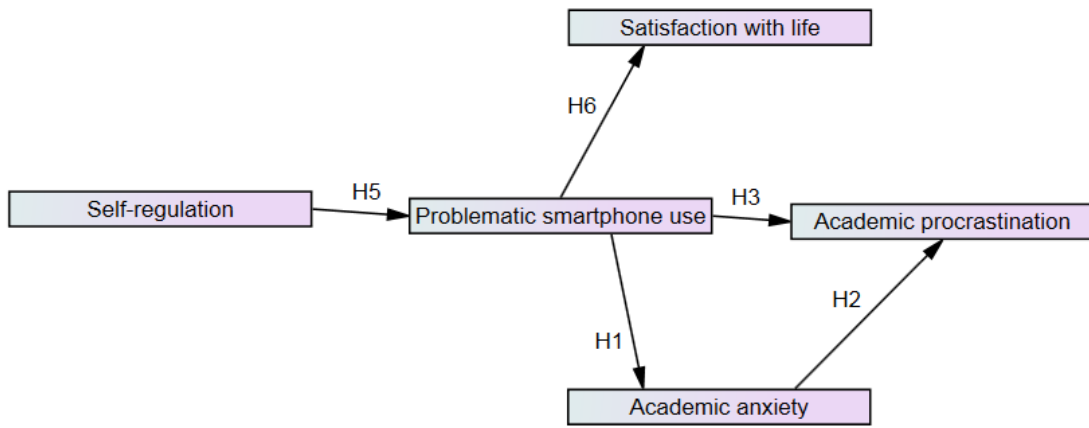
Figure 2.9: A hypothesised model.

Chapter 3 General methodology

3.1 Introduction

This chapter discusses the research methods used in the studies presented in this thesis. The research uses a correlational, mixed-methods design. Both paper-based questionnaires and semi-structured interviews were used for the Chinese participants. For the British participants, online and paper questionnaires were used to collect both quantitative and qualitative data. This chapter presents the general methodology and information specific to particular studies is provided in the following chapters.

In total, four studies were conducted during this PhD, including the pilot study, main study (quantitative), main study (qualitative) and cross-cultural study. The pilot study tested the measurements of PSU, academic anxiety and procrastination, and investigated the hypothesised mediating relationship between the three variables among Chinese undergraduates using paper-based questionnaires. The quantitative part of the main study tested the hypothesised model proposed in previous chapter, and adapted on the basis of the pilot study, using questionnaires among Chinese students. The qualitative part of the main study used semi-structured interviews and participants who volunteered to be interviewed.were recruited from the quantitative part of the main study. The cross-cultural study was conducted in a university in the UK in order to compare Chinese and British participants, and both quantitative and qualitative data were collected using paper and online surveys (including scales and open questions) among the British sample.

3.2 Participants

Non-probability convenience samples were recruited for questionnaire surveys in all studies. Undergraduate students in a university in China and a university in the UK were recruited to take part. The Chinese university is located the city of Wuhan in the central part of China. The university has an upper medium national ranking, and the students represent upper medium level students in China. Participants in the pilot study and main study (quantitative) were 112 and 475 Chinese undergraduate students respectively. Participants in the interviews were 16 Chinese students. The British university in the cross-cultural study is a university located in Northern England, and the students represent upper level students in the UK. In total, 303 British students participated in the research. More detailed information about participants will be presented in the following chapters.

3.3 Measurements

3.3.1 Overview

This section mainly focuses on the choice of measures for the questionnaires. A self-report questionnaire measure was designed to collect quantitative data on five study variables: problematic smartphone use (PSU), academic anxiety, academic procrastination, self-regulation and life satisfaction. The Smartphone Addiction Scale-Short Version (SAS-SV; Kwon, Kim et al., 2013) was used to investigate problematic smartphone use. The anxiety scales of the Achievement emotions questionnaire (AEQ; Pekrun, Goetz, & Perry, 2005) were used to assess participants' levels of academic

anxiety. The Irrational Procrastination Scale (IPS; Steel, 2010) was adopted to assess academic procrastination. The Self-Regulation Scale (SRS) developed by Diehl, Segmon and Schwarzer (2006) was used to measure self-regulation. The Satisfaction With Life Scale (SWLS, Diener, Emmons, Larsen, & Griffin, 1985) was used to assess life satisfaction. Demographic data were also collected. All scales were translated from published English versions into Chinese.

The translation process included four steps. Firstly, the original English versions of the scales were translated by the researcher into Chinese. In the second step, the first Chinese version was evaluated by two bilingual PhD students in Education who had Masters degrees in translation and interpretation. Then the researcher, the initial translator, discussed the translations with the evaluation group and modified the first Chinese versions on the basis of these discussions. In the third step, another bilingual PhD student in Education, who did not participate in the previous steps, translated the revised Chinese version back into English. Lastly, the initial translator and the back translator compared the back translation and the original English version, made corrections and prepared a final translation for the pilot study. After the pilot study, the translator and the back translator discussed the modified questionnaires and no changes were made to the translation.

It was important to operationalize all study variables carefully and well. Therefore, several measures were considered before deciding which ones to use. The following section describes the measures that were considered and presents a rationale for the final choices made.

3.3.2 Problematic smartphone use

Several possible measures were considered as ways of operationalising problematic smartphone use. The following section documents the instruments that were considered and the reasons for choosing the SAS-SV (Kwon, Kim et al., 2013).

3.3.2.1 Mobile Phone Problem Use Scale (MPPUS)

The Mobile Phone Problem Use Scale (MPPUS) developed by Bianchi & Phillips (2005), the third section of Mobile Phone Use Survey, is a 27 item questionnaire with a 10-point Likert-type response format ranging from 1 ("not true at all") to 10 ("extremely true") that measures problematic mobile phone use, including both behavioural and technological addiction. According to Bianchi & Phillips (2005), the MPPUS is highly reliable with a Cronbach's alpha of 0.93. In order to assess the validity of the MPPUS, Bianchi & Phillips (2005) calculated Pearson's correlations between the MPPUS and other measures including time spent on mobile phones, number of people called and average monthly expenditure ($r = 0.45$, $p < 0.01$; $r = 0.42$, $p < 0.01$ and $r = 0.43$, $p < 0.01$ respectively). Furthermore, the MPPUS was significantly correlated with another scale measuring addiction, the MMPI-2 Addiction Potential Scale by Weed, Butcher and McKenna (as cited in Bianchi & Phillips, 2005, p. 41), with a correlation of $r = 0.34$, $p < 0.01$. Therefore, according to Bianchi & Phillips (2005), the MPPUS seems to be both reliable and valid.

However, the MPPUS does not include any items related Internet use focusing instead on text messages and calls as primary functions of mobile phones. As

smartphones include Internet-based functions, it seems important to include the Internet features of mobile phones, a weakness of this measure for the current study. Furthermore, item 7 ("I have received mobile phone bills I could not afford to pay") seems not to be suitable for Chinese students since phone fees in China are not requested via bills.

Foerster et al. (2015) shortened the MPPUS to a 10-item scale (MPPUS-10) in order to explore mobile phone use problems among adolescents. According to a principal component analysis (PCA) by Foerster et al. (2015), 17 items were removed from the original version of the MPPUS-27 and 10 items remained which reflect four factors: Loss of Control, Withdrawal, Negative Life Consequences and Craving. Foerster et al. (2015) reported that this shortened version of the MPPUS-10 is also reliable with a Cronbach's alpha of 0.85. Meanwhile, through the test of Kendall's Tau, 90% of the participants ranked in the same place in both MPPUS-10 and MPPUS-27, which suggests good consistency. To evaluate the validity, Foerster et al. (2015) calculated the correlation between the MPPUS-10 and the MPPUS-27 and found them to be strongly correlated ($r = 0.95$, $p < 0.001$). However, because of the issues mentioned previously it was decided that this measure was not suitable for Chinese students or for the current study.

3.3.2.2 Problematic Mobile Phone Use Questionnaire (PMPUQ)

The Problematic Mobile Phone Use Questionnaire (PMPUQ) was developed by Billieux, Van Der Linden, & Rochat, (2008) and was designed to assess problematic

mobile phone use. The PMPUQ consists of general questions about mobile phone use and a 30-item scale scored from 1 ("I strongly agree") to 4 ("I strongly disagree"). The scale focused on four aspects of phone use: prohibited use (5 items), dangerous use (5 items), financial problems (13 items) and dependence on mobile phone (7 items) (Billieux et al., 2008). The reliability coefficients for those four subscales were 0.84, 0.85, 0.65 and 0.73 respectively (Billieux et al., 2008).

However, limited number of studies have adopted the PMPUQ and some researchers have criticised the measure as unclear and lacking sufficient evidence (Güzeller & Coşguner,2012; Yildirim & Correia, 2015). Furthermore, the PMPUQ focused on the general public and specified that they should have a driving licence, while other measures have focused on students or adolescents, the focus of the current study.

3.3.2.3 Smartphone Addiction Scale-Short Version (SAS-SV)

Kwon, Lee et al. (2013) developed the 33-item 6-point Likert scale: Smartphone Addiction Scale (SAS) based on the KS-scale (Kim, Chung, Lee, Kim, & Cho, 2008) which originates from the Internet Addiction Test (IAT) presented by Young (1998a). The SAS showed high internal consistency (α >0.96) in two studies (Kim et al.,2008; Kwon, Kim et al., 2013). Subsequently, Kwon, Kim et al. (2013) shortened the SAS into a 10-item scale for adolescents, the SAS-SV, which was found to be highly reliable in their sample of 540 Korean junior high school students (α = 0.91). All corrected item-total correlations were higher than around 0.50 (0.57) which also indicates good internal

consistency. Meanwhile, the overall Cronbach's alpha did not increase with any of the items deleted. In order to test the concurrent validity of the SAS-SV, the SAS, the SAPS (Shin, Kim, & Jung, 2011) and the KS-scale were also included in the study. Results show that the SAS-SV was strongly correlated with the SAS ($r = 0.96$, $p < 0.001$), the SAPS ($r = 0.76$, $p < 0.001$) and the KS-scale ($r = 0.42$, $p < 0.001$), indicating good concurrent validity. The SAS-SV has also been used and validated in different languages within different contexts (Haug et al., 2015; Lee, 2015; Lopez-Fernandez, 2015; Samaha & Hawi, 2016). Furthermore, based on the results of a consultation with 90 boys and 60 girls by clinical psychologists, Kwon, Kim et al. (2013) proposed cut-off points for smartphone addiction for females (33 points) and males (31 points). Irrespective of whether it is appropriate to medicalise problematic smartphone use in this way, these thresholds offer a useful way of identifying the level of smartphone use that can reasonably be considered problematic. Therefore, it seems that the SAS-SV is a suitable measure for the current study.

3.3.2.4 SAS-SV for this study

In this study, the 10-item Smartphone Addiction Scale-Short Version (SAS-SV) developed by Kwon, Kim et al. (2013) was adopted to evaluate problematic smartphone use. The SAS-SV uses a 6-point Likert scale from "strongly disagree" (1) to "strongly agree" (6). Kwon, Kim et al. (2013) diagnosed smartphone addiction with different cut-off values by gender, 31 out of 60 points for males and 33 out of 60 points for females. These diagnostic criteria were adopted in this study.

However, for practical reasons, the English wording of several items was modified. The items in the English version of the SAS-SV in Kwon, Kim et al. (2013) were incomplete sentences such as "Won't be able to stand not having a smartphone" and "Using my smartphone longer than I had intended". Thus, before the process of translation, the items were modified into complete sentences so that the translated Chinese version could be understandable for the participants. The items noted above were modified to "I wouldn't be able to stand not having a smartphone" and "Sometimes I use my smartphone for longer than I intend to". "Smartphone" was translated as "cell phone" since the direct translation of "smartphone" was unusual according to group evaluation. Thus, at the beginning of the SAS-SV, participants were asked whether their cell phones are smartphones. Item 7 (I would never give up using my smartphone even if my daily life is already greatly affected by it) was translated as "I will still use my smartphone even if my daily life is already greatly affected by it" since the double negative was problematic in the Chinese version according to group evaluation. In item 8, "Twitter or Facebook" was modified into "'WeChat' or another social media" since it is not convenient to use "Facebook" or "Twitter" in China. The same translated and modified version of the 10-item SAS-SV were used in the two pilot studies and the main study.

3.3.3 Academic anxiety

3.3.3.1 Measurements of academic anxiety

Alpert & Haber (1960) investigated anxiety in academic achievement situations. By comparing specific anxiety scales and general anxiety scales, they concluded that the scales for specific anxieties (e.g. test anxiety) measure qualitatively different constructs from general anxiety. According to the responses to the questionnaires, specific anxieties rather than general anxieties are better predictors of academic performance. Alpert & Haber (1960) developed the Achievement Anxiety Test (AAT) with 19 items assessing facilitating and debilitating anxiety towards test situations. Their suggestion was that measuring a specific type of anxiety, such as test anxiety, could be an appropriate way of evaluating anxiety in academic situations.

However, Ludlow & Guida (1991) evaluated the Test Anxiety Scale for Children (TASC) by Sarason, Davidson, Lighthall & Waite (1958) and found that the TASC should be regarded as a measure of academic anxiety i.e. a more comprehensive construct than just test anxiety. Through factor analysis and Rasch model analysis, Ludlow & Guida (1991) discovered that the TASC measures not only test anxiety but also anxiety in other evaluative situations such as recitation anxiety. Therefore, besides test anxiety, academic anxiety might involve other situational-specific anxieties such as classroom anxiety. Nevertheless, it is necessary to note that Alpert & Haber (1960) discussed situations in college, the focus of the current study, while the TASC was designed for children in schools.

Milgram & Toubiana (1999) investigated the relationship between academic anxiety and procrastination among middle and high school students in Israel. They measured academic anxiety using the Academic Anxiety Scale (AAS) which is made up of the Test Anxiety Inventory (TAI) (Spielberger, 1980) and two self-designed scales related to homework anxiety and paper-writing anxiety. It seems reasonable that homework and writing anxiety were included in their measure of academic anxiety since homework and writing are part of students' learning process and are both subject to evaluation. Also, as indicated in the control-value theory of achievement emotions by Pekrun (2006), academic emotions including academic anxiety is determined by an individual's control-value appraisals about environment such as design of learning and social environments. Therefore, it seems clear that it is necessary to include the other academic situations such as learning besides test situations when measuring academic anxiety.

The Achievement Emotions Questionnaire (AEQ; Pekrun et al., 2005), which was also called the Academic Emotions Questionnaire (AEQ; (Pekrun et al., 2002), measures academic anxiety in three situations including class, learning and tests. The anxiety subscales of the AEQ contain 12 items for class-related anxiety, 11 items for learning-related anxiety and 12 items for test anxiety (Pekrun et al., 2005). The AEQ was developed originally in Germany but translated into English by Pekrun et al., (2005). It assesses nine academic emotions including enjoyment, hope, pride, relief, anger, anxiety, shame, hopelessness and boredom in three academic situations including class, learning and tests. The reliability and validity of the AEQ have been confirmed

in a number of recent studies in different contexts (Ahmed, Minnaert, Kuyper, & Van Der Werf, 2012; Artino & Jones 2012; Marchand & Gutierrez, 2012; Tempelaar, Niculescu, Rienties, Gijselaers, & Giesbers, 2012; etc).

3.3.3.2 AEQ-anxiety for this study

In order to assess academic anxiety, the anxiety subscales of the Achievement Emotion Questionnaire (AEQ; Pekrun et al., 2005) were used in this study. The AEQ tests academic anxiety in three situations including class-related anxiety (12 items), learning-related anxiety (11 items) and test anxiety (12 items), with reliabilities of 0.86, 0.84 and 0.92 respectively (Pekrun et al., 2005). The AEQ uses a 5-point Likert scale for responses from "strongly disagree" (1) to "strongly agree" (5). Sample items from the AEQ-anxiety are "Thinking about class makes me feel uneasy", "I worry whether I properly understand the material" and "I worry whether I will pass the exam". It was felt that the AEQ represents a 'state of the art' measure of academic anxiety that can be trusted to be reliable and valid.

In the translation process, item 7 in the class-related anxiety scale and item 3 in the learning-related anxiety scale were discussed as problematic. The two items included the word "queasy" which was translated into a Chinese word referring to "vomit". It was then back translated as "sick" but still discussed as an unusual wording in Chinese. Thus the word "queasy" was finally translated according to its figurative meaning of 'uneasy' suggested in the dictionary by Kleeman & Yu (2010). Additionally, in the

class-related anxiety scale, item 8 (I feel nervous in class) and item 11 (I get tense in class) were translated as the same sentence in the first step since "tense" and "nervous" were translated as the same Chinese word "Jin Zhang". After discussion with the evaluators and the back translator, "tense" was finally translated with additional explanations as "both mental and physical". Furthermore, the translation of item 9 in the class-related anxiety scale, item 2 in the learning-related anxiety scale, item 2 and 7 in the test-related anxiety were modified with better wording in Chinese after group evaluation and back translation. The full translated version of the anxiety subscales of the AEQ was used in the pilot study.

However, during the pilot study which used the full 35-item version of the AEQ-anxiety, participants reported that the anxiety section of the questionnaire was too long and they tended to give similar answers to statements which might be repetitive. Thus it was subsequently decided to shorten the measure. Theoretically, Pekrun et al (2011) explained that the AEQ can be categorised into four components including cognitive, affective, motivational and physiological items. Meanwhile, all the emotions were tested with three academic conditions including class, learning and test. Therefore, it was necessary to consider the four components and the three conditions when shortening the anxiety scale.

Taylor & Deane (2002) developed a 5-item short form of the 20-item Test Anxiety Inventory (TAI) by Spielberger (1980), which might be an example of good practice in shortening anxiety scales. Taylor & Deane (2002) selected items with high item-remainder correlations from both worry and emotionality subscales and formed several

different short forms which were all strongly correlated with the full form (r > 0.93).

They pro-rated or recalculated the individual scores of the short forms and compared

the mean scores with the full form. For example, they multiplied the scores of the 5-

item TAI by 4 and produced a recalculated score to compare with the full form using

paired samples t-tests. The 5-item TAI was the only short form that had no significant

mean differences compared with the 20-item full TAI. Thus the TAI-5 was selected as

the most suitable short form of the TAI-20.

In this study, the AEQ-anxiety was shortened using the same approach as Taylor &

Deane (2002). Based on the four components and the three conditions of AEQ

explained by Pekrun et al (2011), items with high corrected item-total correlations

(above 0.60) were selected from the four components and three conditions. The short

form was expected to contain cognitive, affective, motivational and physiological items

under the conditions of class, learning and test. Finally, a 12-item short form of AEQ-

anxiety was selected with four items from four different components in each of the

conditions. The 12-item scale was strongly correlated with the 35-item full length ($r =$

0.96, $p < 0.01$). There was no significant mean difference between the recalculated 12-

item AEQ-anxiety and the full form, $t(111) = 0.79$, $p = 0.43$. The short 12-item version

of the AEQ-anxiety was used in the first tranche of main study and had a better model

fit ($CFI = 0.92$, $RMSEA = 0.08$) than the 35-item full version used in the pilot study

($CFI = 0.74$, $RMSEA = 0.09$) after freeing the errors guided by modification indices in

AMOS.

3.3.4 Academic procrastination

3.3.4.1 Measurements of academic procrastination

One of the widely used measurement tools for academic procrastination is the Procrastination Assessment Scale-Student (PASS) developed by Solomon & Rothblum (1984). The PASS, which has been adopted in several studies (e.g., Alexander & Onwuegbuzie, 2007; Bridges & Roig, 1997; Brownlow & Reasinger, 2000; Fritzsche, Young & Hickson, 2003; Milgram, Marshevsky & Sadeh, 1995; Onwuegbuzie, 2004), is a five-point Likert scale made up of two sections. The first section is an assessment of the prevalence of procrastination in six academic situations: writing a paper, studying for an exam, keeping up with weekly reading, administrative tasks, attending meetings and academic task in general. The second section lists a group of reasons for procrastination including evaluation anxiety, perfectionism, difficulty in decision making etc. However, as reported by Solomon & Rothblum (1984), the items in the PASS were developed based on pilot studies conducted with undergraduate students in the USA. It might be inappropriate to generalise the statements to other contexts because different universities or departments may have different academic systems. It is unknown, for instance, whether undergraduate students in the other contexts (e.g. Chinese Universities) really experience administrative tasks, attend meetings or have reading tasks weekly. Thus this questionnaire seems to be suitable for limited contexts.

Tuckman's (1991) 16-item Procrastination Scale (TPS) is another popular instrument used by several studies (e.g., Burns, Dittmann, Nguyen & Mitchelson, 2000;

Klassen, Krawchuk & Rajani, 2008; Lee, 2005). In order to develop a measure of procrastination, Tuckman (1991) first wrote 72 statements related to procrastination and distributed the 72-item scale with a response scale consisting of four possible answers (that's me for sure, that's my tendency, that's not my tendency, that's not me for sure) to 50 college students. Through the first factor analysis, 35 items with factor loadings over 0.45 were selected to form a scale with a Cronbach's alpha of 0.90. Tuckman (1991) then collected 183 responses using the 35-item scale and conducted a second factor analysis. Among the 35 items, 16 items with factor loadings over 0.40 were highlighted, resulting in a shorter 16-item scale with a Cronbach's alpha of 0.86.

More recently, based on meta-analysis and a study among a sample of 4169 participants, Steel (2010) challenged a previous distinction made between arousal, avoidant and decisional procrastination, and noted that "procrastination is an irrational delay" (p. 929). Principal component analysis conducted by Steel (2010) identified three factors in three procrastination scales: the Adult Inventory of Procrastination (AIP; McCown & Johnson, 1989), the Decisional Procrastination Questionnaire (DPQ; Mann, Burnett, Radford, & Ford, 1997) and the General Procrastination Scale (GPS; Lay, 1986). However, the three-factor model did not have good model fit when confirmatory factor analysis was used ($\chi^2(732) = 11051$, $GFI = 0.761$, $CFI = 0.776$, $RMSEA = .082$). Based on that, Steel (2010) selected the top loading items in the first factor and created a 12-item Pure Procrastination Scale (PPS) which is made up of items from the AIP, the DPQ and the GPS. Steel (2010) reports that the Irrational Procrastination Scale (IPS), a shorter procrastination scale, has the same function of assessing procrastination as the

PPS, with which it correlates $r = 0.96$. The IPS has been used and validated in a number of studies in different contexts (Nguyen, Steel, & Ferrari, 2013; Steel & Ferrari, 2013; Svartdal, 2015).

Both of the 16-item TPS and the 9-item IPS seem to be reliable and valid. However, considering the present investigation of five variables, the shorter IPS appeared to be a wise choice. Furthermore, as argued by Steel (2010), procrastination is a process of irrational delay of tasks or works at hand. As the participants of this study were college students, in most cases, the main tasks of the college students were academic works, it is clear that the IPS measured academic procrastination among the college students. Therefore, the IPS seems to be a suitable short measurement for this study to test academic procrastination.

3.3.4.2 IPS for this study

The IPS (Steel, 2010) is used to evaluate academic procrastination in this study. The 9-item IPS adopts a 5-point Likert scale from "Not at all true of me" (1) to "Very true of me" (5). Items 2, 6 and 9 are reverse scored. The Cronbach's alpha of the IPS was 0.91 in Steel (2010). A sample item is "When I should be doing one thing, I will do another".

Some changes to the original measure were made for the current study. The first item in the IPS was felt to represent a double-barrelled statement: "I put things off so long that my well-being or efficiency unnecessarily suffers". Thus, before translation, the decision was made to split the statement into two separate items "I put things off so

long that my well-being unnecessarily suffers" and "I put things off so long that my efficiency unnecessarily suffers". Furthermore, translation of two other items were modified with better wording in Chinese after group evaluation and back translation. The translated and modified 10-item IPS was used in the pilot study.

However, the results of the pilot study indicated that the 10-item IPS was problematic with poor model fit in confirmatory factor analysis. The same shortening process used for the 12-item AEQ-anxiety was adopted in the IPS and an 8-item short form of the IPS was formed with item 1 and 10 removed. The 8-item was strongly correlated with the 10-item IPS ($r = 0.97$, $p < 0.01$) and there was no significant mean difference between the prorated scores of the 8-item form and the 10-item form, t (111) = - 1.37, $p = 0.17$. The short 8-item version of the IPS was therefore used in the first tranche of main study and had better model fit (*CFI* = 0.95, *RMSEA* = 0.08) than the 10-item version used in the pilot study (*CFI* = 0.68, *RMSEA* = 0.14) after freeing the errors guided by modification indices in AMOS. Further information can be found in Chapter Four.

3.3.5 Self-regulation

The majority of the studies investigating self-regulation in students have used subscales from the 81-item Motivated Strategies for Learning Questionnaire (MSLQ; Pintrich, Smith, Garcia, and McKeachie, 1991) or the 44-item MSLQ (Pintrich & De Groot, 1990) to evaluate students' self-regulated learning or learning strategies.

However, although the 81-item MSLQ (Pintrich et al., 1991) was designed for college students, several items for self-regulation in the subscales of "metacognitive self-regulation" (e.g. "When reading for this course, I make up questions to help focus my reading." "When I become confused about something I'm reading for this class, I go back and try to figure it out." p. 23) and "time and study environment" (e.g. "I make sure I keep up with the weekly readings and assignments for this course." p. 25) might not be suitable for the Chinese students in the targeted university. For some majors, students might not have weekly reading tasks or required reading materials for their courses while most of the courses are focused on the selected text books and the teacher's self-designed materials. The 44-item MSLQ (Pintrich & De Groot, 1990) was used for junior high school students. There are also several unsuitable items for the target participants in the subscale of self-regulated learning strategies (e.g. "When I do homework, I try to remember what the teacher said in class so I can answer the questions correctly." "I often find that I have been reading for class but don't know what it is all about." "I work on practice exercises and answer end of chapter questions even when I don't have to." p. 40). The target participants might not always have required further reading materials out of classes and they might not always focus on the chapter questions of the text books.

Overall, several items in the different versions the MSLQ seem to be too specific and unsuitable for the Chinese college students who were expected to participate in this study. Furthermore, there are several translated and validated Chinese versions of the MSLQ proposed by Rao & Sachs (1999) and Lee, Yin, & Zhang (2010). However,

those Chinese versions not only have the problems with items as discussed above, but also have Cantonese features in wording which are not easy for the students using mandarin to read. Therefore, there seems a need to use a scale that testing more general self-regulation with less specific contents for the Chines college students.

The Self-Regulation Scale (SRS) was originally designed in Germany by Schwarzer, Diehl, and Schmitz (1999). Diehl et al. (2006) first validated the English version of the SRS to evaluate participants' attention control in goal pursuit. The SRS is a 4-point 10-item Likert scale ("1" = Not at all true, "2" = Barely true, "3" = Somewhat true, "4" = Completely true). Item 5, 7 and 9 are reverse scored. As reported in Diehl et al. (2006), the SRS was initially developed as a 16-item scale by a group of experts. The 16-item version was distributed to 83 German psychology undergraduates for reliability testing, and 4 items were removed. The 12 items were then tested among 285 German teachers and 2 more items were deleted. The final 10-item version of the SRS was administered to two groups of teachers to test its reliability. In the study by Diehl et al. (2006), the SRS showed good reliability (Cronbach's alpha = 0.76) among 443 adult participants and obtained a good test-retest reliability ($r = 0.62$, $p < 0.001$) with 239 participants who responded after six weeks. The English version of the SRS has been used and validated in several studies (Gökçearslan et al., 2016; Luszczynska, Diehl, Gutiérrez-Doña, Kuusinen, & Schwarzer, 2004; Van Deursen, et al., 2015). An example item of the SRS is "I can control my thoughts from distracting me from the task at hand" (Diehl et al., 2006, p. 317). Diehl et al. (2006) used "task" rather than specific academic tasks such as "reading materials". Thus the SRS seems to be a

suitable scale for the Chinese students in this study.

3.3.6 Life satisfaction

The Satisfaction With Life Scale (SWLS) was used to test participants' life satisfaction in the main study. Diener et al. (1985) developed the SWLS to evaluate participants' life satisfaction, which is an aspect of subjective well-being. The SWLS is a 5-item measure with a 7-point response scale ranging from 1 (strongly disagree) to 7 (strongly agree). Diener et al. (1985) formed an initial 48-item questionnaire, deleted some items on positive and negative affect, then selected the 10 items about life satisfaction with loadings over 0.60 in factor analysis. After 5 items were removed because of repetition, a 5-item version of the SWLS was formed. The SWLS was distributed to 176 psychology undergraduates in the USA and retested two months later with 76 participants. The test-retest correlation was 0.82 with a coefficient alpha of 0.87. As reported in Diener et al. (1985), the SWLS was also moderately correlated with other measurements of subjective well-being among the 176 sample and another 163 sample of undergraduates. Diener et al. (1985) also tested the SWLS in 53 older adults with an average age of 75. The participants who completed the SWLS were also interviewed and independently rated by two interviewers. The scores of the two interviewers which were strongly correlated ($r = 0.73$) were then summed to one score. The SWLS scores were moderately correlated with the summed interviewers' rated scores, $r = 0.43$ and another life satisfaction index, $r = 0.46$. Overall, the SWLS in

Diener et al. (1985) seems reliable and valid. It is the most widely used measure of self-reported life satisfaction, making it easy to compare results across studies.

The SWLS has also been translated and validated in Chinese contexts. Bai, Wu, Zheng, & Ren (2011) validated the SWLS in mainland China with a large sample of 4795 adults. The sample was reported as nationally representative since it covered almost equal males (47%) and females (53%), a wide range of ages (18-30, 31-40, 41-50 and over 50), different residential religions (metropolitan, county town and rural areas), different educational levels etc. The SWLS was highly reliable with a Cronbach's alpha of 0.92 that was not increased with any of the items deleted. The skewness and kurtosis values were -0.25 and -0.36 respectively, which indicates a normal distribution. The SWLS was also tested through confirmatory factor analysis (CFA) and the modified one-factor model of the scale had a good model fit, $TLI = 0.97$, $CFI = 0.99$, $RMSEA = 0.085$. It seems that their version is suitable for the Chinese context of this study. Thus, the Chinese version of the SWLS validated in Bai et al. (2011) was used in the main study. The original English version was used in the cross cultural study.

3.4 Procedure

3.4.1 Mixed-methods design

A mixed-methods design was adopted for the studies in this thesis. According to McMillan (2012), mixed-methods designs enable researchers to acquire not only results

but also some explanation of, or insight into, their results. As the current study is focused on relationships between variables, it cannot be assumed that such relationships exist prior to data collection. If quantitative data analyses show no relationships between these variables, it will be important to try to understand why this might be the case. If quantitative data analyses indicate the expected relationships to some extent, it will also be important to further interpret these relationships using qualitative data. Thus, for the current study, it seems important to collect both quantitative and qualitative data at about the same time. As mixed-methods studies collect both quantitative and qualitative data, it is helpful to reduce the limitations of only using a single type of data collection (Creswell & Plano Clark, 2017; McMillan, 2012).

There are three types of mixed-method designs: sequential explanatory design, sequential exploratory design and concurrent convergent design (McMillan, 2012). Since the levels of test anxiety, academic procrastination and problematic smartphone use will be unknown before data collection, the numbers of test-anxious people, academic procrastinators or problematic smartphone users cannot be known in advance. The sequential explanatory design seems not practical since it is possible that there will not be categories of participant (e.g. higher or lower levels of procrastinators) to choose from for qualitative data collection. As the variables and instruments of the current study are already clear, it is unnecessary to gather qualitative data to determine the instruments for quantitative data collection. Thus, the sequential exploratory design is not suitable. Therefore, this study will adopt the concurrent convergent mixed-method design in which quantitative and qualitative data are collected at about the same time.

3.4.2 Questionnaire survey

Questionnaire surveys are a commonly used research method in educational research and self-reported questionnaire are suitable for assessing students' personality, subjective perceptions, attitudes and beliefs (McMillan, 2012). They are also suitable for investigating aspects of behaviour (Gorard, 2001). As reviewed previously, most of the relevant studies used self-reported questionnaire surveys to collect quantitative data. Thus, considering the topic and the variables in this study, a questionnaire seems a suitable method of data collection. Meanwhile, as questionnaires collect simple and straightforward answers with standardised information (Cohen, Manion, Morrison, & Bell, 2011; Gillham, 2000), it is a suitable approach for hypothesis testing (Gillham, 2000). Since this study aims to test hypotheses, it seems better to use questionnaires. Furthermore, questionnaire survey can obtain a large number of responses with relatively low cost and less time (Cohen et al., 2011; Gillham, 2000), especially common for postgraduates' research (Wisker, 2008). It seems suitable for this study to conduct a questionnaire survey.

However, recipients sometimes can easily drop out of the questionnaire survey especially for online surveys (Cohen et al., 2011, Reips, 2002). One of the approaches to improving response rates is conducting personally delivered questionnaire research (Cohen et al., 2011; Gillham, 2000). Thus, for this study, in order to ensure the response rate, it seems better to deliver the questionnaires personally rather than by mail or online tools. Furthermore, one of the disadvantages of an online survey is that the target participants might have different chances of doing the survey because of different

Internet accessibility (Gorard, 2001; McMillan, 2012). Also, it has become more likely that people will complete online surveys through mobile devices especially smartphones (Dillman, Smyth, & Christian, 2014). Since this study is investigating problematic smartphone use, it seems unreliable to conduct the survey online since the participants who response to the Internet-based questionnaire might be heavier or more frequent users of smartphones. Therefore, it seems that pencil-and-paper questionnaire survey is more suitable for this study.

In order to ensure a good response rate, the questionnaires used among the Chinese students were distributed as pencil-and-paper measures. This decision was based on a judgement that participants would be less likely to respond to an online survey. However, in the cross-cultural study in the UK, online surveys were used together with paper questionnaires in order to recruit as many participants as possible. After the pilot study, the questionnaire was modified according to feedback from participants and the results (all presented in the next chapter). The main study (quantitative) and the cross-cultural study used the revised instruments. Full details of the questionnaire distribution will be discussed in the following chapters.

3.4.3 Interviews

It is suggested that questionnaire surveys can be problematic and other research methods are necessary to be used together with questionnaires (Gorard, 2001). Interviewing is one of the fundamental research methods in educational studies (Scott & Usher, 2011). Cohen et al (2011) point out that interviews are one of the most suitable

methods for researchers to look deep into the issues and gather rich data. Thus, in this thesis, the main study (qualitative part) adopted semi-structured interviews to collected qualitative data from the Chinese undergraduates. As discussed before, a mixed methods design was applied in this thesis including both questionnaires and interviews. Full details of the interview questions are discussed in the results chapters.

3.5 Data analysis

3.5.1 Quantitative Data analysis

There were three main types of quantitative data analysis: univariate, bivariate and multivariate analysis (Cohen et al., 2011; Muijs, 2004). In order to address the research aims and test the hypotheses of this study, all three types of data analysis were used.

For the aim of exploring the prevalence of PSU, mean scores and standard deviations were calculated in IBM SPSS statistics version 24. The proportion of problematic smartphone users was measured by gender according to the criteria of diagnosing addictive smartphone use set by Kwon, Kim et al. (2013). For the aims of investigating relationships between problematic smartphone use, academic anxiety and academic procrastination, self-regulation and life satisfaction, participants' total scores on each of the variables were calculated. Then, the correlations between the variables were analysed using Pearson's Product-Moment Correlation Coefficient (r). Also, independent samples t-tests were used to test gender differences of the variables, and the effect sizes of mean differences were calculated using Cohen's d. In the cross-

cultural study, multi-group multivariate analysis of variance (MANOVA) and multi-group SEM were used to compare the situation in the two countries.

Structural Equation Modelling (SEM) was used to conduct confirmatory factor analysis and path analysis in AMOS version 23 to test the measures and the proposed hypothetical model underpinning this study, since SEM is a suitable method of data analysis for a complex relationship between several variables in the field of educational research suggested in Muijs (2004). As suggested in Hoyle (2011), the *CFI* (comparative fit index) and the RMSEA (root mean square error of approximation) are suitable indices for model fit testing in social and personality research. In this study, the model fit of the scales and the hypothetical model were evaluated through the p value of the χ^2, the χ^2/df, (rate of chi-square value and degree of freedom), the CFI and the RMSEA. The χ^2 value is expected to be non-significant for an acceptable model (Muijs, 2004; Byrne, 2010). Hu & Bentler (1999) suggested a cut-off point of 0.95 (above this value) for the CFI and 0.06 (below this value) for the RMSEA for good model fit. While Hoyle (2011) suggested a cut-off point of 0.95 for the *CFI* and 0.08 for the RMSEA. Wu (2010) suggests the acceptable range of the χ^2/df, value to be between 1 and 3. Bootstrapping was performed 10,000 times in the SEM and modification indices were referred to for increasing the model fit.

3.5.2 Qualitative data analysis

The framework approach was used to analyse the qualitative data in the main study

(qualitative part) and the cross-cultural study. The framework approach (or framework method) developed by Ritchie & Spencer (1994) is a widely used approach for qualitative data analysis (Gale, Heath, Cameron, Rashid, & Redwood, 2013). Ritchie & Spencer (1994) described this approach in five stages: (1) familiarization, (2) identifying a thematic framework, (3) indexing, (4) charting, (5) mapping and interpretation. They noted that several of these stages could precede the others, i.e. the order of the steps might change in practical situations. Similarly, Gale et al. (2013) note that framework method includes seven steps: (1) transcription, (2) familiarization with the interview, (3) coding, (4) developing a working analytical framework, (5) applying the analytical framework, (6) charting data into the framework matrix (7) interpreting the data. As a systematic method of qualitative data analysis, framework approach could be used with deductive, inductive or combined analysis (Gale et al., 2013). This thesis used the five steps suggested in Ritchie & Spencer (1994).

In the studies in this thesis, the records of the interviews were transcribed and then imputted into NVivo. The qualitative responses in the cross-cultural study were directly imputted into NVivo for analysis. Deductive coding was carried out according to the research aims. Therefore, the codes were be categorised as follows: the levels of PSU; the antecedents and consequences of PSU. Meanwhile, inductive coding were conducted to find out whether there are other predictors, consequences or any other factors related to PSU.

3.6 Ethical issues

As pointed out by Wellington (2000), in educational studies, ethical issues should be carefully taken into account since the research participants are almost always human beings. It is necessary to give the participants full and clear information to ensure that they understand what will happen to them (Thomas, 2009). Newby (2010) clearly notes that the intended participants have the right to know the aims of the study, the means of data protection and the terms of withdrawal.

Participants were given full information about the study and its aims at the beginning of their participation. They were asked to only complete the questionnaire after accepting the terms. Participants were made aware that they could withdraw from the study after reading the consent form and before handing in their completed questionnaires. All responses were anonymous and only the researcher and the researcher's supervisor have access to the data. The Ethics Committee of the researcher's institution approved both pilot studies and the main study.

Chapter 4 Pilot study

4.1 Introduction

In order to test the study's measures with a sample of Chinese university students, and in light of the hypothesised model proposed, a pilot study was conducted in China. Through the pilot study, the researcher had the opportunity to try out the planned research process including participant recruitment, questionnaire delivery and collection, data entry and data analysis. The results of the pilot study offered possible solutions for further validation of the measures and modification of the study's hypotheses.

4.2 Method

4.2.1 Participants

A pilot study was conducted with n=112 first-year undergraduate students in a university in Wuhan-China, using a paper-based questionnaire. The average age of the participants was 19.03 (SD = 0.93). There were 50 female and 61 male students among the participants while one participant did not provide information on gender and age. Participants were drawn from two English language classes for students from a range of majors including science and business.

4.2.2 Measures

4.2.2.1 Smartphone Addiction Scale-Short Version (SAS-SV; Kwon et al., 2013)

The SAS-SV (Kwon et al., 2013) was used to evaluate problematic smartphone use. Participants responded to this 10-item scale using a 6-point Likert scale from "strongly disagree" (1) to "strongly agree" (6). The Cronbach's alpha reported in Kwon et al. (2013) was 0.91 indicating high internal reliability in their study. A sample item is, "I will never give up using my smartphone even if my daily life is already greatly affected by it." The English version was translated and validated before the pilot study, as reported in a previous chapter.

4.2.2.2 Irrational Procrastination Scale (IPS; Steel, 2010)

The IPS (Steel, 2010) was adopted in the pilot study to evaluate participants' levels of academic procrastination. Responses to the IPS items were given via a 5-point Likert scale from "Not at all true of me" (1) to "Very true of me" (5). The Cronbach's alpha reported in Steel (2010) was 0.91. Some adjustments were made to the original measure for this pilot study. A double-barrelled question (item 1: I put things off so long that my well-being or efficiency unnecessarily suffers) was split into two items (I put things off so long that my well-being unnecessarily suffers; I put things off so long that my efficiency unnecessarily suffers) as discussed in previous chapters. Thus the IPS was modified into a 10-item scale. Three items (items 3, 7 and 10) were reverse coded. The English version was translated and validated before the pilot study.

4.2.2.3 Achievement Emotion Questionnaire-Anxiety (AEQ; Pekrun et al., 2005)

The anxiety-related subscales of the AEQ (Pekrun et al., 2005) were used to measure participants' academic anxiety in three contexts including class related anxiety (12 items), learning-related anxiety (11 items) and test anxiety (12 items). Three 5-point Likert scales were used with responses ranging from "strongly disagree" (1) to "strongly agree" (5). Cronbach's alphas for the three scales were good, at 0.86, 0.84 and 0.92, in Pekrun et al. (2005). A sample item is, "Thinking about class makes me feel uneasy."

4.2.3 Procedure

Participants were recruited through their English teacher (the researcher's undergraduate supervisor) who had agreed to help with participant recruitment. The pilot study was introduced to the participants by both their English teacher and the researcher at the beginning of their classes before the paper-based questionnaire was distributed. After reading the consent form, participants filled in the questionnaire if they agreed to take part in this study. The process lasted for about ten minutes.

Because the survey was paper-based, 12 participants did not turn over the first page and missed the whole second page of the questionnaire which includes the scales for academic procrastination (IPS) and class-related anxiety (AEQ-class). Furthermore, one participant ignored the gender and age questions and two participants missed the whole learning-related anxiety scale and test anxiety scales.

4.2.4 Data analysis

Descriptive statistics, t-tests, correlations and regression analyses were conducted. In addition, Confirmatory factor analysis and mediation analyses were conducted using Structural Equation Modelling (SEM) in IBM SPSS Amos version 23. Missing values were coded as -99 during data entry and were excluded from data analysis. Correlation and regression analysis by SPSS adopted pairwise exclusion to deal with missing data. In AMOS, "regression imputation" was adopted to create a complete data file since AMOS requires complete data if the functions of "modification indices" and "bootstrapping" are expected.

4.3 Results

4.3.1 Descriptive statistics

Table 4.1 presents descriptive statistics for all of the main study variables. It presents the number of responses in the current study, the number of items in each scale, response distributions, means, standard deviations, skewness values, medians of item-total correlations and Cronbach's alpha values.

Table 4.1 Descriptive scale statistics

Scale	No. of responses	No. of items	Range		M	SD	Skew	M^R	α
			Potential	Observed					
SAS-SV	112	10	10-60	10-57	35.30	7.37	-.45	.46	.77
IPS	98	10	10-50	17-46	31.15	5.36	.07	.36	.68
AEQ-class anxiety	99	12	12-60	12-46	25.65	8.36	.30	.56	.88
AEQ-learning anxiety	108	11	11-55	11-52	31.64	8.27	-.23	.54	.85
AEQ-test anxiety	108	12	12-60	12-49	29.67	8.33	-.11	.54	.86

Note. M^R = Median of part-whole corrected item-total correlations.

The observed range values, and standard deviations, indicate a sufficient level of variation in responses. The skewness values show that the distributions of the scales were largely symmetrical. Furthermore, the scales were internally consistent as the median of item-total correlations were all higher than 0.30 and Cronbach's alpha values were, with one exception, above .70. It is necessary to note that the deletion of item 3 in the SAS-SV and item 1 and 10 in the IPS slightly improved the alpha of the certain scales. Overall, however, the data were deemed suitable for analysis without correction.

4.3.2 t-test for gender differences

In order to investigate the possibility of gender differences, an independent-samples t-test was used and Cohen's d was calculated to describe effect sizes. As shown in Table 4.2, there was a significant difference for procrastination (Female $M = 32.86$, $SD = 5.46$ and male $M = 29.76$, $SD = 4.89$; $t(96) = 2.96$, $p < 0.01$, two-tailed). The effect size of the difference was medium (Cohen's $d = 0.61$). Female students tended to procrastinate more than male students. However, there was no significant gender difference in the

other variables according to this pilot study.

Table 4.2 Gender differences for problematic smartphone use, academic procrastination and academic anxiety

	Female			Male				
	N	*M*	*SD*	*N*	*M*	*SD*	*t*	*d*
Problematic Smartphone use	50	36.16	8.37	61	34.66	6.47	1.07	.20
Academic procrastination	44	32.86	5.46	54	29.76	4.89	2.96**	.61
Academic anxiety-class	44	25.02	7.98	55	26.15	8.70	-.66	-.13
Academic anxiety-learning	47	32.68	7.64	60	30.88	8.77	1.11	.22
Academic anxiety-test	49	31.27	8.20	58	28.55	8.18	1.71	.33

Note. *$p < 0.05$ (2-tailed). **$p < 0.01$ (2-tailed).

4.3.3 Correlations

The relationships between problematic smartphone use, academic procrastination and three aspects of academic anxiety were investigated using Pearson product-moment correlation coefficients. The results are shown in Table 4.3. There was a moderate to strong positive correlation between problematic smartphone use and academic procrastination, $r = 0.56$, $p < 0.01$, with 31% shared variance ($r^2 = 0.31$). Both problematic smartphone use and academic procrastination were significantly and positively correlated with the anxiety variables. Problematic smartphone use was significantly correlated with class-related anxiety ($r = 0.25$, $p < 0.05$), learning-related

anxiety (r = 0.32, p < 0.01) and test anxiety (r = 0.33, p < 0.01). Academic

procrastination was significantly correlated with class-related anxiety (r = 0.21, p <

0.05), learning-related anxiety (r = 0.37, p < 0.01) and test anxiety (r = 0.31, p < 0.01).

The results of the correlation analysis suggested that regression analysis would be an

appropriate next step since the test of correlation is suggested to be included in the

regression analysis (Pallant, 2013).

Table 4.3 Pearson Product-moment Correlations

Variable	1	2	3	4	5
1 Problematic smartphone use	-				
2 Academic procrastination	.56[**]	-			
3 Academic anxiety-class	.25[*]	.21[*]	-		
4 Academic anxiety-learning	.32[**]	.37[**]	.61[**]	-	
5 Academic anxiety-test	.33[**]	.31[**]	.53[**]	.72[**]	-

Note. *p < 0.05 (2-tailed), **p < 0.01 (2-tailed).

4.3.4 Multiple Regression Analysis

There are three types of multiple regression analysis: standard multiple regression,

hierarchical (sequential) multiple regression and stepwise (statistical) multiple

regression (Tabachnick & Fidell, 2007). In standard multiple regression, all

independent variables are entered into the equation at the same time (Tabachnick &

Fidell, 2007; Pallant, 2013; Muijs, 2004). Hierarchical multiple regression is a

sequential regression based on theoretical grounds in which independent variables are

entered in steps (Tabachnick & Fidell, 2007; Pallant, 2013). In stepwise multiple

regression, the choice of independent variables is determined by statistical criteria (Tabachnick & Fidell, 2007; Pallant, 2013). However, Muijis (2004) suggest standard multiple regression be used instead of stepwise regression. The sample size might determine the significance and in turn affect the selection of variables in stepwise regression, and the judgement in stepwise regression is a mechanical process (Muijis, 2004). However, for this pilot study, both standard multiple regression and stepwise multiple regression were conducted.

4.3.4.1 Standard multiple regression

According to the relationships proposed in the hypothesised model, standard multiple regression was used to assess the capacity of the five independent variables (gender, problematic smartphone use, class-related anxiety, learning-related anxiety and test-related anxiety) to predict the dependent variable (academic procrastination). The five independent variables were selected because they were significantly correlated with academic procrastination. According to the R square value (0.40) of the model, the five independent variables together explained 40% of the variance in procrastination. As shown in Table 4.4, only gender (β = - 0.22, p = 0.01) and problematic smartphone use (β = 0.48, p < 0.01), were individually, significant predictors of academic procrastination. Meanwhile, learning-related anxiety (β = 0.23, p = 0.07) might prove to be a predictor in the main study as the p value was slightly above 0.05 in this sample but could potentially reach statistical significance in a larger sample. Gender was included in the regression model as a pilot data analysis, though gender difference was

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tested using independent samples t-tests in the previous section.

Table 4.4 Regression Analysis for the Predictors of Academic Procrastination

Variable	β
Gender	-.22*
Problematic smartphone use	.48**
Academic anxiety class	-.01
Academic anxiety learning	.23
Academic anxiety test	-.05

Note. R^2 = .40.   *$p < 0.05$, **$p < 0.001$.

As a pilot analysis in this study, problematic smartphone use and academic anxiety were also selected as dependent variables respectively. When problematic smartphone use was selected as the dependent variable, as shown in Table 4.5, the independent variables were academic procrastination, class-related anxiety, learning-related anxiety and test-related anxiety. The Independent variables explained 33% of the variance of the dependent variable. Only academic procrastination was a significant predictor of problematic smartphone use ($\beta = 0.49$, $p < 0.01$). When academic anxiety was selected as a dependent variable as shown in Table 4.6, the scores of the three academic anxiety subscales (class, learning and test anxiety) were combined into a total score for academic anxiety. Problematic smartphone use and academic procrastination were selected as independent variables. However, none of the independent variables significantly predicted academic anxiety, and the R square value was .14 which indicated a very modest model fit.

Table 4.5 Regression Analysis for the Predictors of problematic Smartphone Use

Variable	β
Academic procrastination	.49**
Academic anxiety class	.05
Academic anxiety learning	-.01
Academic anxiety test	.15

Note. $R^2 = .33$. **$p < 0.001$.

Table 4.6 Regression Analysis for the Predictors of Academic Anxiety

Variable	β
Academic procrastination	.22
Problematic smartphone use	.21

Note. $R^2 = .14$.

4.3.4.2 Stepwise multiple regression

As the hypothesised model proposed academic procrastination as a dependent variable, a stepwise multiple regression was conducted to explore how the five independent variables (gender, problematic smartphone use, class-related anxiety, learning-related anxiety and test-related anxiety) predicted the dependent variable (academic procrastination). Three models were selected as shown in Table 4.7. The predictors in the three models explained 31.5%, 36.9% and 40.2% respectively of the variance in academic procrastination by. Table 4.7 presents the coefficients for the three

models in stepwise regression. In model 1, only problematic smartphone use ($\beta = 0.56$, $p < 0.01$) was selected as a predictor of academic procrastination. Model 2 included problematic smartphone use ($\beta = 0.54$, $p < 0.01$) and gender ($\beta = -0.24$, $p < 0.01$) as two predictors in order. Three predictors were included in model 3 in sequence which are problematic smartphone use ($\beta = 0.48$, $p < 0.01$), gender ($\beta = -0.22$, $p < 0.01$) and learning-related anxiety ($\beta = 0.19$, $p < 0.05$). In stepwise regression (also called statistical regression), predictors are excluded based solely on statistical criteria (Muijis, 2004; Tabachnick & Fidell, 2007). A predictor may be excluded when it is closely correlated with another predictor even if it has a high correlation with the dependent variable (Tabachnick & Fidell, 2007). Thus, in this study, several predictors were excluded.

Table 4.7 Stepwise Multiple Regression Analysis for the Predictors of Academic Procrastination

Predictor	R^2	β
Model 1		
Smartphone use	.32	.561***
Model 2		
Smartphone use	.37	.537***
Gender		-.235**
Model 3		
Smartphone use	.40	.478***
Gender		-.220**
Academic anxiety learning		.192*

Note. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

4.3.5 Structural Equation Modelling

4.3.5.1 Confirmatory factor analysis

Confirmatory factor analyses were conducted to evaluate the validity of the scales. The scales were analysed using AMOS software and the three subscales of anxiety were analysed in one model for academic anxiety. Table 4.8 shows the estimates of model fit after model modifications during which no item was deleted and only covariance was drawn between errors. According to the cut off points of *CFI* (higher than .95 for good fit) and RMSEA (lower than .06 for good fit) suggested in Hu & Bentler (1999), only the scale for problematic smartphone use, the SAS-SV, had a good model fit. Therefore, in this pilot study, it seems that the validity of the scales except for the SAS-SV needed to be improved.

Table 4.8 Confirmatory factor analysis

Models	χ^2	df	χ^2/df	p	CFI	RMSEA
Problematic smartphone use	38.21	33	1.16	0.25	0.97	0.04
Academic procrastination	107.64	34	3.17	0.00	0.68	0.14
Academic anxiety-class	150.93	50	3.02	0.00	0.85	0.14
Academic anxiety-learning	99.352	42	2.37	0.00	0.87	0.11
Academic anxiety-test	123.13	52	2.37	0.00	0.85	0.11
Academic anxiety	1068.28	546	1.96	0.00	0.74	0.09

4.3.5.2 Mediation analysis

According to the hypotheses proposed in a previous chapter, there might be bidirectional relationships between problematic smartphone use, academic anxiety and academic procrastination. Thus, mediation analyses between these three variables were used to test whether any mediating relationship would be observed. According to Baron & Kenny's (1986) model of mediation analysis, three steps of regression analyses should be performed: (1) from the independent variable to the mediator; (2) from the independent variable to the dependent variable; (3) from the both the independent variable and the mediator to the dependent variable. When the coefficients of the regression analyses are significant and the effect of the independent variable on the dependent variable was reduced or eliminated (turned insignificant) after the entry of the mediator, a mediating relationship can be considered. It is necessary to test the significance of the indirect effect from the independent variable to the dependent variable with the mediator (Baron & Kenny, 1986). In AMOS, the significance test for the indirect effect was performed though bootstrapping.

When the three variables were included in path analyses by AMOS, all the regression coefficients in the three steps of Baron & Kenny (1986) were significant. As shown in Table 4.9, all of the possible mediation paths were proved significant since the indirect effects were all significant. As shown in Figure 4.1, problematic smartphone use had a significant effect on academic procrastination ($\beta = 0.57$, $p < 0.001$) without the entry of academic anxiety. When academic anxiety was entered in the path analysis, the effect of smartphone use on academic procrastination was reduced slightly but was

still significant ($\beta = 0.50$, $p < 0.001$). The other two paths in the model in Figure 4.1 were significant. Meanwhile, the indirect effect of problematic smartphone use on academic procrastination calculated through bootstrapping in AMOS was significant as shown in Table 4.9. Therefore, academic anxiety was a partial mediator from problematic smartphone use to academic procrastination. It indicates that the participants procrastinate not only for their problematic smartphone use, but also because of their feeling of anxiety predicted by problematic smartphone use, although it should be noted that these analyses are correlational and do not imply causation, that is, the study cannot speak to direction of effects.

Table 4.9 Mediation analysis

	Without mediator	With mediator	
	Direct effect	Direct effect	Indirect effect
PSU→AA→AP	0.57***	0.50***	0.07**
PSU→AP→AA	0.37***	0.23*	0.13**
AA→PSU→AP	0.37***	0.19*	0.18**
AA→AP→PSU	0.37***	0.18*	0.19**
AP→PSU→AA	0.37***	0.24*	0.13*
AP→AA→PSU	0.57***	0.50***	0.07*

*Note. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

PSU = problematic smartphone use, AA = academic anxiety, AP = academic procrastination.

The results indicates partial mediation in all paths.
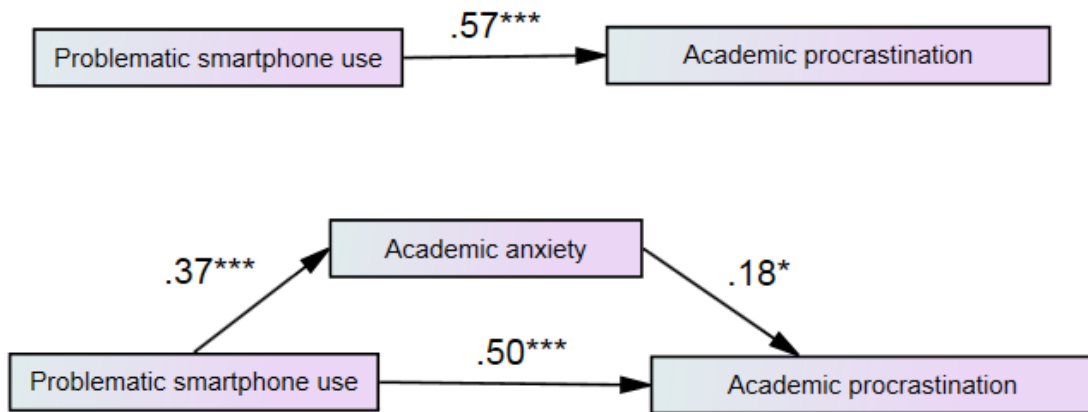
Figure 4.1: Mediation model being tested based on the criteria in Baron & Kenny (1986).

4.4 Discussion

Table 4.10 shows the comparison of means observed in the data from this pilot study and data from previous studies. Previous data on problematic smartphone use, academic procrastination and academic anxiety were collected from studies in Kwon (2013), Steel (2010) and Pekrun et al. (2011) respectively. In order to make the comparison, the mean scores for academic procrastination were grand mean scores which were the means of individual mean scores. The mean scores for problematic smartphone use and academic anxiety were the means of individual total scores.

Table 4.10 Comparison of means between this pilot study and previous studies

Variables	This pilot study			Previous studies			
	N	Mean	SD	N	Mean	SD	d
				Kwon et al. (2013)			
Problematic smartphone use	112	35.30	7.37	540	25.26	10.78	1.09
				Steel (2010)			
Academic procrastination	100	3.13	.54	4169	3.63	.83	-.71
				Pekrun et al. (2011)			
Academic anxiety-class	99	25.65	8.36	389	27.68	8.30	-.24
Academic anxiety-learning	108	31.64	8.27	389	30.69	7.76	.12
Academic anxiety-test	108	29.67	8.33	389	36.19	9.97	-.71

Overall, several results of this study were significantly different from those reported in previous studies. It was obvious that the participants of this study were heavier problematic smartphone users than the Korean group in Kwon et al. (2013)'s study with a large effect size (Cohen's *d* was 1.09). In this study, 32 out of 50 (64%) females and 47 out of 61 (77%) males scored higher than the cut-off points of "smartphone addiction" for females (33 points) and males (31 points) suggested in Kwon et al. (2013). As shown in Table 4.11, the percentages of participants with "smartphone addiction" in this study were also higher than those in two very recent studies (Chotpitayasunondh & Douglas, 2016; Kee, Byun, Jung, & Choi, 2016).

Table 4.11 Comparison of the percentage of addictive smartphone users between studies.

Gender	This pilot study		Chotpitayasunondh & Douglas's (2016) study		Kee et al.'s (2016) study	
	n/N	Percentage	*n/N*	Percentage	*n/N*	Percentage
Female	32/50	64%	51/158	32.3%	38/72	52%
Male	47/61	77%	27/93	29%	12/28	42%

Note. n = number of participants scored above the cut-off value, N = total number.

Furthermore, the participants in this study reported lower levels of procrastination than those in Steel (2010) with a large effect size (d = -0.71). The levels of class and learning related anxieties reported in this study were similar to those in Pekrun et al. (2011) and effect sizes were small. The participants in this study were less anxious about tests than those in Pekrun et al. (2011)'s study with a large effect size (d = -0.71). However, it is necessary to note that the samples in Kwon (2013), Steel (2010) and Pekrun et al. (2011) were much larger than in this pilot study. It is unknown whether sample size differences have affected the results or not. This will be addressed in the main study data collection where as large a sample as possible will be recruited.   As this study was conducted in China, different contexts might also partly explain the different results.

Pearson's correlation coefficients revealed significant correlations between problematic smartphone use, procrastination and academic anxiety and regression analysis indicated that problematic smartphone use appeared to be the strongest predictor of academic procrastination and female students procrastinate more than male

students. Learning-related anxiety seemed to be another possible predictor of procrastination but results in the current sample were not statistically significant. Mediation analysis in AMOS indicated that problematic smartphone use not only predicted academic procrastination directly, but also predicted though the mediating effects of academic anxiety. It seems that problematic smartphone use may be harmful, and could be seen as an "addiction", predicting both academic anxiety and procrastination.

In sum, in this pilot study, the reliability of the scales was found to be almost acceptable with the current sample. Although several items were found to be potentially problematic it remains unclear whether the limited sample or the translation process reduced the reliability. It seems that the length of the questionnaire reduced the reliability since some participants complained the survey was too long. Confirmatory factor analysis in AMOS suggested that the model fit of the scales except for the SAS-SV were not good enough. Therefore, the translated measurements especially the problematic items need to be checked and evaluated further by the translator and the back translator. However, the results of this pilot study were interesting and useful, generally supporting the hypotheses proposed in previous chapters although the validity of the scales were not perfect. The results of this study also supported the relationships between PSU, academic anxiety and procrastination proposed in the hypothesised model. Thus, in the main study with a larger sample, the measures were applied with necessary modifications after re-evaluation of translation (See Chapter Five).

Chapter 5 Main study: Quantitative Analyses

5.1 Background

The pilot study identified a mediating relationship between problematic smartphone use, academic anxiety and academic procrastination, in which academic anxiety was a partial mediator of the observed relationship between PSU and academic procrastination. That relationship provided the basis of the hypothesised model tested in this research. In the main study, data were collected in two tranches in order to allow for a check on model-fit, and to consider any need for further revisions. This was deemed important partly because it was decided to include two new variables in the hypothesised model (self-regulation and life satisfaction) Data were therefore initially gathered from 102 participants and full information about this reduced dataset are available in Appendix G. In the hypothesised model tested in this chapter, the relationship between PSU and academic procrastination is proposed to be partially mediated by academic anxiety. In addition, based on the reviews and discussions in Chapter Two, self-regulation was added as a predictive variable for PSU and life satisfaction was added as an outcome variable for PSU. When testing this model with the exploration sample of 102 participants a modified structural equation model with good fit was observed. The five variable model was therefore tested in a larger sample.

5.2 Method

5.2.1 Participants

As stated above, participants were recruited in two tranches. The first tranche of data was collected in November 2016 from n=102 participants. The second tranche was collected in May 2017 from n=373 undergraduate students from the same university in central China (also the same university as the pilot study). Because no changes in the questionnaire were made between tranche 1 and tranche 2 of data collection the data from both samples were combined and are presented together in this chapter. Thus, in total, 475 responses were gathered (209 females and 266 males). The average age was 19.77 ($SD = 1.11$), ranging from 16 to 27. The participants were from a wide array of different majors including English, computer science, media and mechanics.

5.2.2 Measures

The questionnaire used in the main wave of data collection of the main study was the same as that used in the first stage of the main study including the 10-item SAS-SV, the 8-item IPS, the 12-item AEQ-anxiety, the 10-item SRS and the 5-item SWLS. Cronbach's alphas indicated acceptable levels of internal reliability and will be reported in Table 5.1.

5.2.2.1 Smartphone Addiction Scale-Short Version (SAS-SV; Kwon, Kim et al., 2013)

The main study used the same scale as the pilot study, the SAS-SV (Kwon, Kim et al., 2013), to evaluate problematic smartphone use. No modification was made to this

questionnaire. Participants responded to this 10-item scale using a 6-point Likert scale from "strongly disagree" (1) to "strongly agree" (6). A sample item is, "I wouldn't be able to stand not having a smartphone."

5.2.2.2 Irrational Procrastination Scale (IPS; Steel, 2010)

The modified 10-item IPS (Steel, 2010) was further modified into an 8-item scale as reported in Chapter 3. The questionnaire is answered with a 5-point Likert scale which ranges from "Not at all true of me" (1) to "Very true of me" (5). Item 2 and 6 are reverse coded items. A sample non-reverse coded item is, "At the end of the day, I know I could have spent my time better." A sample reverse coded item is "If there is something I should do; I get to it before attending to lesser tasks." Other than the omission of two items this measure was unchanged from the pilot study.

5.2.2.3 Achievement Emotion Questionnaire-Anxiety (AEQ; Pekrun et al., 2005)

Different from the full 35-item version of the AEQ-anxiety used in the pilot study, the shortened version of the AEQ-anxiety (Pekrun et al., 2005) was adopted in this study to measure academic anxiety. The short version with 12 items includes three parts: class anxiety (4 items), learning anxiety (4 items) and test anxiety (4 items). The AEQ-anxiety is a 5-point Likert scale from "strongly disagree" (1) to "strongly agree" (5). The process of shortening the scales was discussed in previous chapters. A sample item is, "I worry whether the test will be too difficult."

5.2.2.4 Self-Regulation Scale (SRS; Diehl et al., 2006)

A measure of self-regulation was included in this study that had not been included in the pilot in which self-regulation was not measured. The Self-Regulation Scale (SRS; Diehl et al., 2006) was used to measure participants' self-regulation. The SRS is a 10-item 4-point Likert scale from "Not at all true" (1) to "Completely true" (4). Item 5, 7 and 9 are reverse coded items. A sample non-reverse coded item is, "After an interruption, I don't have any problem resuming my concentrated style of working." A sample reverse coded item is "I usually have a whole bunch of thoughts and feelings that interfere with my ability to work in a focused way."

5.2.2.5 Satisfaction with life scale (SWLS; Diener et al., 1985)

The Satisfaction with life scale (SWLS) developed by Diener et al (1985) was adopted to assess the participants' satisfaction with life. The validated Chinese version of the SWLS in Bai et al. (2011) was used in this study. The 5-item SWLS is a 7-point Likert scale ranging from "Strongly disagree" (1) to "Strongly agree" (7). A sample item is, "So far I have gotten the important things I want in life." This measure was included in the current study having not been included in the pilot.

5.2.3 Procedure

Questionnaires were printed on A3 pages which were then folded into booklet form so that participants would be less likely to miss pages, a difficulty experienced in the

Pilot Study. The researcher contacted English teachers in the university who agreed to distribute questionnaires in their classes. The students were informed of the aims of the study by the researcher and their teachers. They then read the consent information and decided whether to volunteer to participate in this survey. In total, combining the two tranches of collection, 493 questionnaires were distributed via convenience sampling to the students during their English classes and 478 questionnaires were received. There could be some bias in this convenience sample since participants were not randomly recruited. However, since participants were undergraduates attending English classes mixed with different majors, and were equally distributed in terms of gender, the sample is likely to represent students from different majors in the university. Among the 478 responses, two participants reported that they did not use a smartphone and one participant only provided data on gender, age and another single item. Thus, those three responses were deleted before data analysis and 475 responses from the main wave of data collection were used.

5.2.4 Data analysis

Missing data were analysed and the regression imputation method in SPSS was applied to replace missing values because SEM in AMOS requires complete data with no missing values. Missing data imputation, descriptive statistics, t-tests, correlation analysis were conducted in SPSS version 24, and SEM was conducted in AMOS version 23.

5.3 Results

5.3.1 Descriptive statistics

Table 5.1 shows the descriptive statistics for the total scale scores. The observed ranges of the scales were as expected. The skewness, and kurtosis values indicate that all scores were normally distributed (See Table 1). The reliabilities were generally acceptable as the Cronbach's alpha values for the SAS-SV, the AEQ-anxiety and the SWLS were above .78, while the alpha values for the IPS and the SRS were .66 and .69 which was nearly acceptable.

Table 5.1 Descriptive scale statistics

Scale	No. of items	Range		*M*	*SD*	Skewness	Kurtosis	M^R	α
		Potential	Observed						
SAS-SV	10	10-60	10-60	36.70	7.55	.05	.31	.49	.80
IPS	8	8-40	11-40	25.14	4.74	-.02	.32	.38	.66
AEQ-anxiety	12	12-60	12-54	30.48	8.07	.00	-.13	.48	.82
SRS	10	10-40	13-40	26.16	3.71	.06	1.12	.37	.69
SWLS	5	5-35	5-35	18.35	5.37	.17	-.03	.58	.78

Note. *N* = 475;

M^R = Median of corrected item-total correlations.

5.3.2 t-tests and effect sizes for gender differences

Independent samples t-tests were conducted to ascertain whether there were gender differences for any of the five variables. As shown in Table 5.2, significant gender

differences were found for two variables: problematic smartphone use and self-regulation. Females (M = 37.89, SD = 7.06) reported significantly higher levels of problematic smartphone use than males (M = 35.77, SD = 7.80), t (473) = 3.07, p < .01 but the effect size of this difference was small, d = -.28. There was also a significant difference between the self-reported self-regulation of females (M = 25.67, SD = 3.84) and males (M = 26.55, SD = 3.56), t (473) = - 2.58, p < .05 but this effect size was also small, d = .24. Therefore, females reported higher levels of PSU than males, while males tended to report better self-regulation than females. Since the effect sizes were small, female and males were combined for further analysis.

Table 5.2 Gender differences for problematic smartphone use, academic procrastination, academic anxiety, self-regulation and satisfaction with life

| | Female | | Male | | | | |
| | N = 209 | | N = 266 | | | | |
	M	*SD*	*M*	*SD*	*F*	*t(df)*	*d*
Problematic smartphone use	37.89	7.06	35.77	7.80	1.13	3.07(473) **	-.28
Academic procrastination	25.53	4.90	24.83	4.60	2.20	1.61(473)	-.15
Academic anxiety	30.08	7.60	30.80	8.42	1.71	-.96(473)	.09
Self-regulation	25.67	3.84	26.55	3.56	.17	-2.58(473) *	.24
Satisfaction with life	18.30	5.30	18.39	5.43	.38	-.18(473)	.02

Note. *p < 0.05 (2-tailed), **p < 0.01 (2-tailed)

5.3.3 Correlations

Pearson's product-moment correlation coefficients were calculated and the five

variables were almost all significantly correlated with each other. As shown in Table 5.3, PSU was significantly and positively correlated with academic procrastination (r = .36, p < .01) and academic anxiety (r = .28, p < .01), and negatively correlated with self-regulation (r = -.35, p < .01) and life satisfaction (r = -.16, p < .01). Academic procrastination was significantly and positively correlated with academic anxiety (r = .39, p < .01), and negatively correlated with self-regulation (r = -.39, p < .01) and life satisfaction (r = -.16, p < .01). Self-regulation was significantly and negatively correlated with academic anxiety (r = -.35, p < .01), and positively correlated with life satisfaction (r = .26, p < .01). There was no significant relationship between academic anxiety and life satisfaction (p > .05).

Table 5.3 Pearson Product-moment Correlations

	1	2	3	4	5
1 Problematic smartphone use	-				
2 Academic procrastination	.36**	-			
3 Academic anxiety	.28**	.39**	-		
4 Self-regulation	-.35**	-.39**	-.35**	-	
5 Satisfaction with life	-.16**	-.16**	-.08	.26**	-

Note. **p < 0.01 (2-tailed).

5.3.4 Structural Equation Modelling

5.3.4.1 Confirmatory factor analysis

CFA was applied to test the hypothesised model that was developed on the basis of a literature review, a pilot study and initial data collection with an exploratory sample, with all items presented as observed variables as shown in Figure 5.1. The model fit indices show different evaluations of the model fit. The criteria for a good fit can be: χ^2/df < 3, *RMSEA* < .08, *CFI* > .90 (Bakker, Hakanen, Demerouti, & Xanthopoulou, 2007), or *RMSEA* < .06, *CFI* > .95 (Hu & Bentler, 1999). Two of the model fit indices ($\chi2/df$ = 2.63, *RMSEA* = .06) indicate this CFA model is acceptable while the *CFI* (.71) was not in the acceptable range. For this situation, Lai & Green (2016) concluded that the disagreement between *RMSEA* and *CFI* is not about the model or data but their different perceptions of model fit judgement, and the fit indices are still lacking in deep understanding. They suggest not judge a model goodness-of-fit good or bad when this situation appears.
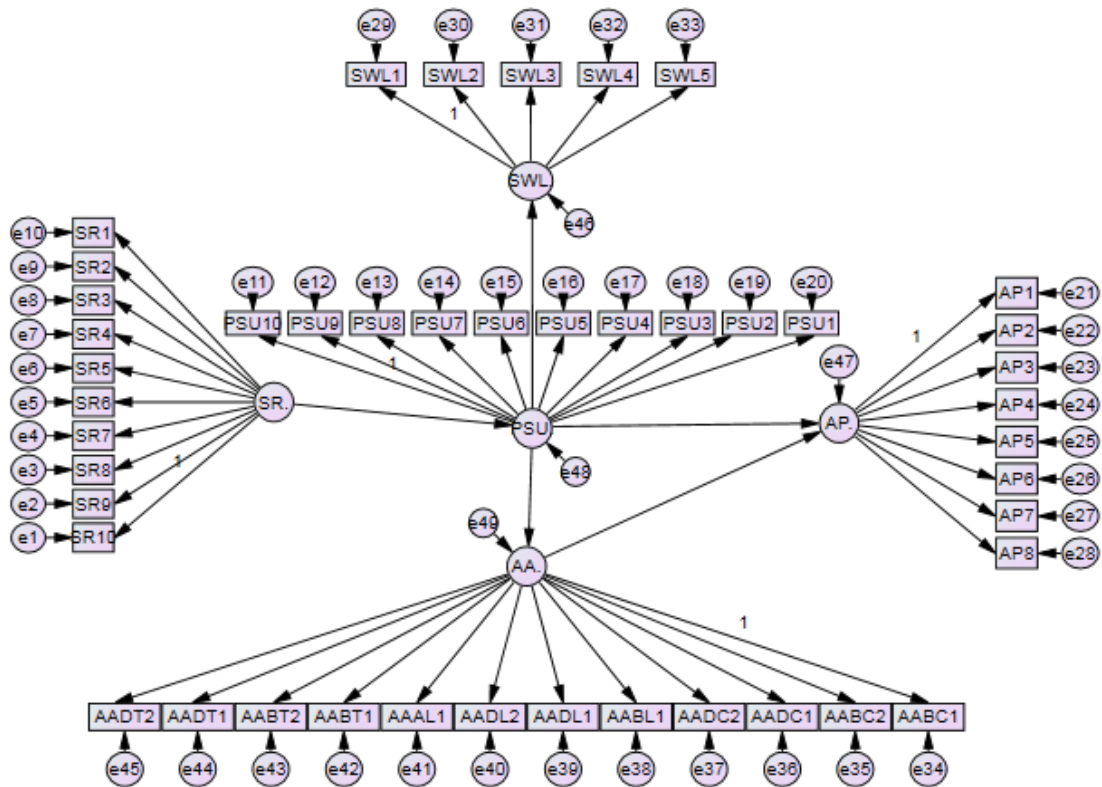
Figure 5.1: Confirmatory factor analysis. χ^2/df = 2.63, CFI = .71, RMSEA = .06.

Note. PSU = problematic smartphone use, AA = academic anxiety, AP = academic procrastination, SR = self-regulation, SWL = satisfaction with life. AABC = academic anxiety before class, AADC = academic anxiety during class, AABL = academic anxiety before learning, AADL = academic anxiety during learning, AAAL = academic anxiety after learning, AABT = academic anxiety before test, AADT = academic anxiety during test.

5.3.4.2 Path analysis of the hypothesised model

Item parcelling has become a generally applied method in SEM (Bandalos, & Finney, 2001). Many studies reviewed in previous chapters used item parcelling (e.g. Lepp et al., 2014; Van Deursen et al., 2015). For the purpose of testing the hypothesised relationships between variables in this study, it seems necessary to focus not only on the factors within the variables but also the links between variables. Thus, besides the CFA, it seems suitable and indispensable for this study to use path analysis in order to explore the relationships between those variables. The scales used in this study have been widely used through computing their total scale scores. Thus, in line with the initial exploratory sample data (presented separately in Appendix G), the items of each scale were parcelled as total scores. Figure 5.2 shows the initial hypothesised model which did not in fact fit the data well ($\chi2 = 93.24$, $df = 5$, $\chi2/df = 18.65$, $p = .00$, $CFI = .72$, $RMSEA = .193$). The modification indices in AMOS recommended additional covariance between self-regulation and error 1, 3 and 4. As self-regulation was significantly correlated with life satisfaction, academic anxiety and academic procrastination, three new paths from self-regulation were added to the initial model and formed a modified model as shown in Figure 5.3. The model fit was good ($\chi^2 = 2.05$, $df = 2$, $\chi^2/df = 1.03$, $p = .36$, $CFI = 1.00$, $RMSEA = .008$), which indicates the model fit the data well. As shown in Table 5.4, the modified model had a good fit and significant fit changes from the initial poor model, $\Delta \chi^2 = 91.19$, $\Delta \chi^2/df = 17.62$, $\Delta CFI = .88$.

The standard regression weights of the paths in the final model are shown in Figure 5.3. Significance was tested using bootstrapping (10,000 times) in AMOS. PSU was negatively predicted by self-regulation (β = -.35, p < .001). PSU positively predicted academic anxiety (β = .18, p < .001) and academic procrastination (β = .21, p < .001). Academic anxiety positively predicted academic procrastination (β = .25, p < .001). Self-regulation positively predicted life satisfaction (β = .23, p < .001), and negatively predicted academic anxiety (β = -.29, p < .001) and academic procrastination (β = -.23, p < .001). PSU was not a significant predictor of life satisfaction in the final model.

Table 5.4 Summary of the model fit indices

| | χ^2 | df | χ^2/df | p | CFI | RMSEA | Fit changes | | |
							$\Delta\chi^2$	$\Delta\chi^2/df$	ΔCFI
Initial model	93.24	5	18.65	.00	.72	.193			
Modified model	2.05	2	1.03	.36	1.00	.008	91.19	17.62	.88
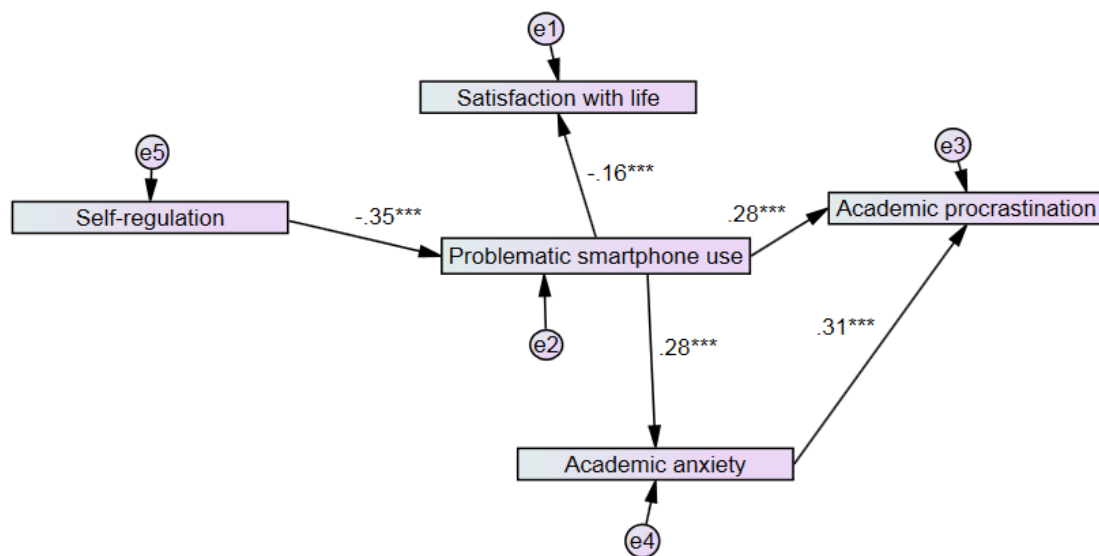
Figure 5.2: Initial model. χ^2 = 93.24, df = 5, χ^2/df = 18.65, p = .00, CFI = .72,

RMSEA = .193

Note*: ***p < 0.001*
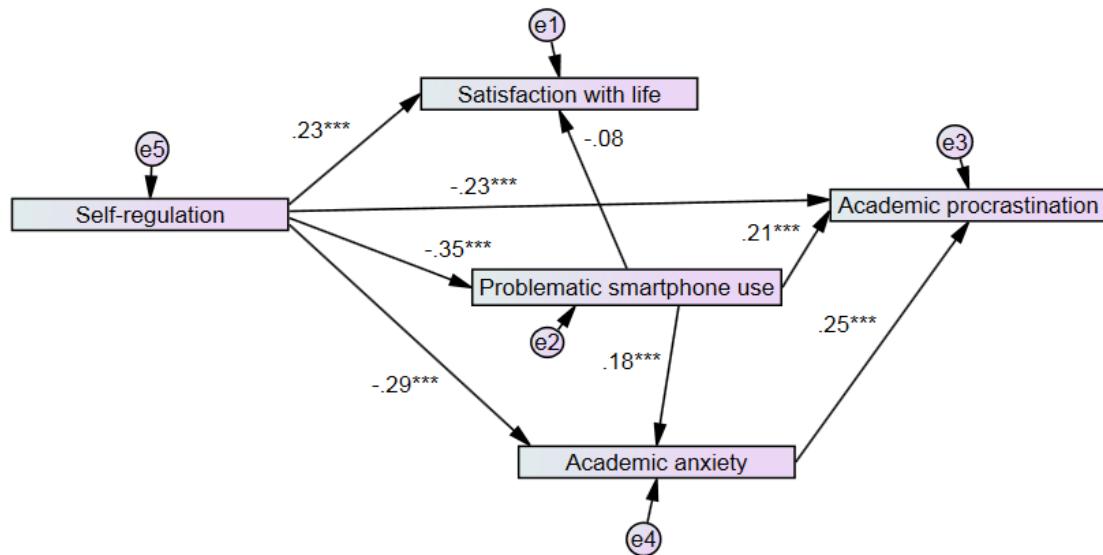
Figure 5.3: Modified model. χ^2 = 2.05, df = 2, χ^2/df = 1.03, p = .36, CFI = 1.00,

RMSEA = .008

Note: ***p < 0.001

Table 5.5Mediation analysis

	Without mediator	With mediator	
	Direct effect	Direct effect	Indirect effect
PSU→AA→AP	.36***	.28***	.09***
SR→PSU→AA	-.35***	-.29***	-.06***
SR→PSU→AP	-.39***	-.30***	-.09***
SR→AA→AP	-.39***	-.29***	-.10***

Note. ***$p < 0.001$.

PSU = problematic smartphone use, AA = academic anxiety, AP = academic procrastination, SR = self-regulation.

The results indicate partial mediation in all paths.

Table 5.5 shows the mediating relationships identified in the final, and best-fitting, model. The significance of the indirect effects was tested using bootstrapping (10,000 times) in AMOS. PSU had significant direct effects on AP ($\beta = .36$, $p < .001$) and AA ($\beta = .27$, $p < .001$) respectively. While AP was significantly predicted by PSU ($\beta = .28$, $p < .001$) and AA ($\beta = .31$, $p < .001$) in a same equation. The effect of PSU on AP decreased from .36 to .28 when AA was added as a mediating variable, and the indirect effect was significant ($p < .001$). Therefore, AA partially mediated the relationship from PSU to academic procrastination. The other mediations in Table 5 were tested and approved in the same way as above and the indirect effects were all significant.

5.4 Discussion

Overall, this study confirmed the hypothesised model with modifications. Self-regulation and life satisfaction were added to the mediation model identified in the pilot study based on reviews in Chapter Two. As shown in the hypothesised model in Chapter Two, self-regulation was hypothesised to predict PSU, and PSU was the predictor of life satisfaction. In order to gain good model fit, in this main study, extra paths were added from self-regulation to life satisfaction, academic anxiety and academic procrastination. All variables in this study were significantly correlated except for academic anxiety and life satisfaction. In the modified structural equation model, self-reported PSU was predicted by self-reported self-regulation, while academic anxiety and procrastination were the possible consequences of PSU. Life satisfaction was significantly correlated with PSU, though PSU did not predict life satisfaction in the model. Independent samples t-tests showed that there were significant gender differences for PSU and self-regulation but with small effect sizes. Although gender difference was not the initial interest of this thesis, it is still interesting to find that females tended to report higher levels of PSU and lower levels of self-regulation. The small effect sizes also suggest the suitability to analyse the combined data. Furthermore, based on the relationships confirmed in the modified model with good fit, several partial mediating relationships were also identified in this study.

Table 5.6 illustrates the comparison between the scales' scores in this study and in previously published studies. The grand mean of the IPS was calculated in order to

compare with the original grand mean in Steel (2010). The AEQ-anxiety subscale scores were multiplied by 35/12 since it was shortened from 35 to 12 items. Problematic smartphone use seems more serious in this study than in others with different samples. Participants in this study scored obviously higher than those in Kwon et al.'s (2013) study with a very large effect size, $d = -1.22$. As shown in table 5.7, participants in this study tended to report higher levels of "addictive" smartphone use than the Korean teenagers in (Kee, Byun, Jung, & Choi, 2016) and the multi-national sample in (Chotpitayasunondh & Douglas, 2016) since more participants scored over the cut-off points (33 points for females and 31 points for males). In this study, 151 out of 209 females (72.25%) scored over 33 points and 193 out of 266 males (72.56%) scored over 31 points. It is obvious that the undergraduate participants reported relatively high levels of PSU. It seems necessary to further investigate this situation using another research method such as interviews. Interview data will be presented in Chapter Six.

In this study, participants reported lower levels of procrastination than the multi-national sample in Steel (2010) with a moderate effect size, $d = .61$. Compared to the Canadian undergraduates in Pekrun et al. (2005), participants in this study seemed to be more anxious about learning ($d = -.37$) but less anxious about classes ($d = .24$) and tests ($d = .73$). Participants in the current study also reported lower levels of self-regulation than the American sample in Diehl et al. (2006) with a large effect size, $d = 1.05$. Participants in this study also seemed to be less satisfied with their lives than the American sample in Diener et al. (1985) with a large effect size, $d = .91$. However,

participants in this study reported slightly lower life satisfaction than a large Chinese

mainland sample (Bai et al., 2011) with small effect size, $d = .33$.

It seems that cultural or nationality differences are likely to have some impact on

the differences between the scores on the scales. However, such differences do not

affect the hypotheses tested in the current study which only looks at Chinese students.

As presented in the results section, the five variables were significantly correlated with

each other. The modified model based on the hypothesised model was acceptable and

fit the data well. Hypotheses 1 to 5 (see Chapter Two) were supported in the modified

model. Hypothesis 6 was not supported since PSU did not predicted SWL significantly

in the modified model although the path was significant in the initial model. It is

obvious that the Chinese undergraduate participants in this study reported relatively

higher levels of PSU than has been seen in other studies. This is an interesting finding

although it is necessary to bear in mind that these participants were drawn from a single

Chinese university and are not necessarily representative of all Chinese students. It

seems necessary to further investigate this distinct situation. Perhaps the participants'

own words or narrations, presented in the next chapter, will be helpful to understand

this situation.

Table 5.6 Comparison of means between this study and previous studies

	This study			Previous studies			d
	N	M	SD	N	M	SD	
				Kwon et al. (2013)			
Problematic smartphone use	475	36.70	7.55	540	25.26	10.78	-1.22
				Steel (2010)			
Academic procrastination	475	3.14	.59	4169	3.63	.83	.61
				Pekrun et al. (2005)			
Academic anxiety							
Class	475	25.62	8.97	389	27.68	8.30	.24
Learning	475	34.16	10.44	389	30.69	7.76	-.37
Test	475	29.12	9.34	389	36.19	9.97	.73
				Diehl et al. (2006)			
Self-regulation	475	26.16	3.71	330	30.48	4.63	1.05
				Diener et al. (1985)			
Satisfaction with life				176	23.50	6.43	.91
	475	18.35	5.37	Bai et al. (2011)			
				4795	20.32	5.99	.33

Table 5.7 Comparison of the percentage of "addictive" smartphone users between studies.

Gender	This study		Chotpitayasunondh & Douglas's (2016) study		Kee et al.'s (2016) study	
	n/N	Percentage	*n/N*	Percentage	*n/N*	Percentage
Female	151/209	72.25%	51/158	32.3%	38/72	52%
Male	193/266	72.56%	27/93	29%	12/28	42%

Note. n = number of participants scored above the cut-off value, N = total number.

Chapter 6 Main study: Qualitative Analyses

6.1 Background

Findings presented in Chapter Five showed that that the Chinese college students in this study reported higher levels of problematic smartphone use than students from different contexts in other studies. Furthermore, PSU was significantly correlated with anxiety, procrastination, self-regulation and life satisfaction. A structural equation model with good fit further confirmed the association between these five variables. However, it is important to note that all of the standardised regression effects of the paths in the model were lower than .40, even though most paths were significant at the p <.001 level. Thus, there might be several other antecedents or consequences of PSU, with noteworthy effect sizes, which are not included in the model. As the questionnaire survey did not include open questions, participants only had the opportunity to express their opinions by rating their agreement with the specific items presented to them. It therefore remains possible that several other antecedents and consequences of PSU were not addressed by the questionnaires, and that participants may have had other relevant thoughts to express. The quantitative data would benefit from triangulation.

It seems that the reasons and consequences of PSU are likely to be complicated. A number of studies in different contexts have found that mobile phone addiction or PSU is associated with poor well-being and other mental health issues (Dayapoglu, Kavurmaci, & Karaman, 2016; Hong, Chiu, & Huang, 2012; Leung, 2008). For example, excessive cell phone use has been found to predict anxiety (Lepp et al., 2014).

PSU has also been identified as a potential consequence of poor self-regulation (Van Deursen, Bolle, Hegner, & Kommers, 2015). Most studies in this area have used questionnaire surveys to collect quantitative data. However, a limited number of recent studies have investigated PSU or mobile phone addiction in educational contexts using qualitative methods (Aoki & Downes 2003; Lapointe, Boudreau-Pinsonneault, & Vaghefi, 2013; Vacaru, Shepherd, & Sheridan, 2014; Walsh, White, & Young, 2008).

Walsh et al. (2008) conducted six focus groups with 32 Australian adolescents (16-24) and identified their general mobile phone usage, perceptions of what constitutes excessive or addictive mobile phone use, and self-reported symptoms of mobile phone addiction. Mobile phones were reported as useful tools with multiple functions, and can be used for life convenience and in emergencies. Besides, over-attachment to mobile phones was also reported. The participants reported their perspectives on mobile phone addiction, including excessive behaviour (e.g. compulsive checking), addiction to being in contact with, etc. They also reported symptoms of mobile phone addiction including salience, conflict with other activities and withdrawal.

A study of 34 young people (aged 13-19) in New Zealand reported that mobile phones were not only tools for making contact with others in daily life but that their use was also related to addiction-like behaviours (Vacaru et al., 2014). Besides the basic functions for practical use, moebile phones were reported to have negative impacts including bullying, communication difficuloties and physical impacts (e.g. poor sleep quality). The participants described problematic use of mobile phones as addiction-like behaviours. They also linked those behavoiours with communication difficulties and

anxiety.

A qualitative study of 11 North American undergraduates identified some reasons, prevalence and consequences of mobile phone addiction (Lapointe et al., 2013). The reasons includes user-related factors (boredom, fear of rejection, need for approval, loneliness, anxiety, stress), and technology-related factors (useful functions). The reported addictive behavours are use when socializing and eating; first thing after waking up; and use when not appropriate. The consequences of mobile phone addiction are decreased productivity, positive or negative impacts on social relationships, and low well-being (e.g. stress and frustration).

Finally, another study conducted with 32 undergraduates (4 focus groups) in a Northeast university in the USA identified attitudes towards mobile phone use among undergraduates (Aoki & Downes, 2003). The main themes related to mobile phone use identified in their study are: personal safety, financial incentive, information access, social interaction, parental contacts, time management/coordination, dependency, image, and privacy management.

To our knowledge, for this topic, there has been no qualitative study investigating the views of Chinese university students. Therefore, it was deemed both useful and interesting to explore the prevalence, and the perceived causes and consequences of Chinese undergraduate students' use of smartphones. For this aim, three research questions were proposed:

RQ1. How much do Chinese undergraduates report using their smartphones (and does

it differ from their questionnaire responses)?

RQ2. What are the reasons given for participants' smartphone use?

RQ3. What do participants see as the consequences of how much they use their smartphones?

As reviewed in previous chapters, a recent pathway theoretical framework of problematic mobile phone use (PMPU) developed by Billieux, Maurage et al. (2015) proposed three pathways leading to PMPU: the excessive reassurance pathway, the impulsive-antisocial pathway and the extraversion pathway. The three pathways were argued to lead to three different types of problematic use including an addictive pattern, an antisocial pattern and a risky pattern of problematic mobile phone use. Details were reviewed in Chapter Two. For the current study, this theoretical model was applied to guide the qualitative data analysis of the antecedents and patterns of PSU.

6.2 Methods

6.2.1 Participants

Participants were 17 university students who were roughly equally distributed in terms of gender including nine females and eight males. They were first and second-year undergraduates from different majors including Chinese language and literature, administrative management, software engineering, English and computer science. In total 86 participants provided their phone numbers in their questionnaire responses, indicating a willingness to be interviewed for this research project. After the

questionnaire survey, 9 of the 86 participants who left their phone numbers agreed to be interviewed either the same day as completing the questionnaire, or the next day. They came to speak to the researcher after handling the questionnaires and booked the interviews, thus they were not contacted by text messages later. The 9 participants attended the interviews as arranged. These 9 participants represent an opportunity sample. The recruitment of these 9 interviewees did not affect the selection of other interviewees. Subsequently, a further 43 participants were contacted by text message to organise a suitable time and place for interview. Seven of these participants replied to the text message and confirmed they would like to participate in the interviews. Times and venues for these interviews were confirmed by text message. Thus, this was a convenience sample. One of these volunteer participants did not show up on the day. One participant arrived with a friend who volunteered to participate in an interview. The participant's friend confirmed that she had completed the questionnaire before. As questionnaire data were anonymous, in order to confirm this participant's SAS-SV, she was asked to complete only the SAS-SV part of the questionnaire and this response was not included in the quantitative data analysis as findings could not be linked to other study variables. In addition, one interviewee was recruited when she volunteered to be interviewed after her friend's introduction, and the SAS-SV score of this participant was unknown. This participant who was introduced by one interviewee did not participate in the questionnaire survey and had no scores for the SAS-SV. She was then excluded in data analysis in order to keep the consistency of data. Therefore, finally 16 interviews were used in data analysis. According to the cut-off point for "addiction" on

the SAS-SV (33 for females and 31 for males), only four interviewees (2 females and 2 males) were "non-addicts" who did not score over the cut-off points. Since all interview data were expected to be anonymised in data analyses, all interviewees were identified with randomly selected Chinese names so that participant anonymity was protected. Details of the participants are shown in Table 6.1.

Table 6.1 Participants of the Interviews

Name	Gender	SASSV score	Grade	Age
Bao	Male	43*	First year	19
Chen	Female	28	First year	19
Feng	Male	30	First year	20
Gu	Female	35*	Second year	-
Han	Female	48*	First year	19
Jiang	Male	47*	First year	18
Ke	Female	50*	First year	20
Liu	Female	34*	Second year	20
Ma	Male	39*	First year	18
Qi	Male	32*	First year	19
Ren	Male	30	First year	18
Su	Female	27	Second year	20
Wan	Female	36*	Second year	19
Xiao	Male	38*	Second year	20
Yao	Female	42*	First year	18
Zhan	Male	33*	Second year	20

Note. * means the participant scored over the cut-off point (33 for females and 31 for males) of "addiction" in SASSV.

6.2.2 Measurements

An interview schedule was designed based on the research questions. There were six main questions:

1. Could you talk about the role of your smartphone in your daily life?

2. Could you describe how you use your smartphone in class or while you are studying?

3. Could you talk a bit about others' use of smartphones in their daily lives or during classes and other learning periods, from your point of view?

4. What factors do you think motivate you or your friends to use smartphones?

5. What are the possible impacts, if any, of smartphone use for you or your friends?

6. Is there anything you would like to add?

There were also sub-questions for probing participants to further explain their responses including: What do you use it for? If your smartphone was taken away, how do you think it would affect your life? Can you describe when you are most likely to use it? How does it change your behaviour? Does it affect your studies or your academic success? All questions were created in English and then translated into Chinese. The Interview schedule was printed on two sides of an A4 sheet with both the English and Chinese versions visible for the interviewer to refer to during the interviews.

6.2.3 Procedure

Semi-structured face-to-face interviews were carried out with all interviewees. Most interviews lasted for 10 to 15 minutes. In order to ensure participants could express their opinions smoothly and deeply, the interviews were conducted in Mandarin since all participants were from mainland China. Places and times for interviews were selected for the convenience of participants in quiet venues on the university campus. Participants read information sheets before providing informed consent to participate in this interview study. After the interviews, participants received 10 RMB (equivalent to about £1) in cash or snacks. All interviews were audio recorded and transcribed anonymously. All transcripts were analysed in Chinese in order to avoid information loss during translation. The transcripts were translated into English after data analysis and before the reporting of results.

6.2.4 Data analysis

The framework analytic approach (Ritchie & Spencer, 1994; Gale, Heath, Cameron, Rashid, & Redwood, 2013) was used for this qualitative data analysis. Five steps were applied: familiarization, identifying a thematic framework, indexing, charting and mapping. Since Computer Assisted Qualitative Data Analysis Software (CAQDAS) is useful to increase the efficiency of framework analysis (Gale et al., 2013), all analyses for this study were conducted in NVivo version 11. In the first step, the researcher read all transcripts and became familiar with the main ideas and thoughts of the interviewees. In the second step, in order to identify a thematic framework, coding was conducted in

several transcripts before a draft thematic framework was identified. However, since the thematic framework cannot be finally confirmed before the last transcript is coded (Gale et al., 2013), coding and framework modification proceeded simultaneously until the last transcript was coded in this step. In the third step, the thematic framework was applied to all transcripts in order to organise all data for interpretation. In the fourth step, all data were charted into a matrix in NVivo with all cases in rows and all themes in columns. Finally, data were interpreted according to the thematic framework.

6.3 Results

This study was designed to investigate the prevalence, self-perceived reasons for, and self-perceived consequences of, problematic smartphone use among Chinese university students. Framework Analysis was used to identify a thematic framework, as shown in Table 6.2, which included four main themes: smartphone usage, antecedents, impacts and perceptions. Usage includes general use of smartphones, usage for study and PSU. Using the theoretical model discussed previously, reports of PSU were then categorised into three patterns: an addictive pattern, an antisocial pattern and a risky pattern. Antecedents of smartphone use were discussed by participants from two specific angles: reasons for normal use and reasons for problematic use. Based on the pathway model, perceived internal reasons for PSU were divided into three categories: excessive reassurance, impulse and extraversion. However, several external reasons for PSU were also discussed. Impacts of smartphone use were discussed in three main ways: positive impacts, negative impacts and no impacts. During the interviews, participants

expressed many personal opinions on smartphone use, which were combined into another broad theme called perceptions. However, this study also found that the cut-off points of the SAS-SV were not reliable criteria for PSU, from the point of view of these study participants. That is, several participants who exceeded the threshold for addiction on the SAS-SV did not perceive their smartphone use as being problematic. This is explored in greater depth in the Discussion section of the current chapter.

Table 6.2 Thematic framework of the interviews

Usage	General use		
	Study		
	Problematic use	Addictive pattern	Frequent checking
			Using late at night
		Antisocial pattern	Irrelevant use in class
		Risky pattern	The others' dangerous use
Antecedents	Normal use	Study	
		Daily life	
	Problematic use	Internal reasons	Excessive reassurance
			Fear of missing messages,
			Reassurance need after transition from high school
			Impulsivity — Poor self-regulation
			Extraversion — Sensation seeking
		External reasons	Teacher
			Course design
			App design
			Transition from high school
Impacts	Positive	Life convenience	
		Help with study	
		Reassurance	

		Social relationship
	Negative	Physical health
		Study (distraction, time wasting, procrastination, test anxiety)
		Privacy safety
	Neutral or no impact	
Perceptions	Positive	
	Negative	
	Neutral	
	Need to change	

6.3.1 Usage

Overall, smartphones were seen as indispensable tools in daily life. Participants reported not only problematic usage of smartphones but also necessary daily use. Smartphone use was identified as problematic when participants reported their behaviour as negative or when they reported using their phones in unsuitable situations. Participants reported that smartphones are used for contact with family and friends, entertainment, information searching, mobile payment, study, etc. Problematic use was reported by a number of participants but several interviewees with high scores on the SAS-SV denied being problematic users.

6.3.1.1 General (non-problematic) use

When participants were asked to report the role of smartphones in their lives, they made comments such as:

First, it is a tool for communication. We use it to contact with our classmates and teachers. Second, it is a tool for entertainment. Third, it is a tool for broadening our knowledge. We can read some news or use software to remember English words. Sometimes, it is also used for entertainment. I watched videos and play games. (Ma, Male, First year, SAS-SV score: 39)

The first function is communication. The second is shopping. That includes some mobile payment methods. The third is learning. Our teacher requires us to install applications such as Moso Teach. Also, our university requires us to use Bu dao tan mi. Almost these three functions. (Gu, Female, Second year, SAS-SV score: 35)

The summaries above suggest that smartphones are used for a wide range of constructive purposes: communication with the other people, entertainment, mobile payment, information searching, sports, study, etc.

Curiosity

Curiosity was mentioned as a reason for beginning to engage with smartphones. For example, Liu said she first used smartphones because of her curiosity about the new technology:

At that time, mobile phones were traditional phones with clamshells or slide phones. I used them for curiosity. I was just wanted to have a try. (Liu, Female, Second year, SAS-SV score: 34)

Communication

Communication or contact with family and friends was the most frequently mentioned use of smartphones. When participants recalled their first use of mobile phones, which were non-smartphones with traditional keypads, communication was the main function. Most participants first used mobile phones in primary school, junior middle school or high school. Many of them used mobile phones since they need to contact with their family from a distance:

(I first used it) in primary school…… My dad was working in Yichang, my school was in Wuchang and my mom was working in Han yang. I lived with my uncle at that time. So, in order to keep in touch, my mom bought me a mobile phone. (Ke, Female, First year, SAS-SV score: 50)

Until high school, my mobile phone was only used for setting an alarm clock and making phone calls. (Wan, Female, Second year, SAS-SV score: 36)

It is obvious that communication continues to be cited as the most basic and important function of smartphones as use becomes more habitual. For their smartphone use in university, all participants reported they used smartphones to communicate with family and friends. For example:

It is now a normal tool. As society has developed, it has become indispensable. If you are in a room without anything, without a smartphone, you will be totally isolated from the world. So, it is impossible to live without a smartphone. Our university is not small, we do need this tool to communicate with each other. (Bao, Male, First year, SAS-SV score: 43)

Then it is used for contacting with family, my parents. Sometimes it is used to communicate with senior students and teachers. (Zhan, Male, Second year, SAS-SV

score: 33)

It is interesting that most participants reported they used calls or social media to contact people, while traditional text messaging was seldom mentioned.

Entertainment

Entertainment was another important function reported by participants as a common use for their phone. Smartphones were used for watching videos, listening to music, playing games and reading novels. For examples:

Second, it is a tool for entertainment. I sometimes used it for entertainment including watching videos, playing games, etc. (Ma, Male, First year, SAS-SV score: 39)

Sometimes, when a group of classmates or roommates have nothing to talk about, we will play online games together (on smartphones). (Feng, Male, First year, SAS-SV score: 30)

These examples refer to using smartphones for entertainment at appropriate times. However, participants also reported entertainment usage during study periods in classes or in the library which will be discussed in the problematic use section of this chapter. Use of smartphones for entertainment in unsuitable situations, including learning, was regarded as PSU because participants identified it as a form of time wasting.

Information searching

Participants used smartphones to search for information, especially news. They reported using them to broaden their knowledge, gain awareness of current politics, hot topics, and news from foreign countries. For example:

I use it to search for information when necessary…… I always use it to have a look at hottest news and topics. (Liu, Female, Second year, SAS-SV score: 34)

Zhi hu was specifically mentioned as a tool for searching for answers to questions. Zhi Hu offers a cyber platform on which different types of questions are answered by a large number of Internet users.

(Zhi hu) is a website on which somebody can propose a question for others to answer. The answerers used their own stories or similar experiences to solve the problem. Sometimes, someone may share his/her own daily experiences of losing weight, makeup, physical practice, and movie watching. (Yao, Female, First year, SAS-SV score: 42)

Social media

Social media was mentioned by all participants. Social media applications offer a wide range of functions: communication, information searching, etc. Wechat and QQ were frequently mentioned smartphone application. Weibo, similar to Twitter, was also noted several times.

Most of the time using smartphone was spent on QQ, Weibo and WeChat. (Xiao, Male, Second year, SAS-SV score: 38)

(Weibo) is mainly used for social contact and reading. (Yao, Female, First year, SAS-SV score: 42)

Mobile payment

Smartphones acted as payment tools among participants. They used smartphones for shopping or paying.

Then it is used for shopping. Generally, I go shopping in my spare time not in classes. (Wan, Female, Second year, SAS-SV score: 36)

Sports

Several participants reported they used smartphones as a tool for sports such as running and cycling.

For example, Bu dao tan mi. I need to sign in everyday to show my daily records of running practice. If I don't have a smartphone, I wouldn't finish the tasks required by the university. It's just run and sign in every day. This application supervises me to practice every day. It sets up a plan for your running distance every day. The record of my practice will be evaluated for my sports credit at the end of the term. Since it is related to my credit and GPA, I need to care about it. (Wan, Female, Second year, SAS-SV score: 36)

6.3.1.2 Use for study

Smartphones were also reported as tools used for study during classes or other learning activities. Participants used their smartphones to learn new English words, look up for information about class content, take pictures of PowerPoint slides, store study materials, finish assignments, etc. Overall, smartphones were seen as important to their learning in university.

New word learning

Several interviewees reported they used smartphones for English word learning and checking. When they found unfamiliar English words in English classes, they checked English-Chinese e-dictionaries in their smartphones. Only Ren said he only

looked up for new words during class breaks because he did not want to miss the teacher's words.

As we are English majors, our tutor recommended us an e-dictionary in smartphone at the beginning of o our first year. We can search words in it. (Bao, Male, First year, SAS-SV score: 43)

I always look up words in class breaks not in class. I think the teacher's words are more valuable than the new words. (Ren, Male, First year, SAS-SV score: 30)

One smartphone application called Bai ci zhan was mentioned as a tool for memorising English words. This application reminds users to sign it and memorise English words every day just like clocking in for a job every day. The application has a schedule which motivates the users to keep using it every day. For every daily task, users need to learn new words and revise the words learned before.

I use Bai ci zhan as a tool for memorising English words. (Ren, Male, First year, SAS-SV score: 30)

Information searching in class

Sometimes participants searched information on the Internet using their smartphones because they did not understand the topics or professional terms discussed in classes. Participants used smartphones to acquire extended knowledge about the topics during classes when they were not satisfied with their teachers' explanation.

You might also use smartphones in classes. If a teacher mentioned a professional term

that you don't know, you never heard of it, you need to check it on your phone. Maybe the teacher thought you knew that term, but you really need to search about it. If you don't search, you may not understand the rest of the class. So, sometimes you need your phone to search information. (Zhan, Male, Second year, SAS-SV score: 33)

Searching on my smartphone is more convenient than referring to books when I don't know what the teacher said. (Xiao, Male, Second year, SAS-SV score: 38)

Keeping up with pace

One participant used her smartphone to take photos of the slides during classes so that she could keep up with the pace of the class.

Now, it is impossible to have classes without a smartphone. Teachers are all using PowerPoint slides in their classes. If you only copy the slides with pen and paper, you can't keep up with the pace of the class. So, you need to take photos of the slides (using smartphones). (Wan, Female, Second year, SAS-SV score: 36)

Storing materials for study

Smartphones were also used for storing materials for study including slides, English listening practice recordings and videos.

I think I frequently use it to take notes. There are a lot of slides in the courses of our major. I would download them and bring them with me to the class. Also I may download some recordings of English listening practice or videos required by some teachers. (Gu, Female, Second year, SAS-SV score: 35)

APPs for multiple usage in university

Because of the requirements of the university, participants installed smartphone

applications for multiple uses including finishing assignments or tests, signing attendance, having online compulsory courses, etc. Without smartphones, they could not keep involved in university activities.

Our university requires us to download something in which we could study…… There is an APP called Xue xi tong developed by the university. We can find our teachers' videos of classes and PowerPoint slides in it. It is still at test stage. Our teachers of Mao gai upload practice questions and test papers to the APP. It is not used by teachers of the other courses yet. Then there are some APPs used for signing attendance. The teacher uses it to count the number of students as we sign our attendance in the APP. What if you don't have a smartphone? (Wan, Female, Second year, SAS-SV score: 36)

There is an APP for oral English practice called Qu pei yin. It contains a lot of English movie and cartoon clips with background music but no dialogues. Our tasks are completing the dialogues of the clips by recording our own speaking. Our teacher has required that. (Ma, Male, First year, SAS-SV score: 39)

6.3.1.3 Problematic use

Besides general smartphone usage, participants also reported behaviours which might be considered as problematic use. Behaviours were discussed as problematic when participants reported they were negatively affected by them. Furthermore, several forms of smartphone use were identified as problematic when the behaviours were reported as occurring in unsuitable contexts including classes or social events. The behaviours are discussed according to the three patterns of PSU proposed in the theoretical model presented by Billieux, Maurage et al. (2015): the addictive pattern, the anti-social pattern and the risky pattern.

The cut-off points for "addiction" in the SAS-SV were not always in line with participants' words in that those below the threshold sometimes reported problematic use while some of those above the threshold did not perceive their use as problematic. For example, Feng and Ren who both scored 30 in the SASSV (a little below the cut-off point for males) still reported problematic behaviours on their smartphones while Ke and Zhan who scored 50 and 33 respectively (above the cut-off points), significantly so in Ke's case, reported they did not see themselves as overusing their smartphones. It seems that participants with different patterns of smartphone use also have different levels of self-perception. It is possible that some individuals with PSU might fail to perceive problematic behaviours as problematic, as is the case with other forms of addiction, while others may be more cautious, worrying about overuse when their use is actually within the normal range.

Addictive pattern

Several participants freely admitted that they overused their smartphones. An obvious specific feature of these participants' narratives was irrational frequent checking. They checked their phones to see if someone was contacting them, even when they were not awaiting any specific contact. This symptom has been described as a reassurance behaviour by Billieux, Maurage et al. (2015).

Maybe it is a kind of smartphone disease. It has reached this level. You want to touch it and can't control yourself.   (Gu, Female, Second year, SAS-SV score: 35)

Maybe it's a kind of my mental dependence on smartphone. I always want to check if

there is a message or someone is contacting me. So, I just can't stop checking my smartphone. (Yao, Female, First year, SAS-SV score: 42)

Now people can't live without smartphones. Subconsciously or without a reason, you might take it out and check if there are new messages. Now people are all communicating through WeChat and QQ. There are messages or information in the chatting group of our class. Mainly information. If your smartphone is not at hand for ten minutes, there might be a pile of messages. (Wan, Female, Second year, SAS-SV score: 36)

Another addictive behaviour reported as problematic by participants was using smartphones until too late at night.

I think I overused it in the second term of my first year. In the first term, I controlled myself well, but in the second term, I overused it…… especially games…… I didn't play games in class. I always play games after finishing my tasks. Sometimes I played late at night until 12 am or 1 am. (Ren, Male, First year, SAS-SV score: 30)

However, reassurance behaviours might serve a positive purpose for some participants.

For the entertainment aspect, I can watch short dramas or talk shows in my smartphone. It is very relaxing. (Bao, Male, First year, SAS-SV score: 43)

This will be further discussed in the section of antecedents and impacts of PSU.

Several participants denied they overused their smartphones including two who did not in fact exceed the threshold for addiction. There were four participants who scored lower than the cut-off points for addiction including two females and two males. Only the two females clearly reported that they did not over use their smartphones. Su and Chen scored 27 and 28 in the SAS-SV which are lower than the cut-off point for addiction, although not very much below it.

It's fine for me. I don't think I use it that much. I rarely use it when I am reading books or having classes. (Su, Female, Second year, SAS-SV score: 27)

During individual study periods, I always finish my tasks first, then spend the rest of the time with my smartphone…… I think I use it less because I spend much time in outdoor activities, volunteering and student union activities…… I seldom take it out (during parties). Because I don't go to parties very frequently, once I go to a party I would try to enjoy myself. (Chen, Female, First year, SAS-SV score: 28)

However, others perceived themselves as normal users in the interviews who in fact scored as "addictive" users in the SAS-SV.

I think they (my friends) use smartphones more than I do. They like watching TV series in smartphones in our dormitory. I don't like watching TV series. When I feel bored, I would like to read books or something else. I think my smartphone use is fine. (Ke, Female, First year, SAS-SV score: 50)

I think I don't use my smartphone too much. I use it less than the others around me. (Zhan, Male, Second year, SAS-SV score: 33)

But it also depended on the situation. Bao said that he would turn off his phone when preparing for an exam. He perceived himself as a normal user, even though he scored 43 in the SAS-SV which was much higher than the cut-off point. Qi scored 32 which was just slightly over the cut-off point but said he does not use it when hanging out with friends.

It depends on the time. *If I have enough time, I would like to play for a while. When exams are coming and time is limited, I will absolutely put my phone aside, disconnect the Internet and study intently…… Once you are disconnected with the Internet, you don't need to worry about the others' messages…… If I don't control myself, I would certainly be affected and fail the exams because time (for study) is not enough.* (Bao, Male, First year, SAS-SV score: 43)

When I hang out with my friends, I rarely use it. (Qi, Male, First year, SAS-SV score: 32)

Overall, most of the participants with higher scores on the SAS-SV showed some

self-awareness about PSU since they were more likely to report problematic levels of smartphone use. Frequent checking was the main reported behaviour addictive pattern. However, one of the high scorers (50), who scored highest among the interviewees but lower than the highest score (60) in the questionnaires, did not report PSU or any symptoms of the addictive pattern.

Antisocial pattern

The antisocial pattern of mobile phone use is described as using it in unsuitable situations or when smartphone use is forbidden (Billieux , Maurage et al., 2015). In this study, participants reported problematic behaviours of this pattern of PSU during learning. Many participants reported themselves or the others used phones during classes for irrelevant purposes. They used their smartphones to kill time, check social media, watch videos or play games in classes.

During classes, sometimes I feel that the teacher's words are boring so I want to kill time with my smartphone. (Su, Female, Second year, SAS-SV score: 27)

In some selective courses, many of us take out smartphones and play. I felt guilty before, but I gradually get used to it later on. (Bao, Male, First year, SAS-SV score: 43)

Maybe sometimes the others are sending messages to you or asking you something, and you feel bored in class. Then you take out and start to check Zhi hu or Weibo, or something interesting...... I think I use my smartphone very frequently. Maybe some good students don't use their smartphones for a whole class or a whole day while studying, but I can't control myself. I just can't stop using smartphone. (Yao, Female, First year, SAS-SV score: 42)

Gaming in classes was a frequently mentioned issue by interviewees. But most of them

reported their observations of other students.

Yes, playing games. I have observed some of my classmates played games during the whole class. (Su, Female, Second year, SAS-SV score: 27)

Boys are all fond of playing games. They start to play once they sit down in class. Girls are fine. But there are also girls who like to use smartphones (during class). (Ke, Female, First year, SAS-SV score: 50)

Sometimes in a class, only during the time of calling names, all students were listening to the teacher. In the rest time of the class, especially when the content was not interesting, someone indeed played games in their smartphones. They were totally distracted or taken away from the class…… For example, in my first year, I played smartphone games in class, especially math class, Calculus. For some games, you are easily totally involved in and then the class is not relevant to you. (Xiao, Male, Second year, SAS-SV score: 38)

There was one special case of irrelevant use of smartphone during class, as described below:

Our listening teacher's pace in class was really slow. He is lower than my high school teacher. I can't get used to my listening class. I think I don't have the feeling of excitement as before…… In high school, I could stay focused all the time in most listening practices. But in this teacher's class, I would be distracted for 20 minutes in the 40-minute class. So, I gradually don't want to have his listening class. I listen to the recording myself and check with the answer myself. I think in that way I am more efficient and focused. Then during the rest of class, I can do something else, such as memorising English words. (Ren, Male, First year, SAS-SV score: 30)

Ren did not follow the teacher's pace in class because he thought he could learn all of the content by himself and even learn more himself during classes. Since he broke the rules of a normal class and followed his own pace of study, which might negatively affect his classmates and the teacher, his behaviour can be described as reflecting the

antisocial pattern of PSU in this study. However, it is unclear if this behaviour is problematic to Ren himself. It may in fact be beneficial if his perception of teacher quality and his own capacity to self-teach is accurate.

Risky pattern

The risky pattern includes dangerous use of mobile phones such as using phones while driving (Billieux, Maurage et al. (2015). However, participants in this study did not report any risky patterns of smartphone use in themselves, only situations they had observed.

Many people were using their smartphones while crossing the road. Many news reported traffic accidents caused by smartphone use. (Gu, Female, Second year, SAS-SV score: 35)

No evidence of risky use was found in the current study, only addictive and antisocial use.

6.3.2 Antecedents of Problematic (or High) Smartphone Use

One of the aims of this study was to identify participants' explanations for problematic, or high, smartphone use. Antecedents of PSU were analysed from three perspectives based on the three theoretical pathways including the excessive reassurance pathway, the impulsive pathway and the extraversion pathway (Billieux, Maurage et al., 2015). However, it is important to note that these three pathways are all about individual or personal reasons. The current study also suggested that the impact of the environment could not be ignored. Participants reported external issues leading to PSU including course design, teacher class management, APP design, etc.

Participants were all living on campus in 4-bed or 6-bed dormitory rooms. It is common for undergraduate and high school students in China to live in dormitories with several roommates on campus. The main difference between high schools and universities is in the strictness of student management and academic stress. According to the interviewees, high school students were forbidden to use smartphones while the university students were free to use smartphones whenever they wanted. Also, the academic stress was reported to be much heavier in high schools than in universities. These context-specific factors may contribute to the high levels of smartphone use observed in the current study of Chinese undergraduates – they are experiencing their first taste of freedom with greatly reduced levels of supervision, perhaps to a greater extent than is the case in some other cultures at the same transition point.

6.3.2.1 Internal reasons

Participants reported many reasons for PSU including fear of missing messages, reassurance needed after the transition from high school, poor self-regulation, sensation seeking, etc. The pathway model suggests three perspectives to discuss PMPU.

Excessive reassurance pathway

The excessive reassurance pathway describes individuals who desire to maintain their relationships with others, and to gain reassurance from others because of low self-esteem and anxiety (Billieux, Maurage et al., 2015). In this study, several reported reasons for PSU can be discussed from this perspective including fear of missing messages, reassurance needed after the transition from high school, fear of peer

pressure and low involvement in social activities.

First, one frequently mentioned reason was the need for reassurance or relaxation after the transition from high school to university. A number of participants reported that they were forbidden from using smartphones in high schools, or were allowed only very limited use. In high school, participants reported that they were told that they could relax when they went to university. Therefore, after enrolling at university, they felt that they deserved more time on their smartphones.

My high school has very strict discipline. After enrolling in university, I suddenly found that nobody is controlling us anymore. We were frequently told by high school teachers that we would be free and relaxed once we go to the university…… In high school, I didn't have my own smartphone, I used my parents' phones for fun on weekends. (Qi, Male, First year, SAS-SV score: 32)

In high school, I never used my smartphone during class or in individual learning periods. But in university, it's different. We didn't have much time in high school. We needed to take part in many extracurricular activities. Academic pressure is not that high in university. (Liu, Female, Second year, SAS-SV score: 34)

My parents were strict to me, I didn't have a smartphone in high school. I started to use it in university. (Zhan, Male, Second year, SAS-SV score: 33)

Second, four participants, including three females (two Second years and one First year) and one male (Second year), said that they frequently checked their phones in order to make sure no messages or calls were missing. This point was also discussed in previous sections about problematic use. Checking messages frequently was one of the means of seeking reassurance. They checked smartphones to maintain social relationships or to calm themselves down. These behaviours can be interpreted as a

reflection of the fear of missing messages or the fear of losing relationships. It can be described as a reason for PSU in the excessive reassurance pathway.

But sometimes I am also worried. Is there anyone sending messages to me? Is anybody contacting me? (Su, Female, Second year, SAS-SV score: 27)

Third, fear of peer pressure was reported as a reason for PSU. However, in some contexts, peer pressure was also seen as reducing PSU. It seems that individuals' perceptions of the environment, and of other people's behaviour, may be linked to PSU.

In fact, I don't have too many things to do in my smartphone every time in our parties. For example, information in Weibo is limited. There's not that many things to check and I read to the end easily. But when I saw the others were still using their phones without talking, I have to look down and continue to use my smartphone. (Su, Female, Second year, SAS-SV score: 27)

I don't take out my smartphone in the library and only use it to listen to music. I feel the environment has great influence on me. The others in the library are all studying hard; (using a smartphone) is not suitable in that situation. You go to the library just for study. (Ma, Male, First year, SAS-SV score: 39)

Another reason was low involvement in social activities. Because of that, one may spend too much time on smartphones. Chen reported one of her roommates as follows:

One of my roommates hasn't joined any society. She failed in all enrolment interviews for the societies. Maybe she is hollow. She always has nothing to do in the dormitory except for learning. She just sits there and uses her smartphone. (Chen, Female, First year, SAS-SV score: 28)

Impulsive pathway

Poor self-regulation was mentioned as a key reason for PSU. Participants reported that they could not stop themselves from becoming distracted during classes. When they were bored or tired in classes, they turned to their smartphones and could not pull themselves back to the class. Boredom and tiredness might be potential explanations for PSU and merit further study. In this study, participants tended to believe that poor self-regulation was the main reason for PSU.

I think the biggest reason is me myself. I just can't control myself, can't stop touching my smartphone. It's like a kind of smartphone disease. (Gu, Female, Second year, SAS-SV score: 35)

Sometimes the class was really boring. I opened my smartphone when I felt sleepy. Once I used my smartphone, I would not feel sleepy any more. Then I would recover…… Also, my self-control is poor. I used my smartphone for leisure when the class was so boring that I couldn't focus on it any longer…… I think the reason is me myself. I didn't understand the course so I couldn't control myself and stopped from using my smartphone. (Han, Female, First year, SAS-SV score: 48)

Several participants said they felt distracted in class and opened their phone because they did not understand the course. This might be associated with academic anxiety since the statements of AEQ-anxiety contain similar symptoms. In this situation, academic anxiety might be a predictor of PSU. Some participants still perceived this as their own fault rather than that of the teachers or the course. However, teachers' class management and the university's course design were also noteworthy reasons given for PSU, which will be discussed later in Section 3.2.2.

Sometimes the teacher's words were too boring. At that moment, I couldn't control myself. I just played my phone for a while. (Bao, Male, First year, SAS-SV score: 43)

The main reason (of distraction) is me. My fundamental knowledge of English was not good. I couldn't understand many points of the teacher in class. The more I couldn't understand, the less willingness to learn I would have. Then I had some emotions of antipathy and did some irrelevant things of myself. (Yao, Female, First year, SAS-SV score: 42)

My academic achievement was not good enough, at the beginning, I would still try to continue to listen to the teacher even when I couldn't understand the course. Now, I just give up when I don't understand the course. Then I check my smartphone to see if someone is contacting with me. If there's no messages, I would play games…… It's not because of the teacher, it's about me. I just don't want to study any more in class and want to spend some time for fun. It's also not because of my tiredness. I just don't want to have the class. (Feng, Male, First year, SAS-SV score: 30)

Poor self-regulation was not only reported in classes but also in daily life. Participants reported they spent too much time on smartphones because they were lazy or had nothing to do.

I feel I spend much time on my smartphone. It's because of my laziness. (Han, Female, First year, SAS-SV score: 48

Overall, through the impulsive pathway, poor self-regulation was reported as a prominent reason for PSU. Besides, academic anxiety symptoms were also mentioned by participants while they perceived their poor self-control was the main reason.

Extraversion pathway

The extraversion pathway proposes that PMPU is caused by sensation seeking, extraversion, reward sensitivity, etc. (Billieux, Maurage et al., 2015). Gaming in class

reported by participants can be understood as a result of sensation seeking. Ke observed and said:

Maybe they thought the games are enjoyable and didn't want to study. Everybody is playing and just join them. (Ke, Female, First year, SAS-SV score: 50)

However, gaming in class could also be considered as a consequence of poor self-control.

Besides sensation seeking in games, Ren's antisocial use of his smartphone in class can also be understood via the extraversion pathway. As he needed "the sense of excitement" during English listening practice, he tried an unusual way of having listening class to reach his "pursuit" at his own pace.

Need for social communication was also suggested as an important reason for smartphone use as discussed in previous sections on general use. Too much use, i.e. frequent checking, for social communication may be considered as one aspect of the addictive pattern of PSU. As discussed in the excessive reassurance pathway, fear of missing messages was one of the reasons for frequent checking. However, the extraversion pathway might also explain frequent checking since extraverted individuals with higher demands of social communication might use smartphones to socialise more frequently. Meanwhile, it seems that frequent message checking can be explained through the impulsive pathway too, since poor self-control might lead to more smartphone checking.

In summary, through the three pathways, the reasons for the PSU reported by

participants were discussed with the reassurance and impulsivity pathways most frequently identified. Notably, frequent checking for messages might be explained through all the three pathways.

6.3.2.2 External reasons

Participants' problematic behaviours were not only seen as being caused by internal or personal reasons. Several external factors were reported as reasons for PSU including teacher's poor class management, inappropriate course design, attractive APP design, transition from high school to university, etc. First, many participants mentioned they felt distracted from the class and turned on their smartphones because the teacher's words were too boring.

Sometimes the teacher was boring and I couldn't understand. I just thought I can't listen to that. (Han, Female, First year, SAS-SV score: 48)

Several participants said they used their phones when the teacher's explanation was unclear or too deep, or the teacher's pace was not good enough.

Some courses were taught in quick pace, you had no time to use your smartphone if you listened carefully. But when some classes were boring or the teacher was talking about unimportant things, I wanted to use my smartphone. Some teachers further explained the content too deep that we couldn't understand. That was not relevant to our text book. (Jiang, Male, First year, SAS-SV score: 47)

In some class with entertainment features, the teacher was not serious, I would use my smartphone. It's easy to pass those courses. (Qi, Male, First year, SAS-SV score: 32)

It seems that the statements above also reflect the poor self-control of the participants, though the teachers' class management was not successful. Thus, both the impact of the

teacher and the attitudes and behaviour of the students are discussed in this study.

The second external reason reported was course design and content. Several participants complained that they were not interested in the courses which were not their major. In this university, students were required to have several courses, unrelated to their major, which were compulsory for their credit and degree. However, participants also reported feeling bored in their major courses.

Because the courses are not important and I don't need to listen…… Also, some general courses are not related to my major and I don't need them…… I usually kill time by using my smartphone in those courses. (Chen, Female, First year, SAS-SV score: 28)

Not all the teacher's words are interesting to me. I was satisfied with some of our major courses talking about novels. But I felt bored with some courses about pure theories. Those courses were so boring. I sometimes took out my smartphone and read Weibo or news. (Wan, Female, Second year, SAS-SV score: 36)

Qi was allocated to English, which was not his original major selection. This adjustment can happen when a student's score is not high enough for the expected major. He was not interested in English at all. Since he would transfer to another department of economy and management after the first academic year, he cared little about his English major courses and reported that he used his smartphone during classes. Qi scored 32 which was slightly above the threshold. Furthermore, his words reflect his unhappiness about his major. This might be associated with his life satisfaction or well-being in university. In this case, PSU was reported as a consequence of low life satisfaction.

To tell you the truth, I extremely dislike English since junior middle school. I feel

depressed…… Now my expectation is not high, I just need a pass. (Qi, Male, First year, SAS-SV score: 32)

Third, participants also noted that several smartphone applications were designed to be very attractive and led them to spend much more time using them than planned.

Of course, it's sometimes about the design of the smartphone applications. APPs such as Taobao and Weibo are designed very attractive for you to use in smartphones. (Gu, Female, Second year, SAS-SV score: 35)

Once you tapped on one web link, you would want to tap on the next link soon. Then you keep tapping on it continuously. (Zhan, Male, Second year, SAS-SV score: 33)

Fourth, as discussed before, participants thought they need to reassure themselves after the transition from high school to the university. High schools strictly forbade smartphone use but these participants were free to use their smartphones as they wished in university. Maybe the steep change of context from high school to university explains the high levels of PSU in this sample to some extent. They were strictly supervised in high schools and got used to the life with high pressure. In university, they were not accustomed to another kind of life that needs better self-regulation. Since they were totally regulated by the teachers in high schools, it may have been difficult for them to adjust themselves immediately in the first two years of university. Nine of the sixteen participants, including 5 females (3 Second years and 2 First years) and 4 males (3 First years and 1 Second year), mentioned the difference between high school and university. They had many restrictions in their younger ages and suddenly were excited about the freedom in university. As Ren said, they need to relax after a long and stressful schooling period.

We have more time in university (compared to high school), more time for relax. Then more time was spent in smartphones. (Han, Female, First year, SAS-SV score: 48)

Because the change was too big, because we should be relaxed, we don't need to devote ourselves like in high schools. We believe we should have a relax after more than ten years' hard study. (Ren, Male, First year, SAS-SV score: 30)

Personal or internal reasons for PSU, such as poor self-control, cannot be ignored when considering those external issues including teacher's management, course design and APP design. Nevertheless, it seems possible to consider those external reasons when actions are needed to control PSU of college students. Thus, besides the three pathways, the external reasons are discussed here as a fourth pathway leading to PSU, a novel contribution from the current research. As participants were recruited from an upper-middle-level university in Wuhan China, the teaching quality and course design in that university might reasonably represent a common context for many Chinese mainland universities, although comparison studies would be needed to ascertain this. It seems that the PSU reported in this study might reflect the common problem of teaching quality and course design in Chinese mainland universities. The problem of attractive APP design also seems to be a common reason for PSU in most Chinese mainland universities since the development of APPs and smartphones has been rapid in mainland China.

6.3.3 Impacts or Problematic (or High) Smartphone Use

Participants reported both positive and negative impacts of their smartphone use. Three main positive impacts were reported: convenience in life; help with study; and reassurance. Smartphones were also seen as having negative impacts on participants' social relationships, physical health, study and privacy safety. Several interviewees thought that smartphones had limited or no impact.

6.3.3.1 Positive impacts

Life convenience

Smartphone use was reported as having many positive impacts for participants. The most mentioned benefit was life convenience. Smartphones offered better communication between people, convenient payment methods and better chances of gaining information. First, participants noted that smartphones made their communication with family and friends more convenient.

With the development of society, the pace of life is getting fast. Smartphones offer a lot of convenient ways of communication. You can receive necessary information and contact with your parents. (Gu, Female, Second year, SAS-SV score: 35)

I think the positive impact (of smartphones) is the more convenient communication with my classmates using smartphones. It's impossible for you to find someone face-to-face as soon as you want to talk to them. They are not free all the time. You can send messages using your smartphone when the person is not with you. He will reply to you after seeing your messages. It won't affect you. (Yao, Female, First year, SAS-SV score: 42)

Second, with payment applications installed on smartphones, mobile payment

made transactions much easier. Participants said they could make payments anywhere and at any time.

Shopping and mobile payment tools in smartphones are very convenient to use, such as Alipay. If you don't have a smartphone, you have to take cash all the time. Bringing too many cash with you is not safe. It is helpful to improve our payment convenience. (Wan, Female, Second year, SAS-SV score: 36)

Third, smartphones made it easier to gain useful ideas and information. For example, ideas in TED talks or the latest news. Participants perceived this as positive to them.

It has some positive impacts. Not only looking up new English words, I can search news and widen my horizons. I can know what happened recently and know more. (Han, Female, First year, SAS-SV score: 48)

Help with study

Smartphones helped participants with their learning in university. By using smartphones, they were able to share ideas, search knowledge beyond books, improve their efficiency and enrol on online courses. However, the function of searching information or knowledge is based on the Internet. Smartphones are just tools to get access to the Internet. After all, smartphones indeed helped the participants with study since they provide mobile access to the Internet.

It's absolutely helpful. After class, you might have something you don't know in assignments. You can take photos of the issues you don't understand and send to your classmates using your smartphone. You can ask them about that. (Zhan, Male, Second year, SAS-SV score: 33)

I can find many resources in my smartphone which can't be found in the library. (Wan, Female, Second year, SAS-SV score: 36)

It also has positive aspects. It is full of information. You can watch presentations and debates in it. It's positive to personal development. (Bao, Male, First year, SAS-SV score: 43)

For study, you can use the sources to the most. For example, you can use the Chinese college MOOC (a system of online courses for college students). (Gu, Female, Second year, SAS-SV score: 35)

Several participants reported smartphones improved learning efficiency through unusual ways. Han used smartphones to keep herself awake in class, though it seems that smartphone was still used in an unsuitable situation and the fact that she needed to be kept awake can reasonably be seen as a problem. Ren listened to music to improve his efficiency during individual study periods. It seems positive for Ren to calm down from distractions according to his reports. However, for Han, she was kept awake in class by her smartphone but not for the class content.

Sometimes the class was really boring. I opened my smartphone when I felt sleepy. Once I used my smartphone, I would not feel sleepy any more. And become excited. (Han, Female, First year, SAS-SV score: 48)

I always listen to music while learning. I can't finish my homework without listening to music during individual learning periods…… In that way, I can study with higher efficiency…. think for many students, listening to music can improve efficiency rather than negatively affect study. Because you can calm down while listening to music. (Ren, Male, First year, SAS-SV score: 30)

Reassurance

Although the need for reassurance can be seen as an antecedent to PSU participants reported benefiting from the reassurance they provided. Reassurance includes two aspects: better social relationships and necessary emotional relief. Participants' social relationships were better maintained or improved through smartphones. However, several interviewees said smartphones also negatively affected their social lives and relationships. According to Han and Xiao's words below, it seems that smartphones not only helped with social communication but also harmed their social relationships to some degree. The section on negative impacts will further discuss this point.

I seldom used smartphones before. I talked to my friends face-to-face and expressed my personal feelings to them. Since I have got a smartphone, I have found face-to-face talks are a bit embarrassing. I think communicating through smartphones is more convenient. I found it easier to express something. (Han, Female, First year, SAS-SV score: 48)

You can know new people through the function of finding near friends in QQ or WeChat. You might chat with them happily and become friends. This is certainly good. It expands your social circle. (Gu, Female, Second year, SAS-SV score: 35)

I think it absolutely has positive impacts. Now everyone is using smartphones. You don't have so many chances to know a person in real life. Then you can know that person in your smartphone. You can chat with many people at the same time using your smartphone. The range and quality of your social interactions are improved. You don't need to react to them quickly. One point I realise is very obvious, I always think the words I said in a face-to-face communication could be changed after the talk. In communication with smartphones, you have time to modify the words you want to say after typing it out. (Xiao, Male, Second year, SAS-SV score: 38)

Besides maintaining social relationships, smartphones were also seen as helpful for relieving difficult emotions. Participants reported that they felt relaxed and better when

they used smartphones to kill time, relax or relieve their angry emotions.

I think my smartphone is positive for my life. I have many feelings to relieve…… At that time (last term), I was not extremely fond of playing games like now. I relieved my feeling by reading or listening to music at that time. But now I played games once I had some (negative) emotions. Now, if I am very angry or tense, I would think about my smartphone and play games. (Ren, Male, First year, SAS-SV score: 30)

Ren played games on his smartphone when he was angry in university.

Not everything in university is satisfactory. When I feel angry, playing games is a good way to relieve my feelings…… It's a good adjustment of my life. For example, we were not having a good time playing volleyball, and I was annoyed. Then I played games when I went back to my room and beat new hands in the game for fun. I felt relaxed after that…… I am positive in my life. I have a lot of emotions. Then I need to relieve my feelings. (Ren, Male, First year, SAS-SV score: 30)

Several participants reported using smartphones to alleviate boredom. They felt it was

positive to relieve their feelings by using smartphones in daily life.

Not much. I use my smartphone when I feel bored, just to kill time. (Su, Female, Second year, SAS-SV score: 27)

It's fine. I take my smartphone out when I am walking alone on the road, on a bus or a metro…… I think it has no impact on me. Walking alone is boring, sitting on the bus is also boring. It is better to read news or something else. (Ke, Female, First year, SAS-SV score: 50)

I think my smartphone gives me a way of killing time for leisure since I have a lot of time in university. (Chen, Female, First year, SAS-SV score: 28)

6.3.3.2 Negative impacts

Smartphones were reported to have negative impacts on participants in four aspects:

social relationships, physical health, study and privacy safety.

Social relationships

The most mentioned negative impact of smartphones was the harm to social relationships. Smartphones' impact on social relationships was reported as negative more often than positive, although some exceptions have been described above. Most participants complained that smartphones changed their parties or meetings with friends. Their relationships with others were negatively affected because everyone focused more on their smartphones than on face-to-face conversation between friends.

Oh, the impact on the parties with friends is too much. I think we had nothing to talk with each other in parties. We just used our smartphones in front of each other. (Su, Female, Second year, SAS-SV score: 27)

There are some (negative) impacts. When you see the others are always using smartphones in front of you, you might feel that they are isolating or ignoring you. Sometimes I really wanted to encourage them to interact with the others. But when I saw they were looking down and using smartphones, I didn't want to disturb them…… Sometimes two people are communicating through smartphones even when they are near to each other. I think smartphones lower our ability to communicate. That atmosphere was so repressive. (Jiang, Male, First year, SAS-SV score: 47)

Everyone is using smartphone. Now when friends meet in a party, they sit down and just use smartphones…… I think we'd better not have parties. Just chat online…… It's always the case recently. (Ke, Female, First year, SAS-SV score: 50)

Last time, three of us went out for dinner. Only three people there. While one of us was using smartphone, the other two were talking. When the talking was stopped and one started to use smartphone, the other had to use smartphone. That was embarrassing. I think it's a kind of emotional abuse. (Xiao, Male, Second year, SAS-SV score: 38)

We had a party among our high school classmates in last Spring Festival. It was a large group of people in the KTV for karaoke. But not many people were involved. Most of

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them were looking down and using smartphones by themselves. I think the situation was embarrassing. I feel our friendship was not that deep (as before). (Zhan, Male, Second year, SAS-SV score: 33)

Our social activities in real life are becoming less and less. We socialise online and the actual socialising stopped…… in junior middle school and high school, our parents didn't allow us to use smartphones. We talked to each other or played games together in parties. The atmosphere was exciting. Now in university, you may find everyone is doing their own things in parties. They held their phone in hands and sit on sofas in the KTV (a place for karaoke). … . I feel that the atmosphere of parties has become colder and colder. Although online socialising has been more popular, the relationship between classmate might be colder than before. (Yao, Female, First year, SAS-SV score: 42)

Smartphones were also seen as having negatively affected participants' relationships with family members or teachers. Ren reported that their family relationships were affected because they used smartphones inappropriately when they stayed with family members. Gu worried that the teachers might be confused by students' PSU during class even though their teaching was not problematic.

But it (smartphone) is a barrier between me and my family. I think it is a real issue. I think I can't stop myself from using the smartphone. For example, the big dinner in Spring Festival. It was very easy for me to have the dinner with my family without smartphones. We chatted with each other happily. But now, I just can't sit there at table and chat with them without looking at my smartphone. (Yao, Female, First year, SAS-SV score: 42)

Sometimes in class, the teacher was lecturing in front of the class, but you were playing with smartphone there. The teacher might worry that his/her teaching was problematic. But in fact, it was not the teacher's problem. (Gu, Female, Second year, SAS-SV score: 35)

Physical health

PSU was seen as leading to physical health issues for several participants including sleeping problems, neck ache, weakened eyesight, and bad appetite. Several participants reported that they played with smartphones for too long and felt uncomfortable. Smartphones were seen as doing harm to their physical health.

I think it has changed my daily timetable of work and rest. Sometimes I watched a movie or read a novel late at night. I just couldn't stop myself. When the movie or the novel was finished, it was very late...... I would be sleepy during the next day. It is bad for my physical health if that case always happens. (Ma, Male, First year, SAS-SV score: 39)

I think I overused it a bit. Considering overuse, I think most of the nights when I stayed up were associated with smartphone use. I always wanted to check my smartphone and see my friends' updates before I go to sleep...... I feel I have a kind of procrastination for sleep.   (Liu, Female, Second year, SAS-SV score: 34)

Considering the negative things, I think smartphones are very harmful to your physical health. Take me for example, my eyesight was affected. Looking at smartphone every day has made my eyesight and skin worse and worse.   (Wan, Female, Second year, SAS-SV score: 36)

After playing games or reading novels for a long time, I felt I had dim eyesight and I could hear the crunch of my neck when I moved my head...... It was because I stared at my smartphone for too long. I just sat there without any body movement. When it lasted for too long, my bones were harmed.   (Feng, Male, First year, SAS-SV score: 30)

Study

PSU was seen as negatively affecting participants' learning in university. Four main impacts were mentioned: distracting from study, time wasting, procrastination on assignments and test anxiety. Participants reported they were easily distracted from

class or individual study periods because of smartphone checking.

It (smartphone) is a thing that makes you distracted easily…… In class or individual study period, it is easy to be distracted. Although you were involved in study, once you were distracted (by smartphone), you need some time to regulate yourself again. You need time to recall the things you have learned before using the smartphone. (Zhan, Male, Second year, SAS-SV score: 33)

However, distraction was not only caused by smartphones. Wan said self-control was the main reason for distraction. You might want to do something else while distracted, not only using smartphones. In other words, smartphone use is just one of the available ways to distract from your current work. Thus, self-regulation was again mentioned as a factor associated with PSU, as predicted by the model tested in this research.

Even if you don't have a smartphone, you might also want to touch something else. Sometimes you might find something to eat when you don't have a smartphone at hand. Or you may chat with the others, read a novel or magazines in paper. In high school, we didn't have smartphones. Someone read paper magazines for irrelevant content. So, I think distraction is not related to smartphones but yourself. (Wan, Female, Second year, SAS-SV score: 36)

Time wasting was seen as another negative impact of smartphones on study. Participants admitted that they spent too much time on smartphones and their time for learning was reduced.

It takes too much time in our lives. Most time was used on smartphones. I feel I should have done many things but I spent the time on my smartphone. (Han, Female, First year, SAS-SV score: 48)

Maybe I planned to study at the beginning, but you used smartphone out of control. The

time for learning and the other things in life was wasted. (Yao, Female, First year, SAS-SV score: 42)

Distraction from study and time wasting were the two main mentioned negative impacts. Furthermore, procrastination on assignment and test anxiety were also mentioned as negative impacts of smartphones on study by two participants, as hypothesised in Studies 1 and 2. It seems that these two impacts were closely connected to time wasting and distraction from study. Although procrastination was not frequently mentioned directly by participants, poor self-regulation, distraction and time-wasting were, as discussed earlier. The impression that procrastination is a key factor related to PSU emerges from the data. Symptoms of academic anxiety were mentioned as antecedents for PSU since participants reported they could not understand the course and use smartphones. Test anxiety, which is one type of academic anxiety, was mentioned below as a negative effect of PSU. It suggests that PSU may be associated with academic anxiety, as observed in the quantitative data.

Smartphones are certainly helpful to study. But sometimes, it was an excuse for distraction. For example, you have an assignment to finish, you may want to use your smartphone first. But you couldn't stop using it once you started. It wasted much time…… last time, we had an experiment report to write. My roommates didn't know how to start. They wanted to watch some TV series for relaxation first. Once they started watching, they couldn't stop. In the evening, they felt they wasted a whole afternoon again. It always happens. Absolutely (it affected the quality of assignment). They rushed their assignments or copied the others' reports when the deadline was approaching. They completed the tasks for their own sake. (Ke, Female, First year, SAS-SV score: 50)

I think it has both positive and negative impacts on me. But most impacts are negative. We had a course about American sociology and culture which was very difficult. It

contains history and cultural studies. I didn't understand and though it was difficult. I seldom listen to the teacher in classes. I always used my smartphone in class so I had few notes in my textbook. Then I felt worried when the exam was approaching because I didn't learn anything in this course. (Han, Female, First year, SAS-SV score: 48)

Privacy safety

Several participants reported social media in smartphones was a threat to their privacy safety. Several social media apps including WeChat and QQ contain functions which allow strangers nearby to send request for making friends online. That may annoy someone.

Sometimes you may receive some messages from strangers who asked for adding you as an online friend. It affected me. I always deleted them. (Chen, Female, First year, SAS-SV score: 28)

The functions such as "nearby people" in QQ and "Have a shake" in WeChat allow you to know new people. You might chat with them happily since it expanded your social range. But you would also possibly be cheated and your private information might be stolen. (Gu, Female, Second year, SAS-SV score: 35)

6.3.3.3 Neutral or no impact

Although smartphones were reported to have positive and negative impacts on participants, several participants said smartphones had little impact on them. Su scored 27 for the SAS-SV and reported she was not affected by her smartphone.

The impact was not that much. Because not too many people would contact me, I don't have too many things to check. (Su, Female, Second year, SAS-SV score: 27)

It's fine for me. If I am eager to study hard or do my tasks, the negative impact is limited…… I don't think my smartphone use for leisure affected me. It's just for relaxation. It doesn't affect my exams too. (Liu, Female, Second year, SAS-SV score:

34)

Chen and Jiang reported that smartphones seldom affected their study or social life because of their high level of self-regulation.

I think smartphones are time wasting during individual learning periods. But when you have finished the tasks for that day, there would be no impact…… When I didn't finish my tasks because of smartphone use, I would still finish them after I went back to my room. I would play less in my room…… Today, I didn't use my smartphone because I had reports to write. I wrote it up and then relaxed…… I could find ways to make up for the loss when it negatively affected me in my study efficiency in class. I might review the course with more effort before exams, read books more carefully and ask the teachers.   (Chen, Female, First year, SAS-SV score: 28)

I think it (smartphone) doesn't affect me very much. In university, besides listening to the teachers in class, I can preview the lesson before class and review it after class. If I indeed can't understand something, I can search information in the library or on the Internet. I can find answers myself.   (Jiang, Male, First year, SAS-SV score: 47)

Besides, several participants reported smartphones changed their lives including their habits for paying and remembering things. They did not report whether those changes were positive or negative. Mobile payment on smartphones might bring convenience to life, but also cause embarrassing moments as reported by Xiao.

The day before, I went to a traditional local restaurant with two friends. None of us had cash at hand. But the old restaurant didn't accept mobile payment. We could only pay by cash. It was embarrassing. Then we waited for our classmates to send cash to us…… Now, most of us pay for the minibus on campus through WeChat, cash is seldom used. (Xiao, Male, Second year, SAS-SV score: 38)

Because mobile payment with smartphones have changed their habit of paying, they sometimes don't have cash with them, while there are still some cash-only shops. Thus, it is hard for them to say this change of habit is positive or negative.

As smartphones were reported as a good tool for information, they were also reported as enabling people to live a "lazy" life. Su said there was no need to remember things as she can search on her phone. She did not say whether she saw this as good or bad.

I am becoming dependent on it. I should have kept something in mind. But when I realise that I can search them in my smartphone, I would choose to use my phone to keep it. (Su, Female, Second year, SAS-SV score: 27)

6.3.4 Perceptions

Many participants expressed their different perceptions of smartphones. Several participants held positive or neutral perceptions of smartphones and regarded them as a necessity or a useful tool. However several participants with high or low scores for the SAS-SV disliked smartphones in some ways and mentioned the word addiction. However, many participants said they needed to change their smartphone use and become more self-regulated. They reported being aware that they were using their smartphones too much or in a problematic way.

6.3.4.1 Positive perceptions

Smartphones were frequently reported as important necessities in life. Participants perceived smartphones as a part of their lives.

I think smartphone is very important in life … I have the feeling that I can't live without it. (Han, Female, First year, SAS-SV score: 48)

I just believe it is a necessity…… I think it plays an important role in my life. Everyone is spending more time on smartphones. (Xiao, Male, Second year, SAS-SV score: 38)

6.3.4.2 Neutral

Several participants mentioned that smartphones could be useful tools when people use them appropriately with enough self-control.

It's just a tool. A tool for study, chatting and information searching. (Chen, Female, First year, SAS-SV score: 28)

Overall, it has both positive and negative impacts. It depends on how you use it. If you can use it in an appropriate way, it certainly has more advantages than disadvantages. If you are addicted to games every day, or only check Weibo every day, your life would probably be affected. (Bao, Male, First year, SAS-SV score: 43)

6.3.4.3 Negative perceptions

However, there were also negative perceptions of smartphones reported. Several participants, including Zhan (33 for the SAS-SV), Wan (36 for the SAS-SV) Ke (50 for the SAS-SV) and Su (27 for the SAS-SV) reported that they disliked smartphones. Only one of them, Su, scored below the threshold for "addiction". However, addiction was used to describe smartphone use of the others or themselves. Zhan likened smartphone "addiction" to smoking.

No, I truly don't like smartphones. When we had English classes, the teacher asked us to answer questions in our smartphones. Compared to speaking out answers, writing answers were more convenient for the teacher to improve efficiency but not good for us to improve our oral English. (Wan, Female, Second year, SAS-SV score: 36)

Nowadays many people have a kind of psychological "addiction". It's just like smoking addiction. they might feel someone was contacting them when they don't have a smartphone at hand. (Zhan, Male, Second year, SAS-SV score: 33)

6.3.4.4 Need to change

Several participants expressed their desire to change their smartphone use patterns. They said they needed to reduce the time of smartphone use, focus on study, set goals and have better self-regulation.

If I need to change, I should set a long-term goal in order to motivate me to work. I can also be more focused. (Han, Female, First year, SAS-SV score: 48)

Considering the games, there are too many kinds of smartphone games including card games, other competitions, etc. You just want to enjoy yourself at the moment of playing. But later you may find it is really time consuming and meaningless. So, I need to reduce the time on gaming consciously…… University students are a group of people without enough supervision. They need to make their right decisions. I used to play games a lot (but now changed). Our available time is limited every day. We should decide (correctly) how to spend our time…… We need self-regulation. There are a lot of APPs for smartphones. Smartphones are not only used for making calls. So, we need to make right decisions. (Xiao, Male, Second year, SAS-SV score: 38)

I think I need to control myself. It's impossible for me to throw away my smartphone. The key point is self-control. We can't just rely on the others' reminders. (Feng, Male, First year, SAS-SV score: 30)

Overall, both positive and negative perceptions of smartphone use were reported. Smartphone was reported as a necessity for life, and a possible "addiction" leading substance. However, participants know they need to change their smartphone use patterns through better self-regulation and goal setting.

6.4 Discussion

6.4.1 Summary of the qualitative findings in China

The interviews for this study covered four main over-arching themes or areas: usage of smartphones (problematic and non-problematic), antecedents of smartphone use, impact of smartphone use and participants' perceptions of smartphones. Overall, the results suggest that the smartphone use of Chinese university students should be discussed from both positive and negative perspectives. Smartphones were reported as important tools in the participants' daily life. General use of smartphones, especially for study, cannot be ignored though in some contexts the use of smartphones can be problematic. Reasons reported for PSU included fear of missing messages, need for reassurance after transition from high school, poor self-regulation (poor self-control) and sensation seeking, which reflect the three pathways suggested by Billieux et al. (2015): excessive reassurance, impulsivity, extraversion. Course design and teachers were also reasons given for PSU. Furthermore, several symptoms of PSU were reported including frequent checking, using phones late at night; irrelevant use in class and use on the road. Those symptoms can be discussed in the context of three patterns, also suggested by Billieux et al. including: an addictive pattern, an antisocial pattern and a risky pattern. Both positive and negative impacts of smartphone use were reported. Smartphones were seen as contributing to life convenience, helping with study, improving social relationships, etc. By contrast, PSU was seen as negatively affecting social relationships, study (distraction, procrastination, test anxiety), physical health and privacy. Participants regarded smartphones as necessary tools in daily life.

However, many of them said they needed to change their patterns of use by improving their self-regulation or setting goals.

6.4.2 Links with the other qualitative studies

This qualitative study identified similar themes to other empirical qualitative studies about smartphone use or mobile phone use, as shown in the background section of this chapter. Similar to the themes of general smartphone use found in this study, Aoki & Downes (2003) identified parental contacts and information access as reasons for smartphone use. Walsh et al. (2008) also found general mobile phone use including multiple functions, convenience, etc. Similarly, Walsh et al. (2008) identified that mobile phones were tools for contacting people and were regarded as necessities in life. Similar themes including technology-related factors (Lapointe, Boudreau-Pinsonneault, & Vaghefi, 2013) and practicality (Vacaru, Shepherd, & Sheridan, 2014) were also identified as the general use of smartphones. Similar themes or symptoms of PSU were also discovered in those studies, for examples: dependency (Aoki & Downes, 2003), compulsive checking (Walsh et al., 2008), use when socializing and eating (Lapointe et al., 2013) and attachment (Vacaru et al., 2014). Like several previous studies (Lapointe et al., 2013; Vacaru et al., 2014), both negative and positive impacts of smartphones on social activities, learning or well-being were identified in this study. However, there are also themes that appeared in other studies but were not found in this study including financial incentive (Aoki & Downes, 2003), use in emergency situations (Walsh et al., 2008) and using first thing after waking up (Lapointe et al., 2013). Furthermore, there

were several points identified in this study that were not mentioned in the other studies and may, therefore, be particular to this sample. Transition from high school to university was identified as an antecedent for PSU in this study. Participants reported they were forbidden to use smartphones and were supervised very strictly in high schools, and felt excited to use smartphones in university since they never had the freedom in their younger lives as students in schools. It seems that this especially happened in the educational contexts in China mainland which is different from the contexts of the similar qualitative studies discussed here. This may suggest that guidance on relaxing rules earlier in education may be helpful in promoting lower levels of PSU. This could be tested in future longitudinal research.

6.4.3 Links with quantitative findings

The results of the interviews seem to reflect several findings from the quantitative research presented in Chapter Five. Self-regulation was mentioned frequently by the interviewees. Self-regulation was mentioned as an antecedent of PSU via the impulsive pathway and one of the ways to reduce PSU. Thus, these results are in line with the results of the questionnaire surveys, which indicate self-regulation can be a negative predictor of PSU. Furthermore, several interviewees reported smartphones helped with their daily life, study and social relationship, etc. These positive impacts of smartphones might represent the positive components of participants' subjective well-being or life satisfaction. However, participants also reported that smartphone negatively affected their social activities, physical health, etc., which might lower their life satisfaction. Thus, from the interviews, it remains unclear whether PSU affected life satisfaction or not – or whether positive and negative effects simply cancel each other out. This finding is similar to the quantitative results in the quantitative main study, which indicate that PSU did not significantly predict life satisfaction. Procrastination and test anxiety, which are variables in the questionnaire surveys, were also mentioned by the interviewees as negative impacts of smartphone use on study. Academic anxiety symptoms were mentioned as an antecedent for PSU as several participants could not understand the course and used smartphones in class. Distraction and time wasting, which might be closely connected to procrastination, were mentioned as perceived

negative effects of PSU.

However, the interviews show contradictory results of PSU compared with the quantitative study considering the cut-off points for "smartphone addiction" in the SAS-SV. Scoring lower or higher than the cut-off points did not always reflect the self-perceived level of PSU of an individual. For example, Ke scored 50 (much higher than 33, the addiction threshold for females) in the SAS-SV, but reported herself as a non-problematic user. It is unclear whether Ke is in denial about having a problem or whether her high level of smartphone use is not actually problematic for her. Ren and Feng, who both scored 30 (slightly lower than 31 for male) in the SAS-SV, although very close to the threshold, reported many symptoms of PSU or overuse. Maybe their relatively lower scores were affected by their different perceptions of what is acceptable and helpful in terms of smartphone use. Nevertheless, most of the interviewees scored above the addiction threshold for the SAS-SV and did in fact report many behaviours or symptoms of PSU.

In cases where there were discrepancies between the questionnaire and interview data it is possible that interviewees lied or hid their problematic use in the face-to-face interviews because of a social desirability bias. Thus, socially desirable answers could be a limitation of this study. Another limitation might be the selection of interviewees. The interviewees volunteered to participate in the study by giving their phone numbers in the questionnaires. They might be a biased group which were more extraverted or willing to express themselves. This might be a factor which can affect their answers since PSU might be analysed through an extraversion pathway as discussed before.

Future studies should focus on more specific aspects of PSU such as excessive social media use, problematic use in class, etc. The impacts of transition from high school to university on students' behaviour could be another useful topic for future studies.

6.4.4 Links with Griffiths' six-component model of behavioural addiction (2005)

The Chinese interviewees reported similar symptoms described in the six-component framework of behavioural addiction by Griffiths (2005). The six components of behavioural addiction are salience, mood modification, tolerance, withdrawal symptoms, conflict and relapse. Griffiths (2002) argued that one's behaviour could be addictive when all the six components are identified.

Salience

Salience refers to activities that dominate a person's life and thinking (Griffiths, 2005). Several symptoms or effects frequently mentioned by the Chinese students seem to be linked with salience, including fear of missing out, irrelevant use in class, waste of time, distraction, procrastination, etc. An example is as below.

It takes too much time in our lives. Most time was used on smartphones. I feel I should have done many things but I spent the time on my smartphone. (Chinese Female, 19, SAS-SV score: 48)

It is similar to the example of gambling in Griffiths (2005):

If I wasn't actually gambling I was spending the rest of my time working out clever little schemes to obtain money to feed my habit. These two activities literally took up all my time. (p. 193)

Walsh et al. (2008) also found salience as one of the addiction symptoms among Australian students. An example is:

I wake up and check my phone straight away. I'll have a shower, then I'll come back and I'll check the phone. (p. 85)

The quantitative findings in study 2 can also be linked to salience. PSU was significantly correlated with procrastination, and negatively correlated with self-regulation. The significant paths in the model with good fit suggested the same pattern. It indicates that PSU is potentially a predictor of procrastination, and procrastination can probably be viewed as a salience activity. Poor self-regulation was a predictor of PSU in the model. This may indicate that participants with poor self-regulation tend to be less able to avoid the dominance of smartphone use or thinking about smartphone frequently. Therefore, both quantitative and qualitative findings in study 2 and 3 indicate that the Chinese students show salience symptoms as one component of addiction.

Mood modification

Mood modification is defined as personal experiences after specific behaviours by Griffiths (2005). He explained it with the example of nicotine use by smokers for self-relaxing. It is similar to excessive reassurance mentioned in the model of problematic mobile phone use proposed by Billieux, Maurage, et al. (2015). Australian adolescents reported mobile phone could be used for euphoria or relief (Walsh et al., 2008) as shown below:

I get excited like say if I have one message received I'm like, yeah, sweet, check it. If there's like 2 or 3 messages I'm like, YES, who's it from kind of thing, like I get excited because I've got a lot of messages. (p. 86)

Linked with this component of addiction, the Chinese interviewees reported several antecedents and effects of PSU including reassurance related to social relationships (or fear of missing out), reassurance after transition from high school to university,   self-comforting, etc. Examples are as below:

But sometimes I am also worried. Is there anyone sending messages to me? Is anybody contacting me?   (Chinese Female, 20, SAS-SV score: 27)

Not everything in university is satisfactory. When I feel angry, playing games is a good way to relieve my feelings… (Chinese Male, 18, SAS-SV score: 30)

It is necessary to note this Chinese male student reported smartphone games could be used to relief anger but the degree of gaming was unclear and it is therefore unknown whether his gaming was addictive. Quantitative findings among Chinese students also showed potential symptoms linked with mood modification.   PSU was significantly correlated with academic anxiety and life satisfaction. PSU significantly predicted academic anxiety in the model. It indicates that Chinese students' use of smartphones may have potential effects on their mental health (i.e. anxiety) and well-being. It seems that Chinese students need smartphones to reassure themselves, which may be similar to the experiences of mood modification as an addiction symptom.

Tolerance

Tolerance, as one of the addiction components, refers to process of increasing

the amount of certain activities to reach the effect as before (e.g. increasing use of heroin or increasing size of bet) (Griffiths, 2005). A few of the Chinese interviewees mentioned they used smartphones longer than expected as shown below:

In the first term, I controlled myself well, but in the second term, I overused it…… especially games…… I didn't play games in class. I always play games after finishing my tasks. Sometimes I played late at night until 12 am or 1 am. (Chinese Male, 18, SAS-SV score: 30)

They smartphones can break your everyday routine. You may want to check your smartphone before sleep because you are dependent on it. You thought you can just play for a while before sleep but the time you spent on smartphone was longer. Then you stayed up. (Chinese Female, 18, SAS-SV score: 42)

These two participants show similar symptoms described as tolerance in Griffiths' (2005) description of addiction. Many other Chinese interviewees reported that they wasted too much time on smartphones but did not mentioned the increase or change of their usage. However, it is still clear that tolerance was reflected in some of the Chinese students interviewed here.

Withdrawal symptoms

Withdrawal symptoms refers to negative feelings that occur after reducing specific activities (Griffiths, 2005). It was one of the identified addiction symptoms of mobile phone use in (Walsh et al., 2008) as an example shown below:

Well for like 4 hours without it, huh, I thought I was going to miss out on everything and have trouble getting in contact with everyone. Yeah, I felt I was going to miss out on everything, lost, a bit like that. (p. 87)

The Chinese students reported similar symptoms that could be linked to withdrawal symptoms. An example is as below:

If I don't check my phone for a while, I feel worried about whether someone is contacting me. I just open my phone and check subconsciously. (Chinese Male, 20, SAS-SV score: 33)

Thus, this component of addiction was also reflected in the Chinese students.

Conflict

Conflict refers to the interpersonal and individual conflict caused by a specific activity/behaviour (Griffiths, 2005). It can be conflicts between friends and family or one's own affairs (e.g. academic, work). In terms of this component, Australian adolescents reported their mobile phone use can sometimes have conflict with activities but not with the other people (Walsh et al., 2008) as an example shown below:

...if it like, calls or something, and you're in the movies or in the middle of a class and your phone rings I get embarrassed. (p. 86)

Conflict was frequently reported in the current interview study. Chinese students reported both interpersonal conflicts with the others and conflicts during their academic activities (e.g. class, learning periods). They complained that their relationships with others were damaged when smartphones become the main focus. Study was also affected as they reported irrelevant use in classes or during learning periods. An example is shown as below:

When you see the others are always using smartphones in front of you, you might feel that they are isolating or ignoring you. ...... That atmosphere was so repressive. (Chinese Male, 18, SAS-SV score: 47)

Thus, it is clear that several effects of PSU reported by the Chinese students are in line with the addiction component of conflict.

Relapse

Relapse refers to the reoccur of certain activities after a long time of control (e.g. relapse for cigarettes) (Griffiths, 2005). This component was not directly mentioned among the Chinese interviewees. However, several of them reported that they used smartphones to play with limited time (only on weekends) in high school and felt free to play after enrolling the university. An example is as below:

My high school has very strict discipline. After enrolling in university, I suddenly found that nobody is controlling us anymore. We were frequently told by high school teachers that we would be free and relaxed once we go to the university…… In high school, I didn't have my own smartphone, I used my parents' phones for fun on weekends. (Chinese Male, 19, SAS-SV score: 32)

This issue is possible linked with relapse since they reported a period of control of smartphone use (i.e. strict management in high school) before university. However, it is unclear whether they were already addicted to smartphones (especially games) before or during high school. It is unreasonable to say reoccur/relapse when the issue did not exist before. Thus, it remains unknown if relapse was truly reflected in the Chinese participants.

Overall, it seems that the six-component framework could be a suitable theoretical basis for the findings in this thesis. It seems appropriate to discuss the students' reported behaviours using this model.

Chapter 7 Cross cultural study of PSU in UK and Chinese undergraduates

7.1 Background

As discussed in Chapter Five, Chinese undergraduate students reported higher levels of problematic smartphone use (PSU) than students from other cultural backgrounds using the same measurement, including multi-cultural students in the UK (mainly British students) (Chotpitayasunondh & Douglas, 2016), Spanish and Belgian adults (Lopez-Fernandez, 2017) and African American students (Lee, 2015). It seems that cultural contexts may affect, or be related to, patterns of smartphone use. No existing study has compared Chinese and UK undergraduate students' levels of PSU. It remains unclear whether different cultural backgrounds or educational contexts (e.g. schooling) makes a difference to students' control on their smartphones. It also remains unclear whether the patterns, motivators and impacts of PSU reported by the Chinese student only exist in the context of China. It therefore seems interesting to explore whether Chinese and UK undergraduates perceive their smartphone use similarly or differently.

In the Chinese sample, the path model with the best fit indicated associations between PSU and correlates including academic anxiety, academic procrastination, self-regulation and life satisfaction. In comparing findings for Chinese and UK undergraduates it will be interesting to assess whether this model fits both groups equally well, in spite of the different cultural backgrounds of the two samples.

Therefore, this study aims to explore whether there is a difference in the prevalence

of self-reported PSU between Chinese and UK undergraduates. The other variables tested before, including academic anxiety, academic procrastination, self-regulation and life satisfaction were also compared between the two groups. This cross-cultural study also explores whether the hypothesised model presented in Chapter Two is a context-specific model only suitable for Chinese students or whether it also fits the data in a UK sample. Furthermore, this study compares qualitative narratives about smartphone use in the two samples, and explores group similarities and differences.

7.2 Method

7.2.1 Participants

Participants from China were the 475 Chinese undergraduates described in previous chapters. For this cross-cultural element of the research $n = 303$ undergraduates who were born and raised in the UK were recruited. All participants were students at a university in northern England. Of these, $n = 93$ were recruited using paper-based questionnaires. In fact, n=105 responses were received in this way but 12 were subsequently excluded because the participants indicated that they were not in fact born and raised in the UK. A further 247 responses were received using an online version of the questionnaire. However, 26 of these were from students not born or raised in the UK and a further 9 were not usable because they only provided demographic information. After deleting those invalid responses, 212 online responses remained. Of the combined total of $n = 305$ two participants said they did not have or use a

smartphone and these too were excluded, leaving a total sample for quantitative analysis of $n = 303$ participants. Qualitative data was retained for these two participants. The 303 UK undergraduates, included 245 female, 57 male and 1 non-binary participant, and were recruited from a broad range of Departments including Archaeology, Economics, Education, Electronic Engineering, Health science, Music, Philosophy, Psychology and Sociology, etc. The average age of participants was 20.14 ($SD = 3.23$) ranging from 18 to 50 (with 6 participants aged over 30 years).

The researcher had originally also planned to recruit Chinese students studying in the UK. However, because of the small population of Chinese undergraduates at the target university, the number of participants recruited was low ($n = 33$). These participants were excluded from the study.

7.2.2 Measures

The questionnaire closely mirrored that used with the Chinese sample. The original English versions of the same scales were used, namely the 10-item Smartphone Addiction Scale-Short Version (SAS-SV), the 8-item Irrational Procrastination Scale (IPS), the 12-item Achievement Emotions Questionnaire (AEQ)-anxiety, the 10-item Self-regulation Scale (SRS) and the 5-item Satisfaction with Life Scale (SWLS). The scales obtained good levels of internal reliability indicated by Cronbach's alpha values (the SAS-SV: .83, the IPS: .88, the AEQ-anxiety: .91, the SRS: .79, the SWLS: .87). The alpha values obtained among the UK students were in fact better than the values for the Chinese students.

In order to generate qualitative data that might shed light on or explain participants'

questionnaire responses five open, free-response, items were added for the UK students.

Interviews were not used because the English language barrier might lead to

information loss during either the interviews or transcription for the researcher whose

first language is not English. Written narrative answers can reduce the potential

information loss. The first four items mirrored those used in interviews with the Chinese

students. An example item is "Could you describe how you use your smartphone during

class or other learning periods?" Participants were also asked to respond to an additional,

final question: "Do you think you use your smartphone too much? If so, why? What

problems does this cause for you?"

7.2.3 Procedure

Both paper and online questionnaires were used in this study in order to recruit as

many participants as possible. Similar to the study conducted in China, the survey was

printed on folded A3 sheets for offline distribution. The researcher distributed the paper

questionnaires around the university campus and during breaks in lectures, where staff

permission had been given. As part of this paper-based data-collection process the

researcher introduced the study to potential participants before distributing the paper

surveys. The students read the consent information before deciding whether to

participate.

At the same time an online version of the questionnaire, using Qualtrics, was

distributed to undergraduate administrators or Departmental receptionists via email.

These gatekeeping staff were asked to consider circulating the invitation and link to undergraduate students in their Department. Invitation emails were sent to 26 administrators or receptionists in the first round and, of these, six administrators agreed to distribute the link, three declined and 17 did not reply so we cannot know whether they circulated the invitation or not. In a second round of recruitment, emails were sent to those administrators who did not reply in the first round, and a further five administrators agreed to distribute the survey with another 12 non-responders. In addition, a QR code for the online questionnaire, together with information about the study, was printed and posted in public spaces around campus. The researcher also sent links to several students with the help of their lecturers. The researcher attempted several other ways to distribute the online survey links including asking the university's international team, student hub, student union and Chinese society for support, but all enquiries were rejected or ignored.

7.2.4 Data analysis

In preparing the data for analysis missing data was initially analysed in SPSS. Among the 303 valid UK responses, 38 participants had missing values for at least one whole scale (e.g. the whole SRS is missing). Dropouts from the online survey might cause this missing type. They did not complete the SRS, the SWLS and the open questions. Thus, these 38 responses were not suitable for imputation and were excluded when using AMOS since AMOS requires a complete dataset. There were three missing

values identified in the remaining 265 responses, which were imputed with the regression imputation method. Multi-group structural equation modelling (SEM) in AMOS was conducted to compare the Chinese and British models. For descriptive statistics, Multi-group multivariate analysis of variance (MANOVA), t-tests and correlational analyses were conducted using data from the full sample of $n = 303$ participants and missing values were excluded pairwise by SPSS. SPSS automatically excluded cases missing values listwise in MANOVA.

Qualitative data analysis was conducted in NVivo. As with the interviews conducted with Chinese students, a framework analysis was used to analyse the data. The main themes found in China were applied as a basic coding framework for the UK student data. All narrative responses were inputted into NVivo before coding. Cases were coded one by one, as with the Chinese interview transcripts. The final thematic framework for the UK students was then compared with the Chinese framework.

7.3 Results

7.3.1 Descriptive statistics

Table 7.1 shows descriptive statistics for the five scales. The observed ranges indicate that the answers were sufficiently well distributed. Skewness and Kurtosis values show that all data were normally distributed. Cronbach's alpha values indicate that all scales obtained good to excellent reliabilities. The medians of corrected item-total correlations also suggested good internal consistency with all values above .47.

Table 7.1 Descriptive scale statistics

Scale	N	No. of items	Range		M	SD	Skewness	Kurtosis	M^R	α
			Potential	Observed						
SAS-SV	303	10	10-60	12-56	31.96	8.57	.24	-.04	.53	.83
IPS	283	8	8-40	9-40	26.28	6.64	-.09	-.55	.66	.88
AEQ-anxiety	283	12	12-60	12-59	33.86	10.62	.06	-.70	.65	.91
SRS	265	10	10-40	11-39	25.86	4.53	-.22	.29	.47	.79
SWLS	265	5	5-35	6-35	23.23	6.58	-.41	-.47	.70	.87

Note. N = 303;

M^R = Median of corrected item-total correlations.

7.3.2 Multivariate analysis of variance (MANOVA) and t-tests

Multi-group (two-way) MANOVA was performed to investigate differences in the five variables according to gender and country. The mean scores for all scales in both the British and the Chinese samples are presented in Table 7.2. Independent samples t-tests were conducted across gender within the British sample, and between the two countries, as shown in Table 7.4 and Table 7.2 respectively. MANOVA identified statistically significant main effects for gender, $F (5, 732) = 5.97$, $p < .001$, Pillai's Trace = .04, $\eta^2 = .04$; country, $F (5, 732) = 43.68$, $p < .001$, Pillai's Trace =.23, $\eta^2 = .23$; and interaction effect $F (5, 732) = 5.47$, $p < .001$, Pillai's Trace = .04, $\eta^2 = .04$ on the combined dependent variables. It indicates that some significant difference exist among the five variables across gender and country.

Table 7.2 Comparison of means between UK and Chinese students

		Chinese			UK			Cohen's d	F	t(df)
		N	M	SD	N	M	SD			
Problematic smartphone use	T	475	**36.70**	7.55	303	31.96	8.57	**-.60**	4.12*	7.89(583.86)***
	F	209	**37.89**	7.06	245	32.65	8.60	**-.66**		
	M	266	**35.77**	7.80	57	29.16	7.85	**-.85**		
Academic procrastination	T	475	25.14	4.74	283	26.28	6.64	.20	46.90*	-2.54(454.75)*
	F	209	25.53	4.90	231	25.98	6.74	.08		
	M	266	24.83	4.60	51	**27.73**	6.03	**.60**		
Academic anxiety	T	475	30.48	8.07	283	33.86	10.62	.37	33.34***	-4.61(475.88)***
	F	209	30.08	7.60	231	**34.65**	10.45	**.50**		
	M	266	30.80	8.42	51	30.24	10.85	-.06		
Self-regulation	T	475	26.16	3.71	265	25.86	4.53	-.08	14.03***	.941(461.84)
	F	209	25.67	3.84	219	25.69	4.40	.01		
	M	266	26.55	3.56	46	26.65	5.10	.03		
Satisfaction with life	T	475	18.35	5.37	265	**23.23**	6.58	**.84**	17.95***	-10.30(460.81)***
	F	209	18.30	5.30	219	**23.35**	6.32	**.86**		
	M	266	18.39	5.43	46	**22.63**	7.79	**.73**		

Note. T = total, F = female, M = male.

*p < 0.05 (2-tailed), ***p < 0.001 (2-tailed)

Cohen's d values with larger than .50 (medium or large effect size) and higher values with medium or large effect sizes are presented in bold.

After the tests for main effects in MANOVA, the mean differences for the five variables were then considered separately and using a Bonferroni adjusted alpha level of .01. A significant interaction effect for gender and country was revealed only for

academic anxiety, $F(1, 736) = 9.99$, p < .01, $\eta^2 = .01$. It suggests that the gender effect for academic anxiety was different between the two countries. In line with this, independent samples t-tests found that British females were more anxious about academic activities than males, $t(280) = 2.71$, $p < .01$, $d = -.42$ (shown in Table 7.4), while no gender difference was found in the Chinese sample. Meanwhile, for the difference between the two countries, Chinese students reported significantly lower levels of academic anxiety than UK participants, $t(475.88) = -4.61$, $p < .001$, $d = .37$ (shown in Table 7.2).

Besides the interaction effect, a significant gender difference was revealed among the whole group (combining Chinese and British students) only for PSU, $F(1, 736) = 13.26$, $p < .001$, $\eta^2 = .02$. When the gender effect was not considered, a significant difference was found between the two countries for PSU, $F(1, 736) = 9.99$, $p < .01$, $\eta^2 = .01$; academic procrastination, $F(1, 736) = 9.99$, $p < .01$, $\eta^2 = .01$; and life satisfaction, $F(1, 736) = 9.99$, $p < .01$, $\eta^2 = .01$. In line with MANOVA, independent samples t-tests between the two countries found significant differences for PSU, academic procrastination, academic anxiety, and life satisfaction. The detailed comparisons are as below.

Focusing on the prevalence of PSU specifically, Chinese students seem to report higher levels of PSU than the British students. Multi-group MANOVA shows that PSU was different between genders and countries, but with no interaction effect. It suggests that gender difference existed for PSU in both countries but the levels of PSU were different. Independent samples t-tests revealed significant gender differences in both

countries. Similar to the Chinese female students, British female undergraduates reported significantly higher levels of PSU than males, t (300) = 2.80, $p < .01$, $d = -.41$. It is clear that Chinese participants reported higher levels of PSU ($M = 36.70$, $SD = 7.55$) than UK participants ($M = 31.96$, $SD = 8.57$) with a medium effect size, $d = -.60$. However, it can also be seen that Chinese and UK students reported similar levels of self-regulation, $d = -.08$.

Table 7.3 shows a comparison of the percentage of participants who scored above the threshold of smartphone "addiction" set in the SAS-SV. Both females and males showed lower levels of "addiction" than Chinese students, which is also reflected in Table 7.2. Regardless of the validity of the thresholds, UK students seems to report less problematic smartphone use, They scored lower in the SAS-SV than the Chinese sample with a large effect size, $d = -.60$. This is in accordance with the lower percentages of "addicted" smartphone users.

Table 7.3 Comparison of the SAS-SV scores between Chinese and UK samples

	N	*Mean*	*SD*	*Cohen's d*	"Addicted" (over threshold)	
					Male > 31	Female >33
Chinese	475	36.70	7.55	- 0.60	193/266 (72.565)	151/209 (72.25%)
UK	303	31.96	8.57		23/57 (40.35%)	106/245 (43.27%)

Table 7.4 Gender differences for problematic smartphone use, academic procrastination, academic anxiety, self-regulation and satisfaction with life among UK undergraduates

	Female			Male					
	N	*M*	*SD*	*N*	*M*	*SD*	*F*	*t(df)*	*d*
Problematic smartphone use	245	32.65	8.60	57	29.16	7.85	.34	2.80(300) **	-.41
Academic procrastination	231	25.98	6.74	51	27.73	6.03	3.6	-1.70(280)	.26
Academic anxiety	231	34.65	10.45	51	30.24	10.85	.07	2.71(280) **	-.42
Self-regulation	219	25.69	4.40	46	26.65	5.10	.38	-1.31(263)	.21
Satisfaction with life	219	23.35	6.32	46	22.63	7.79	4.84*	.589(58.07)	-.11

Note. **$p < 0.01$ (2-tailed)

Furthermore, both the MANOVA and t-test results show that academic procrastination and life satisfaction was differently rated across the two countries. Chinese students reported lower levels of academic procrastination than the British students, but with a small effect size, $t(454.75) = -2.54$, $p < .05$, $d = .20$ (shown in Table 7.2). It is interesting that British students reported higher levels of life satisfaction ($M = 23.23$, $SD = 6.58$) than Chinese students ($M = 18.35$, $SD = 5.37$) and that this difference had a large effect size, $t(460.81) = -10.30$, $p < .001$, $d = .84$ (shown in Table 7.2). Gender difference were found for self-regulation only among Chinese students while there were no gender differences for SR in the UK sample. However, this does not affect the equal levels of overall self-regulation between the two groups as shown

in Table 7.2.

7.3.3 Correlations

As shown in Table 7.5, all five study variables were significantly correlated with each other. PSU was significantly and positively correlated with AP ($r = 40$, $p < .01$), AA ($r = 30$, $p < .01$), and significantly negatively correlated with SR ($r = -.42$, $p < .01$) and SWL ($r = -.15$, $p < .01$). Compared to the Chinese sample, the correlation between self-regulation and academic anxiety was significantly stronger in the UK sample, $z = -2.56$, $p < .05$. In the British sample, life satisfaction had significantly stronger correlations with and procrastination, $z = -2.21$, $p < .05$, and self-regulation, $z = -2.04$, $p < .05$. Academic anxiety was negatively and significantly correlated with life satisfaction in the UK sample while this relationship was not significant in the Chinese sample. Overall, the hypothesised relationships in this study were confirmed among the UK sample, showing suitability for further analysis of the hypothesised model. However, it is worth noting that life satisfaction was significantly higher among the UK sample, which might affect the correlations.

Table 7.5 Pearson Product-moment Correlations

UK undergraduates

	1	2	3	4	5
1 Problematic smartphone use (N = 303)	-				
2 Academic procrastination (N = 283)	. 40**	-			
3 Academic anxiety (N = 283)	.30**	.30**	-		
4 Self-regulation (N = 265)	-.42**	-.42**	**-.51****	-	
5 Satisfaction with life (N = 265)	-.15**	**-.32****	-.37**	**.40****	-

Chinese undergraduates (N = 475)

	1	2	3	4	5
1 Problematic smartphone use	-				
2 Academic procrastination	.36**	-			
3 Academic anxiety	.28**	.39**	-		
4 Self-regulation	-.35**	-.39**	**-.35****	-	
5 Satisfaction with life	-.16**	**-.16****	-.08	**.26****	-

Note. **$p < 0.01$ (2-tailed).

Significantly different correlation coefficients between groups are presented in bold.

7.3.4 Structural Equation Modelling

7.3.4.1 Confirmatory factor analysis

CFA was conducted to test the hypothesised model as shown in Figure 7.1. The

model fit indices show the model had a moderately good fit, χ^2/df = 2.10, *CFI* = .80, *RMSEA* = .065. Similar to the CFA for the Chinese sample, the *CFI* is .80 that is below the good value of .95 (Hu & Bentler, 1999). However, the χ^2/df and the RMSEA indicate the model fitness is acceptable. After freeing the errors and adding paths suggested by modification indices in AMOS, the modified CFA model obtained a good fit, χ^2/df = 1.59, *CFI* = .895, *RMSEA* = .047, as shown in Figure 7.2. In the modified CFA model, new paths from AA to SWL and SR to AA were added to the initial hypothesised model. However, it is worthy of note that the modifications guided by modification indices in AMOS could be the results of similar wording between items in a scale.
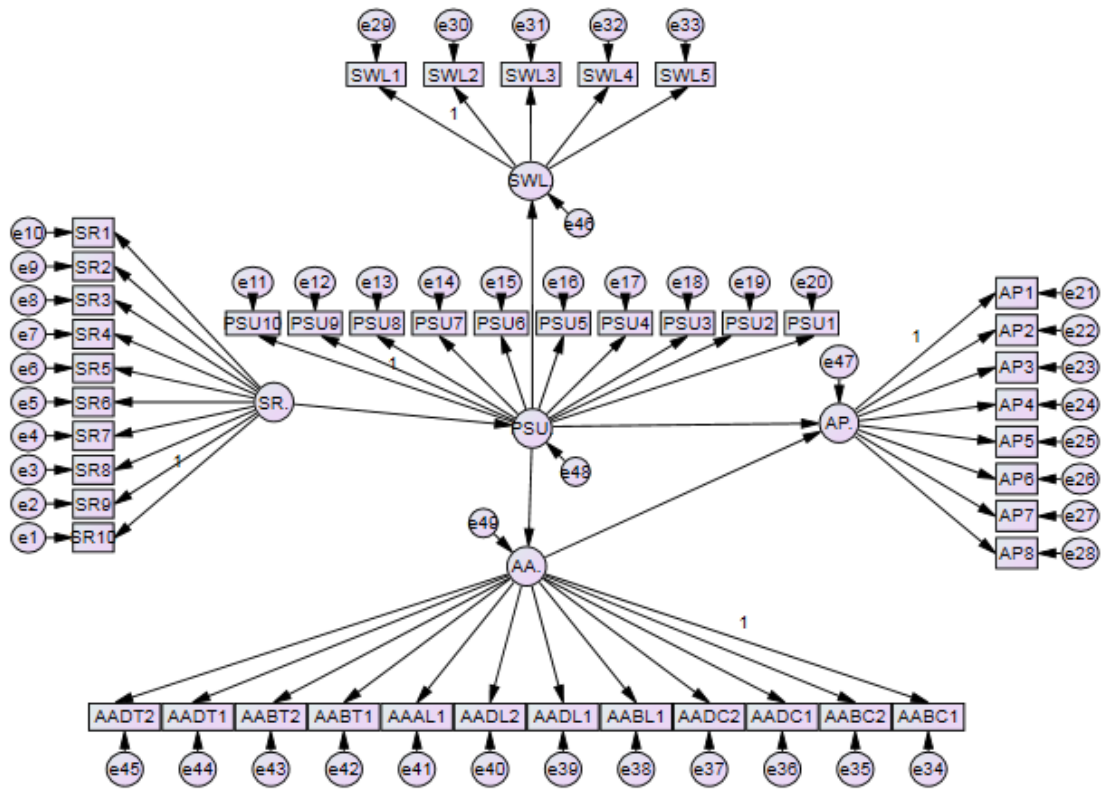
Figure 7.1: Confirmatory factor analysis. $\chi^2/df = 2.10$, *CFI = .80, RMSEA = .065.*

Note. PSU = problematic smartphone use, AA = academic anxiety, AP = academic procrastination, SR = self-regulation, SWL = satisfaction with life. AABC = academic anxiety before class, AADC = academic anxiety during class, AABL = academic anxiety before learning, AADL = academic anxiety during learning, AAAL = academic anxiety after learning, AABT = academic anxiety before test, AADT = academic anxiety during test.
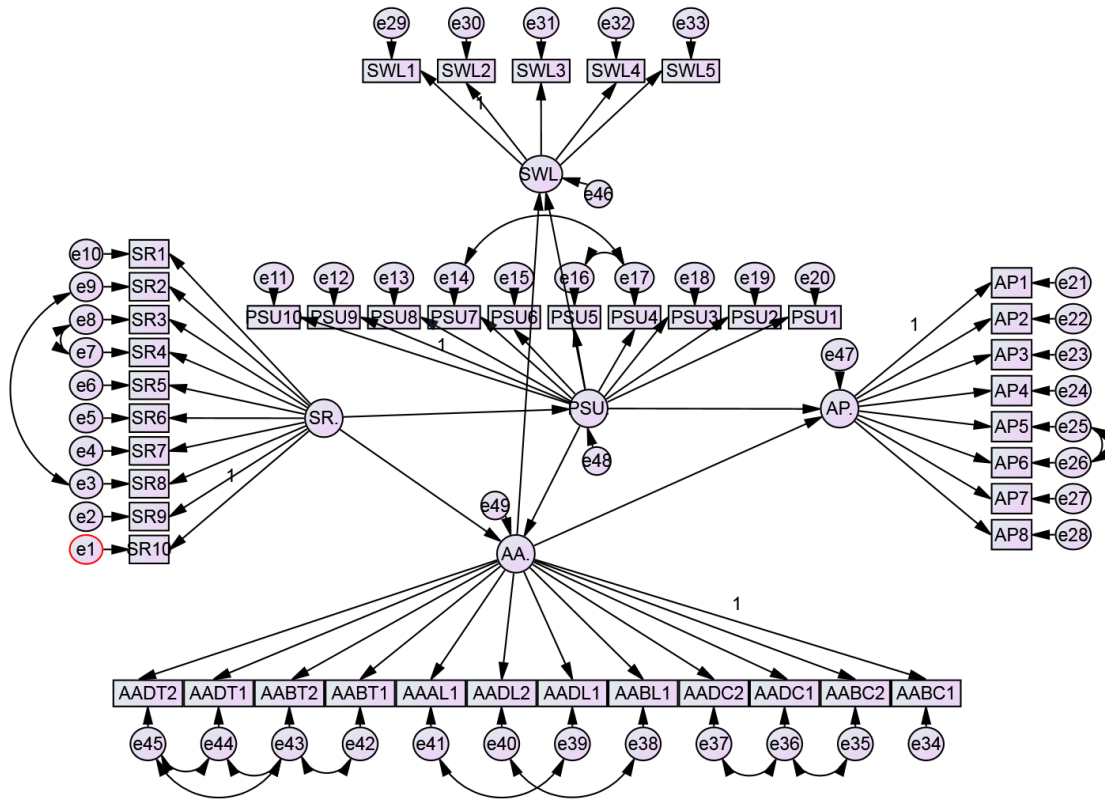
Figure 7.2: Modified Confirmatory factor analysis model. $\chi^2/df = 1.59$, *CFI = .895,*

RMSEA = .047.

Note. PSU = problematic smartphone use, AA = academic anxiety, AP = academic

procrastination, SR = self-regulation, SWL = satisfaction with life. AABC = academic

anxiety before class, AADC = academic anxiety during class, AABL = academic

anxiety before learning, AADL = academic anxiety during learning, AAAL = academic

anxiety after learning, AABT = academic anxiety before test, AADT = academic

anxiety during test.

7.3.4.2 Path analysis of the hypothesised model

Figure 7.3 shows the initial path model with items parceled with poor model fit, χ^2

= 151.30, df = 8, χ^2/df = 18.91, p = .00, CFI = .46, RMSEA = .260. The path model did not fit the data after modification suggested by modification indices in AMOS. As shown in Figure 4, the model with a good fit among the Chinese sample did not fit the data in the UK perfectly, χ^2 = 22.82, df = 3, χ^2/df = 7.61, p = .13, *CFI* = .93, *RMSEA* = .158. It seems that the modified path model is only representative of the Chinese group. Comparing the same model applied in the UK (Figure 7.4) and China (Figure 7.5), the effect of self-regulation on the other variables, especially PSU and AA, was stronger in the UK sample. It suggests that the UK students' PSU and AA may be more dependent on their self-regulation compared with Chinese students.
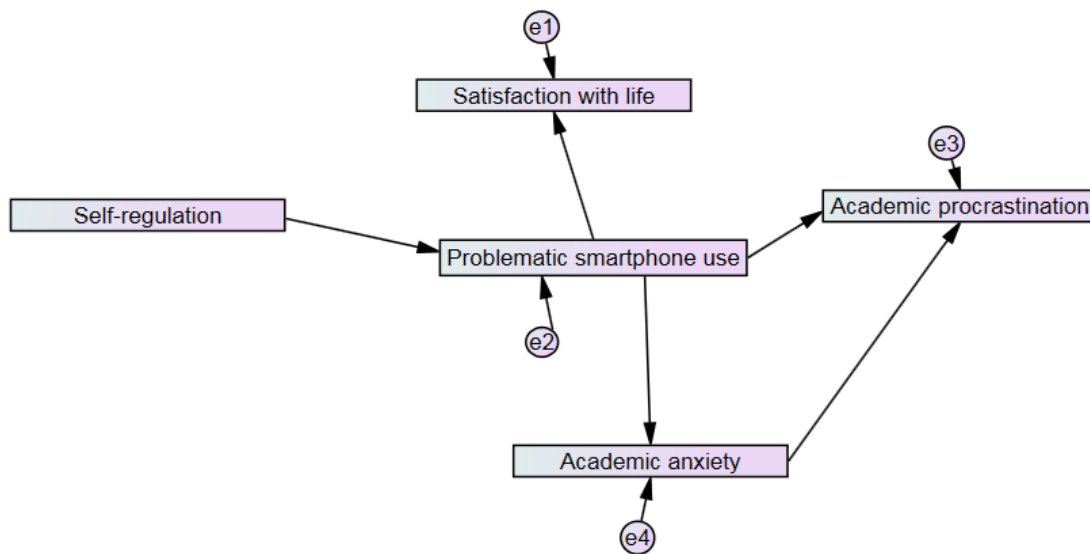
Figure 7.3: Hypothesised model in the UK. χ^2 *= 151.30, df = 8,* χ^2/df *= 18.91, p = .00, CFI = .46, RMSEA = .260*
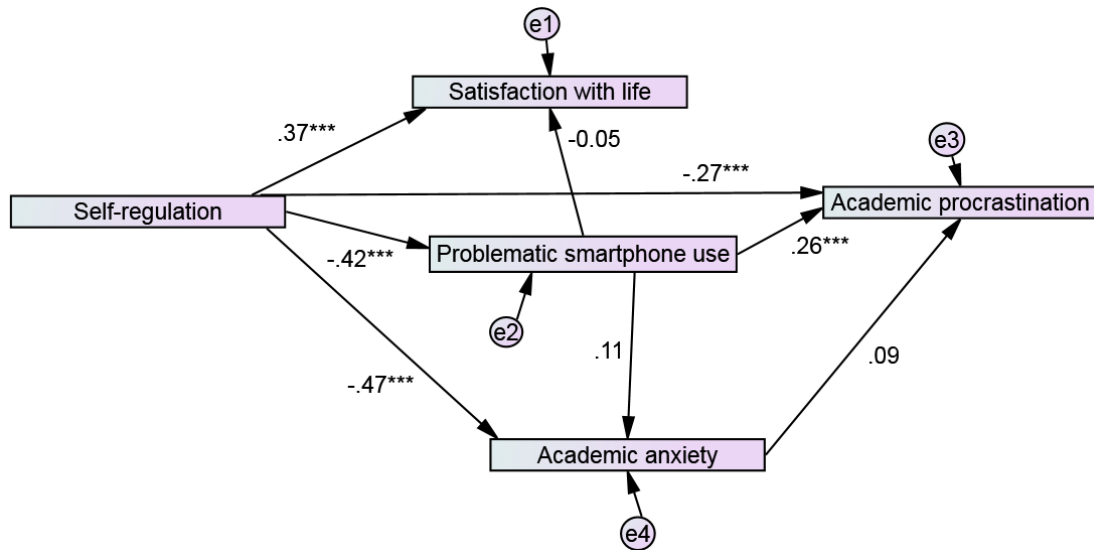
Figure 7.4: Modified model in the UK. $\chi^2 = 22.82$, *df = 3*, $\chi^2/df = 7.61$, *p = .13, CFI = .93, RMSEA = .158* Note: ***p < 0.001*
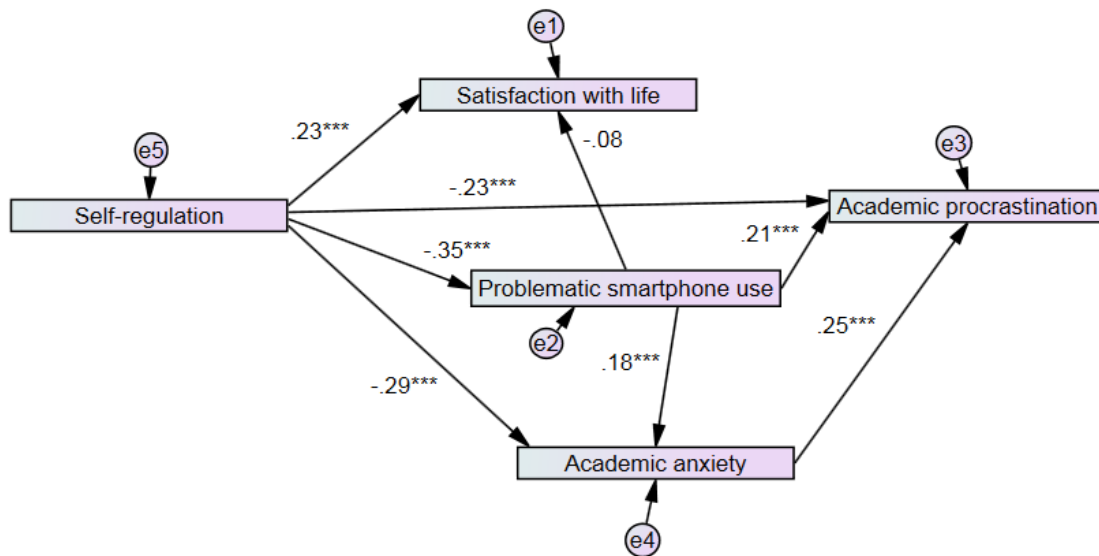
Figure 7.5: Chinese model with good fit. $\chi^2 = 2.05$, *df = 2*, $\chi^2/df = 1.03$, *p = .36, CFI = 1.00, RMSEA = .008*

Note: ***p < 0.001*

7.3.4.3 Multi-group structural equation modelling

Multi-group structural equation modelling (SEM) was used to compare the models

across the groups. As shown in Table 7.6, the model fits were improved by modifying

the initial models with extra paths as shown in the figures above. The modified model

obtained good model fits among the Chinese sample but failed to fit the British data.

However, the modified model fits the combined data with acceptable fit, $\chi^2 = 23.65$, *df*

= 4, χ^2/df = 5.91, *CFI* = .97, *RMSEA* = .041, suggesting that the modified model

represents the whole data well in this cross-cultural study.

Table 7.6 Cross-Cultural Equivalence of the Model

	df	χ^2	χ^2/df	*CFI*	*RMSEA*
British students					
Initial model	8	151.30	18.91	.46	.260
Modified model	3	22.82	7.61	.93	.158
Chinese students					
Initial model	5	93.24	18.65	.72	.193
Modified model	2	2.05	1.03	1.00	.008
Combined groups	4	23.65	5.91	.97	.041

Multi-group path analysis based on SEM was used to compare the path coefficients across groups. The path coefficients for the Chinese and British students are shown in Table 7.7. The path coefficients for the British sample were slightly larger than those for the Chinese sample. Self-regulation appeared to have stronger relationships with the other variables among the British sample. This is in line with the comparison of the correlation coefficients discussed in 7.3.3. In order to compare each path across groups, all paths were first constrained to be equal, then one path was released at a time. The significance of $\Delta\chi^2$ was used to evaluate whether the path was significantly different between groups. There was no significant $\Delta\chi^2$ only when the path from self-regulation to academic anxiety was released. Release of the other paths led to significant $\Delta\chi^2$. Thus, it suggests that the majority of the paths, except for the path from self-regulation to

academic anxiety, were significantly different across groups. It indicates the obvious cultural difference between the Chinese and the British samples, and the models were significantly different across groups.

Table 7.7 Path coefficients for Chinese and British undergraduates

Paths	Chinese		British	
	B	β	B	β
SR→PSU	-.70***	-.35***	-.81***	-.42***
PSU→AA	.19***	.18***	.14	.11
SR→AA	-.64***	-.29***	-1.09***	-.47***
AA→AP	.15***	.25***	.06	.09
PSU→AP	.13***	.21***	.20***	.26***
PSU→SWL	-.06	-.08	.01	.02
SR→SWL	.34***	.23***	.59***	.41***
SR→AP	-.30***	-.23***	-.39***	-.27***

*Note: ***p < 0.001*

Only SR→AA was not significantly different between groups.

PSU = problematic smartphone use, AA = academic anxiety, AP = academic procrastination, SR = self-regulation, SWL = satisfaction with life.

Multi-group confirmatory factor analyses (MGCFA) was used to test the measurement invariance for the SAS-SV (the measure for PSU). However, measurement invariance could not be established using the criteria for measurement invariance test suggested in Milfont and Fischer (2010). There were significant chi-squre changes ($\Delta\chi^2$) when measurement weights ($\Delta\chi^2 = 25.68$, $p < .01$), measurement intercepts ($\Delta\chi^2 = 439.30$, $p < .001$), structural covariances ($\Delta\chi^2 = 449.33$, $p < .001$) and measurement residuals ($\Delta\chi^2 = 523.67$, $p < .001$) were constrained respectively. It means that the SAS-SV was answered in different ways between the Chinese and British

students.

7.3.5 Cross-cultural comparison of qualitative data

Qualitative data were collected in order to investigate the usage of smartphones, motivators/antecedents for smartphone use, impacts and other perceptions among the UK sample, and to compare with the themes found in China. Overall, as shown in Table 7.8, the themes found in British students' responses were largely similar to those identified in the Chinese interviews. The British undergraduates reported similar patterns of PSU including the addictive pattern (frequent checking, using late at night), the antisocial pattern (irrelevant use in class or in gatherings) and the risky pattern (dangerous use). As with the Chinese students, the British students' narrative reports were not always consistent with their answers for the scales. British and Chinese undergraduates reported similar impacts and antecedents of smartphone use.

However, there were also several notable differences between the two groups. British students, even with a significant larger sample of qualitative data, did not report accessing as many types of smartphone applications or functions as the Chinese students. Also, the British students did not mention the effect of transition from high school to university, which was reported as a major explanation for PSU in China. The British students reported several motivations and explanations that the Chinese students did not mention, including low self-esteem, escapism, age, etc.

7.3.5.1 Results from the British sample

Table 7.8 shows the thematic framework for the British undergraduates. The themes identified in the British sample were largely similar to those found in China, which include smartphone usage, antecedents, impacts and perceptions of smartphone use. Smartphone use was classified as non-problematic use (general use and study) and problematic use. Problematic use was judged based on the pathway model by Billieux, Maurage et al (2015). For example, if the participant described   irrelevant use in class, or addiction-like behaviours, the narration would be coded as problematic.

Usage of smartphone

Both general use and problematic use of smartphones were reported by the British students. Smartphones were frequently reported as essential tools in daily life, including contacting people, using social media, information searching, assisting with travel, etc. One example could be as below.

Ease of access to multiple apps and platforms that aid daily lives such as calendars and ease of communication via emails, sms and social media. (British Female, 18, SAS-SV score: 21)

Smartphones were also frequently reported as a tool for study. An example is shown below.

I usually use it for looking things up and that I don't understand, which relates to what we are learning about. (British Female, 20, SAS-SV score: 26)

To answer class polls on menti and to find more information on topics that are interesting or that I don't understand. (British Female, 20, SAS-SV score: 30)

However, besides general use and use for study, features of PSU described in

Billieux, Maurage et al (2015)'s model were mentioned by the British students. Many British undergraduates reported that they used smartphones too much or addictively. Examples could be as below.

Smartphones are great, but they have become a cancer in the minds of the youth. They use them as much as they breathe. (British male, 20, SAS-SV score: 12)

Irrelevant use of smartphones in learning contexts or antisocial use were frequently mentioned. Examples are as below:

Although I sometimes use it to look up material relevent to the class, I usually use it for social media to distract my myself. (British male, 19, SAS-SV score: 36)

Antecedents for PSU

The British students reported antecedents for both general smartphone use and PSU. Since the comments on the antecedents for general use are largely similar to the usage as above, this section specifically focus on the antecedents for PSU mentioned by the British sample. Antecedents for PSU were reported as internal and external reasons. Internal reasons include excessive reassurance (fear of missing out, boredom), impulsity (poor self-regulation) and extraversion, which can be in line with the three paths in the model by Billieux, Maurage et al (2015). Examples could be as below.

It is addictive- don't want to miss out. (British female, 19, SAS-SV score: 36)

I feel like I can't put it down because I constantly want to check what is happening on my phone. (British female, 18, SAS-SV score: 55)

(The others) frequently checking their phones/social media, taking selfies/videos at every opportunity. (British female, 50, SAS-SV score: 40)

Anxiety and stress were mentioned as antecedents for either smartphone use or PSU. These might be under the theme of "reassurance need". Since the British students did not clearly note the situations smartphone use (either in class or in daily life), it remains unclear whether they are antecedents for PSU or general use.

Impacts of smartphone use

Both positive and negative impacts of smartphone use were reported by the British sample. Positive impacts include life convenience, help with study and reassurance when anxious or stressed. These positive impacts might also be found in the comments about the usage of smartphones. Examples are as below.

Convenience - in terms of apps that help organise/track things, connecting with friends, ease of communication. Listening to music. Being able to find out information at the click of a button. (British female, 21, SAS-SV score: 27)

I usually use it for looking things up and that I don't understand, which relates to what we are learning about. (British female, 20, SAS-SV score: 26)

Stress, anxiety and a release from stress and anxiety. Haha when I don't look at my phone all day, I feel a release but also stress because I know I will have missed loads of important emails and messages. (British female, 22, SAS-SV score: 32)

Negative impacts include worse social, physical health issues, problems with study (distraction, time wasting and procrastination) and low life satisfaction. Examples are as below.

I think people are becoming detached from reality. It's uncommon now for a group of people to go out and not look at their phones.I find this really irritating. (British female, 21, SAS-SV score: 14)

Sometimes after long periods, eye start to ache and get tired. (British female, 20, SAS-SV score: 44)

For me its non existant. However, most of my friends will put off work so they can scroll

through social media and waste hours of their lives looking at other people waste theirs. (British male, 20, SAS-SV score: 12)

Harmful interpersonal comparing and bullying online were shortly mentioned by the British students. In the comment on bullying, privacy was also mentioned.

Becoming reliant/unable to live without. Easy access to social media allows you to see what other people are doing and compare yourself to them socially and academically. This can affect ones self confidence and make them feel inadequate/unhappy. (British male, 20, SAS-SV score: 20)

Bullying online, people knowing all of your business, gossiping. (British female, 19, SAS-SV score: 45)

Perceptions of smartphone use

Many British students reported that they used smartphones problematically and need to change.

Yes, I do (use it too much). I don't know exactly why and I do think I should try and use my phone less.(British female, 19, SAS-SV score: 35)

One British student reported that smartphone was not the only distractor since they may turn to the other devices such as laptops during lectures for irrelevant use. It is important to note that smartphones are not the only devices to distract students from their tasks. When students cannot control themselves well, they may lose concentration and use smartphone, laptops or other devices for distraction. This suggests the importance of self-regulation to UK students' lives, which was in line with the quantitative data analysis.

In class I see a lot of people using laptops to check social media - this then looks to the teachers like they are taking notes. However this seems to be a way of accessing smartphone features / apps through another device - if it were allowed / not considered rude to be on smartphones in class these would probably be used instead. In terms of daily lives , I rarely seem to see people glued to their phone when they are in social

groups , but when they are alone in a public setting people (perhaps under the age of 40) will be on their smartphone. (British female, 21 yrs., SAS-SV score: 30).

Table 7.8 Thematic framework for the UK sample

Usage	General use			
	Study			
	Problematic use	Addictive pattern	Frequent checking	
			Using late at night	
		Antisocial pattern	Irrelevant use in class, or in gathering, **escapism**	
		Risky pattern	Dangerous use	
Antecedents	Normal use	Study		
		Daily life need		
		Reassurance need (Anxiety, stress)		
		Age		
	Problematic use	Internal reasons	Excessive reassurance	Fear of missing out
				Reassurance need (boredom)
			Impulsivity	Poor self-regulation
			Extraversion	
		External reasons	Boring lecture (teacher and course)	
			Peer pressure	
Impacts	Positive	Life convenience		
		Help with study		
		Reassurance		
	Negative	Social relationship		
		Physical health		
		Study (distraction, time wasting, procrastination, anxiety)		

		Privacy safety
		Low life satisfaction (Harmful interpersonal comparing and bullying online)
	Neutral or no impact	
Perceptions	Positive	
	Negative	
	Neutral	**Other distracting devices**
	Need to change	

Note. Words in bold were the unique themes for the British students.

7.3.5.2 Similarities with the Chinese sample

Similar patterns of PSU

As with the Chinese sample, UK undergraduates reported similar patterns of PSU: the addictive pattern, the antisocial pattern and the risky pattern. Participants directly used words such as 'addiction' or 'addictive', and reported frequent checking on phones or using late at night.

It is addictive and hard to tune out, and often sleep as head is filled with phone stuff. (British female, 19 yrs., SAS-SV score: 44)

People can get addicted to the instant-gratification kick that smartphones offer. Perpetually checking social media and various websites, scrolling non-stop... Smartphones are second to none when it comes to wasting time. (British female, 22 yrs., SAS-SV score: 23)

I saw some classmates playing games during the whole class…Their gaming [via smartphone] is a kind of addiction. (Chinese female, 20, SAS-SV score: 27)

They also reported antisocial patterns including irrelevant use in classes or gatherings:

I've spotted social media being used a lot during lectures, but not as much in seminars. Smartphone use will happen a lot in free time, although I've noticed an increasing amount of people are focused on the smartphones during social gatherings to either browse social media or keep up to date with their messages. (British female, 20 yrs., SAS-SV score: 35)

Antisocial periods, we don't sit and properly watch a film, we all sit on our phones. (British female, 21 yrs., SAS-SV score: 25)

Sometimes though, I see people using their phones while in class or lectures or excessively at dinner with friends and it surprises me. (British female, 20 yrs., SAS-SV score: 40)

Everyone is using smartphones. Now when friends meet in a party, they sit down and just use smartphones…I think we'd better not have parties. Just chat online…It's always the case recently (Chinese female, 20, SAS-SV score: 50)

Dangerous use was also mentioned:

Not taking care when walking. (British female, 50 yrs., SAS-SV score: 40)

A number of UK participants reported that they rarely used their smartphone during lectures. However, as was also true in China, their words were not consistent with their self-perceived PSU. A few of them reported inconsistently with their SAS-SV scores.

I don't, I keep it on silent and don't look at it during class unless it's urgent. (British female, 21 yrs., SAS-SV score: 33)

*Minimal, it stays in my pocket. (*British male, 27 yrs., SAS-SV score: 18)

I do not tend to use my phone in class because my attention is held a lot more in these situations- it is when I have to rely on my self-discipline do the problems occur. (British male, 18 yrs., SAS-SV score: 49)

I may check it during breaks. I tend to use my smartphone at home rather than in class. (British female, 20 yrs., SAS-SV score: 35)

One participant specified Chinese students in particular as heavy users, according to her own observation.

People spend a lot of time on social media during times when they should be paying

attention - particularly Chinese students. (British female, 19 yrs., SAS-SV score: 26)

Similar antecedents for PSU

The British undergraduates reported similar antecedents for PSU as the Chinese students including internal reasons (fear of missing out on something, need for reassurance, poor self-regulation) and external reasons (boring lecture, peer effect).

I don't use my phone in class, but when studying I go on Facebook and get trapped scrolling through the News Feed. (British female, 19 yrs., SAS-SV score: 36)

Not at all (use it during lectures) if the lecture is interesting, browse social media and message friends if the lecture boring. (British female, 26 yrs., SAS-SV score: 25)

When I am surrounded people who are also procastinating, I find it easy to do myself without feeling guilty. (British female, 22 yrs., SAS-SV score: 36)

Among the British students, anxiety, stress and boredom were frequently mentioned as antecedents for either general smartphone use or PSU. These are similar to the antecedents for PSU reported by the Chinese students. In both countries, smartphone was reported as a tool for self-reassurance in relation to anxiety, stress or boredom. However, some of the British students did not specify whether the situation of smartphone use was in class, during learning periods or during parties. Some of them just typed single words namely "anxiety" or "boredom" to the questions. Thus, it is unclear whether they referred anxiety as antecedents for PSU or general use.

Similar impacts

As reported by one British participant, checking smartphones is not always problematic and it depends on the impact of the behaviour.

Some of my peers will be constantly on their phone, trying to hide it from the lecturer. Others will put their phone in their bag and not touch it throughout the entire lecture, though this might be rare among my age group. I think it would be unusual now for a student to go more than 1 or 2 hours without at least checking their phone for the time or notifications. Even one of my lecturers always uses his phone to check the time. I don't have a problem with this as long as it does not distract from the task at hand. . (British female, 21 yrs., SAS-SV score: 27).

As with the Chinese students, UK students reported both positive and negative impacts of smartphones, including positives such as convenience, help with study and reassurance; and negatives such as worse social relationships, poorer physical health, distraction, time wasting, procrastination and anxiety.

Smartphones were reported as positive tools for study, daily life and personal reassurance from anxiety or pressure.

I can watch some TED videos. They have many new thoughts. A lot of presentations. Really useful (Chinese male, 19, SAS-SV score: 43)

I usually use it for looking things up and that I don't understand, which relates to what we are learning about. (British female, 20 yrs., SAS-SV score: 26).

Practicality. The minor things, like being able to check a map and travel apps (I grew up in London, Citymapper is a godsend). I'm not into social media, but being able to message people on Facebook is admittedly useful. Keeping track of eBay, listening to music, checking the news. Smartphones can help make the day-to-day more streamlined. (British female, 22 yrs., SAS-SV score: 23).

It's also how I wind down or relax, as it's not a stressful activity. (British female, 19 yrs., SAS-SV score: 39).

However, negative impacts of smartphones were also reported including worse social relationships, poorer physical health, distraction, time wasting, procrastination and anxiety.

I dislike it when I'm in a social setting and people aren't talking, but texting other people. It creates barriers in some ways. (British female, 21 yrs., SAS-SV score: 27).

*Staying up too late and being tired the next day. (*British female, 18 yrs., SAS-SV score: 47).

It distracts me a lot from work, which causes me to be more stressed in the long run. (British female, 19 yrs., SAS-SV score: 39).

I spend too much time on social media (comment sections are toxic but addictive), and I sometimes spend too much time on smartphone games. This causes some issues as I end up putting off work or chores I planned to get on with. (British female, 20 yrs., SAS-SV score: 35).

It takes too much time in our lives. Most time was used on smartphones. I feel I should have done many things but I spent the time on my smartphone (Chinese female, 19, SAS-SV score: 48).

Similar perceptions

As with the Chinese students, UK students reported a perception that they need to change their ways of smartphone use by reducing the amount of time they spend on their phones. Those who showed their awareness of their overuse of smartphones tended to be low scorer in the SAS-SV.

I don't even use it that much. But I still think, if I used the time that I spent flicking through the news (or even buzzfeed, god forbid..) to read a book, then that would have been time well spent. (British female, 22 yrs., SAS-SV score: 23)

Not necessarily problems in my life but I mean, when asking the question what could I have done better, there is always at least something I could have done rather than be on a phone. (British male, 20 yrs., SAS-SV score: 20)

As a university student, I need to read more books and use smartphone less (Chinese female, 18, SAS-SV score: 42).

Furthermore, in both countries, PSU was reported as just one of the distracting things. Similar to the British students' comments about the other electronic devices as quoted above, one Chinese student noted that they could be easily distracted by the other things including novels or magazines. Self-regulation might be the real issue according to these students.

7.3.5.3 Differences with the Chinese sample

There were several differences between the themes found in the Chinese and British samples. First, the Chinese sample reported more specific smartphone applications than British students did. Besides calling and text messages, the British students (n=303) mentioned 13 main functions with 23 application, while the Chinese students (n=16) mentioned 14 main functions with 35 applications. Chinese students mentioned not only social media and information searching tools, but also applications for mobile payment, sports and exercise, shared bikes, leisure reading, word memorizing tools, online courses, off-class tests, university required applications, etc. The majority of the British students reported the same functions including social media (Facebook, Instagram, snapchat) and information searching. It appears from this data that the Chinese students used their smartphones for more things, possibly explaining a higher level of usage. The Chinese students mentioned their threatened privacy while British students did not mention this. This may also indicate that the Chinese students perceived themselves living in a more complex context with more applications of smartphones.

Second, the British students did not mention the effect of transition from high school to the university. Where Chinese students complained about their highly restricted use of smartphones in high school, British students did not mention any changes between high school and university life. The sharp contrast between high school and university lifestyle in relation to use of smartphones seems only applicable

to the Chinese students. This seems to be a key finding between the two groups.

Third, British students reported harmful interpersonal comparing as a negative impact of PSU, while the Chinese students did not mention this point.

Social media makes it hard not to compare your life to that of others (British female, 19 yrs., SAS-SV score: 27).

Negative feelings & comparing self to other people's lives. (British female, 21 yrs., SAS-SV score: 38)

Fourth, online bullying was noted briefly by the British students. However, no details of online bullying was reported by the British students. The Chinese students reported bullying offline when smartphones were used prior to talking in gatherings, which was coded as the negative impacts on social relationship.

Besides the differences discussed above, the British students noted some specific words or terms that were not directly mentioned by the Chinese students, including escapism, low life satisfaction, etc. However, these terms could be linked with several themes from the Chinese students indirectly.

Several British participants mentioned escape or self-defense as a reason for using their smartphone, something that was not directly reported by the Chinese students.

As an introvert, my smartphone becomes a defence/somewhere to hide when I am anxious in public. (British female, 25 yrs., SAS-SV score: 32).

To escape (through apps but mostly listening to music), as a social crutch. (British male, 21 yrs., SAS-SV score: 42).

However, although escapism was not directly mentioned in the Chinese students, it might be reflected in their comments about peer pressure. One example is as below.

In fact, I don't have too many things to do in my smartphone every time in our parties.

For example, information in Weibo is limited. There's not that many things to check and I read to the end easily. But when I saw the others were still using their phones without talking, I have to look down and continue to use my smartphone. (Chinese female, 20, SAS-SV score: 27)

Therefore, escapism can be a unique comment/term mentioned in the British sample, but it has some indirect links with similar themes identified in the Chinese sample.

A few of the British students mentioned that smartphone use reduced their self-esteem, self-assurance and satisfaction with life. It seems to be linked with the significant negative correlation between PSU and life satisfaction discussed in the quantitative data analysis, which was not found among the Chinese students.

Reduced ability to hold conversation in uncomfortable situations. Reduced self-assurance. (British male, 20 yrs., SAS-SV score: 35).

I am very concerned about the way smartphones/social media's instantaneous nature induces addictive behaviours in people, and how this leads to a dissatisfaction with the generally slower pace of non-virtualised life. (British male, 18 yrs., SAS-SV score: 49).

Similar to the discussion about escapism, though these comments about the negative impacts of PSU were not directly mentioned in the Chinese sample, they could be similar to some Chinese students' words about the negative impact on social relationships and well-being. For example:

When you see the others are always using smartphones in front of you, you might feel that they are isolating or ignoring you. Sometimes I really wanted to encourage them to interact with the others. But when I saw they were looking down and using smartphones, I didn't want to disturb them…… Sometimes two people are communicating through smartphones even when they are near to each other. I think smartphones lower our ability to communicate. That atmosphere was so repressive. (Chinese male, 18, SAS-SV score: 47)

7.3.5.4 Summary of the qualitative data comparison

Overall, the themes identified in the British sample were largely similar to those appearing in the Chinese sample. Similar themes were found in the patterns of general smartphone use (for daily life and study), patterns of PSU, antecedents for PSU, positive and negative impacts of PSU. The inconsistency of the SAS-SV scores and narrative words were identified in both countries. However, several differences were also identified across the two groups. Chinese students tended to report more complex functions of smartphones and believe they were faced with more attractions, while the British students mentioned PSU largely on similar applications (e.g. social media). Difficulty in adapting to the sharp transition from high school to university was only mentioned by the Chinese students. British students reported harmful interpersonal comparing and online bullying as negative impacts, which was not mentioned by the Chinese students. Furthermore, among the British students, anxiety and stress were reported as antecedents for smartphone use, but not clear whether for PSU or general use. While the Chinese students reported anxiety as antecedents for PSU in class or learning situations.

7.4 Discussion

Compared with the Chinese undergraduates, British undergraduates reported lower levels of PSU but similar levels of self-regulation. In both countries, females reported higher levels of PSU than males. Significant interaction effects for gender and country

was only found in academic anxiety. British students reported significantly higher academic anxiety than the Chinese students. Females were significantly more anxious about academic context in the UK, while no gender difference was found in China. Chinese students reported significantly lower levels of academic procrastination and life satisfaction than the British students.

Correlations and path estimates in the models show that the effects of self-regulation on PSU were larger among the British students. Among the British students, self-regulation had significantly stronger correlations with academic anxiety and life satisfaction. The path model with good fit in China did not perfectly fit the British data. Multi-group SEM shows that the majority of the paths were significantly different across the two countries, suggesting that cultural differences may exist between the two countries. British students reported higher levels of life satisfaction, which was significantly and negatively correlated with academic anxiety. This was different from the Chinese sample in which life satisfaction was not correlated with anxiety. Itseems that among the British undergraduates, self-regulation was more central to their academic life and their perceived PSU. Self-regulation tended to have more effects on the British students and less on the Chinese. The Chinese sample, with the same levels self-reported self-regulation as the British sample, reported significantly higher levels of PSU. For the British students, better self-regulation appears to predict lower levels of PSU. The effect of self-regulation was smaller for Chinese students, possibly because there might be several more reasons for PSU among Chinese students. In other words, simply better self-regulation could not save their high levels of PSU.

The qualitative data showed that British students had similar opinions of the patterns, antecedents and impacts of PSU as the Chinese students. However, the Chinese students appear to experience a different context in which they perceived smartphones to have more complicated functions and accessed more applications than the UK students. The sharp contrast between high school and university life seems to be another specific problem for the Chinese students, which was not mentioned by the students in the UK. British students mentioned harmful interpersonal comparisons and online bullying as negative impacts of PSU, which was not noted in the Chinese students. The narrative responses also confirms the finding of the quantitative data analysis. PSU was associated with the life satisfaction of the UK students but not the Chinese students. The role of self-regulation was more important in British students' lives while the Chinese students were facing with more difficulties such as the huge gap between high school and university.

Table 7.9 shows the cross-cultural comparison of the percentages of 'addicted' smartphone users according to the thresholds in the SAS-SV. Those studies used the same scale to measure the levels of PSU. The current study identified higher percentages of smartphone addiction among the Chinese students according to the self-reported scores for the SAS-SV. This result is in line with the cross-cultural study between German and Chinese students, in which Chinese students were found to be more addicted to smartphones than German students (Lachmann et al., 2018). This might be linked with the sharp transition from high school to university mentioned by the Chinese students. They seem to have problems with adapting to the free and

uncontrolled university life from the highly controlled and strictly managed high school life.

Cultural differences seem to exist for PSU between Eastern and Western countries, or within Western countries. As shown in Table 9, both Chinese and Korean samples scored higher than the other samples in non-Asian contexts including European and American countries (Kee et al., 2016; Lachmann et al., 2018; Lee, 2015; Lopez-Fernandez, 2017). This might be associated with general perceptions in Eastern cultures since Griffiths et al. (2016) reported that parents in South-Eastern Asia tended to perceive any behaviour that use learning time or family time as problematic or pathological. Any online activities without educational purpose appeared to be easily regarded as problematic in some Asian contexts (Griffiths et al., 2016). This might be the reason for the different proportions of PSU. It seems that the Chinese participants in this study and in Lachmann et al. (2018) were too sensitive to the statements in the SAS-SV and scored higher. Meanwhile, the different educational contexts across cultures/nations might be the reason for the differently rated PSU. For example, as discussed in the previous paragraph, the sharp change from highly stressful high school life to a more relaxed university life might influence the Chinese participants' perceptions on PSU. Another reason for the difference might be the time when those studies were conducted. This study was conducted around three years later than the other studies in Table 7.9. The fast development of the communication industry in China as discussed in chapter one might be the reason for the higher perceived PSU among the Chinese sample. However, the reasons behind the differently rated PSU

might need more future studies.Furthermore, the British sample in the current study, similar to the multi-national sample mainly from the UK (Chotpitayasunondh & Douglas, 2016), tended to be more addicted to smartphones than the other European and American samples. These results again suggest the importance of considering cultural differences in PSU.

Table 7.9 Cross-cultural comparison of the percentages of addicted smartphone users judged by the thresholds of the SAS-SV

	Female	Male	Total
African American (>35) (Lee, 2015)	-	-	11.23%
Belgian (>32) (Lopez-Fernandez, 2017)	22%	20%	21.52%
Chinese in Lachmann et al. (2018)	62.3%	64.9%	64.22%
German (Lachmann et al., 2018)	8.7%	6.2%	7.9%
Korean (Kee et al., 2016)	52%	42%	50%
Multi-national (Chotpitayasunondh & Douglas, 2016).	32.3%	29%	31.08%
Spanish (>32) (Lopez-Fernandez, 2017)	10.2%	15.2%	12.82%
British students in the current study	43.27%	40.35%	42.72%
Chinese students in the current study	72.25%	72.56%	72.42%

Note. Cut-off points were changed to 35 for the African American sample by Lee (2015), and 32 for Belgian and Spanish samples in Lopez-Fernandez (2017).

The high levels of addicted smartphone use in the current study seem to raise some

concern regarding the published thresholds for addiction in the SAS-SV. It seems that

the cut-off points at the mid-point of the scale (31 or 33 out of 60) may not always be reliable, since the results from the current study show inconsistency between the scores and the narrations of participants in both countries. One British student reported that smartphone use is not always problematic and it depends on the specific function or purpose. Both the Chinese and British students reported both positive and negative impacts of smartphone use. Thus, it seems that scales measuring PSU should be designed based on specific functions (e.g. social media) rather than general statements of PSU. This indicates an important direction for future studies, especially on measurement development for PSU or other behavioural addictions.

Chapter 8 Discussion

8.1 Summary of the findings

The aims of this thesis were as follows: 1. to investigate the prevalence of PSU among Chinese undergraduate students, 2. to investigate the hypothesised relationships between PSU and academic anxiety, academic procrastination, self-regulation and life satisfaction, 3. to explain this relationships (if observed) and explore the antecedents and consequences of PSU through qualitative study, 4. to compare the situations in China and UK.

This thesis has identified very high levels of PSU (i.e. the sores for the scale measuring PSU) among Chinese undergraduate students. Using the published thresholds for smartphone "addiction", the percentage of "addicted" smartphone users was higher for the Chinese students than the British students. Chinese students also scored higher in the Smartphone Addiction Scale-Short Version (SAS-SV; Kwon, Kim et al., 2013) in the questionnaire than samples with different cultural backgrounds surveyed in other research (e.g. Korea, German, etc). Self-reported PSU appears to be a bigger issue for Chinese undergraduates than for undergraduates in a range of other countries, including the UK. Females reported significant higher levels of PSU than males in both countries. Among the Chinese participants, the hypotheses were mostly supported as proposed and PSU was found to be associated with mental health and well-being (e.g. anxiety, low life satisfaction) and regulation (e.g. procrastination and poor self-regulation). PSU appeared to play a mediating role in associations between these

variables. However, those relationships as a whole map (i.e. the model) seems to work only for the Chinese students but not for the British students. Qualitative data show similarities of self-reported PSU and its antecedents and consequences between China and UK. Chinese mentioned more about their difficulties with transition from high school to university, as they had difficulties controlling themselves with smartphone use in the university.

8.2 Implications

8.2.1 Implications for the field of behavioural addictions

8,2.1.1 Theoretical implications:

8.2.1.1.1 Contribution to the theoretical models

The quantitative and qualitative findings in this thesis offer several implications: 1. new potential frameworks for PSU based on the modified hypothesised model, 2. a potential contribution to existing theoretical models of problematic mobile phone use (Billieux, Maurage et al, 2015); Generalised Internet Addiction (GIA; Brand et al., 2014) and Pathological Internet Use (PIU; Davis, 2001).

The path model with good fit in the main study shows the complex single directional relationships between PSU and the other variables. However, the qualitative findings indicate that the relationships may be bidirectional. For example, anxiety

(especially during class and learning) or procrastination could be an antecedent of PSU (irrelevant use in class or learning). One example could be:

Last time, we had an experiment report to write. My roommates didn't know how to start. They wanted to watch some TV series (using smartphone) for relaxation first. Once they started watching, they couldn't stop.(Chinese Female, 20, SAS-SV score: 50)

In this scenario low self-regulation (or procrastination) is mentioned as a key factor that leads to PSU. As shown in Figure 8.1, self-regulation was also a key factor in the modified model since it predicted all the other variables with significance. Thus, it seems possible to modify the model into another format as shown in Figure 8.2. In the new hypothesised model, academic anxiety results in procrastination and PSU. Procrastination in this context serves to avoid exposure to situations that generate anxiety. Self-regulation might moderate the link between academic anxiety and procrastination. The less you are able to self-regulate, the more you will be tempted to procrastinate. Since life satisfaction was not significantly predicted by PSU in the model with good fit, it is not included in the new model. However, in a follow-up analysis, this model was tested in AMOS using SEM (for full details see Appendix H), but no significant interaction effect was found and the model fit was not good.
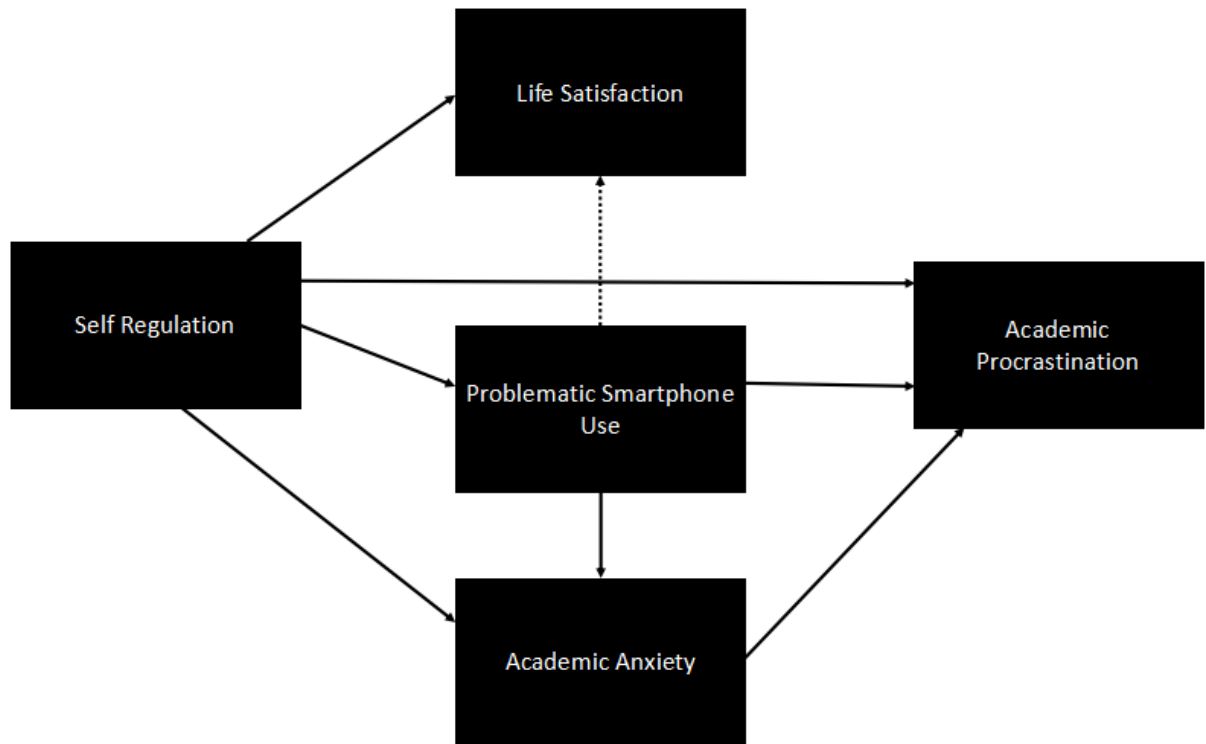
Figure 8.1: The modified model with good fit with the Chinese sample
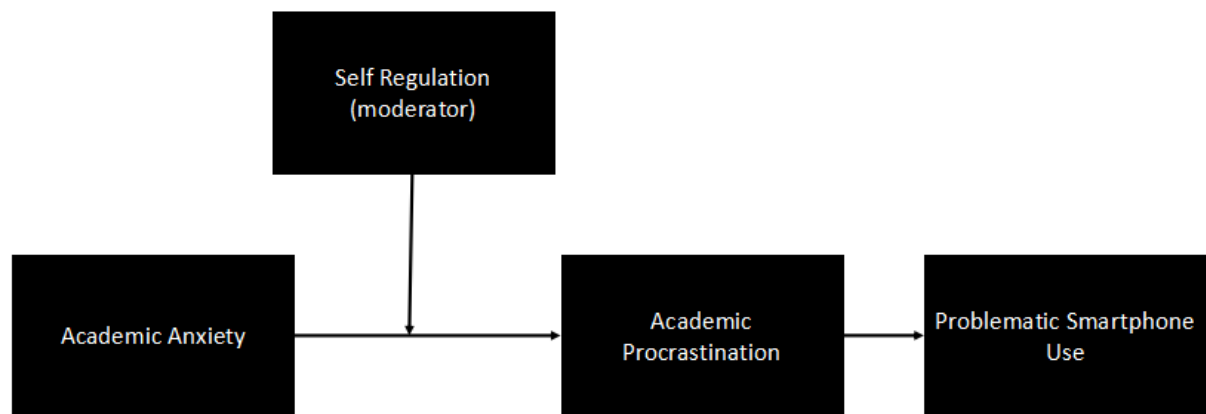
Figure 8.2: New hypothesised model based on qualitative findings

Note. No significant interaction effect was found, and the model fit was not good.

The pathway model of problematic mobile phone use proposed by Billieux, Maurage et al (2015) suggested that anxiety symptoms and low self-control are antecedents of problematic mobile phone use. In line with this, in the research reported in this thesis, PSU was found to be significantly correlated with academic anxiety and self-regulation. In the best fitting model PSU in Chinese undergraduates was significantly predicted by self-regulation and, in turn, acted as a significant predictor of academic anxiety. This indicates that the relationship between problematic mobile phone use and anxiety noted in the Billieux, Maurage et al (2015)'s pathway model might in fact be bidirectional. Evidence for a bidirectional relationship can also be found in the qualitative findings reported in Chapter 6. Both Chinese and British participants reported that PSU can lead to anxiety in academic situations, and anxiety (e.g. anxiety in class) can also lead to PSU. Thus, there might exist a "feedback path" from the symptoms to the established risk factors (i.e. antecedents), as shown in Figure 8.3. However, as the established risk factors in Billieux, Maurage et al (2015) includes personalities (e.g. aggressive traits, neuroticism), the new path being suggested here only refers to negative affect, including anxiety. Another contribution to this model might be some external antecedents for PSU. The Chinese interviewees reported external reasons for PSU including teachers' quality of instruction, course design and the gap between high school and university. There seems to be another potential pathway, the "environmental pathway", in Billieux, Maurage et al (2015)'s model, as shown in Figure 8.3. However, the environmental pathway may well be situation specific since the themes emerged in this thesis were in academic contexts. The

education transition factor, for example, might only be suitable for specific groups of people (i.e. Chinese undergraduates). Thus, cultural factors might be usefully included in Billieux et al.'s (2015) environmental pathway.
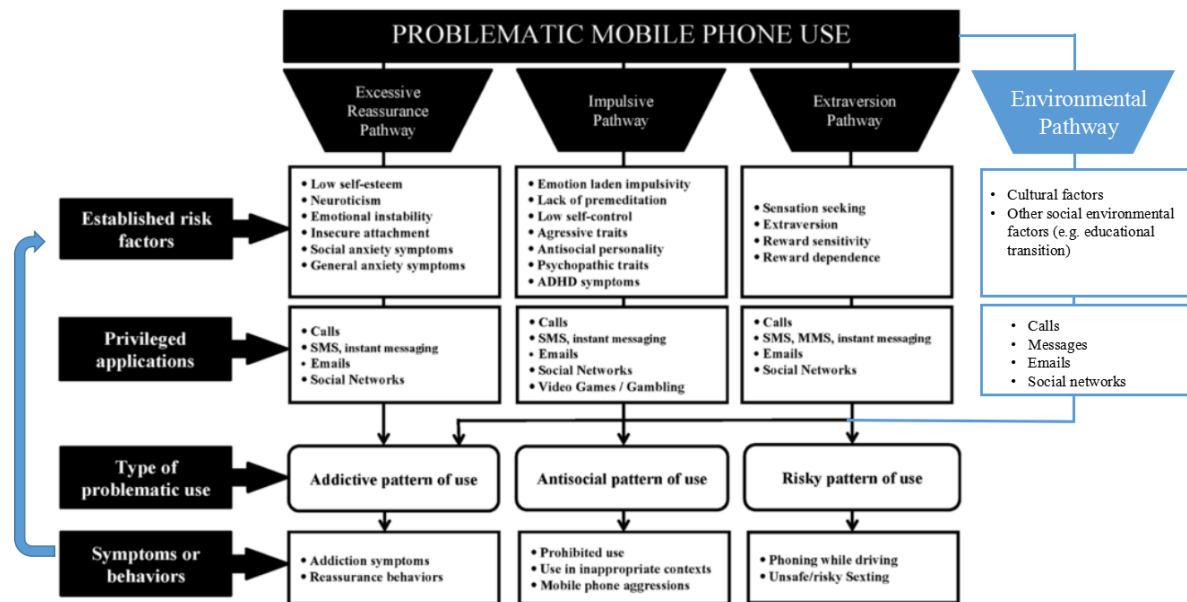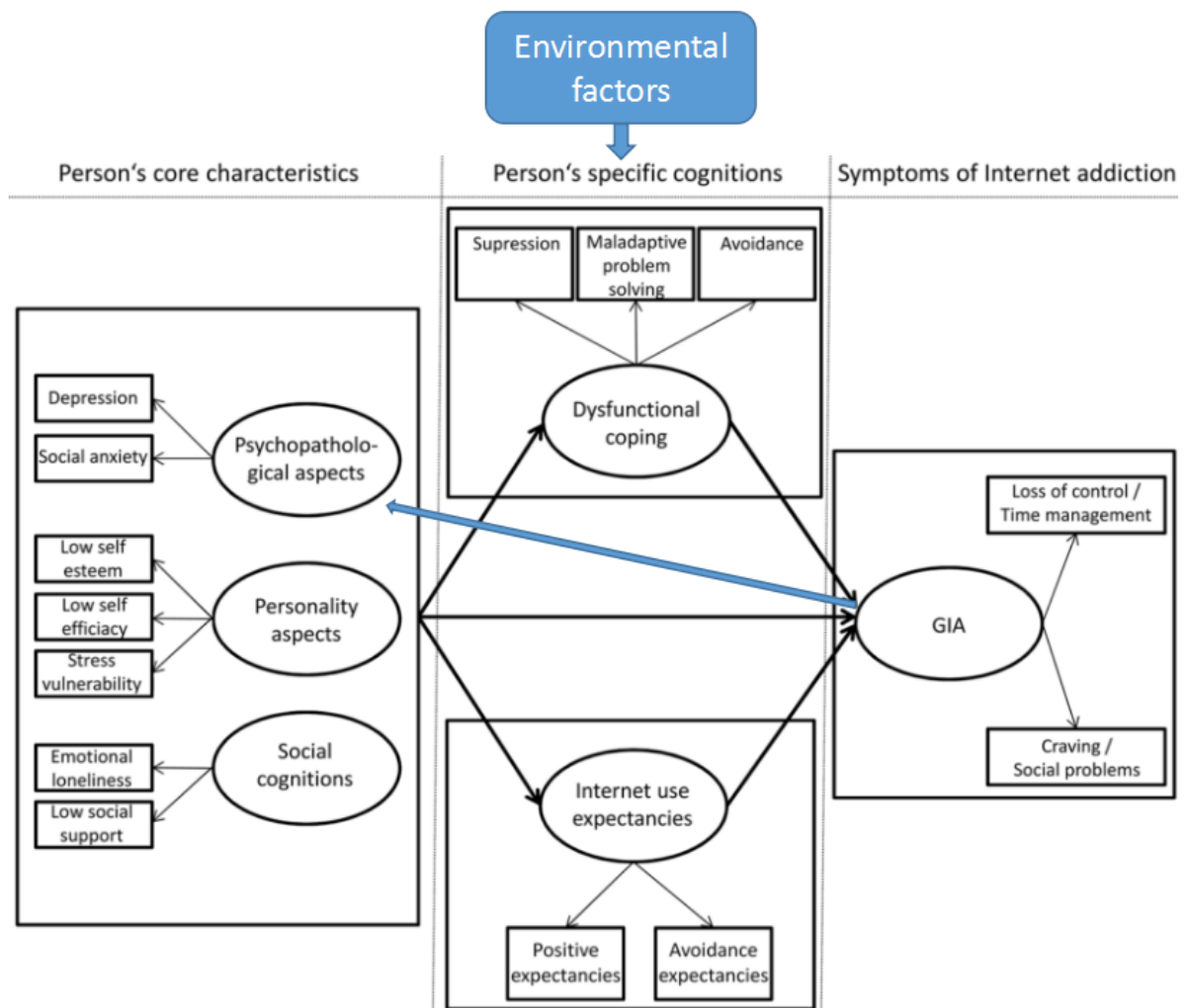

Figure 8.3: Contribution to Billieux, Maurage et al (2015)＇s model

Note. Additions suggested by the current research are presented in a different colour

Findings in this thesis might also contribute to existing models of problematic Internet use since smartphone use is largely based on access to the Internet. One well known cognitive-behavioural model of PIU (Davis, 2001) only shows a feedback path from behavioural symptoms of PIU to maladaptive cognitions. Similar to the discussion of Billieux, Maurage et al (2015)'s model, PSU might predict anxiety in a bidirectional relationship. It seems possible to add a "feedback path" from behavioural symptoms to psychopathology including anxiety as antecedents of PIU (shown in Figure 8.4).

Furthermore, it seems possible, again, to add "environmental factors" as antecedents of

the maladaptive cognitions in the model.
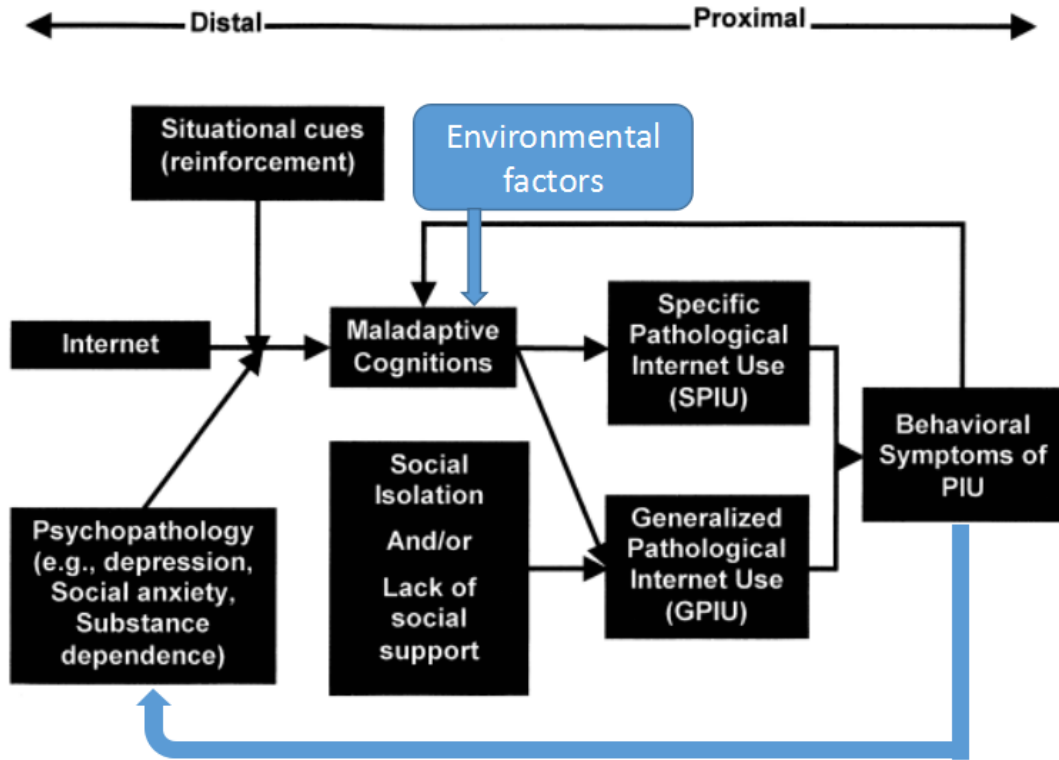
Figure 8.4: Contribution to Davis (2001)'s model

Note. Additions suggested by the current research are presented in a different colour

Similar reinforcements might be added to the model on Generalised Internet

Addiction (GIA; Brand et al., 2014). "Extra paths" might be added from the symptoms

of GIA back to psychopathological aspects considering the bidirectional relationship

between PSU and anxiety identified in this thesis (shown in Figure 8.5). However, it is

necessary to note that anxiety identified in this thesis might be situational specific

anxiety or state anxiety since the anxiety symptoms were reported specifically in

academic settings. An extra section of "environmental factors" including cultural

backgrounds or societal institutions (e.g. education system) could also be added to the

model as antecedents of person's specific cognitions. One of the reasons for this added

path could be the difficulty in education transition, which was mentioned only by the

Chinese students but not the British students. "Environmental" instead of "cultural" is

used here since societal institutions or contextual factors might mediate the relationship

between culture and individual values (Schwartz, 2014).

Figure 8.5: Contribution to Brand et al. (2014)'s model

Note. Additions suggested by the current research are presented in a different colour

Furthermore, the results in this thesis seem to support the "general-specific" classification approach mentioned in Davis (2001) and Brand et al (2014), which described pathological Internet Use and Internet addiction as both generalised and specific. It seems possible to classify PSU into generalized PSU and specific PSU. The qualitative findings in both Chinese and British students show that PSU was reported in either specific use of smartphone applications (e.g. Facebook, twitter, WeChat) and general use of smartphone in gatherings, classes, parties or other anti-social situations. These results seem to be linked with the discussions about generalised and specific Internet use in Brand et al. (2014) and Davis (2001). Thus, based on the results of this thesis and the available theories, PSU might be considered from two perspectives: generalised PSU and specific PSU. Specific PSU refers to the problematic use of certain functions in smartphone (e.g. social media), while generalised PSU might be beyond the area of behavioural addiction and associated closely with other mental health issues (anxiety) or regulation issues (procrastination).

8.2.1.1.2 Link with the six-component framework of addiction

As discussed in previous chapters, Chinese students scored higher in the SAS-SV than British students and also samples from different countries reported in the literature. It shows that Chinese students perceive their smartphone use as more problematic than others do, although it remains unclear whether their scores truly reflect

a more problematic level of smartphone use. Interviews with Chinese participants suggested that their words were often not consistent with their scores. For example participants with higher scores may reported they did not overuse smartphones. This raises the question of how reliable the SAS-SV addiction thresholds are. However, in both the questionnaires and the interviews, Chinese participants reported symptoms reflecting five of the six components of addiction (i.e. salience, mood modification, tolerance, withdrawal symptoms, conflict and relapse) suggested by Griffiths (2005; 2017). The six-component framework for addiction then does seem to be able to explain the situation reflected by both the quantitative and qualitative data in China to some extent. The details of the links with the six components are discussed in Chapter Six.

Griffiths (2002) argued that one's behaviour could be defined as addiction only when all of the six components were identified. Therefore, according to this framework of addiction, it seem inappropriate to label Chinese students as addicted users since none of them showed all of the six components of addiction. Although the quantitative findings indicate the relationship between PSU and negative well-being (anxiety and life satisfaction) or regulation issues (procrastination and self-regulation), this perhaps only reflects some of the symptoms (i.e. salience and mood modification). Overall, the six-component framework of addiction by Griffiths (2005; 2017) seems applicable to explain the symptoms of the Chinese students' PSU, though none of the students can be diagnosed as addictive. The self-reported PSU and correlates among the Chinese students were linked with some of the components of addiction except for the relapse component with uncertainty.

8.2.1.1.3. The ongoing debate of "smartphone addiction"

Since the terms "technology addiction" (Griffiths, 1995) and "Internet addiction" (Griffiths, 1996; Young, 1998a; 1998b) were proposed, smartphone or mobile phone addiction have been used and investigated in many studies during the last two decades (e.g. Hong et al., 2012; Leung, 2008; Wang et al., 2014). In line with this, in the current research both Chinese and British students used the words "addiction" or "disease" to describe their smartphone use. Billieux, Philippot et al. (2015), by contrast, have made a case that dysfunctional use of mobile phones may be over-diagnosed, or inappropriately defined, as a behavioural addiction. Griffiths (2005; 2017), however, argues that any behaviour can be defined as an addiction if all of the six components of addiction are identified. A recent review (Panova & Carbonel, 2018) argued that it is more suitable to use the term "problematic/maladaptive smartphone use" than smartphone addiction, pointing out that there is insufficient evidence to support the existence of 'smartphone addiction'. This suggests that smartphone addiction is not easy to diagnose. Overall, results in this thesis seems to support the use of the term PSU rather than "smartphone/mobile phone addiction".

Findings presented in this thesis suggest that specific functions or applications in smartphones should be considered when investigating smartphone or mobile phone use. Participants' words clearly show that smartphones are beneficial in their lives. They can search useful information, study, make payments, and communicate with

others through smartphones. Although smartphone use can lead to several negative outcomes, it also has highly useful functions and can offer positive benefits. Regardless of the debate about labeling PSU as an addiction or not, it seems more important to focus on the specific functions of smartphone (e.g. social media, games or other applications), because a smartphone is only a tool for the functions (similar to gambling machines are tools for gambling). Furthermore, both Chinese and British students mentioned that other activities (e.g. chatting and reading magazines) or electronic devices (e.g. tablets and laptops) providing similar functions might be alternatives to smartphones. Examples are as below:

Even if you don't have smartphone, you might also want to touch something else. Sometimes you might find something to eat when you don't have a smartphone at hand. Or you may chat with the others, read a novel or magazines in paper. In high school, we didn't have smartphones. Someone read paper magazines for irrelevant content. So, I think distraction is not related to smartphones but yourself. (Chinese, Female, 19, SAS-SV score: 36)

In class I see a lot of people using laptops to check social media - this then looks to the teachers like they are taking notes. However this seems to be a way of accessing smartphone features / apps through another device - if it were allowed / not considered rude to be on smartphones in class these would probably be used instead. In terms of daily lives , I rarely seem to see people glued to their phone when they are in social groups , but when they are alone in a public setting people (perhaps under the age of 40) will be on their smartphone. (British Female, 21, SAS-SV score: 30).

It indicates that the problem is not the smartphone itself but the distracting things you can do on smartphones (and similar devices) or off smartphones (e.g. reading magazines). Therefore, it seems that the term "smartphone addiction" could be challenged not only on "addiction" but also on the word "smartphone". It is the use of specific functions (e.g. social media) or poor self-regulation that cause the problems.

Furthermore, it seems necessary to consider the other topics (e.g. escapism and social anxiety) beyond the topics in behavioural addiction. British students mentioned that a smartphone can be a tool to escape from the real world:

As an introvert, my smartphone becomes a defence/somewhere to hide when I am anxious in public. (British Female, 25, SAS-SV score: 32).

To escape (through apps but mostly listening to music), as a social crutch. (British Male, 21 yrs., SAS-SV score: 42).

Not only anxiety in public, anxiety in academic situations were also reported. Both Chinese and British students noted that they use their smartphones when they could not understand the class or when they felt anxious or bored during learning. As quoted above, Chinese students mentioned that they might do something else (e.g. reading magazines or chatting) as a distraction when their smartphone was not available. A smartphone is sometimes used as a tool to escape or distract from the real world. Chinese students also mentioned external reasons including teachers' quality, course design, and educational transition as antecedents of PSU. Therefore, PSU might be just a reflection of the other issues including poor self-regulation, social anxiety, academic anxiety, procrastination, other external reasons, etc. In other words, "smartphone addiction" might be one of the effects of something else, similar to fever as a symptom of some diseases.

8.2.1.1.4 Summary of the theoretical implications

In summary of the theoretical contributions, this thesis suggests the additions to existing theoretical models of problematic mobile phone use (Billieux, Maurage et al,

2015); Generalised Internet Addiction (GIA; Brand et al., 2014) and Pathological Internet Use (PIU; Davis, 2001). This thesis shows some links between self-reported PSU and the six components of addiction by Griffiths (2005; 2017). This thesis also contributes to understanding of the ongoing debate regarding the label "smartphone addiction". There could be several issues behind PSU including uncontrolled use of specific screen functions, poor self-regulation, escapism, social anxiety, etc. It might be possible to consider PSU as generalised PSU and specific PSU similar to the descriptions of Internet use in Brand et al. (2014) and Davis (2001).

8.2.1.2 Methodological implication:

8.2.1.2.1 Translation of the scale into Chinese and the validated shortened versions

The widely used SAS-SV was translated into Chinese and validated with large samples including a pilot study with 112 Chinese undergraduates and 475 in the main study. The Cronbach's alpha values were .77 in the pilot and .80 in the larger, main study, indicating good reliability of the scale. In order to use it in mainland China, item 8 of the SAS-SV was modified: "Twitter or Facebook" was changed into "WeChat or other social media." Chinese students do not commonly use, or have easy access to, Twitter or Facebook. A few studies have also used the SAS-SV among Chinese mainland undergraduate students (Chen et al., 2017; Jin, Sun, An, & Li., 2017) but have not mentioned the modification of "Twitter or Facebook". Thus, the reliability of those studies seem to be problematic. The translated and validated Chinese version of the

SAS-SV in the current thesis could be a practical and reliable version for future studies to use in mainland China.

8.2.1.2.2 Challenges regarding the thresholds for addiction in the SAS-SV

The case studies in Leon & Rotunda (2000) show that Internet overuse does not mean Internet addiction. In this thesis, both the Chinese and British participants' scores for the SAS-SV were not always consistent with their free response accounts of their own smartphone use. Several high scorers denied that they used smartphones problematically in their narrations, while some low scorers reported heavy use of their smartphone. It might reflect different individual perceptions on their smartphone use rather than the real situation of PSU. It also indicates the uncertainty of the reliability of the thresholds for addiction in the SAS-SV. Thus, it remains unknown whether the cut-off points were too low or too high. The reasons for this situation might be complex. Participants might give socially-desirable answers either in the SAS-SV or interviews and open questions. If they were not entirely truthful in the scales or narrations, the results may have been affected. Another reason might be the different self-awareness of smartphone use in different individuals. Some may perceive themselves normal and did not overuse smartphone but scored higher than the "addiction" point in the scale. However, the challenges for the SAS-SV does not mean the unreliability of the scale but the approach to diagnosing "addiction".

8.2.1.2.3 Mixed-methods design

The sometimes contradictory results between quantitative and qualitative data

indicate suggest that a mixed-methods design might be a reliable way of investigating PSU. Although there are several challenges in using mixed methods including the problems of the researchers' skills, time and resources, mixed methods research allows quantitative and qualitative data to make up for the weakness of one another (Creswell & Plano Clark, 2017). Mixed method designs offer the chance to gain insight and new information that neither quantitative nor qualitative data could offer alone (Creswell & Plano Clark, 2017). In this thesis, a mixed-methods design was applied to both Chinese and British undergraduates. Although the SAS-SV scores were shown to be inconsistent with some narrations, the quantitative and qualitative data showed potential links. For example, the relationship between PSU and anxiety, procrastination, self-regulation and life satisfaction were also shown in the interviews of the Chinese students. New themes emerging from the qualitative data confirmed the quantitative findings and enriched the findings of the whole thesis. Thus, this thesis indicates the advantages of applying mixed-methods design to the studies of behavioural addictions, specifically PSU.

8.2.1.2.4 Cross-cultural perceptions in the field of behavioural addiction

In Chapter 7, a cross-cultural design was applied to compare the Chinese and British groups. Similarities and differences were found between the two groups. Most of the patterns, antecedents and effects of PSU were similar. However, only the Chinese students reported the impact of the educational transition from high school to university, while the British students did not mention this point. This indicates there may be an important difference between the two countries which can explain some cultural differences between east and west. As discussed in Chapter 7 the results of this thesis

are in line with the other studies in different cultures, suggesting that Chinese students do tend to score higher than others on measures of PSU. This thesis makes a potential contribution to cross-cultural comparative studies in the field of behavioural addiction.

Several researchers have cast doubt on the validity of doing cross cultural studies using self-reported measurements. Heine, Buchtel & Norenzayan (2008) found that behavioural and demographic predictors of conscientiousness (one personality), including postal efficiency, people's walking speed and GDP), had strong and stable correlations with perception of national character (PNC) but not with self-reported conscientiousness. They claim that self-reported scores for personalities cannot reflect the real situations in a certain country, indicating that cross national studies should use PNC questions rather than self-reported scales. However, self-reported PSU in this thesis is not the same as self-reported personality or traits (e.g. conscientiousness). It is unknown whether the situation in personality research (Heine et al., 2008) is likely to be the same in the studies of behavioural addictions.

Fischer and Schwartz (2011) argued that culture cannot determine values. They found value priorities were similar across countries. Schwartz (2014) argued that cultural and individual values are different, and can be mediated by societal institutions/systems (e.g. family, education, legal system). The different individual values identified in cross cultural studies might represent individual differences rather than cultural differences. However, self-reported PSU in this thesis is not same as measures of self-reported values. The situation in Fischer and Schwartz (2011) with value priority could be different in this thesis focusing on self-reported behaviour. It

remains unclear whether different scores for the SAS-SV across China and UK represents a difference across countries or individuals. However, it is noteworthy to say that the societal institutions mentioned in Schwartz (2014) might be a potential issue in this thesis. Since the Chinese students reported their difficulty in adapting to university after a sharp educational transition, different educational contexts between China and the UK may be one reason for the differently reported levels of PSU.

Measurement invariance is another emerging concern for the validity of cross cultural studies raised by methodologists (Milfont & Fischer, 2010; Van de Vijver & Leung, 2000). Milfont & Fischer (2010) argue that it is not meaningful to compare groups across cultures when measurement invariance cannot be established. Establishment of measurement invariance requires non-significant $\Delta\chi^2$ in multi-group confirmatory factor analysis (MGCFA). In this thesis, measurement invariance could not be established for the SAS-SV across the Chinese and British samples (see 7.3.4.3 in Chapter Seven). Thus, it might be inappropriate to compare the scores for the SAS-SV between the two groups according to the measurement invariance model.

However, cross cultural studies only focusing on statistical measurement invariance also have limitations since they might ignore alternative interpretations. Van de Vijver & Leung (2000) call those studies generalization studies and theory-driven studies (among their proposed four types of cross cultural studies including generalization studies, theory-driven studies, psychological differences studies and external validation studies), which are hypothesis testing studies focusing on the universality of particular structures or measurement invariance. The cross cultural study

in this thesis could be described as psychological differences study in Van de Vijver & Leung (2000)'s terms, which focuses mainly on exploration. One of the advantages of psychological differences studies could be an open-mindedness about cultural differences. Thus, from a more open perspective outside of the strict measurement structure, it seems that the failure of measurement establishment in this thesis could also be a reflection of cultural difference. Chinese and British students might answer the questionnaires in different patterns, and their overall levels of PSU were clearly different.

8.2.1.3 Practical implication:

The findings in this thesis indicate the potential problem of smartphone use especially among Chinese undergraduates. Chinese participants reported significantly higher scores for the SAS-SV than British students. Although the thresholds for addiction may, as discussed, be unreliable, the higher levels of self-perceived PSU and significant correlations with anxiety, procrastination and well-being still suggest the potential harm of excessive smartphone use to the Chinese students. Results emerging from the interviews also indicate negative consequences of smartphone use among Chinese students. PSU among Chinese students might be related to two main issues: regulation (self-regulation, academic procrastination) and mental health (academic anxiety and life satisfaction). As reported by the Chinese students, the management and learning contexts between high school and university are totally different in

mainland China. They noted that they have difficulties regulating themselves well after the sharp education transition from an environment that was highly rule-driven to one in which there is more freedom and fewer restrictions. Thus, there is a potential need for prevention or training programmes for PSU or problematic Internet use, or managing screen time among undergraduate university students in general, but Chinese students in particular.

8.2.1.4 Summary of the implications for behavioural addictions

This section has discussed the theoretical, methodological and practical implications of the current research to the field of behavioural addictions. This thesis confirms several relationships suggested in extant theoretical models and makes a potential contribution to those models by Billieux, Maurage et al (2015), Brand et al. (2014) and Davis (2001). The PSU of the Chinese students could be largely, but not entirely, explained by the six-component framework of addiction by Griffiths (2005; 2017). It also seems that PSU could be classified into generalised and specific PSU. However, it remains unclear whether Chinese students who exceeded the threshold for addiction are in fact 'addicted' smartphone users. Results from this thesis challenge the use of the term "smartphone addiction". Problematic use of specific functions of smartphones might be the essential issue, and the underpinnings of PSU, including anxiety and environmental or cultural factors, should be seriously considered. Methodological implications include the translated and validated Chinese version of

the SAS-SV, challenges for the thresholds in the SAS-SV, mixed-methods designs and cross-cultural perspectives. Practical implications include prevention and training programmes for PSU especially among Chinese undergraduates.

8.2.2 Implications for topics in psychology in education

8.2.2.1 Academic anxiety:

8.2.2.1.1 Comparing current findings to extant literature

The hypothesised relationship between PSU and academic anxiety was confirmed in this thesis. Significant and positive correlations were found between PSU and academic anxiety. A significant predictive path from PSU to academic anxiety was identified in the best fitting model presented in Chapter 5 among Chinese students. Qualitative findings also suggest a bidirectional relationship: academic anxiety could be either an antecedent or an effect of PSU. These findings are in line with the results of several empirical studies looking at the relationship between anxiety and PSU/mobile phone addiction/mobile phone dependence (e.g. Ha et al., 2008; Hong et al., 2012; Huang et al., 2013; Hussain et al., 2017; Jenaro et al. 2007; Leung, 2008; Wang et al., 2014; Yang & Lay, 2011). It is necessary to note, however, that the anxiety variable in these studies was typically general anxiety disorder rather than academic anxiety. For example, Hussain et al. (2017) measured anxiety using the short form of the Spielberger State-Trait Anxiety Inventory (STAI). As discussed in previous chapters, no existing study has explored PSU and anxiety in academic contexts (i.e. academic

anxiety), although many studies have been conducted among university students (e.g. Hong et al., 2012; Jenaro et al., 2007). This thesis investigated academic anxiety in three specific academic contexts (class, learning and test) and therefore addressed this research gap.

8.2.2.1.2 Theoretical implications

The relationship between academic anxiety and PSU identified in this thesis confirmed the path from "state anxiety" to "defense mechanism" and "behaviour" in the schematic diagram of the classic Trait-State Anxiety Theory by Spielberger (1972a). In an academic context, PSU might be the "defense mechanism" and "behaviour" described by Spielberger (1972a) caused by state anxiety. The "state" here might be the three academic situations including class, learning and test. In other words, the relationship between PSU and academic anxiety identified in this thesis reflects the classic anxiety theory by Spielberger (1972a) when smartphone use can be regarded as a defense mechanism. Maybe about half a century ago, when no smartphones were used, that "behaviour" described in the theory might reflect other distracting or coping activities (e.g. listening to the radio).

Results of this thesis also make a potential contribution to Pekrun (2006)'s control-value theory of achievement emotions, in which academic (achievement) anxiety was one of the achievement emotions. Pekrun (2006) argued that achievement emotions could affect learning strategies and self-regulation of learning. It was discussed in previous chapters that PSU might represent a failure of self-regulation or

poor learning strategies. That hypothesis was supported by the data as PSU was found to be associated with academic anxiety and this association appears to be bidirectional. It seems that this relationship could be explained by Pekrun (2006)'s model (i.e. the reciprocal link between emotions and learning). Furthermore, Pekrun (2006) clearly noted the impacts of design of learning and social environment on achievement emotions. In line with this, the effect of environment (teacher, course, peer, education transition, etc.) on PSU identified in the interviews can also be reflected in this theoretical model.

8.2.2.2 Procrastination:

8.2.2.2.1 Empirical implications

The hypothesised relationship between PSU and procrastination was confirmed. In the pilot study, PSU was significantly correlated with academic procrastination. Bidirectional relationship was identified in regression analysis. The main study with Chinese undergraduates also found a significant correlation ($r^2 = .13$). PSU significantly predicted academic procrastination in the model. These results are well aligned with several empirical studies. For example, procrastination has been found to be associated with Facebook use (Sahin, 2014) and problematic Internet use (Odaci, 2011). Leung & Liang (2016) found procrastination was a significant predictor of PSU, which is reverse to the predictive relationship shown in Chapter Five. Qualitative findings also indicate that the relationship could be bidirectional. Therefore, results from this thesis make an

empirical contribution to our understanding of the relationship between procrastination and PSU.

The hypothesised relationship between academic anxiety and academic procrastination was also supported in this study. In line with several empirical studies looking at procrastination and anxiety (e.g. Cassady & Johnson, 2002; Fritzsche et al., 2003; Klassen et al., 2009; Solomon & Rothblum, 1984), this study found a significant correlation between academic anxiety and academic procrastination ($r^2 = .15$). The significant path from academic anxiety to academic procrastination in the model presented in Chapter Five suggests a predictive relationship. Thus, results from this thesis have contributed to understanding of the association procrastination and anxiety.

8.2.2.2.2 Theoretical implications

The relationships found between PSU, self-regulation, life satisfaction, academic anxiety and academic procrastination potentially contribute to Schraw et al. (2007)'s theoretical framework of academic procrastination. One of the antecedents of procrastination in the model was personal organisational skills, which can be viewed as similar to self-regulation, as a predictor of academic procrastination. Schraw et al. (2007) noted that one of the coping strategies of academic procrastination is stress reduction (physical and psychological). In line with this, PSU may represent a strategy of stress reduction that is significantly correlated with academic procrastination. This was also clearly pointed out in the qualitative data that participants used smartphones to relieve and reassure themselves. Decreased quality of life was one of the

consequences of academic procrastination described in Schraw et al. (2007). In line with this, in this thesis, life satisfaction was significantly and negatively correlated with academic procrastination. However, the idea of increased quality of work as a consequence of procrastination in Schraw et al. (2007) was not supported in this thesis. One participant reported that the quality of their academic work was reduced by their procrastination and PSU. It would be interesting to explore whether this is widely perceived as a problem. Fear of failure was one of the maladaptive characteristics of procrastination in Schraw et al. (2007), which is supported by the relationship between academic anxiety and academic procrastination identified in this research.

8.2.2.3 Self-regulation

The hypothesised relationship between PSU and self-regulation was supported. A few extant empirical studies have identified a relationship between addictive smartphone use and self-regulation (Gökçearslan et al., 2016; Van Deursen, et al., 2015; Wei et al., 2012). In line with them, the current research identified a significant correlation between self-regulation and PSU, and a significant predictive path from self-regulation to PSU in the model for Chinese students. Self-regulation was a significant predictor of academic anxiety, academic procrastination and life satisfaction in this model. Qualitative findings from both Chinese and British students also indicate the significance of self-regulation in undergraduates' academic lives. Different from self-regulated learning tested in Wei et al. (2012), however, self-regulation represented

self-control on general activities not only for learning. In other words, the SRS used in this study asked about self-control on wider activities not only learning. An example item from the SRS used in this thesis is "I stay focused on my goal and don't allow anything to distract me from my plan of action". Thus, it indicates that for the undergraduates, the issue of self-regulation was not only a problem of learning strategy but also about the ability of controlling on personal behaviours.

For the Chinese students, the huge gap between high school and university management might be an explanation for poor self-regulation. They felt they could be free in university and relax after their busy high school years. Smartphone time was reported as a "gift" for themselves. In high school they were teacher-regulated or school-regulated most of the time. By contrast, the loose management in university may have challenged their self-regulation and this may partially explain the high levels of PSU observed. Problems including PSU, academic anxiety, procrastination occurs with poor self-regulation. Therefore, this thesis emphasized the importance and potential negative effects of self-regulation in undergraduate university students, especially Chinese students.

8.2.2.4 Subjective well-being

The hypothesised relationship between PSU and life satisfaction was supported. Previous studies have presented different findings regarding this relationship. Samaha & Hawi (2016) and Lepp et al. (2014) found no significant correlation between life

satisfaction and smartphone addiction or time spent on cell phones, while Kross et al. (2013) found Facebook use had a negative effect on life satisfaction. In this thesis, PSU was significantly correlated with life satisfaction in both Chinese (R^2=2.56%) and British students (R^2=2.25%), but this relationship small and was not significant in the best fitting model. The qualitative findings suggest that PSU affected participants' social relationships and personal emotions and wellbeing (e.g. anxiety, poor physical health), but not necessarily the broader idea of life satisfaction. Thus, as a potential contribution to the empirical studies on this relationship, this thesis indicates that the relationship between life satisfaction and PSU exists among undergraduates, although it appears to be small and further research on different aspects of wellbeing is required. Students' well-being can potentially be associated with their use of smartphones but the relationship is not clear. Well-being or life satisfaction was not directly mentioned in qualitative responses to the current study, while several reflections of well-being including social relationships, privacy safety, physical health and anxiety were reported as the effects of PSU. This indicates the plausible existence of potential mediators or bridge variables (e.g. anxiety, poor social skills) between PSU and life satisfaction. This might explain the findings of Samaha & Hawi (2016) and Lepp et al. (2014), which indicate stress and anxiety were potential bridge variables between PSU and life satisfaction.

8.2.2.5 Cross-cultural perspectives in the topics of psychology in education

As discussed in the cross cultural study, there is a difference in behavioural profiles between Chinese and British undergraduates. The quantitative element of the cross-cultural study between British and Chinese undergraduates identified significantly different levels of academic anxiety, academic procrastination and life satisfaction in these two groups. The British students reported higher levels of academic anxiety and academic procrastination, but also higher levels of life satisfaction than the Chinese students did. The cultural difference was especially obvious for life satisfaction with a large effect size, $d = .84$. No significant difference was found for self-regulation.

The cultural differences identified in this thesis have potential implications for our understanding of academic anxiety, academic procrastination and life satisfaction. British students tended to perceive themselves as more anxious about academic tasks. It might be the effect of the gap between high school and university in the UK, that is, university education represents a 'step up' from high school education. However, in a cross-cultural study between Chinese and German middle school students, Chinese students reported significantly higher levels of achievement-related mathematics anxiety than German students (Frenzel, Thrash, Pekrun, & Goetz, 2007). This indicates that cultural differences across different cultures can be complex. Also, they might represent either individual difference or cultural difference as Schwartz (2014) argues that same culture does not mean same individual value. It also seems necessary to note that the differences in anxiety could be problematic, since Heine et al (2008) argue that self-reported aspects of personality might be unreliable in cross cultural studies.

Pekrun (2006) suggests that achievement emotions (including anxiety) could be affected by social environments including classroom instructions, autonomy support, achievement feedback and cultural values. Thus, according to Pekrun (2006)'s theory, the possible reasons for the gap in academic anxiety between the Chinese and British students may involve several aspects of cultural difference. It could be different cultural values similar to the different values for PSU, or different "societal institutions" mentioned in Schwartz (2014) including education systems, teaching quality, course design or other environmental differences between universities across the two counties. However, these points were not directly reflected in the qualitative studies. Both the Chinese and British students reported that they were not satisfied with their teachers' class instruction or management and turned to smartphones when classes were unsatisfactory. However, only the Chinese students reported they were more relaxed in university because they needed a break after their busy and stressed high school lives, while the British undergraduates did not mention any differences or changes between their current study and high school. Therefore, it seems that the British students maintained their attitudes towards learning and keep on their anxiety for academic tasks, while the Chinese tended to lose some academic tension at the less intense university stage. The significant higher levels of academic procrastination among British students might also reflect this point. British students tended to have higher expectations on their efficiency and were more sensitive to procrastination activities.

The significant and large gap in life satisfaction between the Chinese and British undergraduates was another key finding. British students tended to be much more

satisfied with their lives, in spite of their higher rates of academic anxiety and procrastination. However, the SWLS only measured a limited aspect of subjective well-being, excluding positive and negative affect, other facets of psychological (e.g. anxiety, depression) and physical well-being. Thus, it only reflects one aspect of well-being – life satisfaction - on which the two groups of undergraduates may differ. Furthermore, besides the content of the measurement, another possible reason for the difference might be the social/national backgrounds in China and UK. Self-perceived life satisfaction might be affected by different social backgrounds other than culture-specific issues. Schwartz (2014) points out that societal institutions/systems (e.g. education, political or marketing systems) might be mediators between culture (as a latent construct) and individual values. Van de Vijver & Leung (2000) also emphasized the importance of including contextual factors in cross cultural studies in order to obtain open and alternative interpretations. Nevertheless, it remains unclear whether this gap can be a result of different cultural values for life or other social environmental factors. Overall, the findings in this thesis may contribute to the understanding of university students' self-regulation, anxiety and well-being from a cross-cultural perspective.

8.2.2.6 Practical implications

Results from this thesis suggest that training programmes or interventions for undergraduate university students, especially for junior Chinese undergraduates (considering the clear cultural difference compared with the British students) may

potentially be valuable. Several mental health issues and self-regulation issues associated with PSU were identified in this thesis. It seems possible that more undergraduates will potentially be confronted with psychological issues in their academic lives. Academic anxiety and procrastination were found to be potential consequences of PSU and can also lead to PSU in bidirectional relationships. Self-regulation was a significant predictor of PSU, anxiety, procrastination and low life satisfaction. It suggest a potential need for training programmes on skills such as self-regulation and overcoming academic anxiety and procrastination for the Chinese undergraduate students. For example, it might be useful for the university to provide training sessions on overcoming anxiety and academic procrastination with special focus on their self-regulation on irrelevant behaviours (e.g. PSU). Considering the results of the cross-cultural comparison and the Chinese students' problems of adapting to university lives smoothly after high school, it seems especially necessary to provide help for those Chinese new undergraduates in their first and second years. For example, it might be helpful it the university could provide special programmes or interventions on overcoming mental health issues (e.g. academic anxiety) at the beginning of the first year for all new undergraduates.

8.2.2.7 Summary of the implications for topics of psychology in education

In this section, the theoretical, empirical and practical implications for topics in psychology in education (academic anxiety, academic procrastination, self-regulation

and life satisfaction) are discussed. As empirical contributions, the findings of this thesis confirmed the relationships proposed in the literature review chapter between PSU and the variables as above. The results may also make a potential contributions to theoretical models of anxiety and procrastination and contribute to understanding of these topics from a cross-cultural perspective. Practical implications include the potential need for interventions or progammes for mental health issues among new Chinese undergraduates.

8.2.3 Implications for other aspects of education

This thesis identified several issues beyond the field of behavioural addictions and academic emotions, especially in Chinese universities, including high school student management, university student management, effective teaching, university course system, Chinese students' attitudes to university life, etc. However, it is necessary to note that these emerging themes are based on a small number of interviews and require substantial further research.

First, high school management in China could be an issue that needs more attention. Since the Chinese interviewees reported their problems with adapting to university life, the gap between high school and university may represent an emerging issue in China. Student management was described as too strict in high schools and too lax in universities. Smartphone use is strictly managed or forbidden in Chinese high schools. The Chinese interviewees reported they could only play with smartphones

during weekends or to make phone calls to their family on weekends. Although there seems to be some sense of complaint in the interviewees' words, it is hard to state the restriction of smartphone was totally negative since the students had fewer sources of distraction. Considering the importance of Gaokao (the university entrance exam in mainland China), strict management (including smartphone use management) seems to be reasonable for the high schools. However, strict management does not necessarily equate to effective management. As reported by one Chinese interviewee, except for smartphones, they had other ways of distraction including magazines and novels. Their problem was self-regulation rather than smartphones. This continuing problem would probably be reflected in uncontrolled smartphone use in universities. Therefore, it is necessary for Chinese high schools to focus more on students' self-regulation and related mental health issues, rather than simply strictly manage students as soldiers. This may allow students to develop the necessary self-regulation skills not to fall into a pattern of PSU when they have more freedom to choose how much they use their smartphone.

Second, poor student management in university in China was another potential issue. PSU, especially irrelevant use of smartphones during class (e.g. chatting, gaming), was frequently reported by the Chinese interviewees. Although smartphones were reported as a helpful learning tool, they were also recognized as a source of distraction. Teachers' poor classroom management was frequently noted as an antecedent for PSU. Several interviewees reported that the teachers were teaching either too slowly or too quickly and ignored the students' feelings. For example, one participant complained

that he had to teach himself in classes (using reference materials and smartphone applications to learn) since the teacher's instruction was not effective. It was not only the problem of smartphone use management but also the problem of effective teaching in a university class. Since several British participants also mentioned teachers' problems in class, it might be a general problem for universities. However, considering the difficulties in adapting to the sharp transition from high school to university, the management problems in university may be especially harmful to Chinese university students. Therefore, it is necessary for the Chinese universities to focus more on student management (e.g. classroom management) especially for new undergraduates.

Third, inappropriate course design and content in university was another problem mentioned by Chinese students. They frequently reported that they used smartphones to escape from classes when they did not like the content. Some of their classes were totally irrelevant to their major. For example, one participant reported that they had to select irrelevant courses for credit in order to graduate. These courses were operated by other departments but the students were forced to choose some of them as compulsory for graduation. Some students complained they could not understand the content of several courses, which could also be a problem of teachers' instruction as discussed above. Another issue is the forced major adjustment system in which a few students were adjusted to another major from their original choice. One participant reported that he disliked his adjusted major and he played on his smartphone in class all the time while waiting for his adjust back to his course of interest. Therefore, there seems to be some potential necessary reformation of the university course system in

mainland China.

Fourth, Chinese students' problematic attitudes or perceptions of university may be an issue that needs more attention. Several Chinese participants reported that it was normal for them to relax and "play" in university after their high school lives. They felt free to do whatever they wanted with no one to control. One of them said this idea was delivered by their high school teachers. PSU might only be one of the reflections of this attitude. It is unclear if more Chinese students were holding similar attitudes that university is a place to relax and that hard work is only for high school students. Since none of the British students mentioned this point, it may be a specific issue for Chinese undergraduates. This could be another issue associated with the transition from high school to university. As for this issue, it seems necessary for high schools and universities in China to pay more attention to students' negative attitudes towards their transition from high school to university. It also seems necessary for the Chinese society to notice the trend of ignoring the importance of university education.

8.3 Limitations

8.3.1 Limitations of the research design

There are some limitations in terms of the research designs adopted in this thesis. Self-reported answers in the questionnaires and interviews could be considered a major limitation. This thesis used self-reported Likert scales to measure the five study variables (e.g. PSU, academic anxiety), and self-reported open questions to collect

narrative answers from the British students. Face-to-face interviews also collected self-reported data from Chinese students. Social desirability and random answers could be threats to the reliability of the data collected. It seems possible that the participants did not rate the scales according to their real feelings or situations. For example, they pretended that they were fine in classes and rated a statement of academic anxiety (e.g. Thinking about class makes me feel uneasy) with a low score (e.g. 1 = strongly disagree), even though they might be extremely anxious in classes. The inconsistent results between the SAS-SV scores and the narrative words could possibly be a result of this limitation. This seems somewhat unlikely, given questionnaires were completed anonymously.   However, it was notable that several participants reported high scores in the SAS-SV but denied they use smartphones problematically, while some scored very low in the scale but reported many symptoms of PSU. This could be a consequence of socially desirable answers in the SAS-SV, open questions or the interviews. It is unknown in which part the participants were less honest, if any. Socially desirable answers could also exist in the interviews and answers for open questions. Furthermore, random answers, especially for the Likert scales, could be another problem although we do not have evidence that this was the case. It is possible that the participants rated the items randomly or carelessly without sufficient understanding of the statements. If they misunderstood the statements, their answer would reduce the reliability of the the scales. These are potential rather than actual limitations however.

Several possible research methods were not used in this study including observations and experiments, which could be viewed as a limitation of the research

design. However, there were several reasons for not using these methods including reliability issues and potential ethical harm. Since the topic includes PSU, observation might be an effective method to investigate a specific behaviour (i.e. PSU). However, the main disadvantage of observation is the researchers' effect on participants. It is possible for the participants to change or control their behaviours when they notice an observer. Experimental designs were used in several empirical studies but potential ethical issues existed. For example, Kross et al. (2013) texted the participants five times a day for 14 days to ask about their Facebook use and well-being. It is possible that the participants' lives were affected by their messages during the daytime. Dong, Wang, Du, & Potenza, (2017) tested the participants' craving responses stimuli before and after 30 minutes of gaming. It might be harmful to the participants since their gaming was suddenly disrupted at 30 minutes and the game was an Internet game using personal accounts. Thus, in order to avoid potential ethical issues, studies in this thesis did not adopt such designs to explore PSU.

8.3.2 Limitations of the measures

There are potential limitations of the measures including the scales used to measure the variables (e.g. PSU), the interview schedule and open questions for the British students.   The limitations of the scales include potential issues in the translation process, cultural background of the original scales, the overall length of the questionnaire, and some Cronbach's alpha values between .60 and .70.

First, the translation process could be a limitation. The scales in the questionnaires for the Chinese sample, except for the Chinese version of the SWLS, were all translated from published Likert scales. Although a rigorous process of back-translation was adopted to evaluate the translated version, it is unknown if there was any information loss. Second, the different cultural backgrounds of the scales were also a potential limitation. The original versions of the scales were not in Chinese, i.e. the scales were not developed from Chinese samples. Considering the cultural differences found in this thesis, the non-Chinese cultural backgrounds of the scales could be a limitation. Third, the overall length of the questionnaire was too long according to some participants' reports. This may be another limitation that reduced the reliability. Fourth, the Cronbach's alpha values for the 8-item IPS and the 10-item SRS were .66 and .69 in the main study. These values were slightly below the general acceptable value of .70. However, Loewenthal (2004) argued the acceptable alpha for the scales with 10 items or less could be .60 because of the impact of the number of items on the alpha value.

There also potential limitations of the measures used for qualitative data collection: the interview schedule and the open questions. Since the interviews were designed as semi-structured interviews, the pre-designed questions were not always followed exactly during the interviews. Not all probes or sub-questions were used since the interviewer asked questions in different ways, to suit the participant. Thus, the interview schedule seems not to be as reliable or useful as would be ideal. However, this limitation did not affect the results since the main aims (i.e. exploring the prevalence, antecedents and consequences of PSU) of the qualitative study was

achieved. The open questions for the British students were designed in line with the questions in the interviews. However, a number of the British students misunderstood the questions and gave irrelevant answers or answered in wrong places (e.g. reported antecedents and impacts of PSU in answer to the same question). Nevertheless, this limitation did not affect the coding process or the results.

8.3.3 Limitations of data collection

There were limitations in terms of the convenience sampling and different qualitative data collection. The samples sizes in this thesis are not small: 112 Chinese undergraduates in study 1, 475 Chinese undergraduates in study 2, 16 interviewees in study 3 and 303 British undergraduates in study 4. However, convenience sampling might limit the generalisability of the results. It seems difficult to claim representativeness for the population of Chinese students, with a convenience sample from a single university. Nevertheless, the participants in this thesis can still reflect some issues in the specific group of undergraduate students in both China and UK.

One limitation might be the different qualitative data collection methods used in China and the UK. Interviews were conducted among the Chinese volunteer participants, while the British students were asked to answer the open questions at the end of the questionnaires. It is possible that the qualitative results could be affected by this difference. However, as discussed in study 4, the themes found in the two countries were largely similar to each other. The impact of this design flaw appears to have been

minor.

8.4 Recommendation for studies in the future

This thesis indicates several directions for studies in the future including studies of specific functions or applications of smartphones, studies on school management and educational transition in China, the other academic emotions among Chinese students, studies on Chinese high school students, experimental studies, longitudinal studies, cross-cultural studies and large sample studies.

8.4.1 Studies on specific smartphone functions

As discussed in the implications section of this chapter, there are difficulties with labelling smartphone use or Internet use as addictions. The functions provided by smartphones and the Internet are likely to be the essential focus for future studies. It seems that several functions have already been investigated globally including social networking sites (Kuss & Griffiths, 2017) and Internet games (Dong et al., 2017). However, the Chinese participants in this thesis reported a number of emerging smartphone applications which might need more studies including mobile payment or mobile shopping (especially in China), shared bikes using smartphone applications, emerging new smartphone games, video watching applications, and applications for learning activities (e.g. class instruction, off-class tests, word memorising applications, online courses, etc.). Studies of these specific functions could not only explore the negative effects but also the positive effects including benefits for teaching and learning

among students, or the potential positive effects on well-being.

8.4.2 Studies on high school/university management and difficulties in education transition in China

Future studies could also focus on high school or university management and educational transitions in China. Since some Chinese participants reported that a gap existed between high school and university management (especially in classes), more studies are needed to investigate the difference between Chinese high school and university management especially with regard to classroom management and expectations. It might be necessary to focus on the teachers' attitudes towards students' irrelevant behaviours and negative emotions during class. It seems interesting to explore whether high school teachers and university teachers have different attitudes in classes since their objectives for classes are likely to be different (high school teachers might care more about exam results).   It is also necessary to investigate the difficulties in transition to university faced by graduated Chinese high school students and new undergraduates. As the participants reported their issues in adapting to their new lives in university, more studies on their difficulties in education transition may assist the university to help new undergraduates.

8.4.3 Studies in high school students and adolescents or younger students in China

This thesis investigated PSU and associated factors among undergraduate university students. Since a number of Chinese students frequently compared their smartphone use in high school and university, it seems interesting to investigate Chinese high school students' PSU and associated factors including anxiety, procrastination, etc. Furthermore, young children or adolescents in primary school (6 to 12 yrs) and junior middle school (13 to 16 yrs) in China might be another group that need more studies. The Chinese undergraduates in this thesis reported that the mobile phones they used in primary school or junior middle school were mostly used for calls and text messages when no multiple functions appeared at that time. Given the rapid development of smartphones and apps, it seems important to focus on younger students who use smartphones or even other electronic devices and investigate if any negative consequences exists. Since the higher levels of PSU among the Chinese participants, it seems necessary to especially focus on the Chinese young students and compare with students in the other countries.

8.4.4 Studies on the other achievement emotions

Academic anxiety was one of the achievement (academic) emotions included in the AEQ (Pekrun et al., 2005). This thesis identified a relationship between academic anxiety, PSU, academic procrastination, self-regulation and life satisfaction. It seems interesting for future studies to investigate whether these relationships exist with the

other emotions including enjoyment, hope, pride, anger, shame, hopelessness, relief and boredom in three situations (class, learning and test). University students, high school and primary school students are all possible target groups. For example, it seems interesting to investigate whether procrastination or PSU can be predicted by positive emotions (e.g. enjoyment and pride) or negative emotions (e.g. boredom and anger) among high school students. Furthermore, it is also interesting to compare the achievement emotions between high school and university students especially in China. Since the Chinese participants reported the sharp change from high school to university, it is unknown whether their mental health situations (anxiety and life satisfaction) in high school were better or worse.

8.4.5 Measurement development with the Chinese context

This thesis indicates the need for more measurements originally developed with Chinese samples. The measure/scales used in this thesis were developed either in English (e.g. the SWLS, the IPS, and the SAS-SV) or in German (e.g. the AEQ, the SRS); none of them were designed in the Chinese context. However, several changes were made for the Chinese context in this thesis. The Chinese version of SAS-SV changed the "Twitter and Facebook" into "WeChat or other social media". As discussed in the methodology chapter, the words "tense" and "nervous" in the English version of the AEQ-anxiety refer to the same Chinese word "Jin zhang". After discussion with the back translator and evaluators, an explanation, which was "both mental and physical",

was added to the translated "tense". Also discussed previously, the scale for self-regulated learning strategies in the MSLQ (Pintrich & De Groot, 1990) was not used in this thesis because several contents of the statements (e.g. reading materials out of classes and chapter questions of the text books) were not suitable for the Chinese university context. Furthermore, Van de Vijver & Leung (2000) also suggest that cultural contexts seem important for the use of measurements since the personality scales widely used in Western contexts might not be suitable for Chinese contexts. Therefore, it seems necessary for future studies to develop measures or questionnaires based on grounded theory studies in the Chinese contexts with Chinese samples, either for the topics of behavioural addictions (e.g. PSU) or educational psychology (e.g. self-regulation, academic anxiety).

8.4.6 Studies with different designs

Since this thesis found the problems of the thresholds in the SAS-SV with contrasting qualitative findings, only using the scores in questionnaires seems to be a simplification of the judgement of PSU. Similarly, Billieux, Philippot, et al. (2015) argued that the symptom-based approach (based on an addiction model) can lead to non-relevant treatment for dysfunctional mobile phone use, while a process-based approach (using idiosyncratic clinical case conceptualization) can be more effective to find the psychological process. Therefore, for future studies, case studies or longitudinal case-based studies may be possible directions. For example, future studies

could investigate a small number of participants with longitudinal case-based designs (e.g. using diaries and interviews) to find how the smartphones are used (e.g. how much the applications are used specifically), and idiographic reasons for PSU (if PSU exists) and the real situation of smartphone use including the positive effects.

Although there are potential ethical issues of experimental studies around topics in behavioural addiction especially PSU, it seems necessary for future studies to design experimental studies involving the lowest possible harm to participants' personal privacy or daily lives. For example, if the 30-minute gaming session described in Dong et al. (2017) was ensured as one unbroken session without halfway disruption, the potential harm to the participants' personal gaming accounts could be reduced to the least. Furthermore, cross-cultural studies are also possible directions for future studies. As discussed in study 4, the different self-reported PSU was higher in eastern countries (China and South Korea). It seems necessary for future studies to focus more on the cross-cultural differences between eastern and western countries. Meanwhile, in order to have representative samples, large scale studies are necessary in the future (e.g. above 1800 randomly selected participants in order to represent the Chinese population of around 1.3 billion with 99% confidence level and confidence interval of 3).

Chapter 9 Conclusion

9.1 Summary of this thesis

This thesis investigated problematic smartphone use (PSU) among Chinese undergraduate students. The research aims were: (1) to explore the prevalence of PSU among Chinese undergraduate students; (2) to test the hypothesised relationship (based on theoretical and empirical evidence) between PSU and possible correlates; (3) to explain those relationships (if observed) and explore other potential antecedents and consequences of PSU; (4) to compare the Chinese undergraduates' PSU with another sample (British undergraduate students) from a different cultural background

In order to fulfil the research aims, this thesis used questionnaires and interviews to collect both quantitative and qualitative data. A cross cultural and mixed methods study was also designed to compare Chinese and British students. For the aim of exploring the prevalence of PSU among Chinese students, the Smartphone Addiction Scale-Short Version (SAS-SV; Kwon, Kim et al., 2013) with thresholds for addictive smartphone use was used among 475 Chinese undergraduates. Besides, interviews also included questions about general smartphone usage and PSU. For the aims of exploring the correlates, the hypothesised relationships between PSU and academic anxiety, academic procrastination, self-regulation and life satisfaction were tested using quantitative data from questionnaires and qualitative data from interviews. Several other antecedents and consequences of PSU were also identified in the interviews. For the aim of cross cultural comparison, 303 British undergraduates were recruited in a

cross cultural study, and questionnaires were adopted collecting both quantitative and qualitative data.

The levels of PSU among Chinese students were significantly higher than in the British sample in this thesis and the other samples from different studies using the same scale. Using the thresholds provided in the SAS-SV, 72.25% of Chinese females and 72.56% males were addicted smartphone users. However, the scores for the scale in the questionnaires were not always consistent with the narrative words offered in the interviews. PSU was found to be significantly correlated with academic anxiety, academic procrastination, self-regulation and life satisfaction. The hypothesised model, including all the five variables, was proved to fit the data well with acceptable model fit indices after reasonable modifications. It shows the potential links between the variables and the possible mechanism of PSU among Chinese university students. PSU, as a reflection of poor self-regulation, seems to be potential predictors of the students' mental health issues (anxiety), regulation issues (procrastination) and well-being, but no causal effects can be confirmed. Furthermore, Chinese undergraduates might experience difficulties in adapting to their university lives after transition from strictly controlled high school lives, which was not reported by the British students.

9.2 Main implications

This thesis has potential theoretical, methodological and practical contributions to the fields of behavioural addiction, psychology and educational studies. This thesis also

offers suggestions for future studies.

For the field of behavioural addictions findings confirmed a model including PSU and academic anxiety, academic procrastination, self-regulation and life satisfaction, suggesting that PSU might play an important role in Chinese university students' regulation problems (low self-regulation, academic procrastination) and mental health problems (academic anxiety and low life satisfaction). This thesis also suggests potential additions to the theoretical models of PSU or Internet addiction. It might also classify PSU as both generalised and specific. The findings are largely (though not completely) linked with the six components of behavioural addiction presented by Griffiths (2005; 2017). Meanwhile, there are also methodological and practical implications to this field, including the unreliability of self-reported scales, possible mixed methods and cross cultural designs, and more actions needed for Chinese undergraduates with problems in controlling their smartphone use.

For psychology in education, several relationships between PSU and psychological variables (e.g. anxiety) were supported in this thesis. The findings in this thesis can make a contribution to the theories (e.g. anxiety and procrastination) and empirical studies, while cultural and contextual factors are potential issues to be considered. This thesis also suggests ideas for supporting Chinese undergraduate students' mental health. Furthermore, this thesis raised concerns on other issues in education, including: high school and university management in China, inappropriate course design and content in Chinese universities, and problematic attitudes towards university work by Chinese students.

This thesis also suggest several possible directions for studies in the future. It seems necessary to conduct more studies on problematic use of specific functions in smartphone, i.e. specific PSU proposed in this thesis. It is also necessary to investigate high school and university management and students' difficulties in education transition in China. PSU, metal health issues or other achievement emotions among younger students/adolescents in China seem to be possible research directions. Moreover, considering the methodological aspects, future directions could be as follows: development of measurements for PSU especially for the Chinese context, longitudinal case-based studies, experimental studies with the lowest possible harm to participants, and large scale studies with representative samples.

Appendices

Appendix A Questionnaire for the Chinese sample-pilot study

<div align="center">中国大学生学业焦虑，学术拖延以及智能手机使用调查问卷</div>

亲爱的同学，

您好！感谢您对本问卷的关注！我是一名英国约克大学在读博士生，正在做一项有关中国大学生学术焦虑，学术拖延和智能手机使用的调查研究。我希望通过这项调查了解以上三者之间是否存在联系以及相关原因。

如果您愿意参与此调查，你将需要完成以下的问卷，大概需要10分钟。

调查数据将会被保存在有密码保护的电脑中,只有研究者本人以及其导师可以查看数据。数据将会被用于约克大学博士论文以及可能出版的学术期刊的数据分析。所有参与者都是匿名的，任何参与者的姓名都不会出现在任何相关的论文中。调查数据也可能被用于其他目的的数据分析。

您有任何疑问，都可以随时联系杨泽旸（邮箱：zy664@york.ac.uk）或者Paul Wakeling 博士（邮箱：education-research-administrator@york.ac.uk）。

请注意，您在回答问卷之前或答卷过程中都可以选择退出此调查。但是，因为此调查是完全匿名的，所以您无法在递交以后收回您的问卷。递交您的问卷即表示您同意参与此次调查。

非常感谢您的合作

杨泽旸

1. 您的性别：（请勾选）　女　□　　男　□

2. 您的年龄：　＿＿＿＿

3. 您是本科生还是研究生？　本科生　□　　研究生　□

4. 请指出您是否同意以下陈述 （请在圆圈中勾选）

注：以下陈述中"手机"均指代"智能手机"。 您的手机是否是智能手机？ 是
□ 否 □

陈述	非常不同意	不同意	有点不同意	有点同意	同意	非常同意
1. 我曾因为玩手机误事。	○	○	○	○	○	○
2. 有时因为手机，我很难把注意力集中到课堂，作业或其他工作上。	○	○	○	○	○	○
3. 我在使用手机的时候会觉得手酸脖子疼。	○	○	○	○	○	○
4. 我没法忍受没有手机。.	○	○	○	○	○	○
5. 如果手机不在身上，我会觉得焦躁不安。	○	○	○	○	○	○
6. 我会想着我的手机哪怕我没有在用它。	○	○	○	○	○	○
7. 就算手机严重影响到了我的日常生活，我仍会使用它。	○	○	○	○	○	○
8. 我会不断地查看手机，以确保没有错过微信或其他社交媒体上的会话。	○	○	○	○	○	○
9. 有时我使用手机的时间比我预想的长。	○	○	○	○	○	○
10. 身边的人说我玩手机太多了。	○	○	○	○	○	○

5. 请指出以下陈述是否与您的情况相符合。

陈述	完全不符合				完全符合
1. 我会因为把事情拖得太久而感到不开心。	○	○	○	○	○
2. 我会因为把事情拖得太久而效率低下。	○	○	○	○	○
3. 如果我有一件事情要做，我会先完成它然后再做更次要的事情。	○	○	○	○	○
4. 如果我早点完成一些任务，我的生活会更美好。	○	○	○	○	○
5. 如果我需要马上做一件事情，我会先干点别的。	○	○	○	○	○
6. 在一天要结束的时候，我觉得我本可以更好地利用时间。	○	○	○	○	○
7. 我能明智地利用时间。	○	○	○	○	○
8. 我会不合理地耽搁一些事情。	○	○	○	○	○
9. 我有拖延症。	○	○	○	○	○
10. 我会完成所有我认为必须完成的任务。	○	○	○	○	○

6. 请指出您对以下有关**课堂**的陈述是否同意。

陈述	非常不同意				非常同意
上课前					
1. 一想到上课我就觉得不自在。	○	○	○	○	○
2. 我感到害怕。	○	○	○	○	○
3. 即使是在课前，我也会担心自己能否理解课上的内容。	○	○	○	○	○
4. 我会担心我是否做好了充分的课前准备。	○	○	○	○	○
5. 我会担心课上对我的要求会太高。	○	○	○	○	○

	非常不同意				非常同意
6. 因为紧张我会想着翘课。	○	○	○	○	○
7. 想到要上课我就会心神不定。	○	○	○	○	○
上课时					
8. 我上课的时候心里很紧张。	○	○	○	○	○
9. 我担心其他人会比我懂的更多。	○	○	○	○	○
10. 我害怕会说错什么，所以我干脆什么都不说。	○	○	○	○	○
11. 我感到身心都很紧张。	○	○	○	○	○
12. 当我无法理解课上一些重要的内容时，会心跳加速。	○	○	○	○	○

7. 请指出您对以下有关**学习**的陈述是否同意。

陈述	非常不同意				非常同意
学习前					
1. 当我看到我还需要读的书时，我会感到焦虑。	○	○	○	○	○
2. 我会因为紧张而不想开始学习。	○	○	○	○	○
3. 当我不得不去学习的时候，我会觉得心神不定。	○	○	○	○	○
学习时					
4. 学习时我感到身心都紧张。	○	○	○	○	○
5. 我担心自己是否能应对所有的学习任务。	○	○	○	○	○
6. 会有一门课让我感到恐慌，因为我没有完全	○	○	○	○	○

弄懂它。					
7. 学习时我会通过分心来缓解焦虑。	○	○	○	○	○
8. 学习的时间快用完时我会心跳加速。	○	○	○	○	○
9. 我会因为担心无法完成任务而冒汗。	○	○	○	○	○
学习后					
10. 我赶不上学习进度的时候会觉得害怕.	○	○	○	○	○
11. 我担心自己是否真正掌握了所学的内容。	○	○	○	○	○

8. 请指出您对以下有关**考试**的陈述是否同意。

陈述	非常不同意				非常同意
考试前					
1. 考试前我感到紧张不安。	○	○	○	○	○
2. 我担心是不是学得足够多了。	○	○	○	○	○
3. 我担心考试会不会太难。	○	○	○	○	○
4. 我因为太紧张而不想参加这场考试。	○	○	○	○	○
5. 我感到肠胃不适。	○	○	○	○	○
考试中					
6. 我非常紧张。	○	○	○	○	○
7. 我动笔的时候我会感到惊慌失措。	○	○	○	○	○
8. 我担心自己是否能通过这场考试。	○	○	○	○	○
9. 我太紧张了，迫不及待地希望考试结束。	○	○	○	○	○
10. 我因为焦虑而想要待在别的地方。	○	○	○	○	○
11. 考试开始的时候我心里就在打鼓。	○	○	○	○	○
12. 我的手会发抖。	○	○	○	○	○

如果你对此问卷的版面设计，语言使用等有任何修改建议或评论，请在问卷中注明，非常感谢！

问卷到此结束，非常感谢您的参与！

Appendix B Questionnaire for the Chinese sample-main study

<div align="center">

中国大学生智能手机使用及学习行为的调查问卷

</div>

亲爱的同学,

您好！感谢您对本问卷的关注！我是一名英国约克大学在读博士生，正在做一项有关中国大学生智能手机使用及学习行为的调查研究。完成以下的问卷大概需要10分钟。

调查数据将会被保存在有密码保护的电脑中,只有研究者本人以及其导师可以查看数据。数据将会被用于约克大学博士论文以及可能出版的学术期刊的数据分析。所有参与者都是匿名的，任何参与者的姓名都不会出现在任何相关的论文中。调查数据也可能被用于其他目的的数据分析。

您有任何疑问，都可以随时联系杨泽旸（邮箱：zy664@york.ac.uk）或者约克大学教育学院伦理道德委员会（邮箱： education-research-administrator@york.ac.uk）。请注意，您在回答问卷之前或答卷过程中都可以选择退出此调查。但是，因为此调查是完全匿名的，所以您无法在递交以后收回您的问卷。递交您的问卷即表示您同意参与此次调查。

非常感谢您的合作

杨泽旸

9. 您的性别：（请勾选）　女　□　　男　□

10. 您的年龄：＿＿＿＿＿

11. 请指出您是否同意以下陈述 （请在圆圈中勾选）

注：以下陈述中"手机"均指代"智能手机"。 您的手机是否是智能手机？ 是 □　否 □

陈述	非常不同	不同	有点不同	有点	同	非常

	意	意	意	同意	意	同意
11. 我曾因为玩手机误事。	○	○	○	○	○	○
12. 有时因为手机，我很难把注意力集中到课堂，作业或其他工作上。	○	○	○	○	○	○
13. 我在使用手机的时候会觉得手酸脖子疼。	○	○	○	○	○	○
14. 我没法忍受没有手机。.	○	○	○	○	○	○
15. 如果手机不在身上，我会觉得焦躁不安。	○	○	○	○	○	○
16. 我会想着我的手机哪怕我没有在用它。	○	○	○	○	○	○
17. 就算手机严重影响到了我的日常生活，我仍会使用它。	○	○	○	○	○	○
18. 我会不断地查看手机，以确保没有错过微信或其他社交媒体上的会话。	○	○	○	○	○	○
19. 有时我使用手机的时间比我预想的长。	○	○	○	○	○	○
20. 身边的人说我玩手机太多了。	○	○	○	○	○	○

请翻页，谢谢

12. 请指出以下陈述是否与您的情况相符合。

陈述	完全不符合				完全符合
11. 我会因为把事情拖得太久而效率低下。	○	○	○	○	○
12. 如果我有一件事情要做，我会先完成它然后再做更次要的事情。	○	○	○	○	○
13. 如果我早点完成一些任务，我的生活会更美	○	○	○	○	○

好。					
14. 如果我需要马上做一件事情，我会先干点别的。	○	○	○	○	○
15. 在一天要结束的时候，我觉得我本可以更好地利用时间。	○	○	○	○	○
16. 我能明智地利用时间。	○	○	○	○	○
17. 我会不合理地耽搁一些事情。	○	○	○	○	○
18. 我有拖延症。	○	○	○	○	○

13. 请指出您对以下有关**课堂，学习及考试**的陈述是否同意。

陈述	非常不同意				非常同意
上课前					
12. 即使是在课前，我也会担心自己能否理解课上的内容。	○	○	○	○	○
13. 因为紧张我会想着翘课。	○	○	○	○	○
上课时					
14. 我感到身心都很紧张。	○	○	○	○	○
4. 当我无法理解课上一些重要的内容时，会心跳加速。	○	○	○	○	○

陈述	非常不同意				非常同意
学习前					
12. 当我不得不去学习的时候，我会觉得心神不定。	○	○	○	○	○

学习时					
13. 我担心自己是否能应对所有的学习任务。	○	○	○	○	○
14. 学习时我会通过分心来缓解焦虑。	○	○	○	○	○
学习后					
15. 我赶不上学习进度的时候会觉得害怕.	○	○	○	○	○

陈述	非常不同意				非常同意
考试前					
1. 我担心考试会不会太难。	○	○	○	○	○
2. 我感到肠胃不适。	○	○	○	○	○
考试中					
3. 我非常紧张。	○	○	○	○	○
4. 我太紧张了，迫不及待地希望考试结束。	○	○	○	○	○

14. 以下陈述描述的是您处理日常事物（包括生活和学习）时的感受，请指出是否与您的情况相符合。

陈述	完全不符合	有点不符合	有点符合	完全符合
1. 如果需要，我能专注在一件事情上很久。	○	○	○	○
2. 分心后再回到手头上的事情对我来说并不困难。	○	○	○	○
3. 即使一件事情让我情绪波动，我也能冷静下来继续面对。	○	○	○	○
4. 如果一件事需要解决问题的态度，我能控制自己的情绪。	○	○	○	○
5. 抑制住杂念对我来说很难。	○	○	○	○

6. 我能够控制住分心的念头。	○	○	○	○
7. 当我有所顾虑时，我无法精力集中。	○	○	○	○
8. 做事情被打断后，我能马上继续集中精力。	○	○	○	○
9. 我经常会有一连串杂念使我无法保持专注。	○	○	○	○
10. 我能专注于自己的目标而不会让任何事打乱计划。	○	○	○	○

15. 请根据您的实际感受，选择最符合的一个选项打 √

	非常不同意	不同意	有点不同意	很难说	有点同意	同意	非常同意
1. 在许多方面，我的生活接近我的理想。	○	○	○	○	○	○	○
2. 我的生活状况非常好。	○	○	○	○	○	○	○
3. 我对我的生活感到满意。	○	○	○	○	○	○	○
4. 到目前为止，我已经拥有了我一生中想要拥有的重要事物。	○	○	○	○	○	○	○
5. 如果生命可以再来一次，我不会改变生活中的任何事情。	○	○	○	○	○	○	○

问卷到此结束，非常感谢您的参与！

如果您愿意参加 20 分钟左右的采访，请填写您的联系电话：＿＿＿＿＿＿＿＿

受访者将得到 10 元现金。

Appendix C Interview schedule for the Chinese sample

采访计划

1. Could you talk about the role of smartphone in your daily life? 手机在你日常生活中扮演着一个什么样的角色？ 为什么？

   - Do you think you use your smartphone too much? 你觉得你有过度使用手机吗？

   - Do you use it more than your peers or about the same? 你比你的同学用得更多吗？

   - What do you use it for? 一般用它做啥？

   - How important is your smartphone to you? 手机对你有多重要？

   - If your smartphone was taken away, how do you think it would affect your life? 如果没有手机， 你的生活会受到多大影响？

2. Could you describe how you use your smartphone in class or while you are studying? 请你描述一下你在课堂上或者学习中使用手机的情况？

   - Is it helpful to your learning? 对你的学习有帮助吗？

   - Is it distracting? 会让你走神？

   - Can you describe when you are most likely to use it? 什么时候最可能用手机？ （需要查信息？ 觉得无聊？ 学的东西太难？ ）

(When you need information quickly? When you are bored and not concentrating?

When you don't understand, or are panicked by the academic task?)

3. Could you talk a bit about the others' use of smartphones as you have observed either in their daily lives or during classes and other learning periods? 说一下你看到的身边的人在生活学习中是怎么使用手机的。

  - How does your smartphone use compare to this? 跟你相比呢？

4. What factors do you think motivate you or your friends to use smartphones? 你觉得是什么原因让你或者你的朋友使用手机的？

  - When did you first get a smartphone? 什么时候开始用的？

  - How did it change your behaviour? 手机有改变你的日常行为吗？

5. What are the possible impacts, if any, of smartphone use for you or your friends? 使用手机会对你或者你的朋友有哪些影响？

  - Does it affect your social life? 影响到了社交吗？

  - Does it affect your studies or your academic success? 影响了学习吗？

  - Does it affect how you feel about yourself and your life? 影响了你对生活的看法吗？

6. Is there anything you would like to add? 还有什么需要补充的吗？

Appendix D Informed Consent Form for the Interview

<p align="center">**采访知情同意书**</p>

研究主题: 探究中国大学生的手机使用

我了解将参与杨泽旸的一项调查。

我了解这项调查的目的是研究中国大学生的手机使用情况

我了解调查数据将会被保存在有密码的电脑里，而且只有研究者本人能够查看。

我了解数据将会被用于约克大学博士论文以及相关期刊论文的数据分析，参与者都是匿名的，任何人的姓名不会出现在数据分析中。

我了解数据将会被用于以后的分析或其他目的，但是参与者始终是匿名的。

我了解如果有任何疑问都可以联系杨泽旸（研究者本人，邮箱：zy664@york.ac.uk）或者约克大学教育学院伦理委员会（邮箱：education-research-administrator@york.ac.uk）。

我了解作为参与者我可以对相关的文字记录进行评论。

我了解调查数据将会被保存用于杨泽旸在约克大学的博士论文以及相关期刊论文。

我了解我可以在采访前，采访中或者采访后四周内退出此调查 （联系邮箱：zy664@york.ac.uk）。

您同意参与此调查吗？

是 ___ 否 ___ （请勾选）

参与者签名： _____

日期： _____

Appendix E Questionnaire for the British sample

Problematic smartphone use and learning behaviour among Chinese and UK undergraduate students

Dear participants,

Thank you for your attention to this questionnaire! I am a PhD student at the University of York, UK, and the purpose of my study is to explore smartphone use and various types of learning behaviour among Chinese and UK undergraduate students. Participating in the study will involve completing the questionnaire on the next page. Completing the questionnaire should take no longer than 15 minutes.

The data collected in this study will be stored on a passcode protected computer until two years after my graduation and only the researcher (myself) and my supervisor will have access to the data. The data will be analysed for my PhD thesis at the University of York and may be published in an academic journal. If you decide to take part in this study your data will be anonymous and no names of participants will appear in any write up of the study. Data may also be used for future analysis and/or other purposes.

If you have questions, queries or concerns please feel free to contact Zeyang Yang (the researcher, E-mail: zy664@york.ac.uk) or the Ethics Committee of the Department of Education in the University of York, E-mail: education-research-administrator@york.ac.uk.

Please note that you are free to withdraw from this study before or during completion of the questionnaires. However, you will not be able to retract your data once submitted because the survey is anonymous and we will not be able to identify data that are yours. By submitting your responses, you are giving your consent to participate in this research.

With thanks for your support

Zeyang Yang

PhD student in Psychology in Education

16. Gender (please tick)   Female ☐   Male ☐   Non binary ☐   Prefer not to say ☐

17. Age _____

18. Nationality _____

Did you grow up in this country? Yes ☐   No ☐   If No, where did you grow up? _____

19. Please indicate how much you agree with the following statements (please tick the circle that best describes your response to each)

Is your mobile phone a smartphone? Yes ☐   No ☐

Statements	Strongly disagree	Disagree	Weakly disagree	Weakly agree	Agree	Strongly agree
21. I have missed planned work due to smartphone use.	○	○	○	○	○	○
22. Sometimes I have a hard time concentrating in class, while doing assignments, or while working due to smartphone use.	○	○	○	○	○	○
23. Sometimes I feel pain in the wrists or at the back of the neck while using a smartphone.	○	○	○	○	○	○
24. I wouldn't be able to stand not having a smartphone.	○	○	○	○	○	○
25. I feel impatient and fretful when I am not holding my smartphone.	○	○	○	○	○	○
26. My smartphone is on my mind even when	○	○	○	○	○	○

I am not using it.						
27. I would never give up using my smartphone even if my daily life is already greatly affected by it.	○	○	○	○	○	○
28. I constantly check my smartphone so as not to miss conversations between other people on Twitter and Facebook.	○	○	○	○	○	○
29. Sometimes I use my smartphone for longer than I intend to.	○	○	○	○	○	○
30. The people around me tell me that I use my smartphone too much.	○	○	○	○	○	○

20. Please indicate how true the following statements are of you.

Statements	Not at all true of me		Somew hat true of me		Very true of me
19. I put things off so long that my efficiency unnecessarily suffers	○	○	○	○	○
20. If there is something I should do, I get to it before attending to lesser tasks.	○	○	○	○	○
21. My life would be better if I did some activities or tasks earlier.	○	○	○	○	○
22. When I should be doing one thing, I will do another.	○	○	○	○	○
23. At the end of the day, I know I could have spent my time better.	○	○	○	○	○
24. I spend my time wisely.	○	○	○	○	○
25. I delay tasks beyond what is reasonable.	○	○	○	○	○
26. I procrastinate.	○	○	○	○	○

21. Please indicate how much you agree or disagree with the following statements about

class, learning and test situations

Statements	Strongly disagree				Strongly agree
Before class					
15. Even before class, I worry whether I will be able to understand the material.	○	○	○	○	○
16. Because I'm so nervous I would rather skip the class.	○	○	○	○	○
During class					
17. I get tense in class.	○	○	○	○	○
4. When I don't understand something important in class, my heart races.	○	○	○	○	○

Statements	Strongly disagree				Strongly agree
Before learning					
16. When I have to study I start to feel queasy.	○	○	○	○	○
During learning					
17. I worry whether I'm able to cope with all my work.	○	○	○	○	○
18. While studying I feel like distracting myself in order to reduce my anxiety.	○	○	○	○	○
After learning					
19. When I can't keep up with my studies it makes me fearful.	○	○	○	○	○

Statements	Strongly disagree				Strongly agree
Before a test					
1. I worry whether the test will be too difficult.	○	○	○	○	○
2. I feel sick to my stomach.	○	○	○	○	○
During a test					
3. I am very nervous.	○	○	○	○	○
4. I get so nervous I can't wait for the exam to be over.	○	○	○	○	○

22. The following questions are about how you feel when carrying out activities in daily life (these may include academic activities but also activities at home and elsewhere)，please indicate how true the following statements are of you

Statements	Not at all true	Barely true	Somewhat true	Completely true
1. I can concentrate on one activity for a long time, if necessary.	○	○	○	○
2. If I am distracted from an activity, I don't have any problem coming back to the topic quickly.	○	○	○	○
3. If an activity arouses my feelings too much, I can calm myself down so that I can continue with the activity soon.	○	○	○	○
4. If an activity requires a problem-oriented attitude, I can control my feelings.	○	○	○	○
5. It is difficult for me to suppress thoughts that interfere with what I need to do.	○	○	○	○
6. I can control my thoughts from distracting me from the task at hand.	○	○	○	○
7. When I worry about something, I cannot concentrate on an activity.	○	○	○	○

8. After an interruption, I don't have any problem resuming my concentrated style of working.	○	○	○	○
9. I usually have a whole bunch of thoughts and feelings that interfere with my ability to work in a focused way.	○	○	○	○
10. I stay focused on my goal and don't allow anything to distract me from my plan of action.	○	○	○	○

23. Please indicate how much you agree with the following statements

Statements	Strongly disagree	Disagree	Slightly disagree	Neither agree nor disagree	Slightly agree	Agree	Strongly agree
1. In most ways my life is close to my ideal.	○	○	○	○	○	○	○
2. The conditions of my life are excellent.	○	○	○	○	○	○	○
3. I am satisfied with my life.	○	○	○	○	○	○	○
4. So far I have gotten the important things I want in life.	○	○	○	○	○	○	○
5. If I could live my life over, I would change almost nothing.	○	○	○	○	○	○	○

24. Could you describe how you use your smartphone during class or other learning periods?

_____

25. Could you talk a bit about the others' use of smartphones as you have observed it, either in their daily lives or during classes and other learning periods?

26. What factors motivate you or your friends to use smartphones?

27. What are the possible impacts, if any, of smartphone use to you or your friends?

28. Do you think you use your smartphone too much?

    If so, why? What problems does this cause for you?

Thank you very much for your participation!

Appendix F Invitation email for the British sample

Dear administrator,

Thank you for your attention! I'm Zeyang Yang (zy664@york.ac.uk), a PhD student in the Department of Education at the University of York. I'm conducting a study about "Problematic smartphone use and learning behaviour among Chinese and UK undergraduate students". Taking part involves completing an online questionnaire which takes about 15 minutes. All responses will be anonymous.

I would be very grateful if you could forward the following message and links to all undergraduate students in your department. Thank you very much for your help!

Yours sincerely

Zeyang

****

Dear Students,

I am looking for undergraduates (home students and Chinese students) to take part in a study about problematic smartphone use and learning behaviour.   If you are interested in finding out more, and maybe taking part, please click on one of the links below. Participation involves completing an online questionnaire and will take no more than 15 minutes of your time.

For Chinese undergraduate students, please click on this link for the survey: https://york.qualtrics.com/jfe/form/SV_efIbgpLq2rHAo29, thank you!

For UK undergraduate students, please click on this link for the survey:

https://york.qualtrics.com/jfe/form/SV_e58FJNnVeqQ7C0R

Thank you for your help!   I am very grateful.

Kind regards,

Zeyang Yang

Appendix G The first tranche of main study-quantitative part (n = 102)

1 Background

The results of the previous pilot study indicated a need to conduct a first tranche of main study. Firstly, the measures were modified on the basis of the previous study's findings, making it desirable to conduct another pilot study to test the modified measures before the main study. Furthermore, according to existing research, problematic smartphone use can be associated with self-regulation and satisfaction with life in certain contexts（Van Deursen, Bolle, Hegner, & Kommers, 2015；Samaha & Hawi, 2016. It was therefore deemed appropriate to expand the study's hypotheses to investigate those relationships in a pilot study with Chinese college students and to refine the hypothesised model before embarking on the main study. Thus, self-regulation and satisfaction with life were included in the current pilot study and a revised, and enhanced, hypothetical model was tested. The new hypothetical model, presented in Figure 1, included the mediation relationship that was identified in the pilot study and also proposed associations between problematic smartphone use and both self-regulation and satisfaction with life.
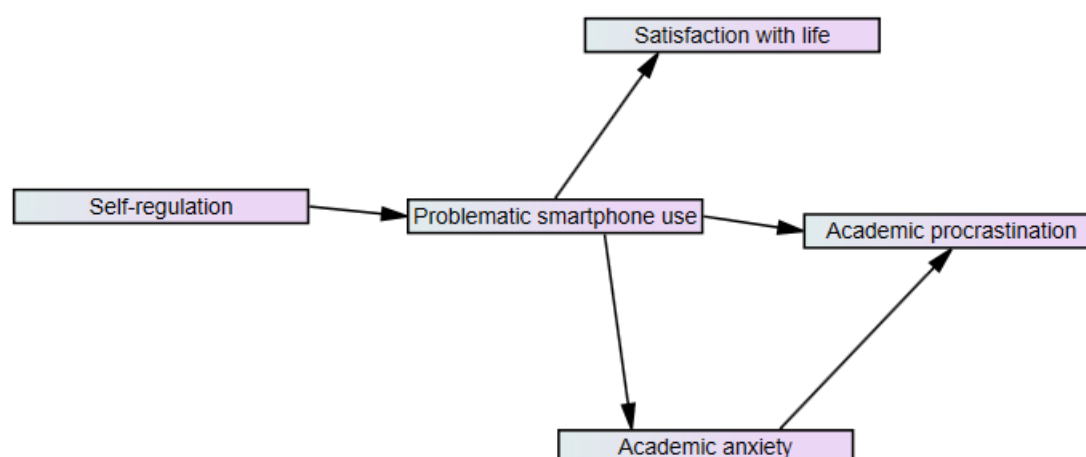
Figure 1. Hypothesised model of causes, correlates and consequences of problematic smartphone use.

4.2 Method

4.2.1 Participants

As with the pilot study, the current study was conducted in the same university in Wuhan China.   Participants were 102 undergraduate students from two English classes who agreed to complete a paper-based questionnaire. The students in the two classes were from different departments majoring in science, business and art. The average age

of the participants was 20.03 (SD = 1.03), ranging from 17 to 23. There were 54 female and 48 male students.

4.2.2 Measures

The measurements used in this tranche of the main study were the 10-item SAS-SV, the 8-item IPS, the 12-item AEQ-anxiety, the 10-item SRS and the 5-item SWLS. Details were displayed in Chapter 5.

4.2.3 Procedure

The recruitment of participants was similar to that of the previous pilot study. Paper-based questionnaires were distributed in two undergraduate English classes with the support of the English teacher (the researcher's undergraduate supervisor) who agreed to help with this research. The study was briefly introduced by the English teacher and the researcher before questionnaires were handed out to the students during the break between the two class periods. The students read the information sheet and consent form and completed the questionnaires if they agreed to take part in the study. Completing the questionnaire took about ten minutes. In total 102 students from the two classes completed the questionnaires and 28 items had one or two missing values. One participant offered invalid responses for the procrastination and anxiety sections as he/she gave more than multiple responses to several statements which all require single choices.

4.2.4 Data analysis

Missing values were replaced using regression imputation in SPSS since AMOS requires complete data without missing values. Descriptive statistics, t-tests, correlations and regression analyses were conducted using SPSS version 24. Confirmatory factor analysis of every scale and path analysis of the hypothetical model were conducted using Structural Equation Modelling in AMOS version 23.

4.3 Results

4.3.1 Descriptive statistics

Table 1 shows the descriptive statistics for the five variables in this study. Overall, after imputation, the data from 102 cases were suitable for further analysis in this pilot study. The observed range and standard deviation values indicate that there was enough variation in the responses. The skewness values indicate the symmetrical distribution of the data. The medians of corrected item-total correlations were larger than .30, showing that the items were largely correlated to the appropriate scales. The scales were almost all internally consistent according to the Cronbach's alpha values. The alpha

values for the SAS-SV, the AEQ-anxiety and the SWLS were larger than .70 indicating good reliability but the alphas for the IPS and the SRS were lower, .62 and .65 respectively. Confirmatory factor analysis of the scales was conducted using Structural Equation Modelling as reported in the following sections.

Table 1

Descriptive scale statistics

Scale	No. of items	Range Potential	Range Observed	M	SD	Skew	MR	α
SAS-SV	10	10-60	16-58	37.03	7.51	-.10	.51	.80
IPS	8	8-40	15-35	24.85	4.59	.07	.40	.62
AEQ-anxiety	12	12-60	12-48	29.86	7.86	-.18	.45	.81
SRS	10	10-40	18-40	26.71	3.57	.43	.36	.65
SWLS	5	5-35	7-32	19.39	5.20	.01	.57	.77

Note. MR = Median of corrected item-total correlations; N = 102

4.3.2 t-tests and effect sizes for gender differences

Independent samples t-tests were used to investigate if there were gender differences for any variables. Although gender is not a study variable these analyses were conducted to establish whether it was reasonable to combine males and females in a single sample. Levene's test was applied before reporting the t values. Equal variances were not assumed only for the variable of academic procrastination (F = 12.28, p = 0.001). Table 2 shows that t-tests found no significant gender differences for any of the five variables among this sample, suggesting that they can be combined. However, Cohen's d values were calculated to assess the effect sizes for the non-significant mean differences. As shown in Table 2, medium effects sizes were observed for gender differences in problematic smartphone use, academic procrastination and self-regulation. There were small mean differences for academic anxiety and satisfaction with life. However, on the basis of these t-test and effect size values, it remains difficult to say whether meaningful gender differences for the five variables exist or not in this sample. It will be important to revisit this issue with a larger sample in the main study.

Table 2

Gender differences for problematic smartphone use, academic procrastination, academic anxiety, self-regulation and satisfaction with life

	Female	Male

	N = 54		N = 48				
	M	SD	M	SD	F	t(df)	d
Problematic smartphone use	38.18	6.64	35.74	8.26	2.12	1.65(100)	.33
Academic procrastination	25.55	5.39	24.06	3.37	12.28*	1.69(90.25)	.36
Academic anxiety	29.76	8.08	29.98	7.68	.37	-.14(100)	-.03
Self-regulation	26.10	3.85	27.39	3.12	.56	-1.85(100)	-.37
Satisfaction with life	18.83	5.40	20.01	4.94	.39	-1.15(100)	-.23

Note. *p < 0.05 (2-tailed).

4.3.3 Correlations

The Pearson product-moment correlation coefficients revealed problematic smartphone use was positively correlated with academic anxiety (r = .33, p < 0.01) and negatively correlated with self-regulation (r = -.20, p < 0.05) and satisfaction with life (r = -.21, p < 0.05). Academic procrastination had moderate positive correlations with problematic smartphone use (r = .43, p < 0.01, r2 = .18) and academic anxiety (r = .46, p < 0.01, r2 = .21). Academic procrastination was negatively correlated with self-regulation (r = -.26, p < 0.01) and satisfaction with life (r = -.22, p < 0.05). Self-regulation was negatively correlated with academic anxiety (r = -.31, p < 0.01) and positively correlated with satisfaction with life (r = .31, p < 0.01). There was no significant correlation between academic anxiety and satisfaction with life. Overall, as shown in Table 3, the five variables were roughly linked with each other. The correlations indicate the possible links in the hypothetical model and further path analysis of the model is needed.

Table 3

Pearson Product-moment Correlations

	1	2	3	4	5
1 Problematic smartphone use	-				

2 Academic procrastination	.43**	-				
3 Academic anxiety	.33**	.46**	-			
4 Self-regulation	-.20*	-.26**	-.31**	-		
5 Satisfaction with life	-.21*	-.22*	-.04	.31**	-	

Note. *p < 0.05 (2-tailed), **p < 0.01 (2-tailed).

4.3.4 Structural Equation Modelling

4.3.4.1 Confirmatory factor analysis for each scale

In order to test the reliability and validity of the scales, confirmatory factor analyses were conducted for each of the scales using structural equation modelling in AMOS. According to Hu & Bentler (1999), the cut off point for CFI is .95 (higher than .95 for good fit) and .06 for RMSEA (lower than .06 for good fit). As shown in Table 4, the models for SAS-SV, IPS, AEQ-anxiety and SRS had good model fit after freeing the error covariances according to the modification indices. The SWLS model had acceptable model fit without modification and a problematic χ^2/df value after modification. The scales in this study were reliable and valid according to the model fits in structural equation modelling.

Table 4

Confirmatory factor analysis

	χ^2	df	χ^2/df	p	CFI	RMSEA
SAS-SV						
Initial model	85.11	35	2.43	.00	.81	.12
Modified model	39.99	31	1.29	.13	.97	.05
IPS						
Initial model	94.49	20	4.73	.00	.54	.19
Modified model	22.97	14	1.64	.06	.95	.08
AEQ-anxiety						
Initial model	199.61	54	3.70	.00	.59	.16
Modified model	73.23	45	1.63	.01	.92	.08

SRS						
Initial model	75.41	35	2.16	.00	.73	.11
Modified model	32.65	30	1.09	.34	.98	.03
SWLS						
Initial model	10.25	5	2.05	.07	.96	.10
Modified model	1.85	4	.46	.76	1.00	.00

4.3.4.2 Path analysis of the hypothetical model

The hypothetical model was tested using structural equation modelling in AMOS. The Initial model (hypothetical model) had a poor model fit, shown in Figure 2, $\chi 2 = 20.09$ df = 5, $\chi 2/df = 4.02$, p = .00, CFI = .77, RMSEA = .17, as presented in Table 5. The modification indices for the initial model only suggested freeing the covariances between self-regulation and errors 1 and 4, which was meaningless according to Byrne (2010). However, when paths from self-regulation to satisfaction with life and academic anxiety were added into the model, as shown in Figure 3, the model fit became acceptable, $\chi 2 = 4.93$, df = 3, $\chi 2/df = 1.65$, p = .18, CFI = .97, RMSEA = .08. Furthermore, when paths from anxiety and procrastination to satisfaction with life were added, as shown in Figure 4, the final model had a good model fit, $\chi 2 = 1.27$, df = 1, $\chi 2/df = 1.27$, p = .26, CFI = .996, RMSEA = .05, although path coefficients were not significant.

Path coefficients in the models confirmed the mediation relationship between problematic smartphone use, academic anxiety and academic procrastination which was found in the previous pilot study. Furthermore, self-regulation was a significant predictor of problematics smartphone use, anxiety and life satisfaction. However, problematic smartphone use, anxiety and procrastination were not significant predictors of satisfaction with life in the final model. While problematic smartphone use only predicted life satisfaction in the initial model. It remains unclear whether problematic smartphone use predicts low life satisfaction, although they were significantly and negatively correlated.

Table 5

Summary of the model fit indices

							Fit changes		
	$\chi 2$	df	$\chi 2/df$	p	CF	RMSE	$\Delta \chi 2$	Δ df	ΔCF

					I	A			I
Initial model	20.09	5	4.02	.00	.77	.17			
Firstly modified model	4.93	3	1.65	.18	.97	.08			
Final model	1.27	1	1.27	.26	.99	.05	18.82	4	.22
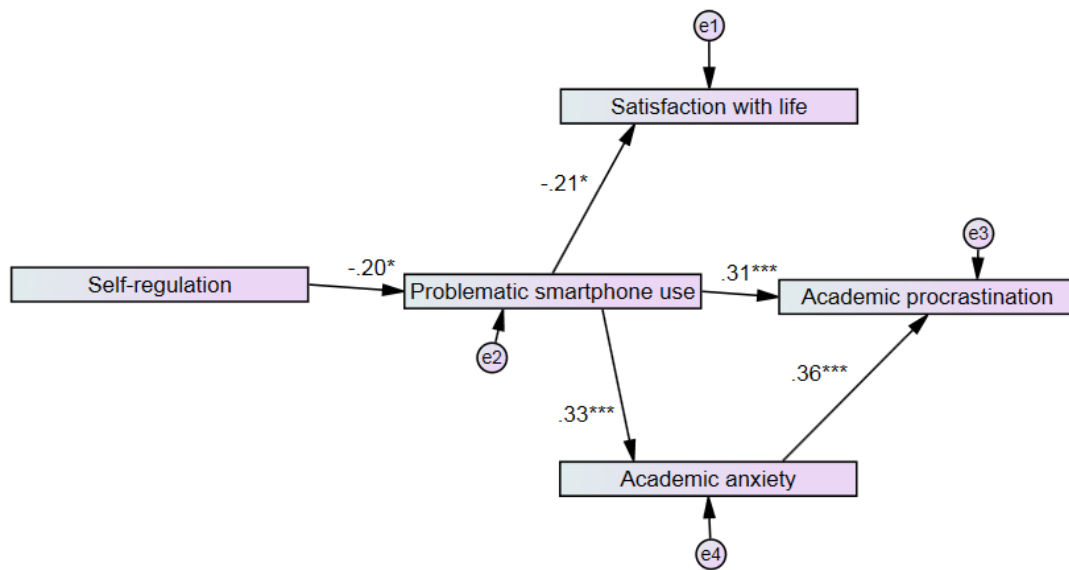
Figure 2 Initial model. $\chi 2 = 20.09$ df = 5, $\chi 2/df = 4.02$, p = .00, CFI = .77, RMSEA = .17
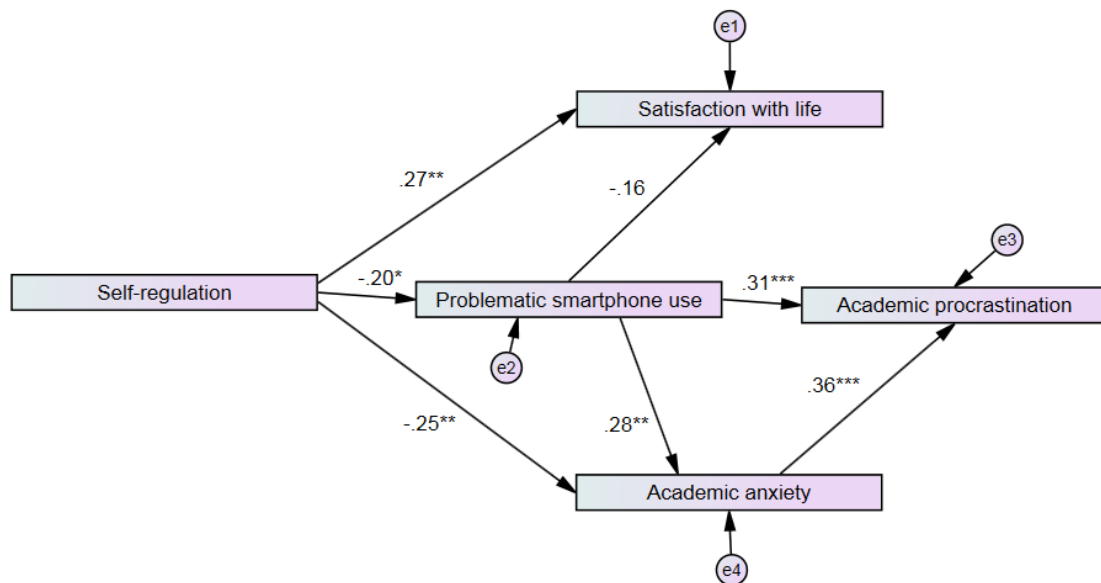
Note: *p < 0.05, **p < 0.01, ***p < 0.001

Figure 3 Firstly modified model, $\chi 2 = 4.93$, df = 3, $\chi 2/df = 1.65$, p = .18, CFI = .97, RMSEA = .08
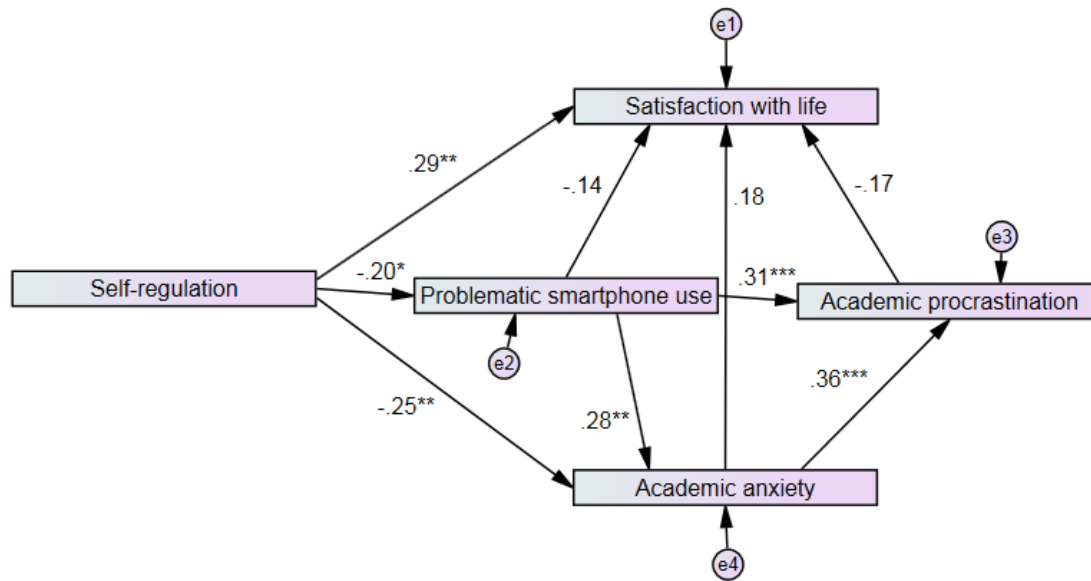
Note: *p < 0.05, **p < 0.01, ***p < 0.001

Figure 4 Final model. $\chi 2 = 1.27$, df $= 1$, $\chi 2/df = 1.27$, p $= .26$, CFI $= .996$, RMSEA $= .05$

Note: *p < 0.05, **p < 0.01, ***p < 0.001

4.4 Discussion

Overall, problematic smartphone was significantly correlated with academic procrastination, academic anxiety, self-regulation and life satisfaction. All the five subscales showed good model fit in confirmatory factor analysis. The modified hypothetical models were confirmed with good model fit. It is important to consider how the results of this pilot study compare with findings from related studies reviewed in Chapter 1. Table 5 presents a comparison. In order to make sure the data from this study was comparable, the grand mean of academic procrastination was calculated. Since the AEQ-anxiety used in this study was shortened from 35 to 12 items with 4 items in each sub scale, the scores of each sub scale were prorated to comply with the original sub scales. For example, the scores of the 4-item short version of learning anxiety scale were multiplied by 11/4 in order to compare them with the scores of the original 11-item scale. Except for academic procrastination, all the other variable means were the means of individual total scores.

Table 5.

Comparison of means between this pilot study and previous studies

	This pilot study			Previous studies			
	N	Mean	SD	N	Mean	SD	d

	N	M	SD	Study	N	M	SD	d
				Kwon, Kim et al. (2013)				
Problematic smartphone use	102	37.03	7.51		540	25.26	10.78	-1.14
				Steel (2010)				
Academic procrastination	102	3.11	.57		4169	3.63	.83	.63
				Pekrun et al. (2011)				
Academic anxiety								
Class	102	25.73	9.24		389	27.68	8.30	.23
Learning	102	32.10	9.62		389	30.69	7.76	-.17
Test	102	28.85	10.26		389	36.19	9.97	.73
				Diehl et al. (2006)				
Self-regulation	102	26.71	3.57		330	30.48	4.63	.86
				Diener et al. (1985)				
Satisfaction with life					176	23.50	6.43	.68
	102	19.39	5.20	Bai et al. (2011)				
					4795	20.32	5.99	.16

It can be seen that participants in the current study tended to report higher levels of problematic smartphone use than those in Kwon, Kim et al.'s (2013) study, since the mean score for the SAS-SV in this study is higher with a large effect size, d = -1.14. Furthermore, according to the cut-off values for smartphone addiction (33 points for females and 31 points for males) suggested in Kwon, Kim et al.'s (2013) study, the levels of smartphone addiction were relatively high compared to other recent empirical studies. In this study, 39 out of 54 (72.2%) females scored higher than 33 and 32 out of 48 (66.7%) males scored higher than 31. As presented in Table 6, percentages of smartphone addicts were obviously lower in recent studies (Chotpitayasunondh & Douglas, 2016; Kee, Byun, Jung, & Choi, 2016). This is a striking finding – notably higher levels of problematic smartphone use among Chinese students – but it need to be confirmed in a larger sample before any inferences can be drawn. It remains unclear, for example, whether the different results were affected by cultural or national differences.

Table 6.

Comparison of the percentage of addictive smartphone users between studies.

Gender	This pilot study		Chotpitayasunondh & Douglas's (2016) study		Kee et al.'s (2016) study	
	n/N	Percentage	n/N	Percentage	n/N	Percentage
Female	39/54	72.2%	51/158	32.3%	38/72	52%
Male	32/48	66.7%	27/93	29%	12/28	42%

Note. n = number of participants scored above the cut-off value, N = total number.

Furthermore, participants in this study scored lower in academic procrastination than those in Steel (2010) with an intermediate effect size, d = .63. Compared with those reported in Pekrun et al. (2011), participants in this study tended to be more anxious about learning (d = -.17) but less anxious about class (d = .23) and tests (d = .73). Participants in this study reported lower levels of self-regulation than those in Diehl et al. (2006) with a large effect size, d = .86. They also reported lower levels of satisfaction with life than those in Diener et al. (1985). However, the Chinese participants in this study reported similar levels of life satisfaction as the large Chinese sample of 4795 reported in Bai et al. (2011) with small effect size (d = .16), using the same Chinese version of the SWLS. Overall, the sample size of this pilot study (N = 102) is relatively small compared with the other studies. The main study will need to replicate these findings if we are to trust them.

In sum, in this pilot study, the questionnaires for the five variables were found to be reliable and valid for further main study according to descriptive statistics and the CFA using SEM in AMOS. This pilot study confirms the mediation relationship between problematic smartphone use, academic anxiety and procrastination, and the links between self-regulation, satisfaction with life and the other three variables. The structural equation model with good model fit indicates that the hypothesised relationships between the five variables exist in this relatively small Chinese sample. Low self-regulation might predict problematic smartphone use, academic anxiety and low level of life satisfaction. Problematic smartphone use appeared to have consequences including academic procrastination and anxiety, and it remains unclear whether problematic smartphone use predicts life satisfaction. Anxiety and procrastination were found to have no effect on life satisfaction according to the path coefficients but life satisfaction was significantly and negatively correlated with

procrastination. Therefore, further study is needed to explore those relationships in a larger sample.

Appendix H Path analysis for the model in Figure 8.2 in discussion chapter

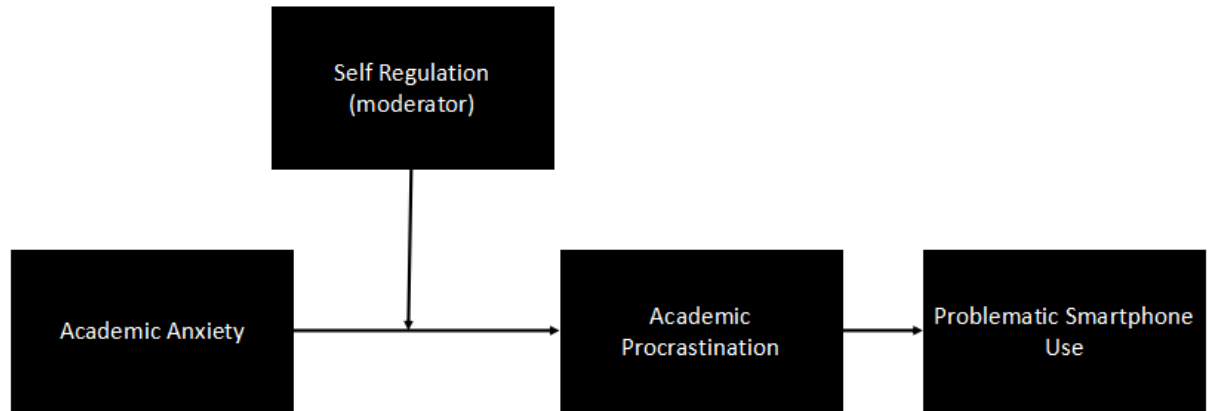Figure 8.1 New hypothesised model based on qualitative findings

In order to test the new hypothesised model based on qualitative findings shown in Figure 8.2, the interaction effects was tested using SEM in AMOS. The results show no significant moderation effect of self-regulation, and the model fit was not good. The path model is shown below.

$\chi2 = 33.16$
$\chi2/df = 11.05$
$p < .00$
CFI = .90
RMSEA = .146
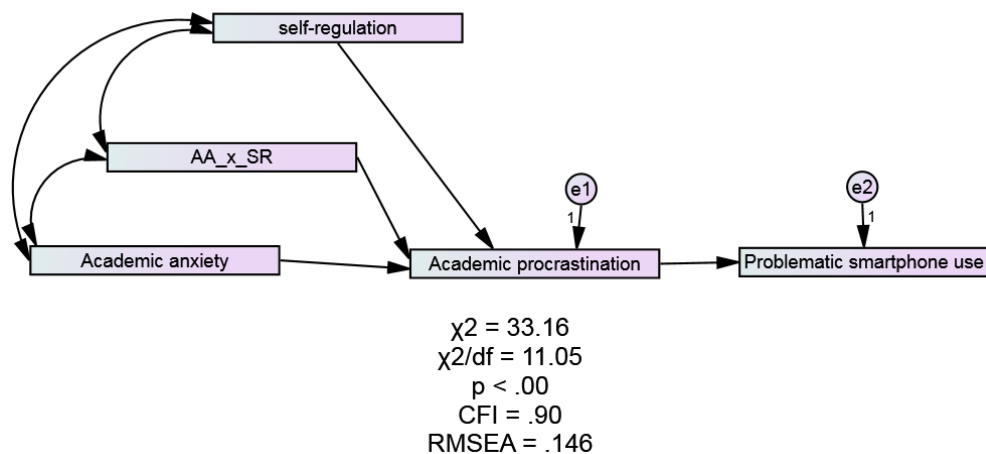
References

Ahmed, W., Minnaert, A., Kuyper, H., & Van Der Werf, G. (2012). Reciprocal relationships between math self-concept and math anxiety. *Learning and individual differences*, *22*(3), 385-389.

Aitken, (1982). *A personality profile of the college student procrastinator*. Unpublished doctoral dissertation, University of Pittsburgh, Pittsburgh, USA.

Akin, A., & Iskender, M. (2011). Internet addiction and depression, anxiety and stress. *International online journal of educational sciences*, *3*(1), 138-148.

Akinsola, M. K., Tella, A., & Tella, A. (2007). Correlates of academic procrastination and mathematics achievement of university undergraduate students. *Eurasia Journal of Mathematics, Science & Technology Education*, *3*(4), 363-370.

Alexander, E. S., & Onwuegbuzie, A. J. (2007). Academic procrastination and the role of hope as a coping strategy. *Personality and Individual Differences*, *42*(7), 1301-1310.

Alpert, R., & Haber, R. N. (1960). Anxiety in academic achievement situations. *The Journal of Abnormal and Social Psychology*, *61*(2), 207-215.

American Psychiatric Association. (1994). *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition*. Washington, DC: American Psychiatric Association.

American Psychiatric Association. (2000). *Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition, Text Revision*. *Text* (Vol. Washington). http://doi.org/10.1002/jps.3080051129

American Psychiatric Association. (2013). *Diagnostic and Statistical Manual of Mental Disorders: DSM-5*. Washington, DC; London: American Psychiatric Association.

Andreassen, C. S., Billieux, J., Griffiths, M. D., Kuss, D. J., Demetrovics, Z., Mazzoni, E. & Pallesen, S. (2016). The relationship between addictive use of social media and video games and symptoms of psychiatric disorders: A large-scale cross-sectional study. *Psychology of Addictive Behaviors*, *30,* 252–262.

Andrews, F. M., & McKennell, A. C. (1980). Measures of self-reported well-being: Their affective, cognitive, and other components. *Social Indicators Research*, *8*(2), 127-155.

Angner, E. (2010). Subjective well-being. *The Journal of Socio-Economics*,*39*(3), 361-368.

Aoki, K., & Downes, E. J. (2003). An analysis of young people's use of and attitudes toward cell phones. *Telematics and Informatics*. http://doi.org/10.1016/S0736-5853(03)00018-2

Armstrong, L., Phillips, J. G., & Saling, L. L. (2000). Potential determinants of heavier Internet usage. *International Journal of Human-Computer Studies, 53*(4), 537-550.

Artino, A. R., & Jones, K. D. (2012). Exploring the complex relations between achievement emotions and self-regulated learning behaviors in online learning.*The Internet and Higher Education*, *15*(3), 170-175.

Augner, C. (2015). Depressive Symptoms and Perceived Chronic Stress Predict Test Anxiety in Nursing Students. *Central European Journal of Nursing and Midwifery*. 6(3):291–297.

Aydin, S. (2013). Factors Affecting the Level of Test Anxiety among EFL Learners at Elementary Schools. *E-international journal of educational research*. 4(1), 63-81.

Ayres, B., & Bristow, M. (2009). *Anxiety in college students*. New York: Nova Biomedical Books.

Bai, X., Wu, C., Zheng, R., & Ren, X. (2011). The psychometric evaluation of the Satisfaction with Life Scale using a nationally representative sample of China. *Journal of Happiness Studies*, *12*(2), 183-197.

Bakker, A. B., Hakanen, J. J., Demerouti, E., & Xanthopoulou, D. (2007). Job resources boost work engagement, particularly when job demands are high. *Journal of educational psychology*, *99*(2), 274-284.

Bandalos, D. L., & Finney, S. J. (2001). Item parceling issues in structural equation modeling. In G. A. Marcoulides & R. E. Schumacker (Eds.), New developments and techniques in structural equation modeling (pp. 269–296). Mahwah, NJ: Lawrence Erlbaum Associates.

Baron, R. M., & Kenny, D. A. (1986). The moderator–mediator variable distinction in social psychological research: Conceptual, strategic, and statistical considerations. *Journal of personality and social psychology*, *51*(6), 1173.

Bartels, M. (2015). Genetics of wellbeing and its components satisfaction with life, happiness, and quality of life: A review and meta-analysis of heritability studies. *Behavior genetics*, *45*(2), 137-156.

Bembenutty, H. (2009). Test anxiety and academic delay of gratification. *College Student Journal*, *43*(1), 10.

Bertrams, A., Englert, C., & Dickhäuser, O. (2010). Self-control strength in the relation between trait test anxiety and state anxiety. *Journal of Research in Personality*, *44*(6), 738-741.

Bian, M., & Leung, L. (2015). Linking loneliness, shyness, smartphone addiction symptoms, and patterns of smartphone use to social capital. *Social Science Computer Review*, *33*(1), 61–79.

Bianchi, A., & Phillips, J. G. (2005). Psychological predictors of problem mobile phone use. *Cyberpsychology & Behavior*, *8*(1), 39–51. http://doi.org/10.1089/cpb.2005.8.39

Billieux, J. (2012). Problematic use of the mobile phone: a literature review and a pathways model. *Current Psychiatry Reviews*, *8*(4), 299-307.

Billieux, J., Maurage, P., Lopez-Fernandez, O., Kuss, D. J., & Griffiths, M. D. (2015). Can disordered mobile phone use be considered a behavioral addiction? An update on current evidence and a comprehensive model for future research. *Current Addiction Reports*, *2*(2), 156–162.

Billieux, J., Philippot, P., Schmid, C., Maurage, P., De Mol, J., & Van der Linden, M. (2014). Is Dysfunctional Use of the Mobile Phone a Behavioural Addiction? Confronting Symptom-Based Versus Process-Based Approaches. *Clinical psychology & psychotherapy*. *22*, 460-468.

Billieux, J., Van der Linden, M., & Rochat, L. (2008). The role of impulsivity in actual and problematic use of the mobile phone. *Applied Cognitive Psychology: The Official Journal of the Society for Applied Research in Memory and Cognition, 22*(9), 1195-1210.

Brand, M., Laier, C., & Young, K. S. (2014). Internet addiction: coping styles, expectancies, and treatment implications. *Frontiers in Psychology*, *5*, 1256.

Brand, M., Young, K. S., Laier, C., Wölfling, K., & Potenza, M. N. (2016). Integrating psychological and neurobiological considerations regarding the development and maintenance of specific Internet-use disorders: An Interaction of Person-Affect-Cognition-Execution (I-PACE) model. *Neuroscience & Biobehavioral Reviews*,

71, 252-266.

Bridges, K. R., & Roig, M. (1997). Academic procrastination and irrational thinking: A re-examination with context controlled. *Personality and Individual Differences*, *22*(6), 941-944.

Brown, R. I. F. (1993). Some contributions of the study of gambling to the study of other addictions. In W. R. Eadington, & J. Cornelius (Eds), *Gambling behavior and problem gambling*. Reno, NV: University of Nevada Press.

Brown, W. F., & Holtzman, W. H. (1967). *Survey of Study Habits and Attitudes: SSHA; Forms C and H; Manual*. Psychological Corporation.

Brownlow, S., & Reasinger, R. D. (2000). Putting off until tomorrow what is better done today: Academic procrastination as a function of motivation toward college work. *Journal of Social Behavior and Personality*, *15*(5), 15-34.

Burns, L. R., Dittmann, K., Nguyen, N. L., & Mitchelson, J. K. (2000). Academic procrastination, perfectionism, and control: Associations with vigilant and avoidant coping. *Journal of Social Behavior and Personality*, *15*(5; SPI), 35-46.

Byrne, B. M. (2010). *Structural equation modelling with AMOS: Basic concepts, applications, and programming*. New York; London: Routledge.

Çakıcı, D. Ç. (2003). Lise ve üniversite ögrencilerinde genel erteleme ve akademik erteleme davran ıs¸ ının incelenmesi [An Examination of the general procrastination behaviour and academic procrastination behavior in high-school and university students]. Unpublished master thesis. Institute of Education Sciences, Ankara University, Ankara, Turkey.

Caplan, S. E. (2007). Relations among loneliness, social anxiety, and problematic Internet use. *CyberPsychology & Behavior*, *10*(2), 234-242.

Carbonell, X., Chamarro, A., Oberst, U., Rodrigo, B., & Prades, M. (2018). Problematic use of the internet and smartphones in university students: 2006–2017. International Journal of Environmental Research and Public Health, 15(3). http://doi.org/10.3390/ijerph15030475

Cassady, J. C. (2004). The influence of cognitive test anxiety across the learning–testing cycle. *Learning and Instruction*, *14*(6), 569-592.

Cassady, J. C. (2010). *Anxiety in schools: The causes, consequences, and solutions for academic anxieties* (Vol. 2). Peter Lang. Ayres, B., & Bristow, M. (Eds.). (2009). Anxiety in College Students. New York, NY, USA: Nova.

Cassady, J. C., & Johnson, R. E. (2002). Cognitive test anxiety and academic performance. *Contemporary Educational Psychology*, *27*(2), 270-295.

Ceyhan, E., Ceyhan, A. A., & Gürcan, A. (2007). The validity and reliability of the problematic internet usage scale. *Educational Sciences: Theory & Practice, 7*, 411–416.

Chen, B., Liu, F., Ding, S., Ying, X., Wang, L., & Wen, Y. (2017). Gender differences in factors associated with smartphone addiction: a cross-sectional study among medical college students. *BMC psychiatry, 17*(1), 341.

Chen, S, Weng, L., Su, Y., Wu, H., & Yang, P. (2003). Development of a Chinese Internet addiction scale and its psychometric study. *Chinese Journal of Psychology, 45*(3), 279-294.

Choi, S. B., & Lim, M. S. (2016). Effects of social and technology overload on psychological well-being in young South Korean adults: The mediatory role of social network service addiction. *Computers in Human Behavior*, *61*, 245-254.

Chotpitayasunondh, V., & Douglas, K. M. (2016). How "phubbing" becomes the norm: The antecedents and consequences of snubbing via smartphone. *Computers in Human Behaviour, 63*, 9-18.

Cohen, L. Manion, L., Morrison, K. & Bell. R (2011). *Research methods in education* (7th ed). London: Routledge.

Cohen, M., Ben-Zur, H., & Rosenfeld, M. J. (2008). Sense of coherence, coping strategies, and test anxiety as predictors of test performance among college students. *International Journal of Stress Management*, *15*(3), 289.

Collins dictionary: 175 years of dictionary publishing. (2007). London: Collins.

Coopersmith, S. (1981). *SEI, Self-Esteem Inventories*. Consulting Psychologist Press.

Costa, P. T., & McCrae, R. R. (1992). *NEO PI-R Professional Manual.* Odessa: Psychological Assessment Resources, Inc.

Creswell, J. W., & Plano Clark, V. L. (2017). *Designing and conducting mixed methods research. (Third edition)*. Los Angeles: Sage.

Culler, R. E., & Holahan, C. J. (1980). Test anxiety and academic performance: The effects of study-related behaviors. *Journal of Educational Psychology*, 72, 16–20.

Dan, O., & Raz, S. (2012). The relationships among ADHD, self-esteem, and test anxiety in young adults. Journal of Attention Disorders. Advance online publication. doi:10.1177/1087054712454571

Davis, R. A. (2001). A cognitive-behavioral model of pathological Internet use. *Computers in human behavior*, *17*(2), 187-195.

Davis, R. A., Flett, G. L., & Besser, A. (2002). Validation of a new scale for measuring problematic Internet use: Implications for pre-employment screening. *Cyber Psychology & Behavior*, *5*(4), 331-345.

Dayapoglu, N., Kavurmaci, M., & Karaman, S. (2016). The Relationship between the Problematic Mobile Phone Use and Life Satisfaction, Loneliness, and Academic Performance in Nursing Students. *International Journal of Caring Sciences*, *9*(2), 647-652.

Derogatis, L. R., & Melisaratos, N. (1983). The brief symptom inventory: an introductory report. *Psychological medicine*, *13*(03), 595-605.

Derogatis, L. R., Rickels, K., & Rock, A. F. (1976). The SCL-90 and the MMPI: a step in the validation of a new self-report scale. *The British Journal of Psychiatry, 128*(3), 280-289.

Diehl, M., Semegon, A. B., & Schwarzer, R. (2006). Assessing attention control in goal pursuit: A component of dispositional self-regulation. *Journal of personality assessment*, *86*(3), 306-317.

Diener, E. D., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of personality assessment*, *49*(1), 71-75.

Diener, E., Lucas, R. E., & Oishi, S. (2002). Subjective well-being: The science of happiness and life satisfaction. In C. R. Snyder & S. J. Lopez (Eds.), *The handbook of positive psychology* (pp. 63–73). Oxford, England: Oxford University Press.

Dong, G., Wang, L., Du, X., & Potenza, M. N. (2017). Gaming increases craving to gaming-related stimuli in individuals with Internet gaming disorder. *Biological Psychiatry: Cognitive Neuroscience and Neuroimaging*, *2*(5), 404-412

Dong, Y., & Yu, G. (2007). The Development and Application of an Academic Emotions Questionnaire (Article written in Chinese). *Acta Psychologica Sinica*, *39*(5), 852-860.

Eum, K., & Rice, K. G. (2011). Test anxiety, perfectionism, goal orientation, and academic performance. *Anxiety, Stress, & Coping*, *24*(2), 167-178.

Everson, H. T., Smodlaka, I., & Tobias, S. (1994). Exploring the relationship of test anxiety and metacognition on reading test performance: A cognitive analysis. *Anxiety, Stress and Coping, 7*(1), 85-96.

Fischer, R., & Schwartz, S. (2011). Whence differences in value priorities? Individual, cultural, or artifactual sources. *Journal of Cross-Cultural Psychology*, *42*(7), 1127-1144.

Frenzel, A. C., Thrash, T. M., Pekrun, R., & Goetz, T. (2007). A cross-cultural comparison of German and Chinese emotions in the achievement context. *Journal of Cross-cultural Psychology*, *38*(3), 302-309.

Fritzsche, B. A., Young, B. R., & Hickson, K. C. (2003). Individual differences in academic procrastination tendency and writing success. *Personality and Individual Differences*, *35*(7), 1549-1557.

Fu, K. W., Chan, W. S., Wong, P. W., & Yip, P. S. (2010). Internet addiction: prevalence, discriminant validity and correlates among adolescents in Hong Kong. *The British Journal of Psychiatry*, *196*(6), 486-492.

Fujii, Y. (1993). Construction of a test influence inventory (TII). *Shinrigaku kenkyu: The Japanese journal of psychology*, *64*(2), 135-139.

Gale, N. K., Heath, G., Cameron, E., Rashid, S., & Redwood, S. (2013). Using the framework method for the analysis of qualitative data in multi-disciplinary health research. *BMC medical research methodology*, *13*, 117.

Gao, Y., Li, H., & Zhu, T. (2014). Predicting Subjective Well-Being by Smartphone Usage Behaviors. In *HEALTHINF* (pp. 317-322).

Gillen-O'Neel, C., Ruble, D. N., & Fuligni, A. J. (2011). Ethnic stigma, academic anxiety, and intrinsic motivation in middle childhood. *Child development*, *82*(5), 1470-1485.

Gogol, K., Brunner, M., Goetz, T., Martin, R., Ugen, S., Keller, U., Fischbach, A., & Preckel, F. (2014). "My Questionnaire is Too Long!" The assessments of motivational-affective constructs with three-item and single-item measures.*Contemporary Educational Psychology*, *39*(3), 188-205.

Gökçearslan, Ş., Mumcu, F. K., Haşlaman, T., & Çevik, Y. D. (2016). Modelling smartphone addiction: The role of smartphone usage, self-regulation, general self-efficacy and cyberloafing in university students.*Computers in Human*

Behavior, *63*, 639-649.

Gorard, S. (2001). *Quantitative methods in educational research: The role of numbers made easy*. London: Continuum.

Grant, J. E., & Chamberlain, S. R. (2016). Expanding the definition of addiction: DSM-5 vs. ICD-11. *CNS spectrums, 21*(4), 300-303.

Griffiths, M. D. (1995). Technological addictions. *Clinical Psychology Forum, 76*, 14-19.

Griffiths, M. D. (1996). Gambling on the Internet: A brief note. *Journal of Gambling Studies*, *12*(4), 471-473.

Griffiths, M. D. (1996). Internet addiction: An issue for clinical psychology? *Clinical Psychology Forum, 97*, 32-36.

Griffiths, M. D. (2000). Internet addiction - Time to be taken seriously? *Addiction Research*, *8*, 413-418.

Griffiths, M. D. (2002). *Gambling and gaming addictions in adolescence*. Leicester: British Psychological Society/ Blackwell.

Griffiths, M. D. (2005). A 'components' model of addiction within a biopsychosocial framework. *Journal of Substance Use*, *10*(4)*, 191-197.

Griffiths, M. D. (2017). Behavioural addiction and substance addiction should be defined by their similarities not their dissimilarities. *Addiction, 112,* 1718-1720.

Griffiths, M. D., Kuss, D. J., Billieux J. & Pontes, H. M. (2016). The evolution of internet addiction: A global perspective. *Addictive Behaviors, 53*, 193–195.

Ha, J. H., Chin, B., Park, D.-H., Ryu, S.-H., & Yu, J. (2008). Characteristics of excessive cellular phone use in Korean adolescents. *Cyberpsychology & Behavior: The Impact of the Internet, Multimedia and Virtual Reality on Behavior and Society*, *11*(6), 783–784. http://doi.org/10.1089/cpb.2008.0096

Ha, J. H., Yoo, H. J., Cho, I. H., Chin, B., Shin, D., & Kim, J. H. (2006). Psychiatric Comorbidity Assessed in Korean Children and Adolescents Who Screen Positive for Internet Addiction. *The Journal of Clinical Psychiatry, 67*(5), 821-826.

Haug, S., Castro, R. P., Kwon, M., Filler, A., Kowatsch, T., & Schaub, M. P. (2015). Smartphone use and smartphone addiction among young people in Switzerland. *Journal of behavioral addictions*, *4*(4), 299-307.

Haycock, L. A., McCarthy, P., & Skay, C. L. (1998). Procrastination in college students: The role of self-efficacy and anxiety. *Journal of counseling & development*, *76*(3), 317-324.

Heine, S. J., Buchtel, E. E., & Norenzayan, A. (2008). What do cross-national comparisons of personality traits tell us? The case of conscientiousness. *Psychological Science*, *19*(4), 309-313.

Higgins, E. T. (1987). Self-discrepancy: A theory relating self and affect. *Psychological Review, 94*, 319-340.

Ho, R. C., Zhang, M. W., Tsang, T. Y., Toh, A. H., Pan, F., Lu, Y., ... & Watanabe, H. (2014). The association between internet addiction and psychiatric co-morbidity: a meta-analysis. *BMC psychiatry, 14*(1), 183.

Hong, F.-Y., Chiu, S.-I., & Huang, D.-H. (2012). A model of the relationship between psychological characteristics, mobile phone addiction and use of mobile phones by Taiwanese university female students. *Computers in Human Behavior*, *28*(6), 2152–2159. http://doi.org/10.1016/j.chb.2012.06.020

Horvath, C. (2004). Measuring television addiction. *Journal of Broadcasting & Electronic Media, 48*, 378–398.

Hoyle, R. H. (2011). Estimation and fit. In *The Sage Library of Methods in Social and Personality Psychology: Structural equation modeling for social and personality psychology* (pp. 36-53). London: SAGE Publications Ltd doi: 10.4135/9781446287965.n3

Hu, L. T., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural equation modeling: a multidisciplinary journal*, *6*(1), 1-55.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. *Structural Equation Modeling: A Multidisciplinary Journal*, *6*(1), 1–55. http://doi.org/10.1080/10705519909540118

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal, 6(1), 1–55.

Hu, L., & Bentler, P. M. (1999). Cutoff criteria for fit indexes in covariance structure analysis: Conventional criteria versus new alternatives. Structural Equation Modeling: A Multidisciplinary Journal, 6(1), 1–55.

Huang, H., Zhou, C., & Yu, L. (2013). Association between mobile phone addiction

and mental health among college students. *Chinese Journal of School Health*, 34(9), 1074-1076.

Huang, Z., Wang, M., Qian, M., Zhong, J., & Tao, R. (2007). Chinese Internet addiction inventory: developing a measure of problematic Internet use for Chinese college students. *Cyberpsychology & Behavior*, *10*(6), 805-812.

Hussain, Z., Griffiths, M. D., & Sheffield, D. (2017). An investigation into problematic smartphone use: The role of narcissism, anxiety, and personality factors. *Journal of behavioral addictions*, *6*(3), 378-386.

In'nami, Y. (2006). The effects of test anxiety on listening test performance.*System*, *34*(3), 317-340.

Jackson, D. N. (1976). *Jackson Personality Inventory.* Port Huron, Michigan: Research Psychologists Press.

Jang, K. S., Hwang, S. Y., & Choi, J. Y. (2008). Internet addiction and psychiatric symptoms among Korean adolescents. *Journal of School Health*, *78*(3), 165-171.

Jenaro, C., Flores, N., Gómez-Vela, M., González-Gil, F., & Caballo, C. (2007). Problematic internet and cell-phone use: Psychological, behavioral, and health correlates. *Addiction Research & Theory*, *15*(3), 309–320. http://doi.org/10.1080/16066350701350247.

Jin, Y., Sun, C., An, J., & Li, J.   (2017). Attachment Styles and Smartphone Addiction in Chinese College Students: the Mediating Roles of Dysfunctional Attitudes and Self-Esteem. *International Journal of Mental Health and Addiction, 15*(5), 1122-1134.

Kalechstein, P., Hocevar, D., Zimmer, J. W., & Kalechstein, M. (1989). Procrastination over test preparation and test anxiety. In R. Schwarzer, H. M. van der Ploeg, & G. D. Spielberger (Eds.), *Advances in test anxiety research* (Vol. 6, pp. 63–76). Lisse, The Netherlands: Swets & Zeitlinger.

Kee, I. K., Byun, J. S., Jung, J. K., & Choi, J. K. (2016). The presence of altered craniocervical posture and mobility in smartphone-addicted teenagers with temporomandibular disorders. *Journal of physical therapy science, 28*(2), 339-346.

Kim, D. I., Chung, Y. J., Lee, E. A., Kim, D. M., & Cho, Y. M. (2008). Development of internet addiction proneness scale-short form (KS scale). *The Korea Journal of Counseling*, *9*(4), 1703-1722.

Kim, J., & Haridakis, P. M. (2009). The role of internet user characteristics and motives in explaining three dimensions of internet addiction. *Journal of Computer-Mediated Communication*, *14*(4), 988-1015.

Klassen, R. M., Ang, R. P., Chong, W. H., Krawchuk, L. L., Huan, V. S., Wong, I. Y., & Yeo, L. S. (2009). A cross-cultural study of adolescent procrastination. *Journal of Research on Adolescence*, *19*(4), 799-811.

Klassen, R. M., Krawchuk, L. L., & Rajani, S. (2008). Academic procrastination of undergraduates: Low self-efficacy to self-regulate predicts higher levels of procrastination. *Contemporary Educational Psychology*, *33*(4), 915-931.

Kleeman, J., & Yu, H. (2010). *The Oxford Chinese dictionary: English-Chinese, Chinese*. Oxford: Oxford University Press [in association with FLTRP Beijing].

Ko, C. H., Yen, J. Y., Yen, C. F., Chen, C. S., & Chen, C. C. (2012). The association between Internet addiction and psychiatric disorder: a review of the literature. *European Psychiatry*, *27*(1), 1-8.

Koc, M., & Gulyagci, S. (2013). Facebook addiction among Turkish college students: The role of psychological health, demographic, and usage characteristics. *Cyberpsychology, Behavior, and Social Networking*, *16*(4), 279-284.

Kross, E., Verduyn, P., Demiralp, E., Park, J., Lee, D. S., Lin, N., Shablack, H., Jonides, J., & Ybarra, O. (2013). Facebook use predicts declines in subjective well-being in young adults. *PloS one*, *8*(8), e69841.

Kuss, D. J. & Griffiths, M. D. (2017). Social networking sites and addiction: Ten lessons learned. *International Journal of Environmental Research and Public Health*, *14*(3), 311.

Kuss, D. J., & Griffiths, M. D. (2011). Online social networking and addiction—a review of the psychological literature. *International journal of environmental research and public health*, *8*(9), 3528-3552.

Kuss, D. J., Griffiths, M. D., Karila, L. & Billieux, J. (2014). Internet addiction: A systematic review of epidemiological research for the last decade. *Current*

Pharmaceutical Design, 20, 4026-4052.

Kwon, M., Kim, D. J., Cho, H., & Yang, S. (2013). The smartphone addiction scale: development and validation of a short version for adolescents. *PloS one, 8*(12), e83558.

Kwon, M., Lee, J. Y., Won, W. Y., Park, J. W., Min, J. A., Hahn, C., Gu, X., Choi, J. H., & Kim, D. J. (2013). Development and validation of a smartphone addiction scale (SAS). *PloS one*, *8*(2), e56936.

Lachmann, B., Sindermann, C., Sariyska, R. Y., Luo, R., Melchers, M. C., Becker, B., ... & Montag, C. (2018). The Role of Empathy and Life Satisfaction in Internet and Smartphone Use Disorder. *Frontiers in Psychology, 9*, 398.

Lai, K., & Green, S. B. (2016). The problem with having two watches: Assessment of fit when RMSEA and CFI disagree. *Multivariate behavioral research*, *51*(2-3), 220-239.

Lapointe, L., Boudreau-Pinsonneault, C., & Vaghefi, I. (2013, January). Is smartphone usage truly smart? A qualitative investigation of IT addictive behaviors. In *System Sciences (HICSS), 2013 46th Hawaii International Conference on* (pp. 1063-1072). IEEE.

LaRose, R., & Eastin, M. S. (2004). A social cognitive theory of Internet uses and gratifications: Toward a new model of media attendance. *Journal of Broadcasting & Electronic Media*, *48*(3), 358-377.

LaRose, R., Lin, C. A., & Eastin, M. S. (2003). Unregulated Internet usage: Addiction, habit, or deficient self-regulation? *Media Psychology*, *5*(3), 225-253.

Lay, C. H. (1986). At last, my research article on procrastination. *Journal of research in personality*, *20*(4), 474-495.

Lay, C., & Silverman, S. (1996). Trait procrastination, anxiety, and dilatory behavior. *Personality and Individual Differences*, *21*(1), 61-67.

Lazarus, R. S. (1966). *Psychological stress and the coping process*. New York: McGraw-Hill.

Lee, E. (2005). The relationship of motivation and flow experience to academic procrastination in university students. *The Journal of Genetic Psychology*, *166*(1), 5-15.

Lee, E. B. (2015). Too much information: Heavy smartphone and Facebook utilization by African American young adults. *Journal of Black Studies*, *46*(1), 44-61.

Lee, J. C. K., Yin, H. B., & Zhang, Z. H. (2010). Adaptation and analysis of Motivated Strategies for Learning Questionnaire in the Chinese Setting through multiple methods. *International Journal of Testing, 10*(2), 149-165.

Leon, D. T., & Rotunda, R. J. (2000). Contrasting Case Studies of Frequent Internet Use: Is It Pathological or Adaptive? *Journal of College Student Psychotherapy*, *14*(4), 9-18.

Lepp, A., Barkley, J. E., & Karpinski, A. C. (2014). The relationship between cell phone use, academic performance, anxiety, and Satisfaction with Life in college students. *Computers in Human Behavior*, *31*(1), 343–350. http://doi.org/10.1016/j.chb.2013.10.049

Leung, L. (2008). Linking Psychological Attributes To Addiction and Improper Use of the Mobile Phone Among Adolescents in Hong Kong. *Journal of Children and Media*, *2*(2), 93–113. http://doi.org/10.1080/17482790802078565.

Leung, L., & Liang, J. (2016). Psychological Traits, Addiction Symptoms, and Feature Usage as Predictors of Problematic Smartphone Use among University Students in China. *International Journal of Cyber Behavior, Psychology and Learning (IJCBPL), 6*(4), 57-74.

Leung, L., & Wei, R. (2000). More than just talk on the move: Uses and gratifications of the cellular phone. *Journalism & Mass Communication Quarterly*, *77*(2), 308-320.

Levine, G. (2008). A Foucaultian approach to academic anxiety. *Educational studies*, *44*(1), 62-76.

Li, J., Lepp, A., & Barkley, J. E. (2015). Locus of control and cell phone use: Implications for sleep quality, academic performance, and subjective well-being. *Computers in Human Behavior*, *52*, 450-457.

Liu, C. Y., & Kuo, F. Y. (2007). A study of Internet addiction through the lens of the interpersonal theory. *CyberPsychology & Behavior*, *10*(6), 799-804.

Loewenthal, K. M. (2004). *An introduction to psychological tests and scales* (second edition). Hove, UK: Psychology Press.

Long, J., Liu, T. Q., Liao, Y. H., Qi, C., He, H. Y., Chen, S. B., & Billieux, J. (2016). Prevalence and correlates of problematic smartphone use in a large random sample of Chinese undergraduates. *BMC Psychiatry*, *16*, 408.

Longman dictionary of English language and culture. (1998). Harlow: Longman.

Lopez-Fernandez, O. (2017). Short version of the Smartphone Addiction Scale adapted to Spanish and French: Towards a cross-cultural research in problematic mobile phone use. *Addictive behaviors*, *64*, 275-280.

Lopez-Fernandez, O., Kuss, D. J., Romo, L. Morvan, Y., Kern, L., … Billieux, J. (2017). Self-reported dependence on mobile phones in young adults: A European cross-cultural empirical survey. *Journal of Behavioral Addictions*, *6*, 168-177.

Lovibond, S. H., & Lovibond, P. F. (1995). *Manual for the depression anxiety stress scales*. Sydney: The Psychology Foundation of Australia.

Lu, X., Watanabe, J., Liu, Q., Uji, M., Shono, M., & Kitamura, T. (2011). Internet and mobile phone text-messaging dependency: Factor structure and correlation with dysphoric mood among Japanese adults. *Computers in Human Behavior*, *27*(5), 1702–1709. http://doi.org/10.1016/j.chb.2011.02.009

Ludlow, L. H., & Guida, F. V. (1991). The Test Anxiety Scale for Children as a generalized measure of academic anxiety. *Educational and Psychological Measurement*, *51*(4), 1013-1021.

Luszczynska, A., Diehl, M., Gutiérrez-Doña, B., Kuusinen, P., & Schwarzer, R. (2004). Measuring one component of dispositional self-regulation: Attention control in goal pursuit. *Personality and Individual Differences*, *37*(3), 555-566.

Maier, C., Laumer, S., Eckhardt, A., & Weitzel, T. (2012). When social networking turns to social overload: explaining the stress, emotional exhaustion, and quitting behavior from social network sites' users. In Paper presented at the ECIS.

Mandler, G., & Sarason, S. B. (1952). A study of anxiety and learning. *The Journal of Abnormal and Social Psychology*, *47*(2), 166.

Mann, L., Burnett, P., Radford, M., & Ford, S. (1997). The Melbourne Decision Making Questionnaire: An instrument for measuring patterns for coping with decisional conflict. *Journal of Behavioral Decision Making*, *10*(1), 1-19.

Marchand, G. C., & Gutierrez, A. P. (2012). The role of emotion in the learning process: Comparisons between online and face-to-face learning settings. *The Internet and Higher Education*, *15*(3), 150-160.

Marteau, T. M., & Bekker, H. (1992). The development of a six- item short-form of the state scale of the Spielberger State- Trait Anxiety Inventory (STAI). British Journal of Clinical Psychology, 31(3), 301–306.

Matthews, G., Hillyard, E. J., & Campbell, S. E. (1999). Metacognition and maladaptive coping as components of test anxiety. *Clinical Psychology and Psychotherapy*, 6, 111–125.

Mazman, S. G. (2009). *The Process of the Adoption of Social Networks and Using Them in Educational Contexts*. Unpublished Master's Thesis. Hacettepe University, Institute of Science, Ankara, Turkey.

McCown, W., & Johnson, J. (1989). Differential arousal gradients in chronic procrastination. *American Psychological Society, Alexandria, VA*.

McMillan, J. H. (2012). *Educational research: Fundamentals for the consumer* (6th ed.). Boston: Pearson.

Meece, J. L., Wigfield, A., & Eccles, J. S. (1990). Predictors of math anxiety and its influence on young adolescents' course enrollment intentions and performance in mathematics. *Journal of educational psychology*, *82*(1), 60-70.

Milfont, T. L., & Fischer, R. (2010). Testing measurement invariance across groups: Applications in cross-cultural research. *International Journal of psychological research*, *3*(1), 111-130.

Milgram, N. A., Batori, G., & Mowrer, D. (1994). Correlates of academic procrastination. *Journal of School Psychology*, *31*(4), 487-500.

Milgram, N., & Toubiana, Y. (1999). Academic anxiety, academic procrastination, and parental involvement in students and their parents. *British Journal of Educational Psychology*, *69*(3), 345-361.

Milgram, N., Marshevsky, S., & Sadeh, C. (1995). Correlates of academic procrastination: Discomfort, task aversiveness, and task capability. *The Journal of Psychology*, *129*(2), 145-155.

Ministry of Industry and Information Technology of the People's Republic of China. (2015). The economic operation of the communication industry in November 2015. Retrieved January 21st 2016 from http://www.miit.gov.cn/n1146312/n1146904/n1648372/c4609596/content.html.

Ministry of Industry and Information Technology of the People's Republic of China. (2018). The report of communication industry in 2017. Retrieved March 29, 2018, from: http://www.miit.gov.cn/n1146290/n1146402/n1146455/c6048084/content.html

Muijs, D. (2004). *Doing quantitative research in education with SPSS*. Los Angeles; London: SAGE.

Newby, P. (2010). *Research methods for education*. Harlow: Pearson Education Limited.

Nie, Y., Lau, S., & Liau, A. K. (2011). Role of academic self-efficacy in moderating the relation between task importance and test anxiety. *Learning and Individual Differences*, *21*(6), 736-741.

Odaci, H. (2011). Academic self-efficacy and academic procrastination as predictors of problematic internet use in university students. *Computers & Education*, *57*(1), 1109-1113.

Ottens, A. J. (1991). *Coping with academic anxiety*. New York: The Rosen Publishing Group.

Pallant, J. (2013). SPSS survival manual: a step by step guide to data analysis using IBM SPSS. Maidenhead, Berkshire, England: McGraw Hill.

Panova, T., & Carbonell, X. (2018). Is smartphone addiction really an addiction?. *Journal of behavioral addictions*, *7*(2) 1-8.

Paris, J. (2013). *The Intelligent Clinician's Guide to the DSM-5*. New York: Oxford University Press.

Park, N., & Lee, H. (2012). Social implications of smartphone use: Korean college students' smartphone use and psychological well-being.*Cyberpsychology, Behavior, and Social Networking*, *15*(9), 491-497.

Pekrun, R. (2006). The control-value theory of achievement emotions: Assumptions, corollaries, and implications for educational research and practice. *Educational Psychology Review*. http://doi.org/10.1007/s10648-006-9029-9.

Pekrun, R., Goetz, T., & Perry, R. P. (2005). Achievement Emotions Questionnaire (AEQ). User's manual. Munich, Germany: Department of Psychology, University of Munich.

Pekrun, R., Goetz, T., Frenzel, A. C., Barchfeld, P., & Perry, R. P. (2011). Measuring emotions in students' learning and performance: The Achievement Emotions Questionnaire (AEQ). *Contemporary Educational Psychology*, *36*(1), 36-48.

Pekrun, R., Goetz, T., Titz, W., & Perry, R. P. (2002). Academic emotions in students' self-regulated learning and achievement: A program of qualitative and quantitative research. *Educational psychologist, 37*(2), 91-105.

Pintrich, P. R., & De Groot, E. V. (1990). Motivational and self-regulated learning components of classroom academic performance. *Journal of educational psychology*, *82*(1), 33-40.

Pintrich, P. R., Smith, D. A. F., Garcia, T., & McKeachie, W. J. (1993). Reliability and predictive validity of the motivated strategies for learning questionnaire (MSLQ). *Educational and Psychological Measurement, 53*, 801–813.

Pintrich, P. R., Smith, D., Garcia, T., and McKeachie, W. (1991). *A Manual for the Use of the Motivated Strategies for Learning Questionnaire (MSLQ)*, The University of Michigan, Ann Arbor, MI.

Poli, R., & Agrimi, E. (2012). Internet addiction disorder: prevalence in an Italian student population. *Nordic journal of psychiatry, 66*(1), 55-59.

Pontes, H. M., & Griffiths, M. D. (2015). Measuring DSM-5 Internet Gaming Disorder: Development and validation of a short psychometric scale. *Computers in Human Behavior, 4*5, 137–143.

Poushter, J. (2016) Smartphone ownership and internet usage continues to climb in emerging economies – But advanced economies still have higher rates of technology use. Retrieved March 29, 2018, from: http://www.pewglobal.org/2016/02/22/smartphone-ownership-and-internet-usage-continues-to-climb-in-emerging-economies/

Rachman, S. (2013). *Anxiety (3rd ed.)*. East Sussex: Psychology Press.

Radloff, L. S. (1977). The CES-D scale a self-report depression scale for research in the general population. *Applied psychological measurement*, *1*(3), 385-401.

Rana, R. A., & Mahmood, N. (2010). The relationship between test anxiety and academic achievement. *Bulletin of Education and Research*, *32*(2), 63-74.

Rao, N., & Sachs, J. (1999). Confirmatory factor analysis of the Chinese version of the motivated strategies for learning questionnaire. Educational and Psychological Measurement, 59(6), 1016-1029.

Richardson, M., Hussain, Z., & Griffiths, M. D. (2018). Problematic smartphone use, nature connectedness, and anxiety. *Journal of behavioral addictions, 7*(1), 109-116.

Ritchie, J., & Spencer, L. (1994). Qualitative data analysis for applied policy research. In A. Bryman & R. Burgess (Eds.), *Analysing qualitative data* (pp. 173–194). London, UK: Routledge.

Rosenberg M. (1965) *Society and the Adolescent Self-image*. Princeton, NJ: Princeton University Press.

Rothblum, E. D., Solomon, L. J., & Murakami, J. (1986). Affective, cognitive, and behavioral differences between high and low procrastinators. *Journal of Counseling Psychology, 33*(4), 387– 394.

Russell, D. W. (1996). UCLA Loneliness Scale (Version 3): Reliability, validity, and factor structure. *Journal of personality assessment, 66*(1), 20-40.

Sahin, Y. L. (2014). Comparison of users' adoption and use cases of Facebook and their academic procrastination. *Digital Education Review*, (25), 127-138.

Samaha, M., & Hawi, N. S. (2016). Relationships among smartphone addiction, stress, academic performance, and satisfaction with life.*Computers in Human Behavior*, *57*, 321-325.

Sansgiry, S. S., & Sail, K. (2006). Effect of students' perceptions of course load on test anxiety. *American journal of pharmaceutical education*, *70*(2).

Sarason, I. G. (1980a). Introduction to the study of test anxiety. In I. G. Sarason (Ed.), *Test Anxiety: Theory, research and applications* (pp. 3–14). Hillsdale, NJ: Erlbaum.

Sarason, I. G. (Eds.). (1980b). *Test Anxiety: Theory, research and applications*. Hillsdale, NJ: Erlbaum.

Sarason, I. G., Pederson, A. M., & Nyman, B. (1968). Test anxiety and the observation of models. *Journal of Personality*, *36*(3), 493-511.

Sarason, S. B., Davidson, K., Lighthall, F., & Waite, R. (1958). A test anxiety scale for children. *Child development*, 105-113.

Schraw, G., Wadkins, T., & Olafson, L. (2007). Doing the things we do: A grounded theory of academic procrastination. *Journal of Educational psychology*, *99*(1), 12-25.

Schwartz, S. H. (2014). Rethinking the concept and measurement of societal culture in light of empirical findings. *Journal of cross-cultural Psychology*, *45*(1), 5-13.

Schwarzer, R., Diehl, M., & Schmitz, G. S. (1999). *Self-Regulation Scale*. Retrieved January 24, 2017 from http://userpage.fu-berlin.de/gesund/skalen/Language_Selection/Turkish/Self-Regulation/self-regulation.htm.

Scott, D. & Usher, R. (2011). *Researching education: data, methods and theory in educational enquiry (2nd ed)*. London; New York: Continuum International Pub. Group.

Senécal, C., Koestner, R., & Vallerand, R. J. (1995). Self-regulation and academic procrastination. *The Journal of Social Psychology*, *135*(5), 607-619.

Shin, K. W., Kim, D. I., & Jung, Y. J. (2011). Development of Korean smart phone addiction proneness scale for youth and adults. *Seoul: Korean National Information Society Agency.*

Sieber, J. E., O'Neil Jr, H. F., & Tobias, S. (1977). *Anxiety, learning, and instruction*. Hillsdale, N.J.: Lawrence Erlbaum Associates.

Siedler, T., Schupp, J., Spiess, C. K., & Wagner, G. G. (2009). The German Socio-Economic Panel (SOEP) as Reference Data Set. *Schmollers Jahrbuch, 12*9(2), 367-374.

Slavin, R. E. (2012). *Educational psychology: Theory and practice*. Boston: Pearson.

Solomon, L. J., & Rothblum, E. D. (1984). Academic procrastination: Frequency and cognitive-behavioral correlates. *Journal of counseling psychology*, *31*(4), 503-509.

Soror, A. A., Steelman, Z. R., & Limayem, M. (2012, January). Discipline yourself before life disciplines you: Deficient self-regulation and mobile phone unregulated use. In *System Science (HICSS), 2012 45th Hawaii International Conference on* (pp. 849-858). IEEE.

Spada, M. M., Nikcevic, A. V., Moneta, G. B., & Ireson, J. (2006). Metacognition as a mediator of the effect of test anxiety on a surface approach to studying. *Educational Psychology*, *26*(5), 615-624.

Spielberger, C. D., Gorsuch, R. L., & Lushene, R. E. (1970). *Manuel for the State-Trait Anxiety Inventory*. Consulting Psychologists Press, Palo Alto.

Spielberger, C. D. (1966). Anxiety and Behavior. New York: Academic Press.

Spielberger, C. D. (1972b). The Nature and Measurement of Anxiety. In C. D. Spielberger, (Eds.). *Anxiety: Current trends in theory and research*. (pp. 23-49). New York: Academic Press.

Spielberger, C. D. (1980). *Test Anxiety Inventory: Preliminary professional manual*. Palo Alto, CA: Consulting Psychologists Press.

Spielberger, C. D. (Eds.). (1972a). *Anxiety: Current trends in theory and research*. New York: Academic Press.

Spielberger, C. D., & Vagg, P. R. (1995a). Test anxiety: A transactional process. In C. D. Spielberger & P. R. Vagg (Eds.), Test anxiety: Theory, assessment, and treatment (pp, 3– 14). Washington, DC: Taylor & Francis.

Spielberger, C. D., & Vagg, P. R. (Eds.). (1995b). Test anxiety: Theory, assessment, and treatment. Washington, DC: Taylor & Francis.

Statista (2018a). Number of smartphone users worldwide from 2014 to 2020 (in billions). Retrieved June 14, 2018, from: https://www.statista.com/statistics/330695/number-of-smartphone-users-worldwide/

Statista (2018b). China: Smartphone Market – Statistics & Facts. Retrieved June 14, 2018, from: https://www.statista.com/topics/1416/smartphone-market-in-china/

Steel, P. (2007). The nature of procrastination. *Psychological Bulletin*, *133*(1), 65-94.

Steel, P. (2010). Arousal, avoidant and decisional procrastinators: Do they exist?. *Personality and Individual Differences*, *48*(8), 926-934.

Stöber, J. (2004). Dimensions of test anxiety: Relations to ways of coping with pre-exam anxiety and uncertainty. *Anxiety, Stress & Coping*, *17*(3), 213-226.

Tabachnick, B. G., Fidell, L. S., & Osterlind, S. J. (2007). *Using multivariate* statistics. (5th ed.). Boston; London: Pearson/Allyn & Bacon.

Tarafdar, M., Tu, Q., & Ragu-Nathan, T. S. (2010). Impact of technostress on end-user satisfaction and performance. Journal of Management Information Systems, 27(3), 303-334.

Taylor, J., & Deane, F. P. (2002). Development of a short form of the Test Anxiety Inventory (TAI). *The Journal of general psychology*, *129*(2), 127-136.

Tempelaar, D. T., Niculescu, A., Rienties, B., Gijselaers, W. H., & Giesbers, B. (2012). How achievement emotions impact students' decisions for online learning, and what precedes those emotions. *The Internet and Higher Education*, *15*(3), 161-169.

The National Bureau of Statistics of China. (n.d.). National Data [Electronic database]. The National Bureau of Statistics of China. Retrieved 2nd February 2016 from http://data.stats.gov.cn/english/easyquery.htm?cn=C01.

Thomas, G. (2009). How to do your research project: a guide for students in education and applied social sciences. Los Angleles London: SAGE.

Titsworth, S., McKenna, T. P., Mazer, J. P., & Quinlan, M. M. (2013). The bright side of emotion in the classroom: Do teachers' behaviors predict students' enjoyment, hope, and pride?. *Communication Education*, *62*(2), 191-209.

Tuckman, B. W. (1991). The development and concurrent validity of the procrastination scale. *Educational and psychological measurement*, *51*(2), 473-480.

Tze, V. M., Daniels, L. M., Klassen, R. M., & Li, J. C. H. (2013). Canadian and Chinese university students' approaches to coping with academic boredom. *Learning and Individual Differences*, *23*, 32-43.

Vacaru, M. A., Shepherd, R. M., & Sheridan, J. (2014). New Zealand Youth and Their Relationships with Mobile Phone Technology. *Int J Ment Health Addiction*, *12*, 572–584. http://doi.org/10.1007/s11469-014-9488-z

Vahedi, Z., & Saiphoo, A. (2018). The association between smartphone use, stress, and anxiety: A meta-analytic review. *Stress and Health, 34*, 347-358.

Van de Vijver, F. J., & Leung, K. (2000). Methodological issues in psychological research on culture. *Journal of cross-cultural psychology, 31*(1), 33-51.

Van Deursen, A. J., Bolle, C. L., Hegner, S. M., & Kommers, P. A. (2015). Modeling habitual and addictive smartphone behavior: The role of smartphone usage types, emotional intelligence, social stress, self-regulation, age, and gender. *Computers in human behavior*, *45*, 411-420.

Walsh, S. P., White, K. M., & Young, R. M. (2008). Over-connected? A qualitative exploration of the relationship between Australian youth and their mobile phones. *Journal of Adolescence*, *31*(1), 77–92. http://doi.org/10.1016/j.adolescence.2007.04.004.

Wang, H., Huang, H., & Wu, H. M. (2014). Relationship between Personality and Mobile Phone Addiction: A Mediating Role of Social Anxiety.*Chinese Journal of Clinical Psychology*, *3*, 015.

Watson, D., & Friend, R. (1969). Measurement of social-evaluative anxiety. *Journal of consulting and clinical psychology*, *33*(4), 448-457.

Wei, F. Y. F., Wang, Y. K., & Klausner, M. (2012). Rethinking college students' self-regulation and sustained attention: Does text messaging during class influence cognitive learning? *Communication Education*, *61*(3), 185-204.

Weiner, B. A., & Carton, J. S. (2012). Avoidant coping: A mediator of maladaptive perfectionism and test anxiety. *Personality and Individual Differences*, *52*(5), 632-636.

Weinstein, A., & Lejoyeux, M. (2010). Internet addiction or excessive internet use. *The American journal of drug and alcohol abuse*, *36*(5), 277-283.

Wellington, J. (2000) *Educational research: contemporary issues and practical approaches*. London: Continuum.

Whang, L. S. M., Lee, S., & Chang, G. (2003). Internet over-users' psychological profiles: a behavior sampling analysis on internet addiction.*CyberPsychology & Behavior*, *6*(2), 143-150.

Widyanto, L., & Griffiths, M. (2006) Internet addiction: does it really exist? In: J. Gackenbach (ed.), *Psychology and the Internet: intrapersonal, interpersonal, and transpersonal applications*. (pp. 141-163). Burlington, MA, USA: Academic Press.

Widyanto, L., & McMurran, M. (2004). The psychometric properties of the internet addiction test. *CyberPsychology & Behavior*, *7*(4), 443-450.

Widyanto, L., Griffiths, M. D., & Brunsden, V. (2011). A psychometric comparison of the Internet Addiction Test, the Internet-Related Problem Scale, and self-diagnosis. *Cyberpsychology, Behavior, and Social Networking*, *14*(3), 141-149.

Wigfield, A., & Eccles, J. S. (1990). Test anxiety in the school setting. In M. Lewis & S. M. Miller (Eds.), *Handbook of developmental psychopathology* (pp. 237-250). New York: Plenum.

Wilson, K., Fornasier, S., & White, K. M. (2010). Psychological predictors of young adults' use of social networking sites. *Cyberpsychology, Behavior, and Social Networking*, *13*(2), 173-177.

Wittmaier, B. C. (1972). Test anxiety and study habits. *The Journal of Educational Research*, *65*(8), 352-354.

Wu, M. (2010). *Structural equation modelling: Operation and usage of AMOS (2nd edition)*. Chongqing University Press.

Yang, H., & Lay, Y. (2011). Factors Affecting College Student's Mobile Phone Dependence and Anxiety. *Proceedings of the World Congress on Engineering and Computer Science 2011*, *II*, 19–22. Retrieved from http://www.iaeng.org/publication/WCECS2011/WCECS2011_pp1117-1120.pdf

Yen, J. Y., Ko, C. H., Yen, C. F., Chen, S. H., Chung, W. L., & Chen, C. C. (2008). Psychiatric symptoms in adolescents with Internet addiction: Comparison with substance use. *Psychiatry and clinical neurosciences*, *62*(1), 9-16.

Young, K. S (2017). The evolution of Internet addiction. *Addictive Behaviors, 64,* 229-230.

Young, K.S. (1998a). *Caught in the Net: How to recognize the signs of Internet addiction and a winning strategy for recovery.* New York: John Wiley & Sons.

Young, K.S. (1998b). Internet addiction: The emergence of a new clinical disorder. *CyberPsychology & Behavior*, *1*(3), 237-244.

Zboralski, K., Orzechowska, A., Talarowska, M., Darmosz, A., Janiak, A., Janiak, M. Florkowski, A., & Gałecki, P. (2009). The prevalence of computer and Internet addiction among pupils. *Postepy Hig Med Dosw. (Online)*, *63*, 8-12.

Zeidner M. (1998). *Test anxiety*: The state of the art. New York, NY: Plenum.