VALIDATION OF MALAY VERSION OF FIVE-FACTOR NONVERBAL PERSONALITY QUESTIONNAIRE (FF-NPQ)

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by

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The Most Merciful and The Most Gracious.

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LIST OF ABBREVIATIONS

A	Agreeableness
AIC	Aikaike Information Criterion
BIC	Bayesian Information Criterion
C	Conscientiousness
CFA	Confirmatory Factor Analysis
CFI	Comparative Fit Index
CI	Confidence Interval
df	Degree of freedom
E	Extraversion
FF-NPQ	Five-Factor Nonverbal Personality Questionnaire
MAD	median absolute deviation
MD	mean difference
MI	Modification indices
MLR	Robust Maximum Likelihood
N	Neuroticism
O	Openness to experience
P	Psychoticism
PPSG	Pusat Pengajian Sains Pergigian
PPSK	Pusat Pengajian Sains Kesihatan
PPSP	Pusat Pengajian Sains Perubatan
RMSEA	Root Mean Square Error of Approximation
SRMR	Standardized Root Mean square Residual
TLI	Tucker-Lewis Fit Index
USM	Universiti Sains Malaysia

IQR	Interquartile range

PENENTUSAHAN SKALA FIVE-FACTOR NONVERBAL PERSONALITY QUESTIONNAIRE (FF-NPQ) VERSI BAHASA MELAYU

ABSTRAK

Pengenalan: Skala Five-Factor Nonverbal Personality Questionnaire (FF-NPQ) merupakan skala kaji selidik yang mengukur lima dimensi berkenaan teori Big Five. Ia terdiri daripada 60 item, dengan lima faktor, 12 item setiap satu. Soal selidik ini adalah berbeza daripada soal selidik personaliti yang lain kerana setiap item dinyatakan dalam bentuk ilustrasi berkenaan sesuatu situasi. Walaupun inventori ini mempunyai beberapa kelebihan berbanding yang lain, masih tiada kajian yang dilakukan untuk menentusahkan skala kaji selidik ini supaya bersesuain dengan suasana dan budaya di Malaysia. **Objektif:** Kajian ini dijalankan bagi menentusahkan FF-NPQ versi Bahasa Melayu dalam kalangan orang diawal dewasa. **Kaedah:** Kajian ini merupakan kajian keratan rentas yang dijalankan di Kampus Kesihatan, USM dalam kalangan orang diawal dewasa dengan linkungan umur antara 18 hingga 30 tahun. Responden terdiri daripada pelajar prasiswazah dan pascasiswazah pada sesi akademik 2015/2016. Seramai 153 orang responden terlibat. Proses terjemahan melalibatkan kaedah terjemahan ke hadapan dan terjemahan ke belakang. CFA digunakan bagi menentukan kesahihan konstruk berdasarkan struktur dalaman model. Independent *t*-test digunakan bagi menentukan kesahihhan konstruk berdasarkan hubungan antara pemboleh-ubah yang lain manakala Mann-Whitney test digunakan sekiranya andaian untuk independent t-test tidak ditepati. **Keputusan:** Pada akhir kajian ini, FF-NPQ versi Bahasa Melayu telah berjaya dihasilkan. Keputusan CFA menunjukkan model FF-NPQ revised memiliki kesepadan model yang bagus dengan lima faktor dan 26 item dikekalkan (χ^2(df), *p*-value = 315.53 (286), 0.111; CFI = 0.958; TLI = 0.952; RMSEA (90% CI) =

0.026 (0.000, 0.042); SRMR = 0.068; AIC = 13824.13; BIC = 14099.30). Tiga ralat korelasi juga diambil kira pada model FF-NPQ revised. Setiap konstruk mempunyai kebolehpercayaan konstruk yang bagus (0.68 hingga 0.77). Keputusan independent *t*-test dan Mann-Whitney test pula menunjukkan terdapat empat pemboleh ubah yang signifikan (*p*-value < 0.05). **Kesimpulan:** FF-NPQ versi Bahasa Melayu berpotensi memiliki kesahihan konstruk dan kebolehpercayaan konstruk yang bagus dalam konteks kajian ini. Skala kaji selidik ini mengekalakan lima dimensi personaliti sebagai faktor iaitu *Extraversion, Agreeableness, Conscientiousness, Neuroticism and Openness to experience*.

Kata kunci: Personaliti, Big Five, skala kaji selidik bukan lisan, FF-NPQ, awal dewasa.

VALIDATION OF MALAY VERSION OF FIVE-FACTOR NONVERBAL PERSONALITY QUESTIONNAIRE (FF-NPQ)

ABSTRACT

Introduction: The Five-Factor Nonverbal Personality Questionnaire (FF-NPQ) is a questionnaire measuring five broad dimension of Big Five theory of personality. It consists of 60 items with five constructs, 12 items each. This questionnaire is different from other personality questionnaire since each item is expressed in form of illustration of a situation. Although this inventory has some advantages as compared to other personality inventory, there is no study carried out to validate the questionnaire to suit it with Malaysian culture and environment. **Objective:** The study was conducted to validate the Malay version of FF-NPQ among Malaysians young adults. **Methods:** The study was a cross-sectional study conducted in Health Campus, USM among the young adults aged 18 to 30 years old. Respondents were selected among undergraduate and postgraduate students of 2015/2016 academic session. Number of the sample was 153 respondents. Translation process was done by forward and backward translation method. Confirmatory factor analysis (CFA) was applied to find the construct validity based on internal structure evidence by dimensionality. Independent *t*-test was applied to find the construct validity based on relationship with other variables while Mann-Whitney test was applied when assumptions of independent *t*-test were violated. **Results:** At the end of this study, the Malay version of FF-NPQ was produced. The CFA resulted in good model fit (FF-NPQ revised) with five factors were maintained and 26 items remained (χ^2(df), *p*-value = 315.53 (286), 0.111; CFI = 0.958; TLI = 0.952; RMSEA (90% CI) = 0.026 (0.000, 0.042); SRMR = 0.068; AIC = 13824.13; BIC = 14099.30). Three correlated errors were also considered in the final model. Each construct also have a good reliability range from 0.68 to 0.77. Independent *t*-test and

Mann-Whitney test resulted in four variables were significant (p-value < 0.05). **Conclusion:** The Malay version of FF-NPQ has a potentially good construct validity and reliability in the scope of this study. The questionnaire maintained the broad five factor personality dimension as its five factors at the end of the study, namely Extraversion, Agreeableness, Conscientiousness, Neuroticism and Openness to experience.

Keywords: Personality, Big Five, nonverbal questionnaire, FF-NPQ, young adults.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

The word "personality" is an English word, derived from the word *pesona*, which is in Latin (Hjelle and Ziegler, 1981). Personality can be defined as the unique pattern of thoughts, feelings and behaviours of an individual (Roberts and Mroczek, 2008). Different individual may have different personality due to different in behaviours, emotions and motivations own by the individual. It persists over time and across situations (Morris and Maisto, 2005).

Many theories describing personality and traits were discovered, for example Cartell's theory, The 16PF (Personality Factor) Test, and Eysenck's three personality dimensions (E – Extraversion versus introversion; N – Neuroticism versus emotional stability; P – Psychoticism versus impulse control) (John and Srivastava, 1999; Schultz and Schultz, 2009). Nowadays, Big Five is one of the well known theories in describing personality. It was known as Big Five as there are five types of factors or dimensions involved. They are Extraversion, Neuroticism, Conscientiousness, Agreeableness and Openness to experience. Extraversion measures the sociality and outgoingness of a person (Bhagat, 2013; John and Srivastava, 1999). It is also related to the energetic approach to the social and material. Agreeableness refers to prosocial and communal orientation toward others with antagonism; Conscientiousness refers to socially prescribed impulse control that facilitates task-directed and goal-directed behaviour; Neuroticism refers to emotional stability and temperedness with negative emotionality; Openness to experience refers to breadth, depth, originality and complexity of the mental and experiential life (John and Srivastava, 1999).

A lot of personality assessments have been developed and used worldwide across the years. For example, NEO Five-Factor Inventory (NEO-FFI) and Revised NEO Personality Inventory (NEO-PI-R) (Costa and MacCrae, 1992), Sixteen Personality Factor Questionnaire (16PF) (Cattell *et al.*, 1970) and Jackson Personality Inventory (JPI) (Jackson, 1979). Among numerous personality inventories, nonverbal personality inventories were also developed. Nonverbal Personality Questionnaire (NPQ) (Paunonen *et al.*, 2000) and Five-Factor Nonverbal Personality Questionnaire (FF-NPQ) (Paunonen *et al.*, 2001) are the two nonverbal personality questionnaires developed.

Five-Factor Nonverbal Personality Questionnaire (FF-NPQ) was constructed by selecting items from NPQ. It was designed and well established to measure five broad factors of personality. FF-NPQ contains 60 items. There are 12 items for each domain. The domains of the items are labelled as Extraversion, Agreeableness, Conscientiousness, Neuroticism and Openness to Experience (Paunonen *et al.*, 2001).

Items in FF-NPQ are different from other inventories because they are present in nonverbal measures where the items are consists of illustrations of a different situations instead of verbal statements. Nonverbal measure of personality has some advantages as compared to verbal measures for studies across cultures since it does not need to translate the item measures (Paunonen *et al.*, 2001). However, some illustration of items may not be relevant for different cultures in some reasons. The reasons are not only the culture of the countries, but also can be due to different geographic, political environment or economic (Paunonen *et al.*, 2001).

1.2 Problem statement

Psychometric properties of FF-NPQ has been examined in many countries including Canada, England, Finland, Germany, Norway, Poland and Russia during the construction of FF-NPQ (Paunonen *et al.*, 2001). However, there is no study conducted to validate this questionnaire in Malaysia culture and environment even though the questionnaire has some advantages compared to verbal questionnaire.

1.3 Justification of study

Since FF-NPQ was developed in different region, some of the illustrations may not be suitable to Malaysian cultures and environment. In addition, its nonverbal assessment intends to have some advantages as compared to regular verbal assessment. Thus, this study was conducted to determine its validity and reliability in order to fit the construct with Malaysia cultures and environment. Meanwhile, the instruction of FF-NPQ was translated into Malay language since it is the main language spoken in this country.

1.4 Research questions

Does FF-NPQ have good psychometric properties among Malaysian young adults?

1.5 General objective

To validate the Malay version FF-NPQ among Malaysian young adults.

1.6 Specific objectives

1. To translate the FF-NPQ into Malay language.
2. To determine construct validity of the Malay version of FF-NPQ by internal structure evidence of dimensionality.
3. To determine construct validity of the Malay version of FF-NPQ by relationships with other variables.

1.7 Research hypothesis

Objective 2:

Malay version FF-NPQ has good psychometric properties in measuring personality among Malaysians young adults.

Objective 3:

It was hypothesized that:

1. Mean score for Neuroticism; Agreeableness; Conscientiousness; Extraversion; Openness to Experience are different between genders.
2. Mean score for Extraversion; Neuroticism are different between students with different routinely exercise status.
3. Mean score for Extraversion is different between students with different activeness in sport status.
4. Mean score for Agreeableness is different between students with different frequently speeding status.
5. Mean score for Conscientiousness is different between students with different frequently violating the traffic status.

6. Mean score for Openness to Experience is different between students with different travelling interest status.
7. Mean score for Extraversion is different between students with different activeness in social media status.

1.8 Theoretical framework

Figure 1.1 below shows the theoretical framework of the Big Five personality theory (Paunonen *et al.*, 2004).

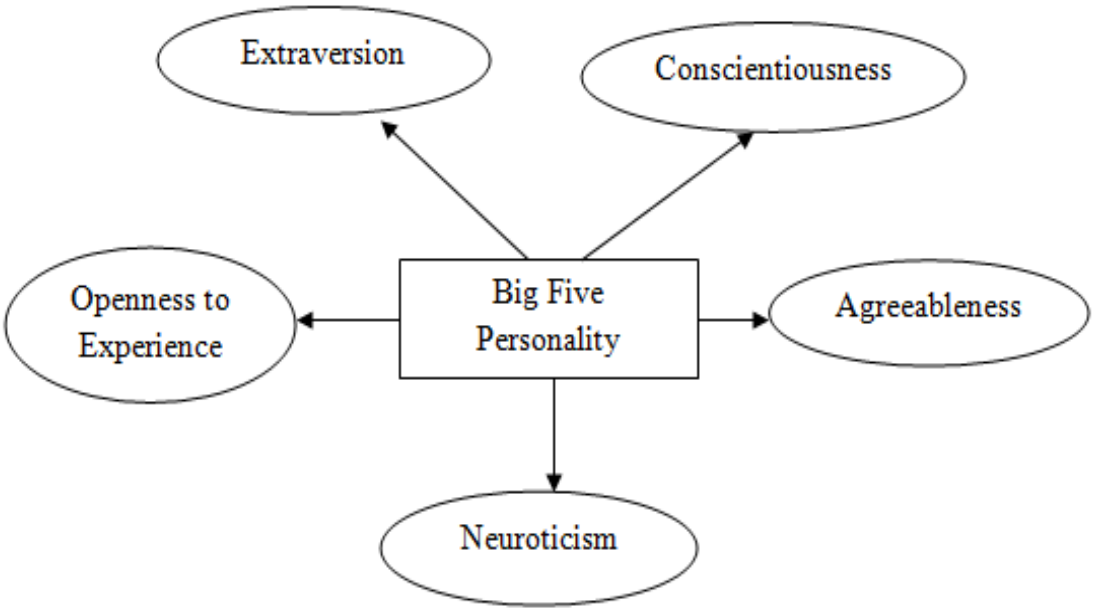

Figure 1.1: Theoretical framework

CHAPTER TWO: LITERATURE REVIEW

2.1 Personality

According to Hjelle and Ziegler (1981), Gordon Allport defined personality as which individual really is and it guides all human activity, while George Kelly defined personality as the unique way of individual making sense out of life experiences. Changes in the thoughts, feelings and behaviours of an individual were defined as the personality processes (McCrae and John, 1992).

2.1.1 Personality theories

Schultz and Schultz (2009), mentioned that Hans Eysenck had discovered personality theory based on three dimensions. The three dimensions are Extraversion versus introversion, Neuroticism versus emotional stability, and Psychoticism versus impulse control (E, N, P). Example of traits include sociable, lively, active, assertive, dominant in E; anxious, depress, shy, moody, low self esteem in N; aggressive, cold, egocentric, impersonal, impulsive, creative in P (Schultz and Schultz, 2009). Eysenck also identified Extraversion and Neuroticism as main components of psychological tests (McCrae and John, 1992).

McCrae and Costa Jr (1987), identified five factors of personality namely neuroticism, extraversion, openness, agreeableness and conscientiousness, called Big Five factors. Big Five framework was the most widely used by researchers in modelling the personality (Gosling *et al.*, 2003).

Individuals who are high in extraversion could be said as those who enjoy being with people, took part in social activities and kind of outgoing and energetic. However

individuals that low in extraversion tend to be a person who more comfortable working by himself, less active in social activities and less outgoing (Bhagat, 2013).

People who are high in agreeableness are seen as people who like to help and support others. Those who score high in agreeableness also tend to be cooperative (Paunonen *et al.*, 2004). Whereas individuals low on agreeableness are unfriendly, rude and irritable (Miles and Johnson, 2003).

People with high neuroticism tend to be impatient, anxious, irritable and tense (Miles and Johnson, 2003). People who rarely feels negative emotion such as fear, anxiety or depression, is kind of people who low in neuroticism. These people also untroubled by negative mood and danger situation (Paunonen *et al.*, 2004).

McCrae and Costa Jr (1987), defined the opposite of conscientiousness as people who not so much uncontrolled. Conscientious people could be labelled as people who hardworking, ambitious and energetic (McCrae and Costa Jr, 1987). People low in conscientiousness, otherwise, can be viewed as irresponsible, careless and rash (Miles and Johnson, 2003).

Another dimension of personality is openness. According to McCrae and Costa Jr (1987), original, imaginative, broad interests and daring are characterized openness people. Open individual also tend to be somewhat more intelligent.

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2.1.2 Personality inventories in Malaysia

There were also a few personality inventories has been developed in Malaysia based on the Big Five theory. For example, the Malay Version NEO Five-Factor Personality Inventory (NEO-FFI) and USM Personality Inventory (USMaP-i).

2.1.2.1 Malay Version NEO Five-Factor Personality Inventory (NEO-FFI)

Malay Version NEO Five-Factor Personality Inventory (NEO – FFI) is a verbal scale, derived from the original NEO Five-Factor Inventory (NEO-FFI) by Costa and McCrae (1992). The item statements in the Malay Version Five-Factor Personality Inventory (NEO-FFI) depict personality-relevant behaviours (Lim and Melissa Ng, 2012). This structured assessment is simple to score and interpret. The inventory was designed to identify Malaysian students' personality based on local cultures and values. It also can be a very useful instrument in identifying the personality of other groups such as adults, workers and teachers. It measures Extraversion, Agreeableness, Conscientiousness, Neuroticism and Openness to Experience. It consists of 53 items with likert scale of one to five. Five means "most agree" and one means "most disagree". Each traits of the personality is represented in 10 items except 12 items for "Agreeableness" and 11 items for "Conscientiousness". For the Malaysian sample, the overall mean alpha coefficient for NEO-FFI was satisfactory, which is 0.642 and indicates satisfactory reliability. It has high validity with overall factor loading of more than 0.4.

2.1.2.2 The USM Personality Inventory (USMaP-i)

USMaP-i was designed to identify personality traits of Malaysian applicants who going to take medical course in Malaysia. The five domains of USMaP-i were developed based on Big-Five Dimensions. The inventory consists of 60 items and each statements

of the items was rated under five categories of response, where "0" indicate "very inaccurate" while "4" indicate " very accurate" (Yusoff, 2013b).

The findings (Yusoff *et al.*, 2011) suggested that all 60 items were reliable and have high internal consistency. Total Cronbach's alpha value was 0.73. Cronbach's alpha value for every domains were 0.80(extroversion), 0.83(Conscientiousness), 0.63(Agreeableness), 0.81(Neuroticism) and 0.70(Opened).

Nur Farliza *et al.* (2016), handled a study to examine validity evidence of USMaP-i among applicants of medical degree program for year 2010-2013 intakes in Universiti Sains Malaysia. In the study, confirmatory factor analysis was applied, which involved 657 cases. In the end of the study, the five-factor model of personality consists of 13 items, five factors. It also had a good fit. However, the reliability of the factors was very poor. Faking Index model was a single factor with six items. Two items left in Extraversion as well as Agreeableness, and three items each for Conscientiousness, Neuroticism and Openness to experience.

2.1.3 Five-Factor Nonverbal Personality Questionnaire (FF-NPQ)

FF-NPQ was designed to measure five broad factors underlying Five-Factor Model (FFM) of personality structure. Items in FF-NPQ was a subset of NPQ items with 7-point scale where 1 indicate "extremely unlikely" and 7 indicate "extremely likely", while 4 indicate "neither likely nor unlikely" (Paunonen *et al.*, 2004).

Paunonen *et al.* (2001), performed a study to examine the psychometric properties of FF-NPQ in data from different cultures. The study involved seven cultures which 701

university students as the respondents. They were from Canada, England, Finland, Germany, Norway, Poland and Russia. From the study, the internal consistency reliability, Cronbach's alpha coefficient ranged from 0.64 to 0.77, with an average of 0.72. Finland showed the lowest reliability over the five scales with mean of 0.66. Meanwhile, English data showed the highest reliability with a mean of 0.79. The mean scale reliability for Canada, Germany, Norway, Poland and Russia were 0.75, 0.69, 0.71, 0.68 and 0.72 respectively. Convergent and discriminant correlations were determined between FF-NPQ and PRF Big Five scales by Pearson's correlation (*r*). The convergent correlations were in a range of $r = 0.35$ (Neuroticism) to $r = 0.54$ (Extraversion), with an average of $r = 0.48$. Discriminant correlations were relatively small. The highest discriminant correlation was $r = 0.26$ and a mean absolute value of only $r = 0.10$. In terms of convergent validity by country, the highest was for Norway with mean $r = 0.55$ across five scales. For Canada, England, Germany, Poland, Russia and Finland, the mean convergent correlations were $r = 0.50$, 0.55, 0.45, 0.49, 0.41 and 0.40, respectively.

In another study by Paunonen (2003), three measures of the big five were used. Two of them were the well-known NEO Five-Factor Inventory (NEO-FFI) and Revised NEO Personality Inventory (NEO-PI-R) questionnaires. The third measure was the Five-Factor Nonverbal Personality Questionnaire (FF-NPQ). The study was conducted to evaluate the generalizability of a few Big Five personality factor inventories as predictors of a common set of criteria. The study also conducted to provide evidence of convergent validity of FF-NPQ. The study involved two different samples of university students as the participants. One sample completed the FF-NPQ and NEO-FFI, while the other sample completed FF-NPQ and NEO-PI-R. All participants also completed the

Behaviour Report Form (BRF), which was the measure to assess several complex behaviours of some social significance. From the study, the Cronbach's alpha coefficients showed a good level of reliability for all measures that ranged from 0.79 to 0.87 for first sample and 0.74 to 0.82 for second sample. On average, FF-NPQ was correlated at $r = 0.55$ with the corresponding NEO-FFI factor scales in the first sample's data; Neuroticism $r = 0.57$, Extraversion $r = 0.51$, Openness $r = 0.64$, Agreeableness $r = 0.48$, and Conscientiousness $r = 0.56$. In second sample's data, FF-NPQ also was correlated $r = 0.55$ with NEO-PI-R; Neuroticism $r = 0.51$, Extraversion $r = 0.57$, Openness $r = 0.63$, Agreeableness $r = 0.58$, and Conscientiousness $r = 0.46$.

2.1.4 Other personality inventories

NEO Inventory is a 144-item questionnaire (McCrae and Costa Jr, 1987). NEO Personality Inventory is a questionnaire measure the five factor model. It comprises the NEO Inventory with another two scales to measure agreeableness and conscientiousness. It was developed through factor analysis to fit a three-dimensional model of personality. NEO Five-Factor Inventory (NEO-FFI) and Revised NEO Personality Inventory (NEO-PI-R) also measure the Big Five personality factors (Costa and MacCrae, 1992). NEO-FFI consists of 60 items (5 factors, 12 items each) while NEO-PI-R consists of 240 items (30 eight-item facet scale).

The Nonverbal Personality Questionnaire (NPQ) is a nonverbal personality measure of Murray's needs. It consists of 136 items measuring 16 traits. The scales labelled as Achievement, Affiliation, Aggression, Autonomy, Dominance, Endurance, Exhibition, Thrill-Seeking, Impulsivity, Nurturance, Order, Play, Sentience, Social Recognition, Succorance, and Understanding (Paunonen *et al.*, 2004). It was designed primarily for

cross-cultural applications. It also useful in assessing the personality of special group in a culture, for example, non native language group, dyslexic individuals and illiterate respondents (Paunonen *et al.*, 2000).

Jackson Personality Inventory (JPI) is a 320-item questionnaire comprising of 15 scales and one validity scale (Paunonen and Jackson, 1996). Each scale contains 20 items. It was constructed in a similar manner to the Personality Research Form. The first factor can be defined as Openness to experience dimension of Big Five. The scales included Breath of Interest, Complexity, Innovation and Tolerance. These variables relate to intelligence and creative side of the Openness to experience dimension. Second scale of JPI defined Neuroticism – Anxiety, Conformity and Interpersonal effect. The scale Self Esteem and Social Participation in JPI appeared to be similar to Extraversion.

Minnesota Multiphasic Personality Inventory (MMPI) and California Psychological Inventory (CPI) are two widely used self-report inventories (Schultz and Schultz, 2009). The MMPI has been translated into over 100 languages and may be the world's most widely used psychological test. It was first published in 1943 and was revised, MMPI-2 in 1989. In 1992, MMPI-A was developed to use among adolescents. CPI was developed in 1957 and revised in 1987. It was designed for use with normal people with the ages between 12 and 70.

2.1.5 Relationship of Big Five with other factors

Paunonen (2003), found that gender differences were the strongest predictors where men showed consistently lower in Neuroticism, Agreeableness, and Conscientiousness compared to women. It was also found that routinely exercise criterion had a

relationship with extraversion. Some nonreplicated criterion such as participation in sports activity, traffic violation and driving fast criterion were found to have relationship with extraversion, conscientiousness and agreeableness, respectively.

There were three personality attributes that could be related to aggressive driving behaviours. They are agreeableness, conscientiousness, and neuroticism (Miles and Johnson, 2003). The behaviours include speeding, violating traffic control and signal devices, also improper changing lanes and passing. Aggressive drivers have lack of concern regarding safety and well being of other drivers due to their carelessness or intent. Miles and Johnson (2003), reported that females had significantly lower driving skill than males in students sample.

In a study to examine the relationship between Internet usage and the Big Five together with narrow personality traits by Landers and Lounsbury (2006), the result indicate that the three Big Five dimensions have negative relationship with total internet usage among 117 undergraduate students. The internet usage included social, leisure and academic. The dimensions – agreeableness (r = - 0.23) conscientiousness (r = - 0.21,) extraversion (r = - 0.21). In the result of multiple regression analysis, extraversion and conscientiousness together explained 8% of the variance in internet usage.

The personality traits – sensation seeking, self-control, aggression, neuroticism, state anxiety, and trait anxiety, was found to have a significant relationship with online gaming addiction (Mehroof and Griffiths, 2010). The study was performed among 123 university students at an East Midlands university in United Kingdom.

Another study by Ehrenberg *et al.* (2008) was carried out among 200 university students who owed a mobile. The study was conducted to examine the role of personality and self-esteem in university students in using communication technologies. Neuroticism was significantly predicted mobile phone addictive tendencies, while agreeableness was significant negative predictor for time spend on mobile phone call.

Correa *et al.* (2010), discovered that extraversion, among men, was positively related to social media use, while openness to experience was not statistically significant. The result was for women, extraversion and openness to experience were both positively related to social media use. The study also discovered extraversion was the only personality predictor that was related to social media use among young adults (18 to 29 years old). Emotional stability and openness were not significant. For adult group (30 years old and above), extraversion and openness were positively related to social media use.

There was also a study by De Moor *et al.* (2006) to examine whether regular exercise is associated with anxiety, depression and personality. The study was conducted in a large population-based sample as a function of gender and age. This study discovered that exercisers, on average, were less anxious and depressed, less neurotic, more extraverted, higher in thrill and adventure seeking, and higher in inhibition, as compared to non-exercisers. The result was also consistent considering gender and age.

2.2 Translation of questionnaire

Aim of translation is to achieve equivalence between translated version and original version of the scale (Streiner *et al.*, 2014). It is necessary to examine the psychometric

properties of the translated questionnaire to assure the measurement equivalence (Streiner *et al.*, 2014).

Process of translation and adaption of a questionnaire may required some effort in term of time and, sometimes also considerable investment of money (Sperber, 2004). In short, it is not an easy process. In this process, two or more translators are involved to produce a meaningful translated questionnaire. The most common and simplest way of translation is, a questionnaire is translated into target language and it is used without further validation (Sperber, 2004).

There also another approach in getting a valid translated questionnaire by applying back-translation method (Sperber, 2004). Although it required some time and can be expensive, this technique is preferred. During back-translation process, a questionnaire is translated into target language and then translated back into source language by different and independent translators (Streiner *et al.*, 2014). The back-translator is blinded from the original questionnaire. Then, the back-translated and original questionnaires are compared. Comparability of language (similarity of words, phrases and sentences) and similarity of interpretability (the two versions give out same response even wording is not the same) are two measures of comparison to evaluate the success of translation. Anyhow, translation process required skill, knowledge and experience (Sperber, 2004).

2.3 Validation

2.3.1 Measurement validity

According to DeVon *et al.* (2007) and Trochim (2006), face validity and content validity are type of translational validity. Face validity means, on the face of instrument, it looks as it measures the construct of interest. As it is the subjective assessment, it considered the weakest form of validity (Trochim, 2006). For content validity, the tool should have a good detailed description of what it should measures (Cook and Beckman, 2006; DeVon *et al.*, 2007; Trochim, 2006). Construct validity refers to the degree of an instrument measures what it tends to measure (Cronbach, 1955).

Rios and Wells (2014), stated that The American Educational Research Association (AERA), American Psychological Association, & National Council on Measurement in Education (1999) listed the sources of evidence in support of the interpretations and the proposed the uses of test scores. There are five sources of evidence listed: evidence based on test content, response processes, internal structure, relation to other variables, and consequences of testing.

Validity evidence based on test content was described as content validity. There are four elements in describing content validity – domain definition, domain presentation, domain relevance, and appropriateness of test construction procedures (Sireci and Faulkner-Bond, 2014). Defining domain, for educational test, measured is typically accomplished by providing detail descriptions of the content areas and cognitive abilities the test is design to measure. It also accomplished by test specifications that list the specific content, as well as the cognitive levels measured. Domain presentation is

the degree to which a test adequately represents and measures the domain as defined in the test specifications. Domain relevance refers to which each item on a test is relevant to the targeted domain. Appropriateness of the test development process refers to all process used when constructing a test. The process to ensure test content measure what it should measured (Sireci and Faulkner-Bond, 2014).

Validity evidence based on response process is the evidence concerning the fit between construct and detail nature of response or performance actually engaged by the researchers (Padilla and Benítez, 2014). Validation study focused on evidence of response processes required a review of the methods used. The methods include response times, eye-tracking methods, interviews, focus groups and cognitive interviewing (Padilla and Benítez, 2014). Response time method focus on connecting response time with the complexity of processes involved in developing the task. Eye-tracking used as indirect cues to attention and cognitive process. Researchers preferred interview method in validation studies based on response processes. Another method is focus group, which considered as useful method in exploring unknown topics through group discussion. Cognitive interview method is aiming to access the participants' cognitive process.

Factor analysis and reliability are generally considered evidence of internal structure. Scores expected to measure a single construct should come out with the same results, while scores expected to measure multiple constructs should yield different responses in a pattern predicted by the constructs. Dimensionality, measurement invariance, and reliability were the three basic aspects of internal structure (Rios and Wells, 2014).

Another source of validity evidence is based on relation to other variables. Source of this validity evidence might come from the correlation with scores from other instrument or outcomes for which correlation would be expected. Low or lack of correlation with unrelated instruments or factors also support the interpretation consistent with the underlying construct (Cook and Beckman, 2006).

Consequences of testing also one of the source of evidence. By evaluating the expected or unexpected consequences of an assessment can reveal sources of invalidity. This evidence anyhow needs a link relating the observations back to the original construct before it can confirm the influence the validity inferences. Some other way is to explore whether the required result have been achieved and unexpected effects were avoided (Cook and Beckman, 2006).

Validity of a scale also could be assessing by dividing into two groups, where one group has the trait or behaviour and the other does not (Streiner *et al.*, 2014). Significantly higher or lower score should be obtained by the expected group, depending on how the items are scored. However there are two methodological problems in designing this method. The first problem is on how to select the extreme group when a new or better tool is going to develop. The second difficulty is how the tool able to differentiate between those people who obviously have the trait in question and those who do not (Streiner *et al.*, 2014)

2.3.1.1 Validity evidence based on internal structure

Dimensionality, measurement invariance, and reliability were the three basic aspects of internal structure. By assessing the dimensionality, researcher is interested to determine

if the inter-relationships support the expected test score that will be used in drawing inference. Measurement invariance is useful to provide evidence that items characteristics are comparable across groups. Meanwhile, reliability provide evidence of consistency of test scores reported across repeated test administrations (Rios and Wells, 2014).

Researcher commonly used factor analysis to access the dimensionality of a set of data (Brown, 2006; Kline, 2011). The purpose of factor analysis is to analyze the relationships among large numbers of variables (DeVon *et al.*, 2007). There are two types of factor analysis, Elementary factor analysis (EFA) and confirmatory factor analysis (CFA) (Brown, 2006; Hair *et al.*, 2010).

The purpose of conducting EFA is to explore the data and provide information of how many factors needed to represent the data (Hair *et al.*, 2010). The factors obtain from EFA are based on statistical results, not from the theory. Theory is no need to derive the factor in EFA. Established guidelines are used when applying EFA to determine which variables load on a particular factor and the appropriate number of factors (Hair *et al.*, 2010).

2.3.1.1.1 Confirmatory factor analysis (CFA)

Confirmatory factor analysis (CFA) is one of the factor analytic method which is the most comprehensive means in comparing hypothesized and observed test structure (Rios and Wells, 2014). Different from EFA, measurement theory is needed to specify number of factors exist and set of items for each factors to be able to handle the CFA (Hair *et al.*, 2010). CFA provides confirmatory test of the measurement theory (Hair *et*

al., 2010). The theory is strongly driven by the CFA and it also allows specification of relationship among error variances (Brown, 2006).

CFA also provides evidence to support validity of internal structure of a measurement instruments. CFA model evaluated for model fit, magnitude of factor loading and correlations among latent variables in examining internal structure of measurement instrument. It also provides evidence of how the instrument should be scored. In multi-factor model, convergent validity is supported when indicators have strong relationship with respective latent variable, while discriminant validity is supported when relationship between different latent variables is small to moderate (Rios and Wells, 2014).

There are some approaches to access model fit. Goodness-of-fit indices are most popular and frequently uses compared to hypothesis testing. Many goodness-of-fit indices are available to researchers to judge model fit (Hu and Bentler, 1999). Commonly used fit indices are Comparative Fix index (CFI), Tucker-Lewis index (TLI), root mean square error of approximation (RMSEA), and standardized root mean square residual (SRMR). These indices have their own cutoff values that help researchers determining the fit of model to the data (Brown, 2006; Hu and Bentler, 1999). Re-specification of model is needed before interpreting parameter estimates if the model does not fit well. Goodness-of-fit and interpretability and strength of parameter estimates are examined in evaluating the acceptability of specified CFA model (Brown, 2006).

The size of factor loading can estimate the convergent validity among item measures. High loadings on a factor indicate that they converge on a common point. It has the range between –1.0 to +1.0. By rule of thumb good standardized loading estimates should be 0.5 or higher and 0.7 or higher is ideally (Hair *et al.*, 2010).

2.3.1.1.2 Reliability

Reliability is concerned with the ability of an instrument to measure consistently (Tavakol and Dennick, 2011). There are four type of reliability. Test-retest reliability is the reliability over time; parallel form is the reliability between different versions of an instrument; inter-rater reliability is the reliability between raters (Cook and Beckman, 2006). Another type of reliability is internal consistency which measure how well the items fit the concept of a tool (DeVon *et al.*, 2007). Most widely used measure of reliability is Cronbach's α (Cronbach, 1951), which measures the internal consistency of the measurement. Its ranges between 0 and 1 (Streiner, 2003; Tavakol and Dennick, 2011). If the scale is multifaceted, α is no appropriate to use.

Reproducibility of test scores on repeated test administrations taking under the same conditions refers to internal consistency reliability (Rios and Wells, 2014). The most commonly used statistic in measuring consistency is coefficient α (Cronbach, 1951). It is the average of all possible split-half reliability values. Most cases, when measurement errors are uncorrelated, coefficient α will underestimate reliability. When the measurement errors are correlated, coefficient α may underestimate or overestimate reliability (Raykov, 2001). CFA can be used to provide more accurate estimate of reliability.

CHAPTER THREE: METHODS

3.1 Study design

This study was a cross sectional study.

3.2 Study duration and location

Data collection for this study was done in four months duration (December 2015 to March 2016) and took place in Health Campus, Universiti Sains Malaysia.

3.3 Study population and sample

3.3.1 Reference population

Malaysian young adults with age between 18 to 30 years old.

3.3.2 Source population

Malaysian young adults in Health Campus, Universiti Sains Malaysia (USM).

3.3.3 Sampling frame

Undergraduate and postgraduate students in Health Campus, USM.

3.3.3.1 Inclusion criteria:

1. Current undergraduate and postgraduate students of 2015/2016 academic session in USM Health Campus.
2. Undergraduate and postgraduate students with age between 18 to 30 years old.

3.3.3.2 Exclusion criteria:

1. Foreigner students.

2. Undergraduate and postgraduate students with a lifetime history of a major medical disorder, uncorrected visual acuity, history of affective disorder and using psychiatric medication.

3.3.4 Sample size determination

3.3.4.1 Sample size determination for Confirmatory Factor Analysis (CFA)

Two approaches were used to calculate the required sample size for CFA:

a) Sample size calculation for CFA was calculated by Computing power and minimum sample size for RMSEA (Preacher and Coffman, 2006). The following information was needed to estimate the required sample size:

- Alpha

  Alpha level was set to 0.05

- Degree of freedom

Degree of freedom was calculated by using the formula (Brown, 2006):

$$df = b - a$$

From the equation,

$$b = \frac{p\,(p+1)}{2}$$

Where,

b = number of elements of the input matrix (number of knowns)

p = number of the indicators included (number of items)

Therefore,

$$b = \frac{60\,(60+1)}{2} = 1830$$

a = number of freely estimated parameters (number of unknowns)

Where a consists of:

- Number of factor loadings $= 5\ factors\ \times (12\ items - 1) =\ 55$
- Number of error variance $= 5\ factors \times 12\ items = 60$
- Number of factor variance $= 5$
- Number of factor covariance $= 10$

Therefore,

$$a = 55 + 60 + 5 + 10 = 130$$

Thus,

$$df = 1830 - 130 = 1700$$

- Desired power

  Power of the study was set to 0.80

- Null RMSEA

  Perfect fit RMSEA = 0.00 (Brown, 2006)

- Alternative RMSEA

  Exact fit RMSEA = 0.05 (Brown, 2006)

Calculation from the website suggested that appropriate sample size with df = 1700 to achieve RMSEA = 0.05 is about n = 37 respondents

b) By simulation study (Hair *et al.*, 2010):

Based on simulation study, the sample size is fixed at n = 150 when the expected constructs is seven or less and items communality is less than 0.5 and no under-identified constructs.