

THE RELATIONSHIP BETWEEN SENSORY PROCESSING PATTERNS AND ANXIETY AMONG INTERNATIONAL STUDENTS

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Abstrak: Kebimbangan adalah salah satu masalah psikologi yang mencatat tahap yang tinggi dan sering berlaku dikalangan orang dewasa terutamanya dalam kalangan pelajar universiti. Tujuan kajian ini adalah untuk meneroka hubungan diantara kerisauan dan corak pemprosesan sensori dalam diri pelajar. Tiga ratus lima puluh empat pelajar yang berumur diantara 20-45 tahun telah melengkapkan soal selidik Demografi *Adolescent/Adult Sensory Profile*, *PROMIS Depression Item bank* dan *PROMIS Anxiety Item bank*. Analisis Korelasi Pearson menunjukkan bahawa terdapat hubungan yang signifikan yang positif diantara tiga daripada corak pemprosesan sensori dan kerisauan, termasuklah *sensation avoiding*, *sensory sensitivity*, dan *low registration*. Analisis Regresi Berganda menunjukkan bahawa *sensory avoiding* and *sensory sensitivity* adalah peramal yang signifikan berlakunya kerisauan. Corak pemprosesan sensori mempunyai kesan keatas tahap kerisauan seseorang individu. Kajian ini mempunyai implikasi kepada ahli professional kesihatan mental seperti ahli psikologi pendidikan dan kaunselor.

Kata Kunci: *Pemprosesan sensori, kerisauan, pelajar antarabangsa*

INTRODUCTION

According to the World Health Organization (2012), anxiety is among the most common psychological difficulties among adults. The studies in different nations revealed that university students are experiencing anxiety (Bayram&Bilgel, 2008; Eisenberg, Gollust, Golberstein, & Hefner, 2007; Hunt & Eisenberg, 2010; Shamsuddin et al., 2013). International students especially need to adjust to a new educational system and a new social environment (Hyun, Quinn, Madon, & Lustig, 2007). Besides that, they often struggle with language barriers, immigration difficulties, culture shock, social adjustment, and homesickness (Sümer, Poyrazli, & Grahame, 2008). Because of the constant need for cultural adjustment and for coping with all these stresses, international students are at greater risk for various psychological problems (Misra& Castillo, 2004; Mori, 2000). Several studies have explored anxiety from different perspectives in international students, but one of the areas requiring more investigation is how students are adapting to the environment from the perspective of sensory experiences. Therefore, the purpose of this study was to explore anxiety from the sensory processing perspective to expand knowledge in mental health.

Sensory processing is defined as the method through which the nervous system receives, organizes, and understands sensory stimuli from inside and outside the body to enable decisions on reacting to the environment (Humphry, 2002). According to Dunn's sensory model (1997), people have different neurological thresholds and different responses to sensory inputs. They may have low or high thresholds and passive or active responses. Each of these components is in the continuum (neurological threshold and self-regulation response) and by interactions between them, four different sensory processing patterns emerge which are sensation seeking (high threshold and active response), sensation avoiding (low threshold and active response), sensory sensitivity (low threshold and passive response), and low registration (high threshold and passive response) (Dunn, 2001). Based on each sensory pattern the interventions are designed to help individuals fulfill sensory needs (Brown & Dunn, 2002).

Although most people have balanced sensory processing abilities, 15% of the total population has more intense sensory processing patterns (Miller, Anzalone, Lane, Cermak, & Osten, 2007). Extreme sensory processing patterns are related to psychological difficulties (Schaaf et al., 2015; Tomchek, Little, & Dunn, 2015; Ben-Avi, Almagor, & Engel-Yeger, 2012). Several studies explored sensory processing in different group of populations with psychological

problems such as people with obsessive-compulsive disorder (Dunn & Bennett, 2002; Kusunoki, Sato, Taga, Yoshida, Komori, Narita, Ozaki, 2000; Rieke & Anderson, 2009), schizophrenia (Braff, 1993; Melle, Friis, Hauff, & Island, 1996; Muntaner, Pulver, McGrath, & Eaton, 1993), anxiety (Kinnealey & Fuiiek, 1999), social anxiety (Hofmann & Bitran, 2007; Neal, Edelmann, & Glachan, 2002), avoidant personality disorder (Meyer & Carver, 2000), relationship anxiety (Jerome & Liss, 2005), alexithymia (Liss, Mailloux, & Erchull, 2008; Nyklíček & Vingerhoets, 2000), and depression (Aron, Aron, & Davies, 2005; Dickens, McGowan, & Dale, 2003; Kimball, Birstler, Bosse, Nelson, & Woods, 2012; Liss, Mailloux, & Erchull, 2008; Rotenberg & Cholostoy, 2004). Each of these studies explored different sensory patterns, mostly sensory sensitivity, and not the four sensory patterns based on Dunn's model of sensory processing in one study and not in the international student population. Therefore, to fill the gap in existing literature, the purpose of this study was to explore the relationship between sensory processing patterns and anxiety in international students.

METHOD

Participants and Sampling Procedure

Three hundred and fifty four international students who met inclusion criteria as studying full-time in Master or Ph.D. programs in University of Malaya participated in the study. Exclusion criteria were having no history of diagnosed mental disorder or illness and using no medication on a daily basis.

According to University of Malaya International Graduate Studies (IGS) Centre, the population of all active international postgraduate students in University of Malaya in 2014 was 2293 students. As proposed by Krejcie and Morgan (1970) the appropriate sample size for this population is minimum 331 participants. The multistage random sampling was applied and from the University of Malaya, five faculties were chosen randomly. The classes and laboratories were selected randomly from each of the selected faculties. Students completed the instruments and after excluding the uncompleted questionnaires, the total number of 354 participants was the final sample in this study.

Instruments

The Adolescent/Adult Sensory Profile® (AASP) (Brown & Dunn, 2002) provides a tool for recording an individual's responses to sensory events in daily life, thereby combining a sensory processing framework perspective with daily life performance. AASP includes 60 items in a self-report questionnaire according to the sensory processing categories. The items on the AASP represent one of the four quadrants (sensation seeking, sensation avoiding, sensory sensitivity, and low registration), which are based on Dunn's (1997) model of sensory processing. Sensory processing categories (taste/smell, movement, visual, touch, activity level, and auditory), the neurological threshold continuum (low and high), and the behavioral response/self-regulation continuum (passive and active) are revealed from the profile. In each item, participants indicate how often they respond to a sensory input by using a five-point Likert scale (from 1 = almost never to 5 = almost always). The report of studies showed that this questionnaire has good internal consistency with coefficient alpha values from .63 to .82 in different studies (Pearson Education, 2008; Brown & Dunn, 2002; Brown, Tollefson, Dunn, Cromwell, & Fillion, 2001). The permission for using the AASP was obtained by purchasing the original copies of the instrument from the copyright holder/publisher.

PROMIS® Anxiety Item Bank is an instrument assessing self-report fear, anxious misery, hyper-arousal, and arousal somatic symptoms (Pilkonis et al., 2011). In this study, the PROMIS® anxiety item bank was used that consists of 29 items with a seven-day period and a five-point scale (from 1 = never to 5 = always). According to previous studies (Pilkonis et al., 2011) PROMIS® Item bank has acceptable psychometric properties to use.

A Demographic Questionnaire included questions concerning age, gender, marital status, nationality, medical history, psychiatric history, and using psychiatric medicine.

Procedure

We obtained ethical approval from the University of Malaya to conduct the research. In a multistage random sampling as mentioned in sampling procedure section, we approach the students. The participants completed the questionnaires after signing the consent form.

Data analysis

The Pearson Correlation and Multiple Regression analysis were employed to explore the relationship between sensory processing patterns and anxiety and its predictability.

RESULTS

Based on the demographic questionnaire, the participants' ages ranged from 20 to 45 years with the average age of 29.68 years ($SD = 5.42$). From them, the number and valid percent of 244 (68.9%) were male, and 110 (31.1%) were female. In terms of marital status 230 (65%) were single, 117 (33.1%) were married, four (1.1%) was divorced, and three (.8%) was in other marital status that includes separated (1 student) and engaged (2 students). The participants were from 24 different nationalities with a high level of English language proficiency in accordance with the university requirements.

As for descriptive statistics of variables, the four categories of sensory processing range from 17 to 62. The Mean value of Sensation Seeking is 45.33 ($SD = 7.42$), the Mean value of Sensation Avoiding is 39.45 ($SD = 6.89$), the Mean value of Sensory Sensitivity is 37.74 ($SD = 8.17$), the Mean value of Low Registration is 31.88 ($SD = 6.52$). The level of anxiety in participants ranges from 31.60 to 70.30, with a Mean value of 53.34 ($SD = 7.45$). According to PROMIS Anxiety instrument, Mean for the normal population including different races, ages, and genders in the US was 50 ($SD = 10$) (Pilkonis et al., 2011).

To make sure that data can be analyzed by Pearson Correlation and Multiple Regression analysis, the assumptions underlying this inferential statistics method was tested. In this regard, bivariate normality of distribution, skewness, kurtosis, linearity, and homoscedasticity, tolerance, and variance inflation factor (VIF) were examined.

Normality of variables can be assessed by either statistical or graphical methods. Two components of normality are skewness and kurtosis. Skewness has to do with the symmetry of the distribution; a skewed variable is a variable whose mean is not in the center of the distribution. Kurtosis has to do with the peakedness of a distribution. (Tabachnick&Fidell, 2013)

While there are tests that can be used to evaluate skewness and kurtosis values, these are too sensitive with large samples. With reasonably large samples, skewness will not create essential difference in the analysis. Kurtosis can result in an underestimate of the variance, but this risk is also reduced with a large sample. Therefore, investigating the shape of the distribution through histograms or normal Q-Q plot is recommended (Tabachnick&Fidell, 2013; Field, 2013; Pallant, 2011). Besides that, as Pallant (2011) stated, many scales and measures used in the social sciences have scores that are skewed, either positively or negatively. This does not necessarily indicate a problem with the scale, but rather reflects the underlying nature of the construct being measured. Clinical measures of anxiety or depression are often positively skewed in the general population, with most people recording relatively few symptoms of these disorders (Pallant, 2011).

In this study, skewness investigation was done to ensure normality. Upon visual examination of the Q-Q Plot of variable, the data were considered sufficiently normal to allow for parametric testing. The other assumptions for Pearson Correlation are linearity and homoscedasticity. Linearity means that the relationship between the two variables must be linear, that is, a straight line can most accurately represent the relationship. In addition, homoscedasticity indicates the variability of scores along one variable should remain constant at all values of the other variable. By using Scatterplots the assumptions of linearity and homoscedasticity was tested and it was considered to meet the assumptions to use Pearson correlation to analyses the data. Besides that, the assumptions of tolerance and variance inflation factor were met as it is reported in Table 2.

After considering the assumptions for Pearson Correlations and Multiple Regression methods, the data was analyzed. As it is shown in Table 1, the results indicated that there is a significant and positive correlation between three of the sensory processing patterns (sensation avoiding, sensory sensitivity, and low registration) and anxiety.

According to Cohen (1988) the effect size of correlation between sensation avoiding and anxiety is medium. The correlation is positive, indicating that an increase in sensation avoiding level will result in increasing the anxiety level. The correlation strength of sensory sensitivity and anxiety is also medium. There is also a significant and positive

correlation between low registration and anxiety with small correlation strength. As it is shown in Table 1, the correlation between sensation seeking and anxiety is negative and statistically not significant.

Table 1

Pearson Correlation between Sensory Processing Patterns and Anxiety (N=354)

	Anxiety	
	Pearson Correlation	Sig. (2-tailed)
Sensation Seeking	-.045	.399
Sensation Avoiding	.356**	.000
Sensory Sensitivity	.353**	.000
Low Registration	.238**	.000

Linear Multiple Regression was used to explore the contribution of each sensory processing pattern to the level of anxiety in participants. As Table 2 shows, sensory avoiding ($\beta = .192, p < .05$) and sensory sensitivity ($\beta = .180, p < .05$) are making a significant unique contribution to the prediction of the anxiety. The other two sensory processing patterns, sensation seeking ($\beta = .090, p > .05$) and low registration ($\beta = .099, p > .05$) are not making a significant contribution to the prediction of anxiety level in this study.

Table 2

Summary of Multiple Regression Analysis for Anxiety (N=354)

	Anxiety						
	B	SE B	β	t	Sig	Tolerance	VIF
Sensation Seeking	-.090	.050	-.090	-1.794	.074	.961	1.04
Sensation Avoiding	.208	.078	.192**	2.674	.008	.468	2.138
Sensory Sensitivity	.164	.068	.180*	2.398	.017	.427	2.343
Low Registration	.113	.064	.099	1.770	.078	.777	1.287

DISCUSSION

These results are in some ways in line with the findings of studies by Ben-Avi et al. (2012), Engel-Yeger and Dunn (2011b), Ahadi and Basharpour (2010), Hofmann and Bitran (2007), Benham (2006), and Jerome and Liss (2005).

The results of this study are consistent with the findings of Engel-Yeger and Dunn (2011) who found strong correlations between anxiety and sensory sensitivity and sensation avoiding, which are both low neurological threshold patterns. In this study, these two sensory processing patterns showed a higher correlation with anxiety level compared to other sensory processing patterns. Similar to the current study, they also found a positive relationship between low registration and anxiety.

The findings of this study are in line with Liss et al. (2008) study. As they identified two potential components of sensory processing sensitivity, which are ease of excitation and low sensory threshold; both are positively related to anxiety. In addition, these sensory sensitivity components have been related to neurotic personality traits (Ahadi & Basharpour, 2010). Moreover, Kimbal et al. (2012) mentioned that sensation avoiding correlated with social introversion, low registration with alienation, thinking disorder, and self-depreciation, and sensory sensitivity with anxiety.

Similarly, as previous studies showed, highly sensitive people experience a higher level of anxiety and high sensory processing sensitivity is associated with greater perceived stress and more frequent symptoms of ill health (Benham, 2006). In other study, individuals reported their anxiety related to their sensitivity to environmental stimuli (Neal et al., 2002).

Pfeiffer and Kinnealey (2003) also found a correlation between sensory defensiveness and anxiety; and found that occupational therapy intervention related to sensory processing resulted in a significant decrease in sensory

defensiveness and anxiety. According to Beck's model (1979), defensiveness is one of the cognitions that underlie anxiety and the harm avoidance is what anxious people are struggling to achieve.

In Beck's cognitive psychopathology model (1979), cognitive schemas related to danger and harm to personal well-being is underlying the experience of anxiety. Anxious individuals mentally focus on danger and harm because of the activation of the maladaptive cognitive schemas, leading them to indiscriminately interpret any environmental events as being dangerous. According to this cognitive model, people have a tendency to exaggerate and enlarge the extent of the danger that they may feel in fearful situations. That is the reason that they feel danger and harm even if the situation and input is very less dangerous and harmful. Considering Beck's cognitive model of psychopathology for anxiety, individuals with sensory processing patterns with a low neurological threshold (sensory sensitivity and sensation avoiding) are receiving most of the stimuli from their environment because of their low thresholds. They can notice even the small amount of stimuli. Therefore, they may more feel themselves the target of harm or danger.

In this study, low registration and anxiety were in a positive relationship. Adults with low registration sensory pattern are the group that notice the stimuli from the environment later than others do. Maybe when they notice the stimuli, it is at their peak and maximum amount and it makes the person feel more in danger and harm that brings anxiety as well. Besides that, low registration and sensory sensitivity are two of the sensory patterns, which are in the passive self-regulation behavioral responses. It means that they are not actively controlling the environment in terms of providing their satisfaction level of input. They are passive with regard to their sensory inputs and let things happen around them without applying control over happenings. Therefore, they may feel environmental stimuli as more uncontrollable, unpredictable, dangerous, and harmful. Consequently, it may increase their level of anxiety.

In this study, the relationship between sensation seeking and anxiety was not statistically significant. Sensation seeking pattern includes high neurological threshold and active responses. Because of these two components, they may feel less danger from the environment as they do not notice some of the stimuli in their environment because of their high threshold and also because they try to control their environment to make the input meet their satisfaction level; hence, they seldom find themselves in overwhelming or uncontrollable situations. These make them not show high anxiety level in their self-report scale as compared to others.

Using the questionnaires in The English language was one of the limitations of this study. Although the study was conducted on international students and based on university requirements they must have high proficiency in The English language, but conducting research on the mother-language of participants is much more reliable as they can answer the items with complete understanding. Besides that, the validity of instruments should be explored on this population.

The results of this study might have implications for different groups of mental health professionals such as psychologists, counselors, and occupational therapists. This study links sensory processing to adults and especially students' daily life and provides the knowledge about how the individuals' sensory processing patterns might relate to their anxiety level.

It is recommended that future studies investigate other psychological difficulties and sensory processing patterns. Moreover, exploring the sensory processing patterns in the individuals with clinical anxiety is recommended. Conducting a mixed-method research, which is combining the AASP and interviews, will be beneficial. Conducting experimental researches to explore the effectiveness of sensory processing interventions on anxiety is recommended.

CONCLUSION

This study was another attempt to investigate university students' mental health factors. Based on the results, sensory processing patterns might be significantly related to the anxiety level in students. Therefore, mental health professionals, especially university counselors, and educational psychologists should consider the students' sensory processing patterns when they are exploring the possible factors related to their mental health and help students to reduce their psychological difficulties and increase their academic achievement. Other studies are recommended to explore this construct more deeply.

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