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EVALUATING COGNITIVE DISTORTION SCALE USING EXPLORATORY FACTOR ANALYSIS AND RELIABILITY ANALYSIS

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Abstract: Despite being used extensively in psychopathology research, the psychometric properties of Cognitive Distortion Scale have not been examined in Malaysia. This study aimed to study the reliability and validity of this scale. A study was performed on 414 university students. Participants had to respond for each item based on the scale of 1 (never) to 7 (all the time). The reliability and validity of the instrument were analysed with the Cronbach's Alpha and Exploratory Factor Analysis using the Statistical Package for Social Sciences (SPSS), version 25. Finding from the reliability analysis suggested high reliability index value with the overall score was above .70. Further, the result for instrument validity based on the exploratory factor analysis suggested three (3) main constructs with eigenvalue more than 1 which explained 61.4% of variance. The factor loading values for each criterion ranged from .47 to .86. Overall, finding obtained from this study has shown that Cognitive Distortion Scale has high reliability and validity, and suggested to load ten cognitive patterns into three patterns.

Keywords: Cognitive Distortion Scale, Validity, Exploratory Factor Analysis, Reliability, Cronbach's Alpha

INTRODUCTION

According to Ara (2016), the cognitive models of psychopathology premised that faulty thinking patterns would cause behavioural and/or

emotional disturbances. These faulty thinking patterns have been known as cognitive distortions. Cognitive distortions are the dysfunctional thought patterns that would adversely impact the individuals' psychopathological state (Jager-Hyman et al., 2014). They are unconsciously controlled by the information processing system, which plays role on interpreting the environmental events and utilizing mental shortcuts to assist human survival through the avoidance of threats (Jager-Hyman et al., 2014). According to Gross, 2015, Aaron T. Beck proposed the Cognitive Theory of Cognitive Distortion, which explains that individuals with cognitive distortions would more likely to perceive reality destructively (Gross, 2015). The formation of cognitive distortion was due to the development of negative schemas, and it had been known as the main contributing factor of having emotional disturbances and poor subjective well-being (Gross, 2015).

Consequently, the existence of cognitive distortions would cause individuals developing mental illness. The previous researches had proved that there was significant positive relationship between cognitive distortion and psychological disorders, including depression and anxiety (Fazakas-DeHoog, Rnic, and Dozois, 2017; Rnic, Dozois, and Martin, 2016; Strohmeier, Rosenfield, DiTomasso, and Ramsay, 2016). Matthews (2013) also proposed the Cognitive Behaviour Theory (CBT) model to suicide, which places cognitive distortions as the main contributing factor that causes individuals committing suicide. Based on the previous research, restructuring cognitive distortions to the more adaptive thinking patterns should be highlighted when preventing and implementing interventions with patients with psychological illness.

Although the aetiology and treatment of psychopathology based on cognitive distortions had been greatly theorized and developed, relatively limited initiatives have been focused on establishing a psychometrically comprehensive inventory to measure the content of cognitive distortions in a quantitative way (Kaplan et al., 2017). The establishment of this inventory could help in the process of planning appropriate

psychological intervention, and monitor the individuals' development by assessing the changes in cognitive distortions periodically (Kaplan et al., 2017). Additionally, the establishment of this inventory would enable researchers to investigate and differentiate the intensity and content of cognitive distortions across individuals and groups (Morrison et al., 2015).

Various inventories had been established to measure the constructs (i.e. negative automatic thoughts) of cognitive distortions, including Automatic Thoughts Questionnaire and Anxious Self-Statements Questionnaire. However, these inventories are unable to identify the types, intensity and content of cognitive distortions (Morrison et al., 2015). According to Kaplan et al. (2017), there are only four inventories focused on assessing cognitive distortions had been developed, namely the Cognitive Error Questionnaire – General Form (CEQ), Inventory of Cognitive Distortions (ICD), Cognitive Distortions Questionnaire (CD-Quest), and Cognitive Distortions Scale (CDS). Basically, there are lacking in term of psychometric development for both CEQ and ICD (Jager-Hyman et al., 2014). On the other hands, CEQ and ICD demonstrated acceptable internal consistency, convergent and discriminant validity in the population of undergraduate and clinical patients (Covin et al., 2011; de Oliveira et al., 2015).

Compared to CEQ, limited researches had been empirically and comprehensively conducted to study the psychometric properties of CDS. According to Rnic, Dozois, and Martin (2016), CDS was developed by Covin, Dozois, Ogniewicz and Seeds. This inventory was developed to assess 10 distinct types of cognitive distortions, namely all-or-nothing thinking, catastrophizing, emotional reasoning, labelling, mental filtering, mindreading, minimizing or disqualifying the positive, overgeneralization, personalization, and should statements (Ozdel et al., 2014). In this inventory, each cognitive distortion is required to be answered in two domains, namely interpersonal achievement (IP) and personal achievement (PA).

Based on previous studies, Covin, Dozois, Ogniewicz and Seeds (2011) assessed the validity and reliability of CDS in a non-clinical sample. A total of 318 undergraduates had been selected. The finding showed that CDS has good psychometric properties in non-clinical samples. Similarly, Ozdel et al. (2014) conducted research to assess the psychometric properties of CDS in Turkish samples. The research selected a total of 325 individuals and divided them into two groups (i.e., clinical and non-clinical samples). The results showed that CDS was highly reliable instruments and possessed good psychometric properties (e.g. construct, discriminant, convergent, and divergent validity, test-retest reliability over two weeks, and internal consistency) in both clinical and non-clinical samples. The previous studies illustrated that CDS is valid and reliable inventory in both clinical and non-clinical samples. However, limited researches related to its psychometric properties have been conducted in the context of Asian, especially Malaysia. To be precise, its appropriateness in Malaysia context is still ambiguous and questionable. Thus, the aim of this study was to investigate the reliability and validity of CDS among Malaysian undergraduates.

METHODOLOGY

The methodology of this study was divided into sample and population, instrument and research procedure.

Sample and Population

This was a quantitative study aimed to assess the validity and reliability of CDS. In this study, the targeted population was the undergraduates at the The National University of Malaysia (UKM), Bangi. Basically, the total population of undergraduates was approximately N = 15,000. Therefore, the sample size representative of the entire population was S = 375 (Krejcie & Morgan, 1970). In term of sampling method, the respondents were randomly selected as the samples after acquiring informed consent.

Instrument

A questionnaire that was divided into two parts had been constructed. The initial part was the demography of the respondents, including gender, races and faculty. The second part focused on assessing the cognitive distortions. The questions were directly adapted from CDS that comprised of 20 self-administered items. The respondents were asked to use the 7-point Likert-type scale, ranging from 1 (never) to 7 (all the time) to identify their frequency of practicing the listed cognitive distortions (Ozdel et al., 2014).

Research Procedure

The research procedure had been divided into 3 stages, namely data collection, screening and analysis. Initially, the researcher collected the quantitative data by distributing both printed and online questionnaires to the selected respondents. After obtaining written agreement from respondents, the respondents were requested to complete self-administered questionnaire within 15 minutes Overall, a total of 437 data had been collected.

After data collection, all data had been keyed in by using "Statistical Package for Social Science" (SPSS for Microsoft Windows) version 25.0. According to Pallant (2005), three steps of data screening had been performed, including checking for errors, finding the error in the data file, and correcting the error in the data file. The Missing Value Analysis and normality test were also conducted to identify the presence of missing data and outliers (Pallant, 2005). The missing data and outliers had been removed. Consequently, only 414 data were retained.

Finally, the gathered data were studied and analysed by using SPSS. The first statistical method was frequency analysis, which had been used to quantify the demography and overall score of cognitive distortions among samples. The reliability test and exploratory factor analysis (EFA) were performed to assess the validity and reliability of CDS.

FINDINGS

The finding of descriptive statistics, reliability and factor analysis were discussed.

Descriptive Statistics

The Table 1 showed that the percentage of female respondents (76.6%) was higher than male respondents (23.4%).

Table 1: The Frequency and Percentage of Respondents Based on Gender

Gender	Frequency	Percentage (%)
Male	97	76.6
Female	317	23.4
Total	414	100.0

In term of races, most of the respondents were Malay (77.3%), whereas other races that were not highlighted in the questionnaire possessed the lowest percentage (0.7%). These findings were shown in Table 2.

Table 2: The Frequency and Percentage of Respondents Based on Races

Races	Frequency	Percentage (%)
Malay	320	77.3
Chinese	54	13.0
Indian	24	5.8
Native of Sabah	9	2.2
Native of Sarawak	4	1.0
Others	3	0.7
Total	414	100.0

Based on Table 3, majority of respondents studied at the Faculty of Science and Technology (FST), which was 37.2%. On the other hands, Faculty of Information Science and Technology (FTSM) and Faculty of Laws (FUU) have lowest percentages, which were 1.4% and 1.2% respectively.

Table 3: The Frequency and Percentage of Respondents Based on Faculty

Faculty	Frequency	Percentage (%)
Faculty of Science and Technology (FST)	154	37.2
Faculty of Social Sciences and Humanities (FSSK)	95	22.9
Faculty of Economic and Management (FEP)	56	13.5

Faculty of Islamic Studies (FPI)	34	8.2
Citra Centre	33	8.0
Faculty of Engineering and Built Environment (FKAB)	21	5.1
Faculty of Education (FPEND)	10	2.4
Faculty of Laws (FUU)	6	1.4
Faculty of Information Science and Technology (FTSM)	5	1.2
Total	414	100.0

The mean scores of cognitive distortions were 79 (*SD* = 22.4). Additionally, the ten types of cognitive distortions were descriptively analysed, namely all-or-nothing thinking (*M* = 8.03, *SD* = 2.88), catastrophizing (*M* = 8.23, *SD* = 2.97), emotional reasoning (*M* = 8.31, *SD* = 3.00), labelling (*M* = 7.71, *SD* = 3.27), mental filter (*M* = 7.34, *SD* = 3.11), mindreading (*M* = 9.17, *SD* = 2.89), and minimizing or disqualifying the positive (*M* = 7.52, *SD* = 3.08), overgeneralization (*M* = 6.87, *SD* = 3.24), personalization (*M* = 7.87, *SD* = 2.81), and should statements (*M* = 7.97, *SD* = 3.08). Based on Table 4, overgeneralization had the lowest mean score, whereby mindreading recorded the highest mean score.

Table 4: The Mean Score and Standard Deviation of Cognitive Distortions

Variable	N	Minimum	Maximum	Mean	Std. Deviation
CD	414	20	134	79.0	22.4
ANT	414	2	14	8.03	2.88
CT	414	2	14	8.23	2.97
ER	414	2	14	8.31	3.00
LB	414	2	14	7.71	3.27
MF	414	2	14	7.34	3.11
MR	414	2	14	9.17	2.89
MDP	414	2	14	7.52	3.08
OG	414	2	14	6.87	3.24
PL	414	2	14	7.87	2.81
SS	414	2	14	7.97	3.08

Note: CD: Cognitive Distortion; ANT: All or Nothing Thinking; CT: Catastrophizing; ER: Emotional Reasoning; LB: Labelling; MF: Mental Filter; MR: Mindreading; MDP: Minimizing or Disqualifying the Positive; OG: Overgeneralization; PL: Personalization; SS: Should Statements.

Reliability Test

The Cronbach's alpha coefficient of CDS was .94 (20 items), which represented that CDS was a highly reliable psychological inventory as its α value was higher than .70. The result was shown in Table 5.

Table 5: The Reliability of Cognitive Distortion Scale (CDS)

Inventory	No. of Items	Cronbach's Alpha
CDS	20	.94*

Note: * α > .70; CDS: Cognitive Distortion Scale

Exploratory Factor Analysis (EFA)

Analysis of inter-correlation between variables was performed. The finding indicated that none of the variable violated the assumptions of multivariate normality and linearity. The 20 items of CDS were factor analysed by using principal component analysis with Varimax rotation. Based on Table 6, three components were found, which have explained 61.4% of variance for the entire set of variables. Basically, each component was formed with two to twenty items. The first component explained 48.6% of the variance with the loading values from .64 to .79, whereas the second component explained 7.22% of variance with the loading values from .89 to .90. Furthermore, the third component explained 5.57% of variance. The loading values in this component were ranged from .44 to .76. Finally, the cognitive distortion (KMO = .88, *p* = .000) was sufficiently related to factor analysis as its Bartlett's Test of Sphericity was lower than .05, whereas the KMO value was higher than .60 (see Table 7).

Table 6: The Factor Analysis Output For CDS

Items	Component		
	1	2	3
A7.1	.79		
A7.2	.75		
B8.1	.69		
B5.1	.69		
B9.1	.68		
B6.1	.68		
B5.2	.65		
B9.2	.65		
B8.2	.64		
B6.2	.64		
B10.2		-.90	

B10.1		-.80	
B3.2			.76
B1.1			.68
B3.1			.67
B1.2			.67
B2.1			.62
B2.2			.61
B4.1			.44
B4.2			.44
Eigenvalue	9.71	1.44	1.12
% of Total Variance	48.6	7.22	5.57
Total Variance	48.6	55.8	61.4

Table 7: The Bartlett's Test of Sphericity and KMO of CDS

Inventory	**KMO**	**Bartlett's Test of Sphericity**		
		Approx. Chi-Square	**Df**	**Sig.**
CDS	.88	6152.2	190	.000

Note: CDS: Cognitive Distortion Scale

DISCUSSION

Based on the result, the cognitive distortions of samples were at moderate level (M = 79.0). Among all cognitive distortions, mindreading was the cognitive distortions with highest score. This represented that undergraduates are more likely to possess higher degree of mindreading. Mindreading is one type of cognitive distortions that causes individuals having unrealistic understanding on one's emotions and thoughts based on telepathic and innate means without concrete justification (Gross, 2015). Although the result showed that the cognitions of samples were moderately distorted, an emphasis on restructuring these dysfunctional thinking patterns into more constructive ways is extremely important as cognitive distortions are believed to be one of the prominent factors contributing to the formation and maintenance of various psychological disorders (Clark & Beck, 2010). Clark and Berk (2010) also highlighted that reduction and reconstruction of negative schemas is the crucial mechanism throughout the process of interventions for patients with psychological disorders. Thus, the future researches were suggested to conduct experimental research to test the appropriateness of designed interventions based on different cognitive distortions. Consequently, a sound and applicable intervention process would act as the manual guideline for the helping professions (e.g., clinical psychologists, counsellors) to assist patients with psychological issues.

Besides that, an easily administered and comprehensive inventory aimed assessing cognitive distortions would facilitate the process of planning

intervention, such as identifying strategies based on types of cognitive distortion of the patients (Morrison et al., 2015). Based on the result, the CDS has the potential to be such inventory to measure individuals' cognitions associates of intervention outcome across a range of treatments as the findings were consistent to the previous studies conducted by Covin et al. (2011) and Ozdel et al. (2014). On the other hands, the finding proved that CDS has good psychometric properties, as it was highly reliable and valid in the context of Malaysia, specifically non-clinical samples (undergraduates). However, the result suggested reconstructing and rearranging the current ten cognitive patterns into three patterns for the population of undergraduates. It might be due to overlapping features shared by all cognitive distortions. For example, in this inventory, labelling and overgeneralization were separated as different identities. However, Gross (2015) proposed that labelling is a form of overgeneralizations, which influences individuals attributing the behaviours to their characteristic rather than an attribute (Gross, 2015). Therefore, the future research was suggested to redesign the subscale of cognitive distortions. The future research was also suggested to improvise the questionnaire that includes wider type of cognitive distortions. For example, the three additional cognitive distortions proposed by Freeman and Dewolf, namely externalization of self-worth, comparison to others, and perfectionism (Roberts, 2015). Additionally, the future researches were recommended to assess the validity and reliability of CDS in different population, especially clinical sample in the context of Malaysia. Future researches should focus on more diverse samples and across different cultural groups.

This research has contributed to the field of psychometric properties of psychological instrument as it has proven the suitability of CDS in Malaysia context, which represented that CDS could be one of the inventories in helping practitioners or university to assess undergraduates' cognitive distortions before initializing studies and planning as well as implementing appropriate interventions throughout their degrees. However, several limitations had been found in this study. Firstly, the selected samples were unable to substantially represent the entire population of undergraduates as only one university was included in this study. The selected samples were also unable to represent the entire non-clinical samples as their age groups were only ranged from 19 to years old. Secondly, this study did not compare the CDS to other inventories

assessing cognitive distortions, such as CD-Quest. Finally, this study was unable to conduct more comprehensive statistical analyses, including confirmatory factor analysis, known groups validity, convergent validity and discriminant validity. Therefore, the future researches were recommended to overcome the limitations.

CONCLUSIONS

This study aimed to study the psychometric properties (i.e., validity and reliability) of Cognitive Distortions Scale (CDS) in the context of Malaysia, specifically the non-clinical samples (i.e., undergraduates). A total of 414 undergraduates from The National University of Malaysia (UKM) were randomly selected. After collecting and analysing the data, the results showed that the cognitive distortions of samples were at moderate level, and mindreading recorded the highest scores among all types of cognitive distortions. Additionally, the results proved that CDS possessed high reliability index value and reasonable instrument validity. The finding also suggested rearranging ten cognitive patterns into three patterns.

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