Investigating the Reliability and Validity of the Cognitive Flexibility Inventory (CFI-I) among Iranian University Students

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ABSTRACT

Objective: The purpose of the present study was to inspect the validity and reliability of the Iranian version of the Cognitive Flexibility Inventory (CFI-I).

Methods: The statistical population of the present study was selected among the university students studying at Shiraz University in the 2010-2011 academic year. Two hundred and seventy seven of the university students were recruited via cluster sampling method. The participants answered the Cognitive Flexibility Inventory (CFI-I), Connor and Davidson Resilience Scale (CD-RISC), Beck Depression Inventory Second Edition (BDI-II) and Billings and Moos Coping Styles Questionnaire (CSQ).

Results: To examine the validity of the CFI-I, factor analysis by principle component analysis method was run, the result of which yielded three factors namely, Control, Alternatives and Alternatives for Human Behaviors that explained 56.02% of the variance. Support for the convergent and discriminant validity of the CFI-I was obtained by its correlations with the measures of depression, coping strategies, and resilience. Evidence for the internal consistency of the CFI was obtained by calculating correlations between the CFI-I and its subscales. Also, the Cronbach's alpha and test-retest coefficients for the CFI-I reliability were 0.90 and 0.71, respectively.

Conclusion: It was concluded that the Iranian version of the CFI has acceptable levels of validity and reliability among Iranian university students and can be utilized in research investigations and therapeutic interventions.

1. Introduction

Major Depressive Disorder is a common disorder with the highest lifetime prevalence (about 17%). Depression not only causes devastation of the wellbeing of individual patients but also has negative effects on their family members, their wider social and vocational relationships, and the health care system. Depression leads to higher levels of disability as compared to chronic medical diseases (except for heart disease). Moreover, chronic depression has more negative effects on individual patients and their ability to perform their role in society (Moor & Garland, 2003). Depression as a common and troublesome disorder is characterized different forms of flexibility loss. Depressed individuals represent pervasive low mood and/or anhedonia and commonly consider their environment and the world as undifferentiated, flat, dull, empty, and fruitless, they describe their situations as hopeless and their behavioral routines often collapse (Kashdan & Rottenberg, 2010).

Today, cognitive behavior therapy (CBT) is the most empirically tested and supported treatment for depression (Young et al., 2001). The essential principle of CBT is to treat depression with interventions focusing

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on breaking down automatic maladaptive cognition and replacing it with more realistic, adaptive one (Young et al., 2001). It seems that CBT reduces the depressive mood of depressed patients by increasing their cognitive flexibility. A large body of research has supported the relationship between cognitive flexibility and depression (Brooks et al., 2010; Farrin et al., 2003; Gan et al., 2006; Goritz & Moser, 2003; Hinkelmann et al., 2009; Meiran et al., 2011; Preiss et al., 2009; Watari et al., 2006). Another line of research has specifically focused on the relationship between cognitive flexibility and coping styles (Dennis &Vander Wal, 2010; Goretti et al., 2010; Zong et al., 2010) and also between cognitive flexibility and resilience (Phillips, 2011).

An extensive body of research has been conducted regarding the construct of cognitive flexibility. Although there is no consensus about its definition and measurement, the ability to alter cognitive sets in order to adjust them to the changing environmental stimuli is considered as an essential component of all operational definitions of cognitive flexibility (Dennis & Vander Wal, 2010). It is suggested that cognitive flexibility is the variance of perceived controllability across situations (e.g. Gan et al., 2004; Zong et al., 2010). Several studies (Cheng et al., 2001; Cheng, 2003; Roussi et al., 2000) have indicated that individuals with high levels of cognitive flexibility can discriminate situations on the basis of high and low controllability. On the other hand, individuals with low levels of cognitive flexibility consider all situations as either controllable or uncontrollable.

The instruments used to measure cognitive flexibility include many performance-based scales such as the Stroop Color and Word Test (Golden, 1975), Trail Making Test Part B (TMT; Reitan & Woolfson, 1993), Wisconsin Card Sorting Test (WCST; Berg, 1948), and a limited number of self-report instruments like Alternate Uses Test (Wilson et al., 1975), Attributional Style Questionnaire (ASQ; Peterson et al., 1982), and Cognitive Flexibility Scale (CFS; Martin and Robin, 1995). However, important practical limitations decrease the clinical use of such instruments. Most of these instruments (Alternate Uses Test, Stroop Color and Word Test, ASQ, TMT, WCST) are time consuming to administer and score, have practical effects and/or require interaction between test administrator and participants. These limitations often inhibit the frequent application of them.

Moreover, many of the performance-based instruments measuring cognitive flexibility such as the WCST, TMT and Stroop Color and Word Test measure cognitive flexibility according to a behavioral response,

that is the extent to which an individual shows perseverative responding on tasks that require changing mental sets in response to concrete new stimuli.

The degree of similarities between this type of cognitive flexibility and the flexibility in abstract thinking which requires changing and restructuring maladaptive thoughts is not clear. The cognitive flexibility measured by set shifting tasks is probably more trait-like and/or suggestive of organic brain abnormalities whereas the cognitive flexibility described as restructuring maladaptive thoughts is more state-like and is a reaction to affective states (Dennis & Vander Wal, 2010).

Recently, however, Dennis and Vander Wal (2010) developed the Cognitive Flexibility Inventory (CFI) to measure cognitive flexibility underlying the effectiveness of thought-challenging techniques used in CBT for treating depression and other psychological disorders. The CFI, unlike other measures of cognitive flexibility, is the first 20-item self-report instrument which is brief and easy to administer and score, and more practical for assessing treatment outcomes (Dennis & Vander Wal, 2010). It that can be utilized in research investigations and therapeutic interventions to first, monitor the levels of cognitive flexibility shown in individuals receiving cognitive behavioral interventions and second to measure the cognitive flexibility that enables individuals to think adaptively when encountering stressful events of life (Dennis & Vander Wal, 2010).

The synopsis of the literature highlights the inadequacy and limitations of most cognitive flexibility measures. These measures are still used in the Iranian research setting and impose serious administration loadings for researchers in this field. As there is a need for a reliable and valid instrument to measure levels of cognitive flexibility, the present study attempts to investigate the validity and reliability of the Iranian version of the CFI, as a novel instrument which is brief and easy to administer and score, and more practical for its employment in research investigations and therapeutic interventions.

2. Methods

Participants

The present study was conducted on university students studying at Shiraz University in the 2010-2011 academic year. Via cluster sampling of the nine faculties, four faculties of basic sciences, engineering, economics and social sciences, and law and politics were randomly selected. Similarly, in each faculty, three classes were

randomly selected for participation in the study. On the basis of the research plan and the number of the CFI items, 277 students (116 males and 161 females) were recruited. The sample ranged in age from 18 to 30 with the mean age of 20.93 (SD=1.69) and GPA (grade point average) of 15.70 (SD=1.51). Of the total number of students, 254 were undergraduates and 23 were graduate students.

Two hundred and forty two students were single and 35 were married. The distribution of the participants according to the field of study was 99 (35.7%) in human sciences, 75 (27.1%) in engineering, and 103 (37.2%) in basic sciences. All students were administered a questionnaire battery that included the CFI-I (CFI-Iranian version), Beck Depression Inventory-II (BDI-II), Connor and Davidson Resilience Scale (CD-RISC), and Billings and Moos Coping Styles Questionnaire (CSQ). In all cases the questionnaires were administered in a counterbalanced order after students signed an informed consent form.

Measures

Cognitive Flexibility Inventory-Iranian Version

The CFI is a brief 20-item self-report instrument designed to measure the aspects of cognitive flexibility that enables individuals to challenge and replace the maladaptive thoughts with more adaptive ones. It can be utilized in clinical and non-clinical areas and also be used to assess the individual's progress in developing flexible thinking in CBT for depression and other psychopathological diseases. The CFI was originally developed to measure three aspects of cognitive flexibility: a) the tendency to perceive difficult situations as controllable; b) the ability to perceive multiple alternative explanations for life occurrences and human behaviors; c) the ability to generate multiple alternative solutions to difficult situations but it ended in two factors and demonstrated adequate levels of validity, reliability and internal consistency. More specifically, the Cronbach's alphas for the CFI, Control and Alternatives subscales were 0.91, 0.84, and 0.91, respectively. The seven-week test-retest reliability coefficients for the CFI, Control and Alternatives subscales were 0.81, 0.77, and 0.75, respectively (Dennis & Vander Wal, 2010).

The original version of the CFI, sent by its developers, was first translated into Persian and then it was back translated by two expert assistant professors in the English department, Shiraz University to assure its correspondence with the original version. The Persian translation was further reviewed and revised by five assistant professors

of psychology and was sent to one of the CFI developers (John P. Dennis) for confirmation before it is administered to the participants.

Beck Depression Inventory-II (BDI-II)

This 21-item instrument was developed by Beck, Steer and Brown (1966) to measure the physiological and psychological symptoms of depression in a self-report format. Each item is scored from 0 to 3. The values from 0 to 13 are regarded as normal, 14-19 as mild to moderate, 20-28 as moderate to severe, and 29-63 as very severe. The one-week test-retest reliability of this measure was 0.93. Additionally, it had a high correlation coefficient with the Hamilton scale (r=0.71) (Beck, Steer & Brown, 1966). The internal consistency and Cronbach's alpha coefficients of the BDI-II indicates that this measure has high reliability and validity for Iranian population. Cronbach's alpha for the Iranian version of BDI-II was 0.91 (Dobson, Mohammadkhani, & Massah, 2007). The BDI-II is a reliable instrument used to diagnose and assess depression severity before and after a treatment.

Connor and Davidson Resilience Scale (CD-RISC)

The CD-RISC was developed by Connor and Davidson (2003). It is composed of 25 items on a five-point Likert scale ranging from 'not true at all' to 'true nearly all the time'. The CD-RISC measures the ability to cope with stress and threat. Connor and Davidson (2003) reported the adequate reliability and validity of this measure in different groups (normal and prone to danger populations). The reliability coefficient of the Chinese version of CD-RISC was 0.91 and exploratory factor analysis resulted in a 3-factor structure of resilience (Xiaonan & Jianxin, 2007). Moreover, the results of investigating reliability and validity of this measure in South African adolescents showed adequate reliability (α=0.93) and validity (Jorgensen & Seedat, 2008). Find all citations by this author (default) Ofilter your current searchCronbach's alpha for Iranian version of CD-RISC was 0.93 and the results of factor analysis yielded one factor (Jokar, 2007).

Billings and Moos Coping Styles Questionnaire (CSQ)

The CSQ was developed by Billings and Moos (1981). It consists of 32 items, evaluating individual's responses to stressful events and measures five coping styles including Problem Solving (3 items), Emotional Control (11 items), Cognitive Evaluation (6 items), Physical Control (8 items), and Social Support (4 items). The internal consistencies are partly satisfactory. The value of this inventory lies in its

theoretical perspective and in the stimulation it has provided at a time when almost no satisfactory coping scales were available (Schwarzer & Schwarzer, 1996). Noorali (2004) reported the test-retest reliability of this instrument as 0.79.

Data analysis

On the administration day, the students were informed of the purpose of the study and given the necessary instructions on how to complete the questionnaires given to them. The participants, thus, completed the Cognitive Flexibility Inventory (CFI), Beck Depression Inventory-II (BDI-II), Connor and Davidson Resilience Scale (CD-RISC) and Billings and Moos Coping Styles Questionnaire (CSQ). Fourteen participants were de-

leted from the sample because they did not complete the questionnaires, and therefore, the sample reduced to 277 participants. In order to assess the test-retest reliability for the CFI, it was administered to 42 participants after 4 weeks.

To analyze the data, SPSS (version 19) was run and the factor analysis and Pearson correlation coefficient were computed.

3. Results

The result of Factor analysis by principle component analysis method, internal consistency analysis, conver-

Table 1. CFI Factor loadings, eigenvalues and variances of the CFI subscales.

CFI Items	Alternatives	Control	Alternatives for human behaviors
19	0.72		
12	0.71		
5	0.70		
14	0.69		
20	0.66		
13	0.65		
3	0.63		
6	0.61		
18	0.59		
16	0.58		
11		0.82	
7		0.79	
17		0.76	
2		0.73	
4		0.73	
9		0.64	
15		0.55	
1		0.48	
10			0.76
8			0.69
Eigenvalues	4.74	4.57	1.89
Factor variances (%)	23.72	22.85	9.45
Total variance (%)	56.02		

Table 2. Correlation matrix of the CFI subscales.

CFI and its subscales	CFI	Alternatives	Control	Alternatives for human behaviors
CFI	1	0.89**	0.82**	0.42**
Alternatives	0.89**	1	0.49**	0.41**
Control	0.82**	0.49**	1	0.07
Alternatives for human behaviors	0.42**	0.41**	0.07	1

** P<0.01.

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gent construct, and concurrent validity conducted to examine the validity of the CFI is as following:

A principle factor analysis with Varimax rotation was conducted to examine the construct validity of the CFI. Kaiser-Meyer-Olkin measure of sampling adequacy (KMO) and Bartlett's test of sphericity provided adequate evidence to conduct factor analysis (0.92 and 2.519, respectively, at P<0.001). Based on the Scree curve and Kaiser's coefficient alpha of generalizability (Kline and Barrett, 1983), a three-factor solution was considered optimal for this data set. The minimal item loading on a factor was set at>0.30 (Table 1).

These factors labeled Control, Alternatives, and alternatives for human behaviors. As shown in Table 1, 10 items of the CFI (3, 5, 6, 12, 13, 14, 16, 18, 19, 20) had acceptable factor loadings on the Alternatives subscale. Eight items (1, 2, 4, 7, 9, 11, 15, 17) had acceptable factor loadings on the Control subscale and, two items (8, 10) had acceptable factor loadings on the alternatives for human behaviors subscale. Results from factor analysis of the CFI also indicated that the Alternatives subscale with the eigenvalue of 4.74 explained 23.72% of the variance. The Control subscale with the eigenvalue of 4.57 explained 22.85% of the variance and the alternatives for human behaviors subscale with the eigenvalue of 1.89

explained 9.45% of the variance. Taken together, the three factors explained 56.02% of the variance (Table 1).

It should be noted that the Persian equivalents of items 14 and 19 in the Control subscale made them closer in meaning to the Alternatives subscale but, if deleted, the reliability coefficient would reduce. Therefore, these two items were retained and included in the Alternatives subscale. On the other hand, we observed that items 2 and 15 in the Alternatives subscale had acceptable factor loadings on the Control subscale. So, given their reliability and Persian equivalent, they were retained and included in the Control subscale. Finally, the result of factor analysis indicated that items 8 and 10 in the Alternatives subscale belong to a separate factor, thus, they were clustered in the third factor which was called the alternatives for human behaviors subscale.

Three CFI-I subscales were constructed based on the item loadings of the three factors. Control subscale had a Cronbach α=0.87 and a mean inter-item correlation of 0.46. Alternatives had an internal consistency coefficient of 0.89 (mean inter-item correlation of 0.59), whereas alternative for human behaviors had an internal consistency coefficient of 0.55 (mean inter-item correlation of 0.30). Cronbach's alpha for the CFI-I was 0.90 and it had a mean inter-item correlation of 0.71. The four-week test-retest reliability coefficients for the CFI-I, Control, alter-

Table 3. Convergent and Concurrent Validity of the CFI.

Variables	CFI	Control	Alternatives	Alternatives for human behaviors
Depression	-0.50**	-0.50**	-0.37**	-0.15**
Resilience	0.67**	0.60**	0.56**	0.21**
Problem solving	0.52**	0.37**	0.51**	0.24**
Social support	0.04	-0.06	0.10	0.13*
Cognitive evaluation	0.39**	0.28**	0.37**	0.25**
Physical control	-0.39**	-0.48**	-0.23**	-0.03
Emotional control	-0.32**	-0.40**	-0.21**	-0.01

** P<0.01
* P<0.05

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natives and alternatives for human behaviors were 0.71, 0.55, 0.72, and 0.57, respectively.

Table 2 shows the correlations between the CFI and its subscales. As can be seen, the correlation between subscales of the CFI was lower than that of the CFI and each subscale. These correlations provided evidence for the validity of the CFI.

In order to examine the convergent and concurrent validity of the CFI, BDI-II, CD- RISC, and CSQ questionnaires were administered. As shown in Table 3, the CFI and its subscales had a negative correlation with the BDI-II (P<0.01), but a positive one with the CD-RISC (P<0.01), CSQ subscales, Problem Solving and Cognitive Evaluation (P<0.01). However, only the alternatives for auman behaviors subscale correlated positively and significantly with the Social Support subscale of the CSQ (P<0.05).

Moreover, the CFI, Control and Alternatives showed negative correlations with the Emotional Control and Physical Control subscales of CSQ (P<0.01). Finally, no significant correlation was found between alternatives for human behaviors and Physical Control and Emotional Control. These findings provided evidence for the convergent and concurrent validity of the CFI. As cognitive flexibility increases, the depressive mood will be alleviated and consequently the tendency to utilize coping styles such as emotional control and physical control will decrease. Conversely, increase in cognitive flexibility will result in increased levels of resilience and, as a result, the tendency to utilize coping styles such as Cognitive Evaluation and Problem Solving will increase.

4. Discussion

The purpose of the present study was to examine the validity and reliability of the CFI-I and to prepare an appropriate version of it for application in research and clinical practices in the Iranian research context. Given the novelty of the CFI which was developed in 2010, and limited literature on it, it was just possible to compare the findings of the present study with those of its developers. Results of the factor analysis in the present study were found to be somewhat different from those of Dennis and Vander Wal's (2010).

As a result, some modifications were made to the original CFI. Unlike the developers of CFI who concluded that a two-factor solution best describes the CFI, we indicated that a three-factor solution explains greater variance and has more clinical advantages. Therefore, a

three-factor solution for the Iranian version of the CFI was accepted. It can be concluded that cultural factors may play an important role in the results of factor analysis. The modifications to the original CFI were made because of the results of factor analysis, achieving higher reliability, and Persian equivalents of the items.

The obtained factors included Control with 8 items, Alternatives with 10 items, and alternatives for human behaviors with 2 items. The differences made to the original CFI to match the existing context of Iran included 1) transferring items 14 and 19, originally belonging to the Control, to the Alternatives subscale, 2) transferring items 2 and 15, originally in the Alternatives subscale, to the Control subscale, and 3) clustering items 8 and 10 in a new category called the alternatives for human behaviors subscale.

High correlations were found between the CFI subscales and the CFI (from 0.42 to 0.89) and the correlations between the subscales of the CFI ranged from 0.07 to 0.49 suggesting that the CFI factors are distinct from each other. This finding is consistent with the earlier work of Dennis and Vander Wal (2010) and provides evidence for the validity of the CFI.

Results from the convergent and concurrent validity of the CFI obtained by its correlations with the measures of depressive symptomatology, resilience and coping styles were also satisfactory. Consistent with findings of Dennis and Vander Wal's (2010), different positive or negative relationships were found between the CFI and its subscales and coping styles based on the type of coping styles. Dennis and Vander Wal's findings (2010) suggested that cognitive flexibility correlated positively with adaptive coping styles of Problem-Focused Coping, Seeking Social Support, and Focusing on the Positive but correlated negatively with maladaptive coping styles of Keeping to Self, Wishful Thinking, and Detachment.

The present study, however, indicated that cognitive flexibility and its subscales correlated positively with adaptive coping styles of Problem Solving and Cognitive Evaluation but correlated negatively with maladaptive coping styles of Emotional Control and Physical Control (with the exception of alternatives for human behaviors showing no significant correlations with Physical Control and Emotional Control). Therefore, it is more likely that individuals who are cognitively flexible use adaptive coping styles and avoid maladaptive coping styles.

In other words, flexible individuals try to adaptively solve a problem instead of worsening their situations. The results also indicated that, contrary to the findings of Dennis and Vander Wal (2010), only alternatives for human behaviors correlated positively and significantly with the Social Support subscale of CSQ, and the CFI, Control and Alternatives had no correlations with Social Support. It means that individuals who are able to perceive multiple alternative explanations for human behaviors search for social support in order to cope with problems.

Cognitive flexibility and its subscales correlated positively with resilience suggesting that as cognitions become more flexible, the capacity to cope with, adjust and recover from stress and adversity will increase. Haglund et al. (2007) argued that, compared to inflexible thinkers, individuals who possess high levels of cognitive flexibility use alternative explanations, restructure their beliefs positively, accept challenging situations or stressful events, tend to be more psychologically resilient, consider negative life events more flexibly and realistically, and often regard difficulties as temporary and limited in scope.

In Dennis and Vander Wal's research (2010), the CFI and its subscales were found to correlate negatively with the BDI-II. This finding was expected because low levels of cognitive flexibility are associated with higher depressive symptomatology and many studies support this correlation (Brooks et al., 2010; Farrin et al., 2003; Gan et al., 2006; Hinkelmann et al., 2009; Meiran et al., 2011; Preiss et al., 2009; Watari et al., 2006). These findings provide some clinical implications because CBT lies on the assumption that depression is treated with interventions focusing on breaking down automatic maladaptive cognitions and replacing them with more realistic, adaptive ones (Young et al., 2001). It is also suggested that CBT causes reduction in depressive mood by increasing the cognitive flexibility of depressed patients.

The findings of this study and Dennis and Vander Wal's research (2010) indicated that both the original CFI and its Iranian version have acceptable reliability. The Cronbach's alpha of the original CFI including the CFI, Alternatives and Control subscales was 0.91, 0.91 and 0.84, respectively, and for the Iranian version of the CFI ranged from 0.55 to 0.89. Moreover, test-retest reliability obtained in the present study for the CFI was 0.71 and for the CFI subscales ranged from 0.55 to 0.72 which is consistent with that of Dennis and Vander Wal's study (2010) in which the test-retest reliability for the CFI, Alternatives and Control was 0.81, 0.75, and 0.77, respectively.

It is important to note that, in the present study, the interval between the first and the second administrations was one month which, as compared to the seven-week longitudinal interval of Dennis and Vander Wal's (2010) might have influenced the findings of the present study. The CFI developers suggested a long interval to examine the test-retest reliability of the CFI and reported higher levels of reliability compared to the test-retest results of the present study so it can be concluded that the longer interval may result in higher levels of test-retest reliability; however, this needs closer inspection in future studies.

Altogether, the present study confirms the validity and reliability of the CFI for its employment in the Iranian clinical and research settings. Among other things, its clinical application to assess treatment outcomes in the evidence-based therapies of depression which primarily include cognitive-behavioral therapy is noteworthy. But certain limitations of the present study include lack of generalizability of the findings to other populations because the sample of the present study solely recruited from university students. Moreover, employment of self-report measures such as the one used in the present study can lead to certain potential biases. So, it is suggested that the CFI is used in further research to examine levels of cognitive flexibility in different psychological disorders such as depression. It is also suggested that the psychometric properties of the CFI especially its factorial structure be investigated in different populations.

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