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Original Article

URDU TRANSLATION AND PSYCHOMETRIC EVALUATION OF COGNITIVE FLEXIBILITY INVENTORY FOR ADOLESCENTS

Arshia Saif [a*], & Dr. Mamoona Ismail Loona [b]

[a] PhD Scholar, Department of Psychology, International Islamic University, Islamabad, Pakistan
[b] Assistant Professor, Department of Psychology, International Islamic University, Islamabad, Pakistan

*Correspondence to: Ms. Arshia Saif, PhD Scholar, International Islamic University, Islamabad, Pakistan. Email: arshia.phdpsy84@iiu.edu.pk.
ORCID: 0009-0008-8276-4042

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ABSTRACT

Cognitive Flexibility Inventory (CFI; Dennis & Vander Wal, 2010) is brief self-reporting instrument to measure an individual's cognitive flexibility. Mental health challenges such as anxiety, depression, impulsivity, aggression and suicidal ideations have been associated with reduced cognitive flexibility. CFI is widely used 20-item self-administered measure with 7-point Likert type scale. Despite growing work on Adolescent's mental health, there is scarcity of tool specifically designed for Urdu speaking population. Current study aims to translate Cognitive Flexibility Inventory in Urdu Language and establish its psychometric properties among Pakistani Adolescents. Berlin's (1970) Forward-Backward translation and expert panel review procedure was used to create Urdu translated version of CFI. Bilingual subsample (n=40) was used to establish cross-language validity. Over period of 2 weeks, test re-test reliability was excellent (r= .90). Present research recruited the sample of 300 Adolescents for Phase II (Age= 13-19 years, M=16.72, S.D.=1.69) from private & Public Sector Educational Institutes of Islamabad & Rawalpindi. Confirmatory factor analysis supported original factors of scales and produced acceptable fit indices. (χ^2/df = 1.54, CFI=.97, RMSEA= 0.04, SRMR= 0.03). Results showed excellent internal consistency (Cronbach's Alpha= .93). Hence, findings indicate that CFI (Urdu translated version) is significantly reliable and valid tool for assessing cognitive flexibility among Urdu speaking Adolescents. It has strong clinical implications for assessment-based research in Pakistan.

I. INTRODUCTION

Cognitive flexibility is directly linked to changing maladaptive beliefs and providing alternative explanations for ambiguous events which are key elements of cognitive-behavioral intervention (Diamond, 2013; Dajani & Uddin, 2015). It is defined as the ability to modify one's cognitive strategies as needed to adjust one's behavior to fit the surroundings (Dennis & Vander Wal, 2010). Less flexibility relates to anxiety, depression, suicidal thinking, impulsivity and emotional dysregulation (Karakus, 2024; Kusi-Mensah et al., 2022). Adolescence is a time of transition, where skills in prefrontal cortex are still developing. Inflexibility in thinking emerges during adolescence as risk factor for their mental health issues (Gabrys et al., 2018; Huizinga et al., 2006). Different factors play an important role in development of cognitive flexibility. Poor self- and parent-reported executive function was found to be strongly correlated with severity of anxiety and depression in community adolescents (Mullin et al., 2018). Flexibility and working memory were also mediates the relationship between parenting styles and emotional adjustment (Carballo-Márquez et al., 2026). Depressed adolescents who engage in self-injury are less flexible than those who do not (Miranda et al., 2013) and decreased flexibility is linked to increased emotional and behavioral

issues post suicide attempts (Novak et al, 2022). These two findings together highlight the clinical significance of flexibility.

The Cognitive Flexibility Inventory (Dennis & Vander Wal, 2010) is a short (20 item) self-report scale comprised of two subscales: Alternatives and Control. While it has been translated into a variety of languages, most studies focused on university students or adults and adolescent evidence is sparse. In Pakistan there are approximately 40 million people in the age group 10-19 (Pakistan Bureau of Statistics, 2023). Urdu is the national language. There are already measures that exist in Urdu to measure anxiety, depression, and cognitive distortions. The Urdu Acceptance of Change Scale comprises of a cognitive flexibility dimension (Aslam et al., 2025), but a more encompassing construct than the CFI. According to the authors, there is no Urdu CFI that is psychometrically evaluated. The present study thus translates the CFI into Urdu language within the framework of Brislin, 1970) and assesses the psychometric properties of CFI among adolescent population of Pakistan. It is a large South Asian language with a growing evidence base for the CFI and provides a developmentally and culturally appropriate measure for clinicians and researchers.

Cognitive Flexibility Inventory has been translated and adapted into at least nine languages, with most studies supporting its original two factor structure of Control and Alternatives. Sapmaz and Dogan (2013) validated the Turkish version of CFI among 551 university students. Their findings confirmed two factor structure with excellent internal consistency (α = .90). In contrast, Iranian translation and adaptation assessed among 227 students, reported three factor structure of CFI. Results added a third dimension “Alternatives for Human Behaviours”. Results showed excellent internal consistency (α = .90), test-retest reliability. The three Factor solution explained 56.02% variance in overall model (Shareh et al., 2014). Russian Adaptation replicated original two-factor structure, examining 298 undergraduate students. Results also demonstrated known-group validity through differentiation between clinical and non-clinical groups (Kurginyan & Osavolyuk, 2018). Similarly, Italian version demonstrated two factor solution and demonstrated measurement invariance among gender (Portoghese et al., 2020). Jaen et al. (2024) reported two factor structure in Spanish Sample of 300 Participants after excluding one item. Similar findings were reported in Columbia, results supported two factor structure with excellent alpha reliability (α = .89) among 968 adults (Navarro et al., 2022).

In Indonesian sample Rahayu et al. (2022) retained two factors in large sample of 1250 adults. They further acknowledged absence of back translation as limitation of their adaptation procedure. The Cantonese version was evaluated on 104 psychiatric outpatients. Findings reported strong negative correlation of cognitive flexibility with perceived stress (r=-.61), excellent internal consistency of translated CFI (α = .91) and good test-retest reliability (.90) (Wong et al., 2024). An Arabic translation was conducted on 230 Iraqi volleyball players, yielded three factors of CFI (Alawadi et al., 2026). Current study used Brislin’s (1970) translation guidelines, he was the one who laid the foundations of back-translation as an important principle. Beaton et al. (2000) suggested a 'forward' translation, 'synthesis', 'back' translation, expert committee review and 'pre' testing procedure to ensure 'semantic', 'idiomatic', 'experiential' and 'conceptual' equivalence. The guidelines adopted by the ITC (2017) cover issues of construct, method, and item bias for development, administration, and interpretation. There is limited consensus: According to a review of guidelines, there was no consensus on the required steps and an experimental study found that an expert committee added value, not back-translation (Epstein et al., 2015). They emphasized the importance of being understandable for the intended age group, thus providing cognitive debrief with adolescents.

II. METHOD

Participants

The survey design was cross sectional. The study was divided into two phases: Phase 1 included translation and cultural adaptation of the CFI to Urdu and Phase 2 included the psychometric evaluation with the adolescent sample. In Phase 2 three hundred adolescents (111 girls, 189 boys) participated. Their ages ranged from 13 to 19 years (M = 16.72, SD = 1.69). Sample was recruited from different educational institutions of Islamabad and Rawalpindi. Those students who were able to read the Urdu language fluently and signed the written consent

were included. Participants identified with intellectual disability or severe psychiatric condition were excluded. A subsample (N=40) of the students re-tested the Urdu CFI after two weeks for test-retest reliability.

Measures

Cognitive flexibility was measured using the Cognitive Flexibility Inventory (CFI; Dennis & Vander Wal, 2010) which taps into two aspects: perceiving challenging situations as controllable and being able to think of several different explanations for life events and human behavior, as well as multiple different solutions to difficult situations. The CFI is a 20-item self-report instrument with ratings on a 7-point Likert scale (ranging from 1 to 7, with 1 representing "strongly disagree" and 7 representing "strongly agree"). Provides a total score and two subscale scores (Alternatives 13 items; Control 7 items). Total scores will be reverse scored for items on the Control subscale, with higher scores reflecting greater cognitive flexibility. The CFI had high internal consistency (.91) and good test-retest reliability after 7 weeks (total scale r = .81, Alternatives r = .75, and Control r = .77). Additionally, the scale demonstrated convergent validity by its relationship with other cognitive flexibility measures, depressive symptoms, and coping (Dennis & Vander Wal, 2010).

Translation Procedure

Brislin et al. (1970) guidelines were followed in five sequential steps to translate the CFI into Urdu.

Stage I: Forward translation. The 20 items of CFI were translated into Urdu by five bilingual translators (Ph.D. scholars; psychology). This combination was selected to ensure that there was a content-informed perspective.

Stage II: Committee Approach. Five forward translations were compared item by item with an expert committee made up of the three forward translators (Assistant Professors of Psychology). All differences were sorted out by consensus of the committee, resulting in one Urdu version all the way.

Stage III: Back-translation. The Urdu draft was translated into English by five bilingual translators who were not aware of the original English scale.

Stage IV: Committee Approach. Committee of three experts (Ph.D. Psychology) reviewed back translated material. Expert compared back translation with original Cognitive Flexibility Inventory to find out discrepancies in meaning and concepts.

Stage V: Pilot testing. Urdu CFI was pre-finalized with 15 boys and 15 girls (total 30 adolescents). Two items were reported as being somewhat confusing, but not due to lack of accuracy in rendering the translation, rather because the sentence structure of these items was too formal for this age group. These were simplified but not changed in their meaning.

Stage VI: Final review. The pilot feedback was considered by the expert committee; final modifications were made to the Urdu CFI and then it was approved for psychometric evaluation.

Procedure

The Institutional Review Board of International Islamic University Islamabad Pakistan approved this project. The packet of questionnaires was distributed to the children by trained research assistants and completed in the classroom units within the school. Duration of each session was approximately 25-30 minutes. Students were informed that participation was voluntary, that their answers were anonymous and that they had the opportunity to stop at any time without repercussions. Descriptive statistics, reliability estimates, and correlational analyses were conducted in SPSS 27, while confirmatory factor analysis (CFA) was performed using AMOS 27. Model fit was assessed for CFA by means of five indices: chi-square/df ratio (acceptable < 3), Comparative Fit Index (CFI ≥ .90), Tucker-Lewis Index (TLI ≥ .90), Root Mean Square Error of Approximation (RMSEA ≤ .08), and Standardized Root Mean Square Residual (SRMR ≤ .08). The cut-offs are based on those recommended by Hu and Bentler (1999) and Kline (2016). Cronbach's alpha (internal consistency) and Pearson's r (test-retest stability) were used for assessing reliability.

III. RESULTS

The total Mean scores for the full sample were 78.96 (SD = 18.40). Mean of Alternatives subscale was 51.10 (SD = 13.42) and the mean of Control subscale was 27.87 (SD = 7.85). Overall, the total CFI scores did not differ significantly between the genders, t (298) = -1.04, p = >.05, which is like the results obtained from the original sample by Dennis and Vander Wal (2010) and from the Turkish sample by Sapmaz and Dogan (2013). Scores were approximately normally distributed (skewness = 0.00, kurtosis = -0.14), which is good for the parametric analyses that follow.

Table I: Descriptive Statistics, Internal Consistency and Test–Retest Reliability of the Urdu CFI (N = 300)

Scale / Subscale	Items	*M*	*SD*	α	Range	Skewness	Kurtosis	Test–retest r
CFI total	20	78.96	18.41	0.93	20–140	+0.01	−0.17	.90***
Control	7	27.87	7.86	0.89	7–49	−0.12	−0.26	.81***
Alternatives	13	51.10	13.43	0.93	13–91	+0.09	−0.37	.87***

Note. Test–retest coefficients are based on the retest subsample (n = 40; two-week interval).
****p*< .001

Results demonstrate good internal consistency. Cronbach's alpha of total CFI score was .93, for the Alternatives subscale was .93, and for the Control subscale was .89. Test-retest reliability over two weeks (n = 40) yielded r = .90 for the total score, r = .87 for Alternatives, and r = .81 for Control. These figures are close to what Dennis and Vander Wal (2010) reported for a seven-week interval (r = .81).

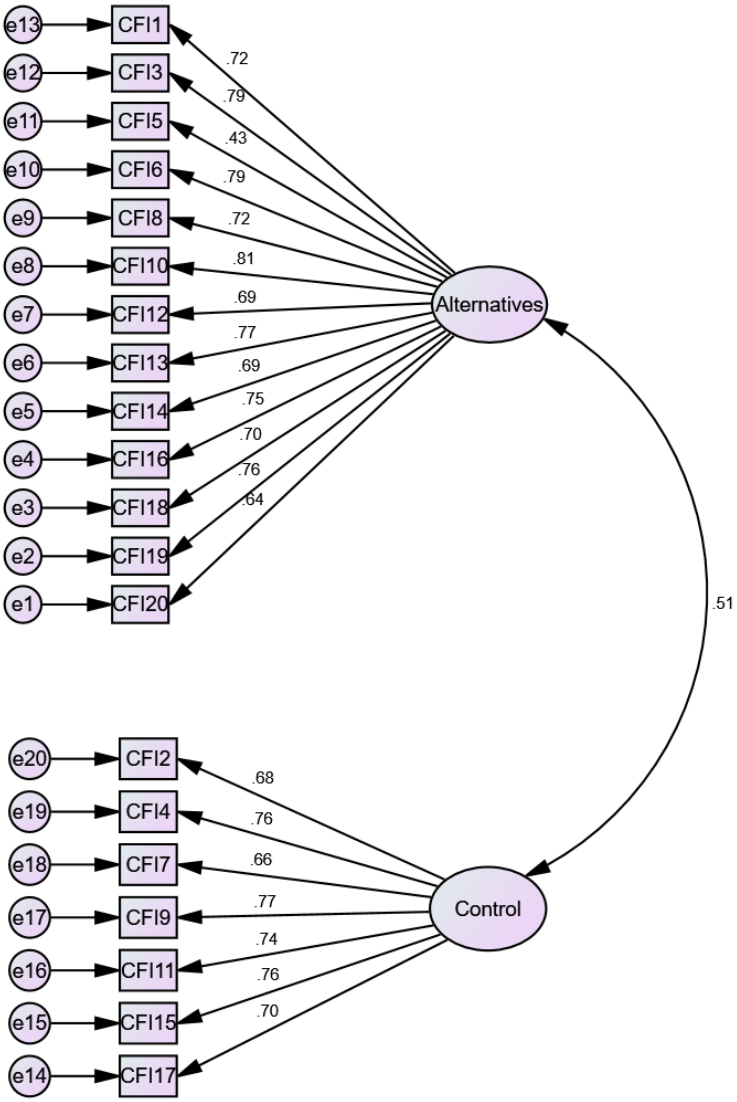
Table II: Model fit Indices for the translated Cognitive Flexibility Inventory (N=300)

Fit Indices	x^2	*df*	χ^2/df	*GFI*	*CFI*	*RMSEA*	*SRMR*
Cognitive Flexibility Inventory	261.39	169	1.54	.91	.97	0.04	0.03

*Note. *p=REMSEA <.01, *p= CMIN<.01*, GFI= Goodness of fit index, CFI=comparative fit index, NNFI = non-normed fit index; RMSEA=root mean square error of approximation, SRMR=Standardized root mean square.

The two-factor model (Alternatives and Control factors) was first investigated using confirmatory factor analysis (CFA). The two-factor model showed acceptable fit: χ^2 (169) = 261.39, p < .001, χ^2/df = 1.54, GFI = .91, CFI = .97, RMSEA = .04, SRMR = .03. The factor loading of all standardized factor loadings ranged from .42 to .78, with most of them having loadings above .50, which suggests the two subscales are related but distinct, consistent with the original validation.

Figure I: Factorial Structure



Two-Factor Confirmatory Factor Analysis Path Diagram of the Urdu CFI

Table III: Standardized Factor Loadings for the Two-Factor Model of Urdu CFI (N=300)

Cognitive Flexibility Inventory					
Subscale	Items	Loading range	CR	MSV	AVE
Alternatives	13	.66-.81	.93	.25	.51
Control	7	.64-.751	.88	.25	.52

Measurement invariance across gender

To test the measurement invariance across male and female adolescents, multigroup confirmatory factor analysis (CFA) was conducted. The configural model indicated good model fit, χ^2 (338) = 485.99, χ^2/df = 1.44, CFI = .954, RMSEA = .038, 90% CI [.030, .046], showing that the factor structure was equivalent across genders. There was no significant loss of fit with constraining factor loadings (metric invariance), $\Delta\chi^2$ (18) = 14.82, p = .67, ΔCFI = .001, ΔRMSEA = −.001. Scalar invariance, $\Delta\chi^2$ (20) = 19.16, p = .51, ΔCFI = .000, ΔRMSEA = −.001, and structural covariances, $\Delta\chi^2$ (3) = 2.54, p = .47, ΔCFI = .000, ΔRMSEA = .000, did not worsen fit. Finally, constraining measurement residuals (strict invariance) also did not significantly reduce fit, $\Delta\chi^2$ (20) = 8.03, p = .99, ΔCFI = .004, ΔRMSEA = −.003. All changes in CFI (< .01) and RMSEA (< .015) scores were within the recommended levels (Chen, 2007; Cheung & Rensvold, 2002). The current findings suggest that the CFI for Urdu is configural, metric, scalar, and strict invariant and thus confirms the construct equivalence across genders in adolescents and supports meaningful comparisons of latent means between genders.

Table IV: Model Fit Indices and Model Comparisons for Measurement Invariance Testing of the Urdu Cognitive Flexibility Inventory Across Gender

Model	χ^2	df	*CFI*	*RMSEA*	$\Delta\chi^2$	Δdf	*p*	*ΔCFI*	*ΔRMSEA*
Configural (Unconstrained)	485.99	338	.954	.038	–	–	–	–	–
Metric (Measurement weights)	500.81	356	.955	.037	14.82	18	.67	.001	−.001
Scalar (Measurement intercepts)	519.96	376	.955	.036	19.16	20	.51	.000	−.001
Structural covariances	522.51	379	.955	.036	2.54	3	.47	.000	.000
Strict (Measurement residuals)	530.54	399	.959	.033	8.03	20	.99	.004	−.003

Note. Group 1 = male; Group 2 = female. $\Delta\chi^2$, Δdf, p, ΔCFI, and ΔRMSEA represent comparisons with the immediately preceding model. CFI = comparative fit index; RMSEA = root mean square error of approximation.

Convergent and Discriminant Validity

AVE was .51 for Alternatives and .53 for Control, and composite reliability was .93 and .89 respectively, which satisfies the requirements for convergent validity. As Table 5 shows, the square root of the AVE for Alternatives (.71) and for Control (.73) was clearly larger than the correlation between the two factors (.47). Put differently, each factor shared more variance with its own items than with the other factor (shared variance = .22).

Table V: Discriminant Validity of the Urdu CFI: Fornell–Larcker Criterion (N = 300)

Factor	*k*	*M*	*SD*	MaxR(H)	CON	ALT
Control	7	3.98	1.12	0.888	0.725	
Alternatives	13	3.93	1.03	0.938	0.506***	0.719

Note. N = 300. k = number of items, M = mean, SD = standard deviation, MaxR(H) = maximal reliability. Diagonal elements in bold parentheses are square roots of AVE; off-diagonal element is inter-factor correlation (p < .001).

Table VI: Mean, Standard Deviation, and Independent Samples t-Test of Study Variables by Gender (N = 300)

Variable	Males (n = 189) *M (SD)*	Females (n = 111) *M (SD)*	*t*(298)	*p*	Cohen's *d*
CFI	3.91 (0.89)	4.02 (0.97)	-1.04	.299	-0.12
Control	3.97 (1.08)	4.00 (1.19)	-0.27	.787	-0.03
Alternatives	3.87 (1.02)	4.03 (1.05)	-1.27	.206	-0.15

Because scalar invariance was achieved, observed means could be compared across gender. Boys and girls did not differ significantly on alternatives, control or the total score, and all effect sizes were negligible.

Table VII: Descriptive Statistics and Pearson Correlation

Variables	*M*	*SD*	1	2
1. Control	1.81	0.56	---	
2. Alternative	2.03	0.57	.46***	---

****p*< .001

Alternatives and Control were positively and moderately correlated, *r* (300) = .46, *p* < .001, and each correlated strongly with the total score (Alternatives: *r* = .92; Control: *r* = .76; both *p* < .001).

I. DISCUSSION

The results suggest that the Urdu CFI is a psychometrically sound measure of cognitive flexibility for Pakistani adolescents. The findings are consistent across every line of evidence examined. The Urdu CFI was stable over time and internally consistent, it reproduced the original two-factor structure without any modifications, it measured the construct equivalently in boys and girls, and its two factors were related yet clearly distinguishable. Cronbach's alpha for the full scale was .93, while those for Alternatives and Control were .93 and .89, respectively. These values are higher than the .70 level for research use and are in the .90 range, which is recommended for scores used to inform decisions about individuals (Nunnally & Bernstein, 1994). They are similar to and slightly higher than those reported by the original inventory (Dennis & Vander Wal, 2010) and also by the Persian version (α = .90;

Shareh et al., 2014) and by the Colombian version (α = .89; Navarro et al., 2022). This correlated two factor model showed good fit with every index measured: ratio of chi-square to degrees of freedom was 1.54, CFI was .97, RMSEA was .04 and SRMR was .03, all of which met the very strict criteria proposed by Hu and Bentler (1999); GFI was .91, above the conventional .90 for acceptable fit (Schermelleh-Engel et al., 2003). All the items loaded strongly on the intended factor ranging from .66 to .78 in the standard loadings.

The important point to be underlined is, that no modifications were made to get this fit. There were a number of previous adaptations of the CFI that required such changes: The Italian version had to be adapted with the removal of one item (Jaén et al., 2024), the Indonesian version had to be adapted with the removal of five items (Rahayu et al., 2022), and the Persian version had to be split into three factors (Shareh et al., 2014). Our findings are most similar to the original structure (Dennis & Vander Wal, 2010) as well as to the Russian and Colombian results (Kurginyan & Osavolyuk, 2018; Navarro et al., 2022). All the 20 items remain and scores on the Urdu version may be compared with the extensive work conducted with the full inventory. Metric invariance demonstrates the equal contribution of the items to the underlying factors of boys and girls, indicating that this construct has the same meaning for both boys and girls. The condition that allows comparison of means is called scalar invariance and states that boys and girls with the cognitive flexibility level would be expected to provide identical item responses. An ideal of strict invariance is not always realized in the applied research, but it is the one that would indicate that the items are equally precise in both groups. This result corroborates with the Italian study that found that the CFI did not vary by gender in university students (Portoghese et al., 2020), and adds a younger age group and a very different cultural context. This is important in a country such as Pakistan where boys and girls are often separated in the classroom, and socialized into specific roles, which one might assume would mean different weight being given to items relating to personal control. They did not. The Urdu CFI can then be gender neutral and can be applied in co-education and single gender environments.

Model fit indicates a possible two-factor solution, but it does not prove that the items are well defined by each factor or that two factors are necessary. Both points are taken care of by the Fornell–Larcker approach (Fornell & Larcker, 1981). In terms of convergent validity, the AVE .50 for both factors was satisfied and the composite reliability was greater than .70 for both factors (Hair et al., 2019). The square root of the AVE of each factor (.71 and .73) was much greater than the correlation between the factors (.47) for discriminant validity. This was further confirmed by the HTMT ratio which is more sensitive in detecting lack of discriminant validity than the Fornell–Larcker comparison (Henseler et al., 2015). This finding validates reporting subscale scores as well as total scores, which is what Dennis and Vander Wal (2010) recommend; clinically, a young person who can think of many options but feels that nothing he/she does will make a difference needs help from someone who feels capable but only sees one way to go. There was no difference between boys and girls on Alternatives, Control or overall scores and effect sizes were small. This finding is consistent with the gender similarities hypothesis which, on the basis of a voluminous body of meta-analytic evidence, suggests that males and females are similar on most psychological variables (Hyde, 2005). It also aligns with a review of the executive function literature that found that sex differences were limited, varied across tasks and in some instances context and strategy dependent, but not ability (Grissom & Reyes, 2019).

There is admittedly not a uniform view of the published evidence on self-reported flexibility. In a previous Pakistani study, girls were found to exhibit greater cognitive flexibility than boys (Bashir & Majeed, 2023) while some other studies on college students worldwide have preferred males. These discrepancies could be due to measurement differences, or to sampling and age differences; however, they could also be due to the fact that between-means comparisons were made with rarely conducted tests for invariance, thus allowing for item-level bias in the data. This possibility was ruled out in the current study, thus supporting the null result. On the substantive side, the finding indicates that, when they enter adolescence, school-going boys and girls in Pakistan have similar confidence in their capacity to assess and respond to challenges. This could be related to exposure to formal schooling, examinations and digital media broadly. The implication for use of the scale is that norms for boys and girls do not need to be developed separately. The two subscales were positively and moderately correlated. This is what would be predicted if two aspects of one general higher-order ability were considered. When adolescents think they can make a difference in a difficult situation, they become aware of other ways of understanding and solving their problem, and when they have multiple options, a situation seems more

manageable. In the original study (Dennis & Vander Wal, 2010) and in subsequent adaptations (e.g., Kurginyan & Osavolyuk, 2018; Portoghese et al., 2020), there was an also modest positive correlation between the subscales. The Urdu CFI can thus be considered as a measure of two closely related sub-components of a single construct.

Implications and Recommendations

The research is helpful because it does the following: Theoretically, it compounds the cross-cultural evidence that the two-component model of cognitive flexibility is true across non-Western, educated and industrialized samples (Henrich et al., 2010), and it does so in a sample of adolescents, which is under-represented in the CFI literature. The short tool takes less than 15 minutes to administer and is now available to school counsellors, clinical psychologists and researchers in Pakistan to screen for inflexible thinking, assess the effectiveness of cognitive-behavioral and resilience-based interventions, and investigate the relationship between flexibility and academic and emotional outcomes. The instrument is also suitable for other settings because Urdu is also widely read in the diaspora, however their properties will have to be assessed. There were a number of constraints to be considered. First, the participants were recruited from schools and colleges in urban areas and may not be representative of rural or out-of-school or clinical population. Second, the all data were self-reported. However, since there is only a weak correlation between self-report and performance-based assessment of flexibility (Howlett et al., 2021), using the Urdu CFI should not replace assessment of task-switching and set-shifting ability. Fourth, invariance was examined only with regard to gender. Equivalence across age bands, school type, socio-economic status and regional language groups of Pakistan, and longitudinal invariance should be investigated and cut-off scores and norms should be developed. Lastly, the cross-sectional design does not permit conclusions regarding changes in cognitive flexibility over the course of adolescence.

II. CONCLUSION

The Urdu version of the Cognitive Flexibility Inventory maintains the original two factors, the original 20 items, good test–retest reliability, high internal consistency, gender equivalence, and good separation between the two factors. It provides a psychometrically robust and culturally appropriate instrument to measure cognitive flexibility among Pakistani adolescents and a solid foundation for research and intervention with this group.

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