

Research Paper

Reliability, Validity, and Factor Structure of the Persian Version of the Children Reinforcement Sensitivity Scale

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ABSTRACT**Objectives** The revised Reinforcement Sensitivity Theory (RST) has a decisive role in the different dimensions of behavior, emotions, personality and pathology of children. The goal of this research was to validate RST in children.**Methods** The research is descriptive correlational. The statistical population included all school children in Hamedan City, Iran in 2018 academic year. Study participants included 417 children selected by multi-stage cluster sampling. Then RST, positive and negative affect and depression anxiety stress scales were distributed among them to respond. The reliability was assessed by alpha coefficient, test-retest and split-half coefficient, and validity was assessed with other questionnaires to determine the psychometric properties of RST. The confirmatory factor structure was assessed by confirmatory factor analysis.**Results** Factor analysis indicated that RST has 3 factors and checking the validity of the inventory using Cronbach alpha, respectively for the factor fight-flight system, behavioral activation system, behavioral inhibition system (0.75, 0.76, 0.68) test-retest (0.48, 0.56, 0.61) and split-half coefficient (0.56, 0.51, 0.61) reflects the stability of the scale. The criterion validity of RST with other questionnaires indicated desirable discriminant and convergence validity ($P < 0.05$).**Conclusion** Overall, the findings indicate that RST has good psychometric properties in children, and can be used in studies in normal population. However, it seems that RST subscales has a low internal consistency in Iranian children in comparison with the original version.**Extended Abstract****1. Introduction**

The Reinforcement Sensitivity Theory (RST) was initially recognized as anxiety and impulsiveness theory, but now it embraces neuropsychology, emotion, motivation and learning as a broad theory [2]. According to RST, the three brain systems encompass

two basic types of behavior, called reward and avoidance [2], and the personality is the result of the interaction between these systems, each of which is associated with the distinctive neuro-cognitive system [1].

A variety of measures was used to measure RST. Developed scales to measure reinforcement sensitivity in children have few major drawbacks: 1. These scales are often based on the original RST; 2. Lack appropriate reliability and validity in children; 3. Also do not differenti-

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ate between BAS, BIS and FFFS. Accordingly, Cooper and colleagues have developed self-report questionnaire for revised RST (r-RST) in children. Although r-RST is valuable in different dimensions of the behavior, emotions, personality and pathology of children, it has not received proper attention [19]. In this research, the most important reason for the implementation of the research is not the study of the psychometric properties of the sensitivity scale to strengthen the children. Instead, this study aimed to evaluate the psychometric properties of reinforcement sensitivity scale in children, and whether the scale can distinguish between BAS, BIS and FFFS according to r-RST.

2. Method

In this research, we used descriptive psychometric method. The study population comprised all children of Hamadan schools in 2018 academic year. A total of 417 children were selected based on a multistage cluster sampling method. Of the total participants, 286 (68.6%) were fourth grade of elementary school, and 131(31.4%) ones were third grade, also 236 (56.7%) participants were boys and 181 (43.3%) ones were girls. The boy students' Mean±SD age was 9.85±0.59 years and girl students' Mean±SD age was 9.37±0.86 years. To evaluate the criterion validity, two tests of the Depression, Anxiety and Stress Scale (DASS-21) and Positive and Negative Affective Schedule (PANAS) were simultaneously used. Finally, the collected data were analyzed using descriptive statistics, correlation coefficients, exploratory and confirmatory factor analysis and analyzed in SPSS V. 22 and LISREL 8.8.

3. Results

The confirmatory factor analysis using LISREL software, offered 3 levels of fit indices: 1. Absolute fit indices such as Chi-square index and Standardized Root Mean Square Residual (SRMR); 2. Parsimony goodness-of-fit index such as Root Mean Square Error of Approximation (RMSEA); and 3. Comparative Fit Index (CFI). The reliability of the test was assessed by Cronbach alpha, test-retest and split-half coefficient. The results showed that

Cronbach alpha values were 0.75, 0.76 and 0.68 for the factor fight-flight system, behavioral activation system, and behavioral inhibition system respectively; re-test values for the same factors were 0.48, 0.56, 0.61 and split-half coefficient values were 0.66, 0.51, 0.67, respectively all indicating the stability of the scale.

The correlation coefficients between the subscales with PANAS scales, indicates the construct validity of the RST in children. Bivariate correlations showed that the FFFS was significantly and negatively associated with BAS, while BIS is positively associated with BAS (Table 1). Sensitivity with other scales showed a good convergence and divergence validity (P<0.05).

Exploratory factor analysis with different rotations and using T The analysis of the main component and the varimax rotation was done. The value obtained for the qualitative sampling of Kaiser-Meyer-Olkin was equal to 0.252. Also, Bartlett's test of sphericity (Chi-Square=2246.384) indicated that factor analysis is possible. Analysis of principal components showed the presence of a component with values greater than 1. The data indicated that the extracted load factors were higher than 0.40.

4. Discussion

The findings also reveal that 3 factors have a desirable internal reliability similar to factor structure of the original questionnaire. Studying the factor structure of RST and patterns of factor loadings, using confirmatory factor analysis, presents the same results as the original version. All the factor loadings were higher than 0.4. However, some items have weak load factor and thus were excluded from the factor analysis to achieve a better fit.

Investigating the RST reliability, using alpha coefficients, test-retest coefficients and split-half, revealed the appropriate reliability of the scale. The subscale's alpha coefficients of 0.75, 0.76 and 0.68 and the values of test-retest and split-half's coefficients suggested the suitable reliability of RST to measure the reinforcement sensitivity in children.

Table 1. Correlations between the subscales of RST and convergent measures

Variable	1	2	3	Positive Affect	Negative Affect	Stress	Anxiety	Depression
FFFS	1			-0.6	0.11*	0.23**	0.28**	-0.10
BIS	-0.2	1		-0.14*	0.7	0.34**	0.29**	0.14*
BAS	-0.14**	0.51**	1	0.05	-0.08	0.16*	0.06	0.04

**P<0.01; *P<0.05

The validity of the RST with PANAS scales indicates validity of the RST (Cooper et al., 2016), and this correlation was significant and confirms that RST can be a good scale for measuring aspects of RST. The reliability, validity and confirmatory factor analysis demonstrated the desirable psychometric characteristics of RST and the present findings are consistent with the original version. The RST in children samples showed a valid tool for assessing reinforcement sensitivity.

The calculated indices to evaluate the fit of the RST model suggested that SRMR, RMSEA, and χ^2/df indices, as the most valid fit indices support the five factor model's fit. The questionnaire for sensitization in children has shown that it is a valid tool for assessing the reinforcement sensitivity. According to the above facts, lack of valid and useful tools for assessing the reinforcement sensitivity children is a weak point of research in this area. As a result, it seems that, regardless of language and culture, and taking into account the factor load pattern, the childhood reinforcement sensitivity questionnaire is a useful tool in measuring fundamental structures that are associated with susceptibility enhancement. Clinical specimens appear to require more precision and precaution.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles were considered in this article. The participants were informed about the purpose of the research and its implementation stages; They were also assured about the confidentiality of their information; Moreover, They were allowed to leave the study whenever they wish, and if desired, the results of the research would be available to them.

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Authors contributions

The authors contributions is as follows: Conceptualization, data duration, analysis and drafting: Sohrab Amiri; Writing and review: Karim Babaei Nadinlui; and Data compilation: Mehdi Ghasemzadeh.

Conflict of interest

The authors declared no conflict of interest.