

*Research Paper*

## Validity and Reliability of Shifting Component Tasks of Executive Functions

**Baghkhani, Soodeh<sup>1</sup>; Mousavinasab, S. M. Hossein<sup>2</sup>; Pourehsan, Somayeh<sup>3</sup>**

1- Master Degree of Clinical Psychology, Department of Psychology, Literature and Humanities Faculty, Shahid Bahonar University of Kerman, Kerman, Iran.

2- Associate Professor of Health Psychology, Department of Psychology, Literature and Humanities Faculty, Shahid Bahonar University of Kerman, Kerman, Iran, ORCID: 0000-0002-7102-2835

(Corresponding Author): Email: hossein.mousavi-nasab@uk.ac.ir

3- Assistant Professor of Psychometric, Department of Psychology, Literature and Humanities Faculty, Shahid Bahonar University of Kerman, Kerman, Iran.

### Abstract

The aim of the current research was to study of validity and reliability of shifting component tasks of executive functions. This research was descriptive- analytical by survey method. The statistical population of the study included normal people from 16 to 60 years old and people with various clinical disorders from the city of Kerman. Among them, using the non-random quota sampling method in the pilot phase, 100 individuals were preliminarily, 406 normal people and 74 people with schizophrenia, major depression, brain injury and Alzheimer's dementia were examined as a sample size. Participants performed shifting component tasks. Data were analyzed using descriptive statistics, different types of validity and reliability and MANOVA. The results showed that the shifting component tasks have acceptable validity and reliability and there is a significant difference between the performance of normal people and the people with clinical disorders.

**Keywords:** Clinical Disorders, Reliability, Shifting, Validity

### Introduction

Executive functions are cognitive processes that control human thoughts, behavior, and excitement to achieve a subject or goal and are vital to daily life (Willoughby, 2016). Miyake and Friedman's theory of executive functions proposes that there are three aspects of executive functions: updating, inhibition, and shifting. A cornerstone of this theoretical framework is the understanding that individual differences in executive functions reflect both unity (i.e., common EF skills) and diversity of each component (e.g., shifting-specific) (Miyake, et al., 2000). One of the important components of this model is shifting. The shifting component refers to the ability to rapidly change mental strategies and shift between tasks. (Fiske, et al., 2019). At present, there is no validity and reliability test in Iran that exclusively measures the shifting component of executive functions. For this reason, the present study was conducted to investigate the validity and reliability of shifting component tasks of executive functions. It's assumed that shifting tasks have acceptable validity and reliability.

### Method

The present research is descriptive-analytical which has been done by survey method. The population of the study included normal people from 16 to 60 years old and people with disorders who attended clinics of the city of Kerman. For research sample size using the non-

random quota sampling method in the pilot phase, 100 individuals were preliminarily, 406 normal people and 74 people with schizophrenia, major depression, brain injury and Alzheimer disease were selected as available.

Shifting component tasks of executive functions includes the following three tasks:

**Color-Shape:** In this task (taken from Miyake, et al., 2004), participants are asked to classify circles and triangles in red or green as quickly and accurately as possible. The reliability of this task with Cronbach's alpha method in the study of Friedman, et al., (2016) was 0.85 and in the present study was obtained 0.89.

**Category Switch:** This task (taken from Mayr, et al., 2000), has the same structure and timing parameters as the shape-color task. One word is displayed in each attempt. The word can be classified as living or non-living, as well as larger or smaller than a soccer ball. The reliability of this task with Cronbach's alpha method in the study of Friedman, et al. (2016) was 0.83 and in the present study was obtained 0.96.

**Number-Letter:** In each attempt of this task (taken from Rogers, at al., 1995), a pair of numbers-letters or letters-numbers are presented in a square. Participants were asked to classify numbers and letters by location. The reliability of this task with Cronbach's alpha method in the study of Friedman, et al. (2016) was 0.86 and in the present study was obtained 0.94.

## Results

The results obtained from Cronbach's alpha internal consistency, test-retest and split half reliability are shown in Table 1.

**Table 1: Reliability of tasks by different methods**

Tasks	Cronbach's alpha	Test-retest	Split half	Spearman-Brown
Color- Shape	0.89	0.67	0.69	0.82
Category-Switch	0.96	0.70	0.86	0.92
Number-Letter	0.94	0.73	0.87	0.93

Experts in the field of cognitive psychology were asked to evaluate the face validity. Experts' opinions indicated that this tool was appropriate for the purpose of the study. According to the opinions of 7 experts in the field of content of shifting component tasks and relevance, clarity and simplicity of each task, the number one was obtained which indicates the content validity of the shifting component tasks. In order to evaluate the discriminant validity, people with clinical disorders of schizophrenia, major depression, brain injury and Alzheimer disease were compared with normal people. As table 2 show, there is a significant difference in the shifting component between the performance of people with clinical disorders and normal people ( $p < 0.05$ ).

**Table 2: Tests of Between-Subjects Effects**

Groups	Dependent Variable	Type III Sum of Squares	DF	Mean Square	F	Sig.	Effect Size
Schizophrenia Disorder	Color- Shape	11812.68	1	11812.68	74.80	0.000	0.61
	Category-Switch	14214.08	1	14214.08	68.90	0.000	0.60
	Number-Letter	15856.96	1	15856.96	43.21	0.000	0.48
Major Depression Disorder	Color- Shape	1677.02	1	1677.02	8.80	0.005	0.16
	Category-Switch	2775.52	1	2775.52	11.69	0.001	0.20
	Number-Letter	7978.65	1	7978.65	23.24	0.000	0.33
Brain Injury Disorder	Color- Shape	3027.40	1	3027.40	24.62	0.000	0.44
	Category-Switch	1590.54	1	1590.54	13.51	0.001	0.30
	Number-Letter	11024.37	1	11024.37	36.66	0.000	0.54
Alzheimer Disease	Color- Shape	12423.29	1	12423.29	37.56	0.000	0.59
	Category-Switch	18164.08	1	18164.08	43.39	0.000	0.62
	Number-Letter	26375.38	1	26375.38	48.16	0.000	0.64

## Discussion and Conclusion

The aim of the current research was to study of validity and reliability of shifting component tasks of executive functions. Considering the coefficients of different types of validity and reliability it can be concluded that shifting component tasks of executive functions has an internal consistency and acceptable validity and reliability. The results showed that the reliability obtained is consistent with the reliability of previous research (Friedman, et al., 2016; Ito, et al., 2015). Also, results of people with schizophrenia, major depression, brain injury and Alzheimer disease showed that they made more repetitive errors in the tasks than normal people. As a result, these patients are unable to change their function based on negative feedback and perform poorly where the response pattern to another (e.g., color to shape) should change. Among the limitations of the study were the difficulty of accessing and testing people with clinical disorders due to the Covid19 virus. Given that the shifting component tasks can be used as a valid and reliable tool in cognitive assessments in diagnosis and treatment. It is suggested to design programs based on cognitive rehabilitation for treatment of different disorders.

## References

- Fiske, A & Holmboe, A. (2019). Neural substrates of early executive function development. *Developmental review*, 52, 42-62. <https://doi.org/10.1016/j.dr.2019.100866>.
- Freidman, N. P., Miyake, A., Altamirano, L. J., Corley, R. P., Young, S. E., Rhea, S. A. (2016). Stability and change in executive function abilities from late adolescence to early adulthood: a longitudinal twin study. *Developmental Psychology*, 52 (2), 326-340.
- Ito, T. A., Freidman, N. P., Barthlow, B. D., Correll, J., Loersch, C., Altamirano, L. J., Miyake, A. (2015). Toward a comprehensive understanding of executive cognitive function in implicit racial bias. *Journal of Personality and social psychology*, 108 (2), 187-218.
- Mayr, U., & Kliegl, R. (2000). Task-set switching and long-term memory retrieval. *Journal of Experimental Psychology: Learning, Memory and Cognition*, 26(5), 1124-1140.
- Miyake, A., Emerson, M. J., Padilla, F., & Ahn, J.C. (2004). Inner speech as a retrieval aid for task goals: the effects of cue type and articulatory suppression in the random task cuing paradigm. *Acta Psychologica*, 115(2-3), 123-142.
- Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: a latent variable analysis. *Cognitive psychology*, 41(1), 49-100.
- Rogers, R. D., & Monsell, S. (1995). Costs of a predictable switch between simple cognitive tasks. *Journal of Experimental Psychology, General*, 124(2), 207-231.
- Willoughby, M.T. (2016). Commentary on the changing nature of executive control in preschool, *Child Development Perspectives*, 81(4), 151-165.

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