Providing Validity and Reliability of Cognitive Scale of Educational Guidance

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Abstract: Purpose: The present study falls into the field of psychometric studies as a subset of methodological designs. Methodology: The statistical population of this study included two different layers of experts who were from among expert counselors in the area of educational counseling, cognitive science experts, and psychological experts. In this population 20 individuals were introduced as a population comprising experts or specialists. The second layer included a population of first grade high school students, which included 400 students in the preliminary phase, 30 students and final phase. The measuring instrument in evaluating the psychometric properties is the new version the Woodcock-Johnson Cognitive Ability Scale that has a desirable reliability and validity. Findings: the psychometric findings showed that the instrument in students had validity (internal consistency and homogeneity), criterion validity (concurrent with the fourth version of the Wechsler Intelligence Scale for Children), and criterion validity (predictor with field of study). It also has construct validity, with emphasis on the orthogonal hierarchical model of cognitive abilities and the confirmatory factor analysis method. Conclusion: academic guidance tool had desirable psychometric properties and could be used as a test of ability and aptitude. **Keywords:** Validity, Reliability, Cognitive Guidance Scale, Counselors.

Introduction

Counseling can be considered as a complex and specialized process that is applied in a variety of fields and can lead to the selection and consignment in the fields of study. Regarding the specialized measurements that are taken in the area of educational guidance and counseling, counselors should be provided with useful instruments to be able to obtain and store any required information from students (Ardebili, 2010).

Since educational guidance is considered as one of the most important life developments in the student, with the emphasis that educational guidance can provide an appropriate basis for career guidance and subsequently career adaptation and then productivity, it is essential to provide useful instruments for fertilizing educational guidance. However, no credible action has been taken regarding the formulation and standardization of educational guidance scales, and the weakness in the psychometric findings of educational guidance tools is considered as the source of the problem. Considering that the current test of educational aptitude, which is introduced as the test of educational aptitude, was formulated in 2001 by Brahini, Kamkari, Jamalfar and Alavinia, and although the aim of designing these instruments was to evaluate an educational aptitude, due to weakness in its psychometric

properties, its publication and application was rejected in the educational systems of the Islamic Republic of Iran (Ebrahim & Kamkari, 2014).

Thus, according to the researcher's suggestion that the third version of the Woodcock-Johnson Cognitive Scales is considered as the cognitive scale of educational guidance, the source of the present research problem can be the lack of psychometric findings. By referring to the designing process and then standardization in the new third edition of the Woodcock-Johnson's Cognitive Scales of Educational Guidance, problem dimensions can be related to identification of the validity, reliability, and norms of the Educational Guidance Scale. Psychometric characteristics of an instrument deals with validity, reliability, norms, and question analysis, and when the source of the problem is related to the lack of information about the psychometric properties of the psychological tools, the domain of the source of the problem is broad and it includes at least content validity, criterion validity and construct validity. In addition, by emphasizing the standard error of measurement, the coefficients of internal consistency and coefficients of intrinsic homogeneity are discussed and the dimensions of psychometric properties can be restricted to the domains of internal consistency and homogeneity based on the reliability properties. Hence, ambiguity in construct validity (factorial) and criterion validity (concurrent), in the context of validity and lack of information about internal consistency and homogeneity regarding validity is considered as a total set of the source regarding the present research problem with regard to lack of information in the field of psychometric properties a tool related to educational guidance.

It was found in Shokrzadeh's (2013) research, entitled "Standardizing the Modern Version of Woodcock-Johnson Cognitive Ability Tests for Primary Children with Learning Disabilities", that the mentioned instruments are used in Iran to identify cognitive abilities and measure educational ability. However, it still cannot be decisive in the field the psychometric properties of the mentioned instruments regarding educational guidance. Although it is attempted to provide a suitable context for the cognitive-scale application of educational guidance through the design, but there are numerous ambiguities regarding the psychometric properties of this tool with an emphasis on various dimensions of validity and reliability. Finally, numerous studies have been conducted on the psychometric properties of cognitive tools and academic achievement, including Floyd, (2009); Taub & McGrew, (2005); Schrank, McGrew & Woodcock, (2010); Locke, McGregor & Ford, (2011); Kaufman, Reynolds, Liu, Kaufman, & McGrew, (2011) (Shokarzadeh, 2013), however, we cannot find exact and comprehensive information regarding construct validity, concurrent validity, intrinsic homogeneity, and cognitive consistency scale of the educational guidance which is based on the new version of the Waddock-Johnson Cognitive Ability Scales in junior high school students. Lack of information considering the criterion and construct validity on the one hand and lack of psychometric information regarding the validity coefficients on the other hand are mentioned as the source of the present research problem.

Research methods

This study was a mixed research, i.e. qualitative and quantitative. The study population in the qualitative section included educational consultants specialized in the field of educational counseling and cognitive and educational psychologists (316 individuals) and in the quantitative section included tenth grade students (13 thousand individuals) in Tehran during the academic year 2014-2015. According to Cochran formula in the qualitative part, 20 students were selected by the convenience sampling and in the quantitative part 400 students were selected by the stratified sampling method. In the available sampling method, the researcher selected a number of those with a master's degree in counseling and a doctorate in psychology based on his recognition regarding those specialists, but in the stratified sampling method, after preparing the list of students by their gender and geographical location to the

same proportion of boys and girls in the population, the researcher selected a sample. Therefore, considering the size of the population, almost equal to the male and female students in the sample, i.e. 200 girls and 200 boys, 40 girls and 40 boys from each of the north, south, east, west and central areas were randomly selected using a random number table.

The measurement tool in the qualitative part was interview with experts, and in the quantitative part was the cognitive scale of Woodcock-Johnson educational guidance (2013). The qualitative section was conducted by examining the strengths and weaknesses of the third new version of Woodcock-Johnson Cognitive Ability Test as a suggested instrument in the area of educational guidance. Then, the third new version of the Cognitive Ability Test was introduced as a measurement tool in the two preliminary and final stages. This instrument was revised in 2001, and was significantly different from the second version. In fact, the second and third versions together provide a comprehensive set in individual performance of the test to measure mental ability and academic achievement. This test was also revised in 2007, but no changes were made, only new psychometric indicators were estimated, and the process was repeated in 2013 as well. The third version of Woodcock-Johnson (2013) Cognitive Ability Scale is increasingly used in the psychological fundamentals of exceptional children's education and is highly desirable for assessing subjects who have difficulty in learning language, verbal understanding, and learning. In addition, it is also useful in assessing learning disabilities and comparing verbal and nonverbal performance. There is no specific time to run the above scale, but the average time to run this test varies between 45 and 60 minutes, and this variability varies according to the scale tests performed and each test has its own timing. Regarding the psychometric analysis of construct validity of the third version of Woodcock-Johnson Cognitive Ability Scale, it can be said that this instrument's construct validity is confirmed by factor analysis method and in addition it has a desirable content validity, criterion validity, apparent validity and formal validity. The reliability of the instrument was also confirmed to be higher than 0.70 (quoted in Shokrzadeh, Afrooz, Kamkari, and Dawaii, 2014). After being entered into the computer via Amose and Lisrel softwares, the data obtained from running the cognitive scale of academic guidance were analyzed with factor analysis methods.

Results

Considering that in order to design cognitive scale of educational guidance, the exploratory interview method was used and the findings related to strengths and weaknesses of experts were determined, all information related to the individual characteristics of the academic aptitude test and the Cognitive Educational Guidance Scale were presented through the following simple frequency distribution table (1).

Table 1: Face Validity of Available and Suggested Academic Guidance Tools

		Face validity	Cognitive scale of educational guidance	
Frequency	percent		Frequency	Percent
9	45	Weak	0	-
10	50	Moderate	7	35
1	5	Desirable	9	45
0	-	Excellent	4	20

According to Table 1, it can be said that the expert group considered the face validity of the academic aptitude test as poor and average; while the face validity of the cognitive scale of the academic guidance was considered to be average and desirable.

Table 2: Review of test stability with an emphasis on the "test-retest" method in students

Test	Girl	Boy	Total
Verbal perception	0.86	0.87	0.88
Visual-audio learning	0.89	0.90	0.89
Space relations	0.87	0.89	0.88
Sound combination	0.83	0.84	0.85
Concept formation	0.87	0.86	0.87
Visual adaptation	0.89	0.87	0.88
Number reversal	0.83	0.82	0.85
Unfinished words	0.85	0.86	0.85
Active audio memory	0.86	0.89	0.85
Delayed visual-audio learning	0.87	0.89	0.88
Total scale (general ability	0.86	0.89	0.87

In answer to the question of whether the cognitive scale of educational guidance has a desirable stability (with emphasis on test-retest method), and according to Table (2) that was conducted on 40 samples of the educational guidance scale with 3 to 4 weeks of interval, it can be stated that with the exception of numbers inversion test which has lower validity coefficients in comparison with the other tests, the constructive standardized tests of cognitive scale of educational guidance had a stability coefficient beyond 0.85 and indicated "excellent" stability coefficient. In addition, given the coefficient of stability of 0.83 in the inversion test, it is possible to put an emphasis on the "desirable" coefficient of stability in this test. Therefore, regarding students, the cognitive scale of educational guidance has an "excellent" consistency coefficient. In addition, it can be stated that the inversion of numbers has a lower stability coefficient in comparison with other standard tests and the variability in this test can be pointed out. Therefore, the inversion test of numbers is considered as a measure of the variability associated with individual differences in applied interpretations for the group.

Table 3: Review of test stability with an emphasis on the “Alpha Cronbach's" method in students

Test	Girl	Boy	Total
Verbal perception	0.87	0.89	0.87
Visual-audio learning	0.86	0.91	0.92
Space relations	0.87	0.92	0.90
Sound combination	0.83	0.89	0.91
Concept formation	0.89	0.92	0.91
Visual adaptation	0.91	0.93	0.94
Number reversal	0.89	0.85	0.90
Unfinished words	0.92	0.91	0.93
Active audio memory	0.86	0.87	0.88
Delayed visual-audio learning	0.84	0.87	0.88
Total scale (general ability	0.83	0.91	0.92

In response to the question whether the cognitive scale of academic guidance has a good internal consistency (with an emphasis on alpha Cronbach's method), and according to Table 3, it is proposed that with the exception of verbal comprehension and delayed audiovisual learning tests, other constructive standard tests of cognitive scale of academic guidance have internal consistency coefficient higher than 0.85 and show “excellent” internal

coefficient. In addition, given the intrinsic homogeneity coefficient higher than 0.85 in verbal comprehension and delayed auditory-visual memory tests, it is possible to emphasize the "desirable" intrinsic coefficient in these tests. Therefore, regarding students, the cognitive scale of academic guidance has an "excellent" internal consistency coefficient. In addition, it can be stated that verbal comprehension and delayed visual-auditory learning tests in comparison with other standard tests have a lower intrinsic homogeneity coefficient, and it may indicate variability in these tests. Therefore, these tests are considered as a measure of the variability associated with individual differences in applied interpretations for the group.

Table 4: Factor analysis of Woodcock-Janson Cognitive Ability Scale with an emphasis on the Cattell-Horn-Carroll hierarchical model to investigate construct validity in students

Test	Index	Common	Interpretation	Specific	Interpretation
Verbal comprehension	Impact intensity Variance	0.67 0.42	High	0.63 0.37	High
Visual-auditory learning	Impact intensity Variance	0.73 0.52	High	0.69 0.49	High
Spatial relations	Impact intensity Variance	0.47 0.26	High	0.36 0.17	Moderate
Sound combination	Impact intensity Variance	0.57 0.42	High	0.49 0.39	High
Concept formation	Impact intensity Variance	0.72 0.53	High	0.54 0.41	High
Visual adaptation	Impact intensity Variance	0.45 0.32	Moderate	0.41 0.30	Moderate
Number inversion	Impact intensity Variance	0.43 0.35	Moderate	0.41 0.32	Moderate
Unfinished words	Impact intensity Variance	0.37 0.32	Low	0.21 0.19	Low
Active auditory memory	Impact intensity Variance	0.69 0.57	High	0.67 0.53	High
Delayed visual auditory learning	Impact intensity Variance	0.49 0.41	Moderate	0.43 0.21	Moderate

According to the results obtained from the orthogonal hierarchical factor analysis, it can be concluded that two tests have low common variance and 4 tests have a moderate common variance; while 5 tests have a high common variance. Therefore, the general ability factor has been confirmed and the resultant findings represent the general ability or g factor. In addition, given that 2 tests have low specific variances, 4 tests have medium specific variances and 5 tests have high specific variances, it can be stated that the factors of verbal

understanding (test 1), visual-auditory learning (test 2), sound composition (test 4), concept formation (test 5), and auditory working memory (test 9) have autonomy and can be described as a major or broad speaking ability. Therefore, the hierarchical model of cognitive ability is confirmed.

Finally, it can be stated that 5 tests of verbal comprehension, audio-visual learning, sound composition, concept formation and auditory active memory are proposed as a combined axis of academic guidance that can be effective in determining the field of study. 25 + 1.87 (verbal understanding + audiovisual learning + sound composition + concept formulation + auditory active memory). In other words, using the orthogonal hierarchical confirmatory factor analysis, it can be stated that the five tests of verbal comprehension, auditory-auditory learning, sound composition, concept formation and auditory active memory are considered as a set suggested tests in the case of cognitive academic guidance scale. Therefore, based on the findings of psychometrics and the experts' opinions, 5 factors are considered as related factors to academic guidance and thus the design is based on psychometric analysis. Therefore, based on these findings, one can refer to the design process based on the psychometric data.

Discussion

The most important responsible and trusted organization for educational guidance should be the ministry of education. The act of goals and duties of this organization places this ministry in charge of "general" and "semi-professional" education. On the one hand, 'semi-specialized' education is paves the way for the entry of individuals into specialized professions and disciplines, and this pavement requires specific measures to facilitate the choice of students' field of study. On the other hand, because of the strong connection between the concept of "education" with the concepts of "talent" and "guidance", "general" training also has indirectly significant effects on talents guidance. It should be noted that at present, more than 12 million students are at their best ages to identify and develop their talents, and the organization has a very rich opportunity that no other institution has. For this reason, the Fundamental Transformation Document considers the establishment of a comprehensive educational guidance system as one of the solutions in ministry of education.

The findings showed that the cognitive scale of educational guidance consisted of 10 components of verbal comprehension, visual-auditory learning, spatial relationships, sound composition, concept formation, adaptability, number reversal, incomplete words, auditory active memory, and delayed visual-auditory learning. Face, content, prediction, diagnostic, and construct validities and internal consistency coefficient of the instrument and its reliability were confirmed by Cronbach's alpha and test-retest methods, respectively. These findings are in line with the findings of the studies of Shrank and Windling (2009), McGrew et al. (2007), Navidi (2018), Tale'zari (2016), Moradi and Akhavan Tafti (2013), Karmdoust et al. (2006), Bigdeli and Abam (2003), and Sharif Khalifa Soltani et al. (2000). For example, McGrew et al. (2007) reported that the highest increase in verbal comprehension occurred with an emphasis on preschool period and the highest increase occurred in the general information test. Also, Navidi (2018), while conducting research, concluded that creating an appropriate context, specifying the needs and possibilities of the community, promoting the level of knowledge and the professional skills of counselors, the constant effort and dedication to identify and guide students from the beginning of their education to the stage of self-directed competence and continuing to research and evaluate actions and programs are factors that can help improve their educational guidance. In another study, Tale'zari (2016) reported that the results showed the impact of mass media, business week schedules, school counselors, academic and career planning lessons, and friends and acquaintances in informing and creating job interest in students. On the other hand, students' own motivation and interest,

students' perceptions regarding the role of government support, students' perceptions considering monetization, social media, vocational and academic planning lessons, and school counselors were involved in informing students about their choice of academic fields. In addition, the results of Sharif Khalifa Soltani et al.'s (2000) study showed that the results of correlation coefficient between counseling and academic achievement showed that among the four criteria of academic guidance, counselor opinion, teacher opinion, intelligence test and test of interest, three criteria had the highest significant correlation with academic achievement, teacher's view, counselor's view and test of interest, respectively, and intelligence test criterion had no significant relationship with academic achievement. In addition, the students' attitude toward the field of study was higher than average in the theoretical branch, and lower than the average in the technical and professional branches.

According to Navidi's research (2018), academic guidance can be defined as the process of helping students to select the appropriate field of their study based on their perception of their talents and abilities and their environmental conditions and facilities. Student decision-making in the field of study depends on three categories of personal competence information, characteristics of existing fields of study, and the relationship of academic fields with future professions and careers. The more accurate and real the student's understanding of these three factors, the more successful his or her choice of field of study will be. Secondary school is a transition stage from school to the world of work and life or entering higher education. It is, therefore, necessary to cover these two functions, but the school system is such that it is very difficult to implement these dual-purpose programs, especially organizing and providing facilities. The costs of specialized training workshops are heavy and specialist employees are not easily accessible. For this reason, one of the functions of the secondary school has always succeeded over the other.

In the last few decades, the primary function of secondary schools has been to prepare students for entry into the world of work, but as the time passes and technology advances, the social demand for higher education gradually increases, in such a way that nowadays the higher education has become prevalent in most developed countries, and the tendency of young individuals to enter universities has increased. Modern developments in gender patterns and roles and the problem of girls' employment have also challenged educational guidance, while creating some conflicts between tradition and modernity and confusion in defining roles. In general, the academic guidance program is implemented in order to achieve two goals. One is that students to be guided to study paths based on their personal characteristics (talent, ability, interest, and knowledge) in such a way that everyone's field of study is suited to his/her personality. On the other hand, students are guided to the disciplines based on the needs of the society, so that the educated individuals in various disciplines can qualitatively and quantitatively meet the needs of the community regarding human resources.

According to the Basic Education Transformation Document, academic guidance as a continuous process involves guiding students from elementary to the end of secondary education and is not limited to the choice of a discipline at a time such as 9th grade. Regardless of the provisions of the Development Document, students' academic guidance from the academic year 2016-17 will be performed at the end of the ninth grade for students entering to high school and tenth grade. However, there is a serious doubt regarding the suitability of the ninth grade for the final choice of academic field, because in the first three years of secondary school, there are not enough opportunities and tests to show and express potentials, feedback and testing. In fact, during this period student are not very different in terms of their academic performance and their grades are similar and standard tools are not used for their educational guidance. As a result, the student and his/her parents cannot choose the future academic path based on the three-year academic performance measurements. Early separation of the academic disciplines and guiding the student onto a narrow path of

education is performed, while the 15-year-old teenager still lacks sufficient knowledge of his potential resources and cognitive and emotional capacities.

Limitations of the present study include the lack of national norms in Tehran that place restrictions on the national version. Another limitation is the weakness regarding the use of advanced multi-parameter question-answer theories in line with classroom equivalents. Problems related to the standard implementation by examiners in Tehran were another limitation. Therefore, it is recommended to perform the re-test process of other research communities with an emphasis on educational levels so that the process of comparability of findings can be made with one another. Another suggestion is to replicate research in other cities in order to achieve national norms with an emphasis on Tehran in different subcultures. Verbal comprehension tests can also be reviewed with emphasis on different ethnicities, including Lur, Turk, and Kurdish, and separate versions for different ethnicities can be designed. Based on the findings and psychometric indicators of the cognitive scale of academic guidance in students, it is recommended to use these tools in schools to identify the strengths and weaknesses of the students and to reinforce them through intervention programs. Another suggestion is for counselors to use the cognitive scale of academic guidance so that they can better identify students' academic guidance and academic aptitude and lead them to appropriate academic disciplines.

Summary

According to the Basic Education Transformation Document, academic guidance as a continuous process involves guiding students from elementary to the end of secondary education and is not limited to the choice of a discipline at a time such as 9th grade. Regardless of the provisions of the Development Document, students' academic guidance from the academic year 2016-17 will be performed at the end of the ninth grade for students entering to high school and tenth grade. However, there is a serious doubt regarding the suitability of the ninth grade for the final choice of academic field, because in the first three years of secondary school, there are not enough opportunities and tests to show and express potentials, feedback and testing. In fact, during this period student are not very different in terms of their academic performance and their grades are similar and standard tools are not used for their educational guidance. As a result, the student and his/her parents cannot choose the future academic path based on the three-year academic performance measurements. Early separation of the academic disciplines and guiding the student onto a narrow path of education is performed, while the 15-year-old teenager still lacks sufficient knowledge of his potential resources and cognitive and emotional capacities.

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