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Psychometric properties of the Learning Potential Test

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Abstract

The use of cognitive ability tests to help select highly performing students is becoming a standard in most major Czech universities. Such tests need to show good psychometric properties. To highlight the importance of these properties to the process of selection, this study explores the psychometric properties of the Learning Potential test, which is used as a selection criterion within the admission procedure at a major Czech university. This study's objective is to assess the psychometric properties of the Learning Potential Test and provide an insight into its structure. The Cronbach's alpha were computed to assess the internal consistency of the test. The structure of the items was explored by the factor analysis methods. Factor analysis indicated the anticipated structure of the test with two major factors - critical thinking/verbal reasoning abilities and numerical/spatial/analytical abilities. Since the role of admission tests in the process of selection new university students is crucial, it is essential to periodically reassess its psychometric characteristics to ensure that our test remain relevant and applicable.

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1. Introduction

Every year, colleagues and universities are faced with a difficult task to select the best prospective students among the applicants. The admission procedure is supposed to be effective and equitable. In the Czech Republic, there has been a shift from the achievement tests to aptitude tests during the last two decades. The aptitude test are perceived as less influenced by the quality of secondary education and therefore social and family background.

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Masaryk University in Brno developed their own aptitude test called The Learning Potential Test (LPT), designed to ascertain the applicant's potential for successful studies. The test rationale and structure is the result of agreement of the faculties involved in the development. Currently, seven of nine faculties of Masaryk University uses the LPT (at four faculties, the LPT is used together with specialized achievement tests). The name of the test reflects the concept of aptitude as a degree of readiness to learn and to perform well in a particular situation or domain (Corno et al, 2002). The test has gradually developed on the grounds of ongoing analysis. Primarily, the number of items was reduced and the time limit increased.

In this paper we present an analysis of test data from 2013, when it consisted of 70 items grouped in 7 subtests (10 items each; see below the description of the subtests). All items in the LPT are multiple-choice, with only one of five possible answers being correct. The correct answers are assessed by one point, the wrong answers by -0.25 point. Missing answer means 0 points. Since there is around 20 000 applicants to Masaryk University each year, the test is administered in multiple sessions and there is 12 parallel versions of the test. The raw score of each applicant is transformed to percentile score, computed on the base of comparison with all the applicants taking their LPT version. The percentile scores range from a maximum of 100 to a minimum of zero. The percentile score of any particular individual indicates the percentage of applicants whose performance was the same or worse as his/hers.

1.1. Description of the LTP subtests

The *verbal ability* subtest assesses comprehension of written material and language skills. It is based on understanding of the structure of language and its rules. In this subtest, the applicants are supposed to choose best synonyms, antonyms or analogies. *Numerical reasoning* evaluates the ability to apply known procedural numerical skills and reasoning in order to solve problems. The items require operations like numerical computation, estimation and interpretation of provided facts. The numerical computation involve basic arithmetic without using a calculator. *Operations with symbols* measures the ability to create, remember and analyze symbols. This subtest integrates perception, attention, memory and simple logical reasoning skills. *Spatial ability* items assess the ability to mentally manipulate objects. The subtest involves visual memory, spatial perception, spatial visualisation / imagery and mental operations with objects (rotation, scanning, comparison etc.). *Analytical reasoning* captures a variety of deductive reasoning skills, including the understanding of the structure of a set of relationships, conditional statements reasoning, finding logically equivalent statements or negations of the statements, inferring true or false statement based on a set of facts or rules. *Cultural awareness* items assess the general overview of humanities disciplines. It includes the ability to perceive and self-reflect historical, political, cultural and other social events. *Critical thinking* as defined by Moon (2007) is the ability to perceive a range of information from many different sources, to process this information in a creative and logical way, challenging it, analysing it and arriving at well-thought-out conclusions. The items in this subtest are usually based on short passages of a text.

The LPT lasts 100 minutes, with no fixed limit for individual subtest. An important part of the test is therefore the choice of strategy and timing of the work on individual items. This approach is grounded on an aspect of Sternberg's theory of successful intelligence - the ability to achieve success is dependent also on capitalizing on one's strengths or compensating for weaknesses (Sternberg, 2008, 2004).

2. Research objectives

This study's objective is to assess the psychometric properties of the Learning Potential Test and provide an insight into its structure. Further explorations involved the analysis of solution strategies in one particular subtest - Spatial ability.

3. Method

The data of 21022 applicants to seven faculties of Masaryk University collected during 2013 entrance exams were analyzed. The median age of the applicants was 20 years ($m=22,03$; $sd=2,07$), ranging from 17 to 64 years. Over the half of the sample (54,1%) consisted of people finishing the secondary school, 16,4% finished the

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