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MIDAS FACTOR STRUCTURE ANALYSIS FOR ROMANIAN 12-14 YEAR OLD STUDENTS

Sanda Bordei,
Colegiul "Henri Coandă" Bacău, Romania

Abstract: *Nowadays education plays more than ever a key role for the economical development of a country and also for its citizens` life quality, therefore teachers and policy makers become more and more essential actors at the social level. Due to the latest and quickest technological and informational advances , many voices claim that the teaching and learning process in schools should be changed from a traditional one to a different or multiple educational perspectives one. Teaching taking into account the multiple intelligences of the students might prove thus to be a winner approach, by enhancing students` academic performance and understanding , but also school motivation and self-esteem. The present paper analyzes for the first time in the Romanian literature Branton Shearer`s 93 items Multiple Intelligences Developmental Assessment Scale for Kids- All About Me for Romanian students of 6th grade (12-14 years old). A sample of 300 students was used for adaptation of the scale for my PhD research paper purpose and the main findings will be discussed.*

Keywords: *multiple intelligences; MIDAS; factor structure analysis;*

1. Introduction

Theory of Multiple Intelligences was formulated by Professor Howard Gardner in 1983 in his book called Frames of Mind. He defined intelligences as "a biopsychological potential to process information that can be activated in a cultural setting to solve problems or create products that are of value in a culture" and demonstrated that each person has at least 8 different ways to process the information , having a clear distinct brain localization ,which he called "intelligences"(Gardner, 2001,2006). Although these intelligences are relatively independent , they do not act isolated in the real life situations but are always found -several or all of them- involved together in daily activities , tasks , roles or products. Thus besides the "traditional" types of intelligences already described such as verbal, mathematical and spatial ones, Gardner also talks about musical, naturalistic, kinesthetic, interpersonal and intrapersonal intelligences. In this way he clearly rejects the monolithic conception about the intelligence and thinks of it as a pluralist notion in the line of other psychologists such as Guilford, Thurstone, Ceci and Sternberg (Prieto & Ferrándiz, 2001). He ran various studies carried out with different types of population , and founded his theory upon

neurological, evolutionary and cross-cultural evidence (Gardner, 2001). Short time after it was released, the Theory of Multiple Intelligences has got a huge impact especially into the educational field.

Although Gardner has always supported the observation of the person in various contexts and tasks as the best method of identifying one´s strongest and weakest developed intelligences at a certain moment, rejecting firmly any kind of psychometrical approach for measuring one´s cognitive development as being too limitative and artificial in the sense that is completely abstract and not rooted into the person´ life experience and context, he still supported Multiple Intelligences Developmental Assessment Scales (MIDAS™) created by Branton Shearer Ph.D. in 1996 as a proper assessment for the multiple intelligences depending on age groups. And that because Shearer understood very well the MI philosophy and did not focus on labeling the respondent but instead he offers a broad cognitive profile as a starting point for exploration and insight (Shearer,2013).

The current study examined the psychometric properties of the Multiple Intelligences Developmental Assessment Scale for Kids- All About Me for Romanian students of 6th grades in order to check whether this could be used further on during the experimental phase of our PhD research which will test some of the advantages of using multiple intelligences in the classroom in the teaching and learning process in secondary school.

2. Participants

Participants were 300 pupils of 6th grade from 7 secondary schools from three counties in the NE part of Romania (Neamț, Bacău and Iași) plus Bucharest city, both from rural and urban areas. The schools were selected upon the results got at the end of the year 2013-2014 at the national evaluation exam (we took into account the mean of means of all the pupils of the 8th grade who took the exam and thus we selected the schools as follows: 2 schools with very good results– average mean of means between 10 and 8, 3 schools with good results, average mean of means between 7.99 and 6.50 and 2 schools with low results, average mean of means between 6.49 and 5,00.

The participants were between 10 and 14 y.o. (mean 11,79; SD=.663). Out of the 296 pupils included into the study, 0.7% were 10 years old, 31.4% were 11 years old, 57.8% were 12 years old, 8.8% were 13 years old and 1.4% were 14 years old.

As for the gender and living distribution, 50,30% were males and 49,70% were females, 24.30% lived in rural areas and 75.70% lived in urban areas. According to http://www.indexmundi.com/romania/demographics_profile.html, the population of the studied sample was representative for the national general population in terms of sex ratio , but was not in line regarding the urbanization . Altogether the sample reflected the main ethnic and social characteristics of the Romanian population of pupils. We had the acceptance of the school directors and official agreements were concluded in this respect. The questionnaire was administered by us to intact classes in 50

minutes sessions, following standardized procedures and the confidentiality and all the other ethical requirements were respected.

3. Instrument

MIDAS-KIDS as well as the other 4 MIDAS™ scales were built as an objective manner to assess the multiple intelligences. MIDAS-KIDS "All About Me" questionnaire consists of 93 items that are self-completed by children aged 10 to 14 years old if they are able to read at 5th grade level at least. When this is not the case, the help of a teacher or another person would be necessary (Shearer, 2013). The answers are of Likert scale type from A = not at all or slightly to E= very much, excellent or most of the time. There is also an F option of answering which says "I do not know" or "I have never had the occasion to do such an activity".

The MIDAS-KIDS profile has 3 pages and provides information about the child development level in each of the 8 intelligences (Linguistic, Logical-mathematical, Spatial, Musical, Kinesthetic, Naturalist, Interpersonal and Intrapersonal), but also in 24 sub-scales plus two intellectual style scales (Innovation and Technical) and finally offers qualitative information that can be taken from each question , which is very contextualized in the daily life (Shearer,2013) .

The MIDAS-KIDS intrascale reliabilities consistency of the original tool as explained in the manual were calculated on 2144 subjects and test-retest on n=93. The result was that Alpha´ s ranged from a low .83 for Kinesthetic and Linguistic to a high of .91 for Intrapersonal, which indicates strong internal consistency for the eight scales. Similar results were obtained for the intellectual style scales: .82 for Innovation and .83 for Technical (Shearer, 2013).

MIDAS-KIDS was translated into Romanian and then independently back-translated (Sava,2011). The Romanian version quality was checked then on a sample of 54 pupils in September 2015 and we found a high internal consistency of the scales , alpha Cronbach values being from: .786 for Musical Intelligence to .892 for Intrapersonal Intelligence. The two scales of intellectual styles had also very good alpha Cronbach values: .800 Technical one and .847 the Innovative one.

When calculated for the sample of 296 children, the psychometric properties still remained very good in spite that there was a bit of lowering. Thus the alpha Cronbach values were from .740 for Linguistic Intelligence to.873 for Intrapersonal Intelligence , .789 for Technical and .788 for the Innovative scales.

4. Data Analysis

We entered the data into SPSS version 23 for Windows in which all the analysis were conducted. In the end our database kept only 296 cases out of 300 since one child could not finish his work and another three kids were aged 15. The number of participants (296) reported to the number of

variables (78) is thus appropriate for running a factor analysis since Kline (1994) suggests a minimum ratio of 2:1. We took into account the Scoring Matrix provided by B.Shearer where actually **78 items** out of 93 were considered for the scales.

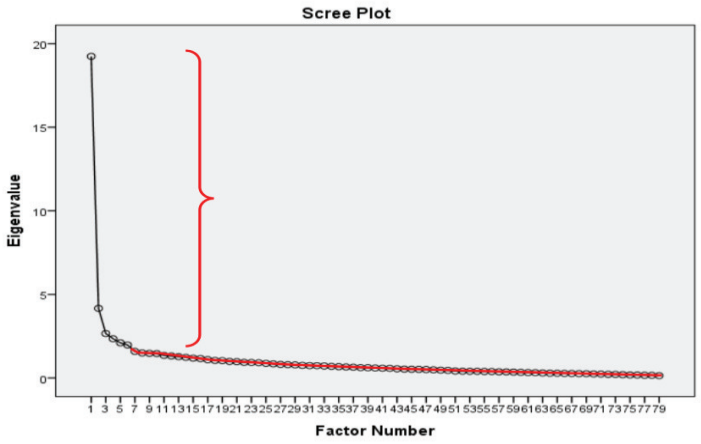
As Likert-type scales data are neither continuous nor normally distributed, a special program would be needed to conduct familiar factor analysis on the matrix of polychoric inter-item correlations rather than on the matrix of Pearson correlations.

However " as long as PCA and FA are used descriptively as convenient ways to summarize the relationships in a large set of observed variables, assumptions regarding the distributions of the variables are not in force"(Tabachnik and Fidell, 2001).

An exploratory factor analysis was conducted in order to investigate whether we could find among these variables an underlying structure of 8 dimensions corresponding to the 8 intelligences identified by Gardner. Our sample size also was enough to do this analysis as Kline (1994) suggests a minimum ratio of subjects-factors of 20:1. Anyway, a sample size of 200 is a sensible minimum target (Brace, Kemp, Snelgar, 2009).

We had a hard debate in order to establish what type of method of rotation would be the most suitable to usee. At first glance we would tend to use the Principal Components Analysis with Varimax rotation (orthogonal) as Gardner states that the eight intelligences are independent (Gardner,. Then we read in the MIDAS-Kids manual that the author used Maximum Likelihood with Promax rotation (kappa=4) as he based on Gardner´ s assumption that intelligences are "relatively" independent and took into account that in real world activities the MIs are never isolated but interacting to various degrees. So we decided to use the same method as Shearer did .

5. Results



When we ran Kaiser-Meyer-Olkin Measure of Sampling Adequacy and Bartlett´ s Test of Sphericity, we got the following results: KMO=.910, Approx. Chi-Square= 10108,843, df.=3003, sig.=.000 which means that the sampling is adequate for the EFA.

The scree plot in Fig.1 shows six factors instead of eight as we were expecting, but when we take a closer look at the Pattern Matrix we realize that the first two factors are each composed mainly of items corresponding to two intelligences. Thus we identified a first factor composed of interpersonal and intrapersonal intelligences items and a second factor composed of logical-mathematical and linguistic intelligences items. We could call the first factor the "Personal" intelligence and the second factor the "Academic" intelligence. The third factor is gathering items of Spatial Intelligence, the 4th of Kinesthetic Intelligence, the 5th of the Naturalist Intelligence and the 6th of the Musical Intelligence. The eigenvalues of the six factors were: 19.042, 4.065, 2.648, 2.346, .106 and 1.970. Total variance explained by the six-factor oblique rotation solution was 41.253%.

Factor 1 has 10 items of Interpersonal Intelligence (46,54,55,56,58,60,63,65,66,75), 11 items of Intrapersonal Intelligence (59,68,69,70,71,72,73,76,77,78,79) , 2 items of Linguistic Intelligence (51 and 57) and 1 of logical-mathematical Intelligence (27).
Factor 2 has 6 items of Logical-Mathematical Intelligence (24,25,26,30,34,41) and 4 items of Linguistic Intelligence (41,42,44,48) .
Factor 3 has 6 items of Spatial Intelligence (16,31,32,33,35,36,37,40) , one of Interpersonal Intelligence (43) and one of Linguistic Intelligence (53).
Factor 4 has 7 items of Kinesthetic Intelligence (12,13,14,15,19,20,38) and one of Spatial Intelligence (28).
Factor 5 has 13 items of Naturalistic Intelligence (81-93).
Factor 6 has 9 items of Musical Intelligence (2,3,5,6,8-11, 18).
The internal consistency for each factor remained high, the alpha Cronbach values being as follows: .921 for Factor 1, .828 for Factor 2, .831 for Factor 3, .796 for Factor 4, .854 for Factor 5 and .740 for Factor 6.
In Table 1 one can notice that several moderate to high correlations between some factors.

Table 1.Factor Correlation Matrix

Factor	1	2	3	4	5	6
1	1					
2	.652	1				
3	.508	.418	1			
4	.504	.380	.317	1		
5	.560	.465	.476	.285	1	
6	.429	.303	.460	.260	.325	1

Extraction Method: Maximum Likelihood.

Rotation Method:Promax with Kaiser Normalization

5. Discussion

The high internal consistency of the 6 factors we have found reflects very well the structure of multiple intelligences as presented by is author (Gardner,2001).The combination of interpersonal and intrapersonal intelligences grouped into a strong first factor of our EFA is in line with the theory which says that the acquirement of a mature sense of Self is strongly linked with relating to the others, as during childhood we build our inner emotional world and became persons only based on knowing and interacting with the others (Gardner, 2001). In fact Gardner talks about one personal intelligence and comments that "while all the other intelligences were easily studied independently, here we have two types of intelligences related…there are two types of one personal intelligence which cannot exist one without another"(Gardner,2001,pp.190-195). The combination of the logical-mathematical and verbal intelligences might be carefully checked with a large sample size. All the other factors fit the theory assumption about the different types of intelligences one possesses (Gardner,2001, 2006).

Being a self-reported questionnaire it must be taken into account with care and the best would be to use triangulation of data, that is to compare the profile given by MIDAS-KIDS with other sources of information about a child such as his teachers, parents or some knowledgeable person(s)′ opinions about his/her strengths and weaknesses in various areas, in-depth interview with the child, observation while the child is performing various tasks in order to notice his/her preferences and also favorite activities and ways to do things

Since we noticed from practice that generally speaking teachers and pupils tend to confide much more in this kind of psychometric tools rather than in "mere" observation and since in Romania there is no MI tool with good psychometric properties developed so far, but there are used in schools some with unknown authors and properties, we recommend MIDAS-KIDS as a trustful tool for identifying the cognitive profile of a child with the only mention that its nature and purpose must be clearly understood before using it: namely that MIDAS-KIDS does not mean just another "label" for a child but that it shows the strengths and weaknesses of a child as he/she reports them at a certain moment and the profile is supposed to change so that all the intelligences might be at least medium level developed. As a matter of fact we believe that MIDAS-KIDS might be a really helpful tool especially for those teachers who still keep an old traditional way of teaching , who tend to relate more only to the "most academically intelligent kids in the classroom" and almost neglect the others. It would be a great way for them to discover that all their pupils have strengths that could be used as "anchors" to build knowledge also in the areas less developed.

Overall we believe that MIDAS-KIDS scale can be used further in our research, always taking into account the use of other complementary sources of information about pupils′ intellectual profile .

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Appendix A.

Table 2.Pattern Matrix (as recommended by Pelhazur&Schmelkin,1991)

Items/Factors	1	2	3	4	5	6	7	8
IMU02						.556		
IMU03						.669		
IMU04	.254		.235					.269
IMU05						.363		
IMU06				.210		.383		
IMU08						.333		
IMU09			.221			.555		
IMU10			.299			.323		.234
IMULINGV11						.393		
IKI12	.228			.662				
IKI13				.521	.204			
IKI14				.398	.272			
IKI15				.316				
IKISP16			.271					
IMUKI18								
IKI19						.469		.210
IKI20				.532				
IMUKI21				.635	.231			
ILM22		.508		.289				
ILM23		.345				.295		
ILM24		.738					.569	
ILMNAT25		.580					.515	
ILM26		.499						
ILM27	.338		.282				.431	
ILMSP28			.274					
ILM30	-.225	1.049		.442				
ISP31			.563					
ISP33			.586					
IKILMSP34		.368						
ISP35			.590					
ISP36			.596	.270				
ISP37			.528					
ISP38	.219							
ISP39			.266					
ISP40		.216	.368					
ILMLINGV41	.340	.387		.269				
ILINGV42		.404					.418	
IINTER43			.342			. 229		
ILINGV44	.308	.456				.258		
IINTER46	.546				.-210			
ILINGV48		.371						

ILINGV51	.496						
ILINGV53			.246				
IINTER54	.362						
ILINGVINTER55	.758		-.211				
IINTER56	.433						
ILINGV57	.466						
IINTER58	.320	-.259					
IINTRA59	.523			.225			
IINTER60	.486			.265		.255	
IINTER63	.331	.230			.232		
IINTER65	.551						
ILINGVINTER66	.752					.249	
IINTRA68	.486						
IINTRA69	.497						
IINTRA70	.560				-.232		-.252
IINTRA71	.442	.330					-.202
IINTRA72	.441	.347					
IINTRA73	.490						
IINTER75	.747						
IINTRA76	.406						
IINTRA77	.701						
IINTRA78	.529						
IINTRA79	.417	.282					
INAT81					.387		
INAT82	.263				.280		.249
INAT83					.356		
INAT84				.281	.640		
INAT85				.210	.475		
INAT86				.218	.569		
INAT87					.307		-.206
INAT88					.391		
INAT89					.481		
INAT90					.307		
INAT91	.277				.283		.202
INAT92			.220		.315	.219	
INAT93					.384		
ISP32			.654				

Extraction Method: Maximum Likelihood.Rotation Method: Promax with Kaiser Normalization. Rotation converged in 14 iterations.