The Predictive Validity of School Readiness Assessment: Results from an Eight-Year Longitudinal Study

Benő Csapó
MTA-SZTE Research Group on the Development of Competencies
University of Szeged, Hungary

Poster Presented at the 2013 Annual Meeting of the
American Educational Research Association
San Francisco, CA, April 27 – May 1, 2013

Abstract

Several instruments were developed to assess students' skills relevant for schooling. Such an instrument is the DIFER test battery developed in Hungary. To explore its predictive power, five of the DIFER tests were administered to a cohort of the Hungarian Educational Longitudinal Program when they started school. The sample was longitudinally followed for eight years. The assessments focused on reading and mathematics; science, second language and general reasoning skills tests were also included. The results indicated a persistent impact of the early achievements with the counting and social skills tests proving to be the best predictors.

1 Objectives

This study investigates the relationships between performance on the tests of a school readiness test battery and the later school achievements. The objectives are

(1) to identify the tests administered to students at the beginning of schooling that are the best predictors of later school achievements,
(2) to identify the domains most sensitive to the differences in early development, and
(3) to estimate the strength of the effects of early developmental levels on later school achievements.

2 Theoretical Frameworks

Previous research consistently arrived at the conclusion that early cognitive development plays a decisive role in later school achievements; therefore developing reliable assessment instruments (Janus & Offord, 2007) are vital for diagnosing early difficulties. In Hungary, research on school readiness started in the early 1970s, and then a comprehensive large-scale data collection established the empirical bases for policy proposals and oriented further research (Nagy, 1980). A comprehensive school readiness assessment system was devised (Nagy, 1976) and was used for about two

decades. At the end of the 1990s, the test battery was renewed under the acronym DIFER (Nagy, Józsa, Vidákovich, & Fazekasné Fenyvesi, 2004). As the relationships between the achievements measured at different ages of the same students can only be studied by longitudinal data collection, a number of longitudinal programs have been launched in educational contexts (for an overview see e.g. Kristen, Römmer, Müller & Kalter, 2005), including the Hungarian Educational Longitudinal Program (HELP, Csapó, 2007).

3 Methods

3.1 Design and Participants

This study is a part of the Hungarian Educational Longitudinal Program, which started in 2003 for studying the impact of schooling on students' development. The program started with 1st, 5th and 9th grade students aiming to cover the 12 years of schooling in four years, and a new 1st grader sample enters the program every four years. At the beginning of the program, five tests of the DIFER test battery were administered to the youngest cohort (first grade students), when they began school.
Samples for HELP were selected representatively from the Hungarian student population. Schools were the units of selection, and about 5% of each cohort were included in the samples giving a total of about 5000 students at the beginning of the longitudinal assessments.

Table 1 Context of the Study: The Design of the Hungarian Educational Longitudinal Program

Year	Sample 5	Sample 4	Sample 3	Sample 2	Sample 1
2003/04			Grade 1	Grade 5	Grade 9
2004/05			Grade 2	Grade 6	Grade 10
2005/06			Grade 3	Grade 7	Grade 11
2006/07			Grade 4	Grade 8	Grade 12
2007/08		Grade 1	Grade 5		
2008/09		Grade 2	Grade 6		
2009/10		Grade 3	Grade 7		
2010/11		Grade 4	Grade 8		
2011/12	Grade 1	Grade 5	Grade 9		
2012/13	Grade 2	Grade 6	Grade 10		
2013/14	Grade 3	Grade 7	Grade 11		
2014/15	Grade 4	Grade 8	Grade 12		

3.2 Assessment Instruments

Five tests of DIFER were administered individually to the first graders by their class teachers at the beginning of the school year, (1) In the *Social skills* test teachers observed students in social situations typical of a school context. (2) The *Writing movement coordination* test examined the precision of students' fine motor skills in

drawing (copying) small lines and curves similar to the ones used in writing. (3) The *Relational reasoning* test assessed understanding of the meaning of words expressing spatial or temporal relations. (4) The *Inferential reasoning* test measured some basic logical relationships, and the (5) *Counting and basic numeracy* test measured familiarity with numbers and the level of counting skills. For the entire DIFER package Cronbach-α=0.91.

All other tests used in the project were paper and pencil tests. In Hungary, in the framework of the National Assessment of Basic Competencies (NABC), every student is tested in Grade 6, Grade 8, and Grade 10 in reading comprehension and mathematics. At present, the 6th and 8th Grade NABC data are merged into the HELP data-base; 10th Grade NABC assessment takes place in May 2013 and its data will be added later.

For the purposes of this paper, HELP data of the cohorts that started school in 2003 were used (marked blue in Table 1) in combination with the Grade 6 and Grade 8 NABC reading and mathematics data. The sample size was N=5286 at the beginning of the program. The attrition rate was modest in the first four years (grade retention was the main reason), and somewhat higher from grade five (changing schools).

4 Results

The correlation coefficients between the examined variables are presented in Table 2. (Thanks to the large sample sizes, all coefficients presented here are significant at $p<.001$.) In the row headings, the names of the tests and the grades of testing are given followed by the letters *b* or *e* showing whether the test was administered at the beginning (b) or at the end (e) of the school year.

The most obvious pattern that can be observed in the table is that the greater the temporal distance between the two testing sessions, the weaker the correlations, although some correlations remain high even after eight- years. Another observation is that, as expected, in most cases there are closer relationships between the results of tests which are based on similar constructs. The DIFER counting test scores show a stronger correlation (r=0.599) with Grade 2 counting performance than with other variables in the same grade, and the correlations with the mathematics tests are also some of the strongest ones.

Having a look at the differences between correlations of the DIFER tests, on average, DIFER counting shows the strongest correlations especially with the mathematics tests in Grade 6 (r=.511), and at the end of the eights grade (r=.485). Surprisingly, counting is a good predictor of later performance even in reading.

The second best predictor of later performance is the social skill test. This result is unexpected, as social skills are considered to be distinct from the constructs of cognitive tests. However, previous research reported similar findings. For example, Caprara, et al. (2000) found in a longitudinal study that children's early prosocial behavior significantly influences their later developmental trajectories and academic achievements. The third strongest predictor is the inferential reasoning test; its impact is especially high in the first years regardless of the test domain. It does not have a stronger impact on reading than on mathematics and other variables. These data suggest that this relational reasoning test mirrors reasoning skills more than simple knowledge of the meanings of the words. Writing movement proved to be the weakest predictor, which is understandable, as its psychomotor emphasis is distinct from the mainly

cognitive tests. Mathematics and the reading test show strong relationships; mathematics performance appears to be slightly more predictable.

Table 2 Correlations between the DIFER Tests and students' later Performance

Tests	Social skills	Writing	Relational reasoning	Inferential reasoning	Counting and basic numeracy	DIFER Index
Reading 2e	.436	.258	.319	.376	.469	.517
Counting 2e	.423	.294	.359	.389	.599	.571
Mathematical reasoning 3b	.384	.223	.317	.341	.464	.475
Reading 4b	.450	.267	.323	.378	.455	.526
Inductive reasoning 4e	.361	.254	.287	.282	.418	.442
Science knowledge 4e	.373	.219	.310	.332	.388	.453
Science concepts 4e	.365	.207	.266	.339	.348	.430
Mathematics 4e	.407	.280	.298	.320	.495	.498
Reading 5b	.429	.272	.314	.362	.441	.509
Inductive reasoning 5e	.401	.221	.286	.329	.456	.465
Mathematical reasoning. 5e	.404	.281	.334	.366	.489	.518
Reading 5e	.402	.238	.299	.330	.415	.462
Problem solving 7e	.268	.188	.215	.237	.311	.339
Scientific literacy I. 7e	.310	.174	.246	.326	.315	.387
Scientific literacy II 7e	.292	.139	.204	.243	.283	.323
English 8b	.350	.169	.261	.258	.330	.381
German 8b	.370	.200	.131	.182	.243	.330
Mathematics 8e	.336	.191	.250	.297	.396	.404
Reading 8e	.311	.230	.215	.284	.306	.376
Science 8e	.326	.179	.219	.282	.357	.383
Mathematics NABC 6e	.393	.257	.322	.367	.511	.515
Reading NABC 6e	.431	.241	.332	.399	.446	.520
Mathematics NABC 8e	.373	.260	.309	.361	.485	.498
Reading NABC 8e	.403	.247	.315	.385	.414	.498

5 Scientific and Educational Significance

The results indicated that, in general, there were strong correlations between the results of school readiness tests and later school achievements. Those who started school better prepared tend to perform better even after eight years, at the end of the elementary school. The set of school readiness tests included in this study were most suitable for predicting students' achievements in numeracy/mathematics. This finding prompts for an extension of the test battery with instruments more suitable for the measurement of pre-reading skills. One of the most interesting findings of the study is the strong predictive power of the assessment of early social skills. For practical applications, this result emphasizes the role of kindergarten in fostering children's prosociality and social

skills. For research, these findings show the directions for developing more sensitive instruments. Further research is needed to explore the mechanisms of how certain early skills influence the development of some others.

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