Different influence of contextual educational factors on boys' and girls' reading achievement

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Abstract

The results of IEA (The International Association for the Evaluation of Educational Achievement) PIRLS 2006 (Progress in International Reading Literacy Study) has showed that Latvia has the 6th largest gender gap in reading literacy scores and that is an indication of a serious problem of education in this country. The purpose of the paper is to find out reasons behind boys' low achievement to help improve their reading literacy. The proposed hypothesis is that boys and girls are differently affected by the same factors. If that is so, teachers, parents and other education practitioners should be aware of this fact to adapt reading literacy studies for both genders at maximum efficiency.

In this research PILRS 2006 data are used and different structural equation models are created to find out which factors have the most influence on boys' reading achievement. Structural equation modeling (SEM) is based on achievement scores and student and parent questionnaire data. The model formed using all population data was applied to boys' and girls' data separately to observe different influence of the same factors on students reading achievement scores. The comparison of standardized coefficients of structural equation model among five countries (Spain, Russian Federation, Lithuania, Latvia and Trinidad and Tobago) has been performed.

Running the same model over different boys' and girls' data of different countries has showed that the strengths of relationships among the variables are similar. It was expected to observe noticeable differences between SEM coefficients of boys' and girls' data, but it turned out that big gender differences in reading achievement does not mean big differences in standardized coefficients of structural equation model and vice versa. It is found that school environment has greater impact on boys reading literacy as well as boys' achievement could be raised by stimulating them to read more outside the school.

Keywords: structural equation modeling, PIRLS, reading literacy, gender differences

Introduction

IEA studies are the ones which help to provide a world wide view on different learning achievements. In a case of Latvia, IEA PIRLS 2006 study has showed that it has the 6th largest gender gap in reading literacy scores and that is an indication of a serious problem of education in this country. The purpose of the paper is to find out reasons behind boys' low achievement to help improve reading literacy level of boys in Latvia. The proposed hypothesis is that boys and girls are differently affected by the same factors. The research questions are:

1. Which factors have different impact on boys' and girls' reading achievement?

2. What are the differences among countries in strengths of relationships among variables in the same model affecting boys' and girls' reading literacy?

Theoretical framework

There is a plenty of factors explaining students achievement in reading. Several studies have indicated gender, self-esteem, motivation and interest towards reading, parents' education, socioeconomic and culture capital, situation at home as well as ethnicity being factors influencing reading literacy level (Elley, 1994; Lehmann, 1996; Lietz, 1996; Fredriksson, 2002).

Denton and West (2002) have indicated that pre-school reading activities and reading in family have a great impact on a later reading achievement. D. A. Wagner (1991) points on home factor in reading literacy – home should provide environment which stimulates or encourages reading. Several studies have proved that reading aloud to children at pre-school age has a positive effect on reading literacy level at school age (Lyon, 1999; Denton, Reaney, West, 2001; Snow, Burns, Griffin, 1998).

IEA RLS 1991 (Reading Literacy Study) results also indicated that for 9 year olds amount of books and newspapers at home as well as language at home and regular meals play a great role in students' reading achievement (Taube, Mejding, 1996).

Another bunch of factors which correlate with success in reading are: school and parent cooperation, emphasis on reading instruction, school size and dislocation (Postlethwaite, Ross, 1992; Lietz, 1996).

It is already a well known fact that overall female gender means higher reading achievement level, e.g., in PIRLS 2001 in all participated countries girls had significantly higher achievement than boys, and the international average difference was 20 points (Mullis et. al, 2003). In PIRLS 2006 only two of participating countries (Luxembourg and Spain) did not have a statistically significant gender difference in reading achievement, and the

international average difference was 17 scale points (Mullis et. al, 2007).

What might be the theoretical reasons behind the gender gap in reading? Willis (1989) offers three different explanations:

1. Biological determinism: "girls are just born to read better".

2. Social determinism: "girls are the ones who study languages".

3. Free choice: "boys just do not choose reading".

One of suggestions to improve boys reading is changes in cultural environment (Baker et al., 1996). The purpose of this study is to find out, which changes could be more effective because they have a greater impact on boys reading literacy than the others.

Methodology

In the data analyses part of this study different structural equation models are created to find out which factors have the most influence on boys' reading achievement.

In this research PILRS 2006 data are used (IEA, 2008). Structural equation modeling is based on achievement scores and student and parent questionnaire data. The study is focused on student level data therefore software as Streams 2.51.2 and Amos 4 are used in the data processing.

The model has been created using Latvian data and then applied to other countries datasets in order to observe differences in strengths of relationships of factors influencing reading literacy between boys and girls in five countries. In the very beginning for the first conceptual model all the questionnaire items which had significant correlation with reading achievement were considered. The first model contained 86 observed variables. Based on the correlations between the observed variables, several latent variables were formed, e.g., socioeconomic status, reading achievement, language of testing, school environment, students' attitude towards reading, students' self-esteem, parents' attitude towards reading, preschool reading, family cooperation in reading, students' reading activities and computer and internet. Student's age, class size and dislocation of school were also included in the first model. But the very first model did not fit the data as well as it should. This is the reason why the first conceptual model was further improved by removing several observed as well as latent variables. In the development of the model the maximum likelihood factor analysis was used.

After rebuilding the model several times the 7^{th} try was successful and the model parameters were good and only 20 of the previously mentioned 86 observed variables were retained. The

final model is presented in the next section of the paper. Comparing with the first model, in the final one several latent variables such as language of testing, students' attitude towards reading, parents' attitude towards reading, family cooperation in reading, and computer and internet were taken out along with observed variables like student's age, dislocation of school and class size. The former latent variable *socioeconomic status* was changed into *parents' education* in the final model since only observed variables concerning parent's educational level were left. For all latent variables included in the model the Cronbach's Alpha coefficient among the observed variables was calculated to ensure the scale reliability and that the chosen observed variables really fit well together under one latent variable.

The final model, which was developed by using all Latvian population data, was applied to boys' and girls' data separately to observe different influence of the same factors.

In order to find out if the gender differences in factors influencing the reading achievement are universal, four other countries were chosen for comparison. These were: Spain – a country with no statistically significant gender difference in reading according to PIRLS 2006 data, Russian Federation – a country which had the highest average tests scores in the PIRLS 2006 study, Lithuania – a neighboring country of Latvia and culturally and historically the most similar one, and Trinidad and Tobago – a country with the largest gender gap in reading for which the developed structural equation model worked well.

Finding and Discussion

The developed structural equation model of factors influencing students' reading literacy is shown in Figure 1.

[Take in Figure 1 about here]

The model fits data well which is approved by a fact that when run on boys' and girls' data of countries mentioned above the Root Mean Square Error of Approximation (REMSEA) varies between 0.014 and 0.022, degrees of freedom (df)=144, and Chi-square varies between 209 and 389. The entire model can explain between 8% and 18% of students' reading literacy.

According to the model students' reading literacy is mainly affected by four latent variables: school environment, preschool skills, parents' education and reading activities out of school. School environment manifests as answers to four questions: *Was something stolen from someone in your class during the last month at school?, Were you bullied by another student during the last month at school?, Were you injured by another student during the last month at school?* and *Was something stolen from you during the last month at school?* These questions have a negative correlation with the reading literacy which means that the safe school

environment facilitates better reading skills. Preschool skills manifest as answers to parents' questionnaire items: *When your child began 1st grade, how well could he/she write some words?* and *When your child began 1st grade, how well could he/she write letter of the alphabet?* Preschool skills correlate positively with students' reading skills it follows that reading achievement in 4th grade is affected by a fact if a child could write when entering the first grade. Students' preschool skills correlate with parents' education. Parents' education manifests as the highest level of education of ether parent, the highest level of education of the mother and the highest level of education of the father. Parents' education correlates positively with reading achievement and which means that children of better educated parents have higher reading achievement and preschool writing skills. The fourth latent variable influencing reading literacy is students' out of school reading activities manifested by answers to three student questionnaire items: *How much time do you spend reading stories and articles in books or magazines outside of school?, How often do you read stories or novels outside of school?* and *How often do you read for fun outside of school?* Out of school reading activities are positively correlated with reading literacy consequently this means that the more children read out of school (including the reading for self-enjoyment) the better readers they are. Out of school reading activities correlate with preschools skills as well which might mean that better readers (those who were more skillful even before school age) enjoy reading (and this is a reason why they read a lot in their spare time).

The reading literacy manifests as PIRLS 2006 plausible values 1 to 5 could be also considered PIRLS 2006 test scores. Reading literacy affects latent variable of students' self-esteem which manifests as answers to two students' questionnaire items*: I do not read as well as other students in my class* and *I read slower than other students in my class*. These items correlate negatively with the reading literacy and it follows that low reading literacy leads to low self-esteem.

In Table 1 standardized structural equation coefficients derived from the model run over boys' and girls' data separately for five countries are presented. The standardized abbreviations of country names are used: *esp* stands for Spain, *rus* for Russian Federation, *ltu* for Lithuania, *lva* for Latvia and *tto* for Trinidad and Tobago. *g* marks a column with coefficients from girl data, and *b* marks a column where coefficients of boys' data are presented. The letter labels in the first column correspond to the ones in the model (Fig. 1).

[Take in Table 1 about here]

The five compared countries have different reading achievement as well as different gender differences in the reading achievement: Russian Federation – average PIRLS scale score 565, difference between girls' and boys' achievement 15 points; Latvia - average PIRLS scale score

541, difference between girls' and boys' achievement 23 points; Lithuania – average PIRLS scale score 537, difference between girls' and boys' achievement 18 points; Spain – average PIRLS scale score 513, difference between girls' and boys' achievement 4 points; Trinidad and Tobago – average PIRLS scale score 436, difference between girls' and boys' achievement 31 point.

When comparing differences between boys' and girls' structural equation coefficients of different factors for several countries some indications can be drawn. The only country, where no gender differences bigger or equal to 0.1 were found, is Russian Federation. In Trinidad and Tobago boys' reading literacy is less affected by out of school reading activities. For boys in Spain and Lithuania there is smaller correlation between the preschool skills and out of school reading activities. In Spain comparing to girls boys reading achievement is more negatively affected if they suppose they read worse than other students. In Lithuania girls' reading literacy is more negatively affected than boys' if there have been thefts happening in classroom. In Spain boys' reading achievement suffers more from by the bullying at school. In Lithuania boys' are more affected by undesirable school environment too. In four countries except the Russian Federation boys' achievement is more affected by fact if they spend a lot of time reading out of school.

Conclusion and Implications

During the study several variables of educational context were found which influence boys' and girls' achievement differently. Although the observed differences were smaller than expected, recommendations can be developed for parents and teachers how to treat both genders in reading instruction.

It has been found that school environment has greater impact on boys reading literacy as well as boys' achievement could be raised by stimulating them to read more outside the school.

For both genders following factors facilitate better reading skills: safe school environment, out of school reading activities, ability to write when entering the first grade, high level of parents' education.

A conclusion can be drawn that large gender differences in reading achievement do not necessarily mean noticeable differences in standardized coefficients of structural equation model.

For further investigation on gender differences in factors influencing reading literacy it seams that more specific and comprehensive data are needed like information about different possibilities provided for boys and girls leisure activities as well as available children's

literature suitable for interests of both genders.

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Table 1: Standardized structural equation coefficients for boys and girls separately in five countries

Label	esp-g	esp-b	rus-g	rus-b	ltu-g	ltu-b	lva-g	lva-b	tto-g	tto-b
A	0.46	0.42	0.42	0.41	0.50	0.45	0.48	0.45	0.56	0.54
B	0.10	0.14	0.14	0.18	0.23	0.23	0.19	0.23	0.16	0.18
C	0.17	0.16	0.25	0.20	0.26	0.27	0.25	0.27	0.19	0.25
D	0.17	0.24	0.09	0.07	0.16	0.13	0.29	0.26	0.26	0.07
E	0.24	0.25	0.30	0.28	0.35	0.38	0.23	0.23	0.29	0.34
F	0.18	0.11	0.22	0.20	0.19	0.13	0.12	0.12	0.13	0.09
G	0.14	0.04	0.08	0.09	0.20	0.04	0.11	0.06	0.10	0.06
a	-0.48	-0.59	-0.71	-0.68	-0.75	-0.72	-0.72	-0.67	-0.64	-0.58
b	-0.70	-0.69	-0.77	-0.76	-0.73	-0.73	-0.74	-0.77	-0.74	-0.72
c	0.93	0.93	0.92	0.93	0.91	0.91	0.91	0.92	0.95	0.95
d	0.93	0.93	0.92	0.93	0.91	0.92	0.92	0.92	0.95	0.95
e	0.93	0.93	0.92	0.93	0.92	0.92	0.91	0.92	0.95	0.95
f	0.93	0.93	0.92	0.93	0.91	0.92	0.91	0.92	0.95	0.95
g	0.93	0.93	0.93	0.93	0.91	0.92	0.91	0.92	0.95	0.95
h	-0.63	-0.54	-0.57	-0.56	-0.67	-0.57	-0.52	-0.53	-0.44	-0.37
i	-0.17	-0.31	-0.27	-0.25	-0.28	-0.30	-0.29	-0.31	-0.30	-0.33
j	-0.35	-0.40	-0.28	-0.35	-0.23	-0.36	-0.29	-0.33	-0.31	-0.39
k	-0.67	-0.75	-0.62	-0.55	-0.51	-0.64	-0.64	-0.64	-0.63	-0.67
l	0.99	0.99	0.97	0.96	0.94	0.94	0.88	0.93	0.99	0.99
m	0.81	0.76	0.33	0.40	0.62	0.64	0.55	0.60	0.69	0.74
n	0.82	0.79	0.75	0.72	0.84	0.83	0.79	0.71	0.72	0.73
o	0.82	0.81	0.93	0.95	0.83	0.88	0.95	0.95	0.81	0.87
p	0.89	0.92	0.82	0.83	0.80	0.78	0.79	0.80	0.73	0.70
q	0.16	0.26	0.32	0.35	0.26	0.38	0.32	0.46	0.21	0.39
r	0.20	0.31	0.50	0.52	0.42	0.52	0.50	0.59	0.54	0.58
s	0.83	0.78	0.63	0.69	0.61	0.57	0.64	0.67	0.47	0.47
t	0.20	0.17	0.17	0.12	0.28	0.26	0.20	0.26	0.09	0.11

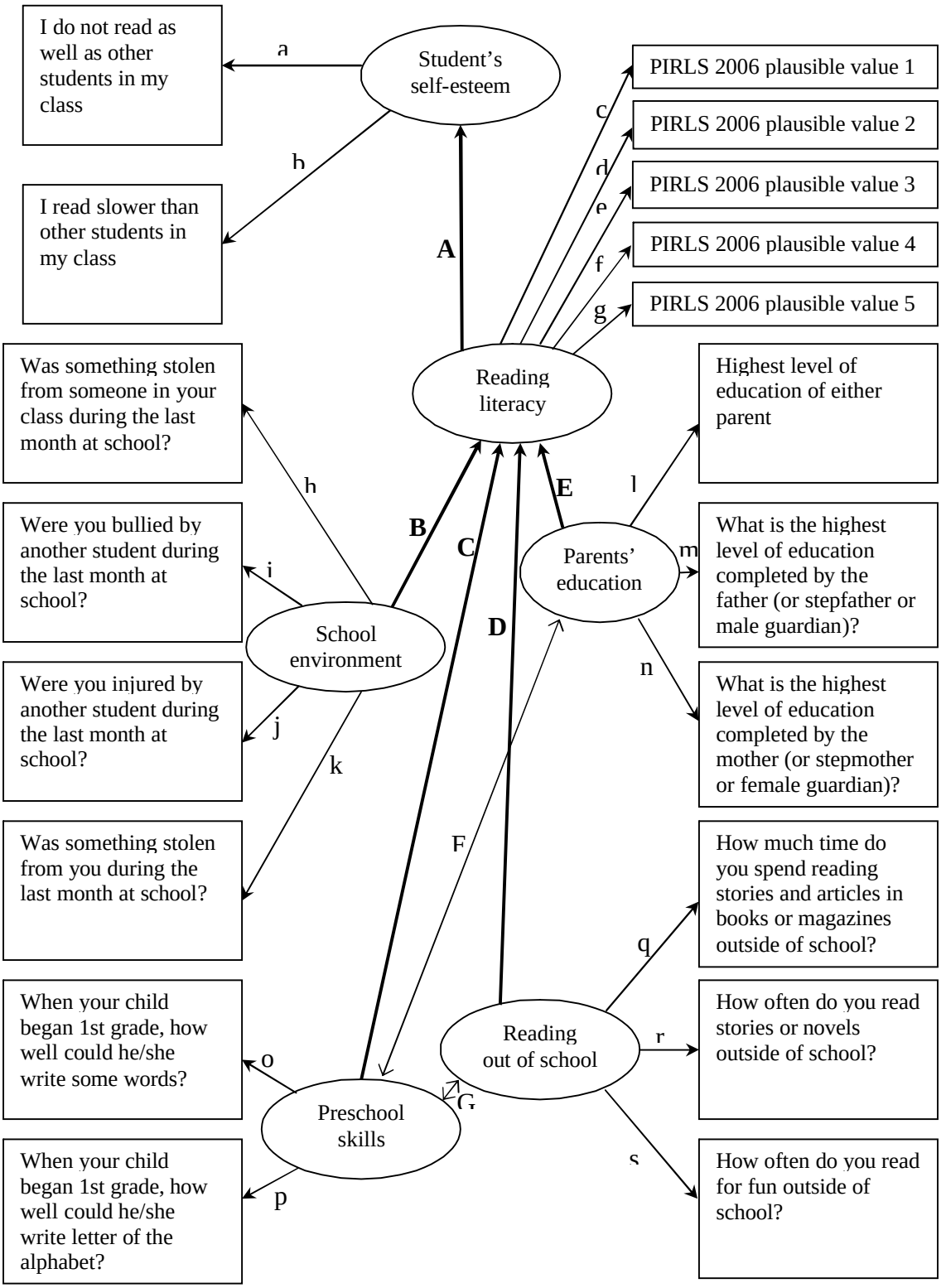

Fig.1: Structural diagram of the model

COV between residuals of *Were you bullied by another student during the last month at school?* and *Were you injured by another student during the last month at school?* are labeled as *t*.