
Learning strategies explaining boys’ and girls’ reading performance in schools with different language

Ülle Säälik*

University of Tartu, Salme 1a, Tartu 50103, Estonia

Abstract

Reading literacy is considered to be an essential life skill, but the large-scale international studies report a worringly high number of those struggling with reading. The struggling readers tend to have certain background characteristics such as male gender or low socioeconomic status, but some countries also express concern about schools with different language performing on a lower level. Wishing to improve students’ reading performance, it is necessary to study the possible disadvantaging factors alongside with the enhancing ones. In the current paper the impact of learning strategies on reading literacy performance was analyzed, gender and school language aspects being taken into account, to discover the sources of the variation in students’ reading literacy performance on student and school level. Multilevel modeling methods were used to analyze PISA 2009 students’ reading literacy test results and their awareness of learning strategies in Finland and Estonia. It was discovered that in both countries students’ awareness of learning strategies explained about one third of school level variation and about one fifth of student level variation. Learning strategies appeared to play an important role in explaining the differences in students’ reading test results not only on individual level, but students’ results depend on school they go to.

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Keywords: learning strategies; gender; school; multilevel modeling

* Corresponding author. Tel.: +37-256-690-591.
E-mail address: ulle.saalik@ut.ee

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1. Introduction

Reading literacy is considered to be an essential life skill, which provides solid ground for further studies, working life and active citizenship (Linnakylä, Välijärvi and Arffman, 2007). Such important skill obviously needs educators’ attention, and those struggling with reading deserve research-based help. Several international reading literacy assessments such as PISA (Programme for International Student Assessment) or PIRLS (Progress in International Reading Literacy Study) have researched students reading literacy skills, and discovered gender differences in reading performance in favor of girls, stating that in PISA 2000-2009 studies the gender gap had even increased (Mullis et al., 2012; OECD, 2010b, 2011). How gender is related to reading ability is not very clear, but the PISA analyses imply that students’ approaches to learning mediate the gender gap in reading performance so that if the boys had the same level of awareness in metacognitive skills their results could be around 15 points higher (OECD, 2010b, 88-91). Thus, student’s use of learning strategies seems to be related to gender.

The PISA reports have shown that students from schools with different school language tend to perform differently. In Estonia the Russian-speaking schools have performed on a lower level compared to Estonian-speaking schools, as presented in table 1 (Tire et al., 2010). Also in Finland the Finnish-speaking schools outperformed the Swedish-speaking schools (Hautamäki et al., 2008; Harju–Luukkainen and Nissinen, 2011). In Finland the leading principle in educational policy is to promote equality (Malin, 2005; Linnakylä, Välijärvi and Arffman, 2007). Thus the low-performing schools are seen as an issue that needs intervention. When some schools perform on lower level, it worries parents when choosing the best school for their children (Malin, 2007). School language itself cannot cause lower results, but what is actually done differently in those schools? Could it depend on what happens in the classrooms, how children are taught or how they are taught to learn?

The reading literacy was the main component in 2009 PISA study. Students’ use of learning strategies such as memorization, elaboration and control strategies has been explored in PISA studies for years, but in 2009 a more complex part was added to reveal student’s metacognitive awareness and use of summarizing skills (OECD, 2010 a, b), giving us valuable data and a chance to reveal its effects. Analyzing the PISA 2009 results in Estonia, using multilevel modeling methods, it was discovered that student’s awareness of learning strategies, especially metacognitive ones, had important impact on student’s learning performance. There was also a group effect identified – about 30% of between-school variation could be explained by students’ awareness of metacognitive learning strategies (Säälilik, Malin and Nissinen, 2013).

Metacognition is defined as a cognition of one’s own cognitive processes (Flavell, 1976; Baker, 2002). It is a higher level thinking skill and it is related to reading comprehension (Brown, 1980; Brown et al., 1983, Baker and Brown 1984). Metacognitive learning skills have been proved to improve learning results, they appear to be strong predictors of academic performance, and even the children with rather low learning ability could be trained to use them and achieve better results (Pennequin et al., 2010; van der Stel and Veenman, 2010).

Thinking and learning skills are possible to teach, it ‘enhances the quality, complexity and intensiveness of children’s thinking, develops creativity and therefore helps them to respond to a rapidly changing world where the ability to make sense of new information, to think creatively and to solve problems are increasingly valuable, as well as promoting lifelong learners, ready to face the uncertainty (Simister, 2007, 8-9). The development of such thinking skills goes through talk and dialogic teaching in the classroom, while freely articulating ideas and viewpoints in a risk-free environment, and that sets teachers’ work at the heart of this task (Jones, 2007). A large-scale comparative study of good practices of teaching reading (ADORE-Teaching Adolescent Struggling Readers) found out that when teachers practiced teaching both cognitive and meta-cognitive strategies continuously, encouraging reasoning for learning, thinking aloud, it was successful and helped everyone to become a more fluent reader (Stekläcs, 2010).

Since metacognition is proved to have such an essential role in improving learning results, and as it is greatly teachers’ opportunity and responsibility to teach learning skills, a questions could be posed if such skills are being systematically developed and taught to students in schools or not. In most PISA countries, a great share of the variation in student performance has been attributable to differences between schools (Malin, 2005; OECD, 2010c, 26-27). One might assume that the reason behind it could be school’s admittance selection, but both in Estonia and Finland comprehensive schools are non-selective so that cannot be the case.
The influence from the surrounding environment and other people’s attitudes is often referred to as group effect on individual outcomes. It means that individual outcomes depend on group characteristics they belong to (Hox, 2010). In school situation it means a situation in which less capable students in a group of more learning-oriented and well-performing students tend to become better learners in time and ultimately obtaining better results as well. That could be the result of same teacher(-s) teaching all students in the group in a similar way, or in other words the students are exposed to similar ‘treatment’, and therefore individual characteristics are affected by this group ‘treatment’ or other school characteristics shared by all students in school (Malin, 2005).

The interest of the current research was to find out whether the effect of learning strategies on reading literacy test results is connected to individual abilities, or is there a group effect evident, revealing possible ‘source’ of the variation. In other words, if student’s awareness of learning strategies explains considerable part of differences between schools, it is possible to assume that it could be the result of different teaching practice and metacognitive skills being developed in some schools and in others not so much. As Estonia and Finland have similar issue of schools with minority language, and they are also relatively similar with their 9-year compulsory education and cultural traits, the data of those two countries were used in the analysis.

The aim of the paper is to discover how learning strategies explain reading test results on student level and school level. The research questions were set as follows:
- How much variation in reading literacy performance is attributable to learning strategies, when main background factors (economical-social-cultural status, gender and school language) are controlled for?
- Are there any similarities between Estonia and Finland regarding how learning strategies explain the variation of gender and school language subgroups’ reading performance?

2. Research data and methods

2.1. Sample and data

The PISA 2009 Estonian and Finnish data were used in the analysis. In the PISA 2009 study, individual schools with 15-year-old students were sampled systematically from a comprehensive national list of schools with probabilities that were proportional to a measure of size – the number of PISA-eligible 15-year-old students enrolled in the school. Then, the students were randomly sampled within each sampled school (OECD, 2012). The national sample sizes used in the current study are given in table 1.

Table 1. National samples, mean reading literacy scores (plausible value 1) and standard deviations by gender and school language

<table>
<thead>
<tr>
<th>School language</th>
<th>N of schools</th>
<th>Gender</th>
<th>N of students</th>
<th>Mean score</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Estonian</td>
<td>138</td>
<td>Female</td>
<td>1812</td>
<td>532</td>
<td>72</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>1922</td>
<td>489</td>
<td>78</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>3734</td>
<td>510</td>
<td>78</td>
</tr>
<tr>
<td>Russian+ mixed</td>
<td>37</td>
<td>Female</td>
<td>485</td>
<td>499</td>
<td>74</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>508</td>
<td>459</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>993</td>
<td>479</td>
<td>77</td>
</tr>
<tr>
<td>Finnish</td>
<td>147</td>
<td>Female</td>
<td>2215</td>
<td>565</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>2188</td>
<td>510</td>
<td>86</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>4403</td>
<td>538</td>
<td>86</td>
</tr>
<tr>
<td>Swedish</td>
<td>56</td>
<td>Female</td>
<td>739</td>
<td>535</td>
<td>76</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Male</td>
<td>668</td>
<td>479</td>
<td>87</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Total</td>
<td>1407</td>
<td>509</td>
<td>86</td>
</tr>
</tbody>
</table>
As a part of the PISA study each student filled in a pencil–and–paper reading literacy test booklet with either multiple-choice, closed–constructed response items or with open answers requiring students to develop their own responses designed to measure broader constructs. After the test the students answered a questionnaire about their personal background, their learning habits and choice of reading strategies (OECD, 2010a).

The test scores from PISA data are derived from the students’ responses using the item–response methodology, the Rasch model (OECD 2009, 81). To determine the scores, PISA uses plausible values, which are scaled to have the international OECD average of 500 and standard deviation of 100. PISA has adopted an approach of calculating five different plausible values for each student. Since the plausible values of a student are highly correlated, an approximate analysis can be obtained in a less complicated way by selecting just one plausible value and performing the analysis with it. This simpler approach was adopted here.

The indices were constructed through scaling of items from students’ questionnaires, and then standardized so that the mean of the index value for the OECD student population was 0 and the standard deviation was 1, countries being given equal weight in the standardization process (OECD, 2012, 280). The indices describing student’s awareness and use of learning strategies used in the analysis were as follows: Metacognition: Understanding and remembering, Metacognition: Summarizing, Control strategies, Memorization strategies and Elaboration strategies.

The struggling readers tend to have certain background characteristics such as male gender or low socioeconomic status (Garbe et al, 2010; OECD, 2010b). The socioeconomic background of students and schools is said to have powerful influence on academic performance, although the low socio-economic status does not necessarily end up with poor performance (OECD, 2010a). Although the current study was focused on learning strategies, the background factors should not be ignored but included in the analysis to see the ‘pure’ effect of learning strategies when the effect of background variables has been taken into account, or in other words – they are controlled for. The background index Economic, social and cultural status (ESCS) was calculated out of the highest occupational status of the parents, highest educational level of the parents in years of education, and home possessions.

2.2. Statistical analyses

In educational studies single observations are not completely independent, as the data are hierarchically structured with two levels (students are nested within schools), and students in same school tend to perform more similarly, often indicated as group effect (Hox, 2010). The statistical analyses were conducted using multilevel modeling in which these dependencies are taken into account (e.g. Goldstein, 2011; Hox, 2010). Multilevel modeling allows to draw correct statistical inference for regression–type analyses under the hierarchical data structure. It has been noted that the indicators of central tendency have been excessively overused, and more attention should be paid on the variation of the results instead, to detect the systematic variation and thereby to determine the ‘source’ for this variation (Malin, 2005, 22).

In the applied multilevel modeling a separate intercept for each gender and language subgroup was fitted to control for the variation in reading literacy performance due to mean differences between gender and language subgroups. This way the main effects and the possible interaction effects of gender and school language were taken into account. Thus the separate explanatory dichotomous variables for each student group were included. In the analysis of the Estonian data the subgroups were set as follows:

- girls in schools with Estonian language (Est Girls);
- boys in schools with Estonian language (Est Boys);
- girls in schools with Russian or mixed language (Rus Mix Girls);
- boys in schools with Russian or mixed language (Rus Mix Boys).

The subgroups in the analysis of the Finnish data were set as follows:

- girls in schools with Finnish language (Fin Girls);
- boys in schools with Finnish language (Fin Boys);
- girls in schools with Swedish language (Swe Girls);
- boys in schools with Swedish language (Swe Boys).

These subgroup variables were used to estimate student level variance components separately for each group. First, the baseline model was built to control for the effect of main background variables: the four separate intercepts of gender and school language subgroups were used, and the index of economic-social-cultural status (ESCS) was
added. Then, the five explanatory variables of learning strategies were added to see how much of the total variance could be explained by student’s awareness and use of learning strategies. The variance components of the full model were compared to the variance components of the baseline model. The total variance was divided, describing the variation between schools (group level) and between students within schools (individual level). The proportional reduction in variance components (Snijders and Bosker 2002, 99) was used as a measure for the explained proportion of variance.

The statistical analyses were conducted using MLwiN 2.29 software (Rasbash et al., 2013). Student weights were used in modeling. Separate analyses were conducted with Finnish and Estonian data.

3. Results and discussion

First, the overall intra-class correlation coefficient (ICC) was calculated for Estonia and Finland, using the variance components of null models (no subgroup intercepts added), to see if any group effect occurred. The ICC is calculated by dividing the between-school variance component by the total variance. The Estonian school level variance component was 1408 and total variance component 6772, thus the ICC in the reading literacy was 0.21. It means that 21% of the total variance in reading literacy test scores was due to differences between schools. The Finnish between-school variance component was 651 and total variance 7571, thus the ICC in reading literacy performance was 0.09, showing relatively small but still considerable 9% of the total variance in reading literacy scores due to differences between schools.

Although the Finnish result of 9% is smaller than the Estonian 21%, it could be called considerable, because in earlier studies of PISA 2000 or 2003 data it was lower with only 4 – 6% (Malin, 2007). If the differences between schools arise, the claim of equality seems to fail. The current analysis proved that in Estonia and Finland students’ individual reading test results were at the rate of 10-20% influenced by the group effect, or in other words – student’s reading test results depend partly on the school they go to.

Setting separate intercepts for the gender and language subgroups enabled to apply more fair statistical approach towards these subgroups and to reveal how girls’ or boys’ awareness and use of different learning strategies might be associated with their reading performance, or whether there is connection to school type defined by school language. To ‘purify’ the results out of the effect of background factors the variable of economical-social-cultural status (ESCS) was added to the null model, forming a baseline model.

Tables 2 and 3 present the variances and reductions in variance components due to learning strategies according to separate gender and school language subgroups in Finland and Estonia. When the background factors (gender, school language and ESCS) were controlled for, the student’s awareness and use of learning strategies still played important role in explaining the variation in reading performance.

In Finland the variables of learning strategies reduced about 22-27% of the variation, while in Estonia it was about 16-20%. In Finland the girls’ reading results seemed to be more influenced by the learning strategies than boys’ in both Finnish and Swedish speaking schools, as for the girls the reduction in variance component was larger than that for boys. In Estonia, quite the opposite, the learning strategies explained more of boys’ variance that of girls’ with about 16 - 17% reduction of the variance for girls’ and 20% for boys’. The learning strategies all together appeared to matter on school level both in Finland and Estonia, showing 34% variation due to differences between schools in Finland and 37% in Estonia.

Table 2. Variances in models and reduction in variance components in subgroups and on school level in Finland (student weights in use).

<table>
<thead>
<tr>
<th></th>
<th>Fin Boys</th>
<th>Fin Girls</th>
<th>Swe Boys</th>
<th>Swe Girls</th>
<th>School level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null model</td>
<td>6822</td>
<td>5452</td>
<td>7160</td>
<td>5449</td>
<td>455</td>
</tr>
<tr>
<td>Baseline model with ESCS</td>
<td>6357</td>
<td>4995</td>
<td>6477</td>
<td>4993</td>
<td>314</td>
</tr>
<tr>
<td>Full model with all learning strategies</td>
<td>4978</td>
<td>3814</td>
<td>5000</td>
<td>3630</td>
<td>206</td>
</tr>
<tr>
<td>Reduction in variance component due to learning strategies</td>
<td>21.7%</td>
<td>23.6%</td>
<td>22.8%</td>
<td>27.3%</td>
<td>34.4%</td>
</tr>
</tbody>
</table>
Table 3. Variances in models and reduction in variance components in subgroups and on school level in Estonia (student weights in use).

<table>
<thead>
<tr>
<th></th>
<th>Est Boys</th>
<th>Est Girls</th>
<th>RusMix Boys</th>
<th>RusMix Girls</th>
<th>School level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Null model</td>
<td>5419</td>
<td>4575</td>
<td>4749</td>
<td>4831</td>
<td>1180</td>
</tr>
<tr>
<td>Baseline model with ESCS</td>
<td>5225</td>
<td>4350</td>
<td>4581</td>
<td>4684</td>
<td>847</td>
</tr>
<tr>
<td>Full model with all learning strategies</td>
<td>4175</td>
<td>3589</td>
<td>3664</td>
<td>3930</td>
<td>537</td>
</tr>
<tr>
<td>Reduction in variance component due to learning strategies</td>
<td>20.1%</td>
<td>17.5%</td>
<td>20%</td>
<td>16%</td>
<td>36.6%</td>
</tr>
</tbody>
</table>

Conclusions

How students learn is closely related to their learning outcomes, just like presented in the meta-analyses by Hattie (2009) or Wang et al. (1993–1994). The current study also proved that, when the effect of background factors was eliminated, the student’s awareness of learning strategies still showed strong explanatory power in explaining variation in reading literacy performance in PISA 2009. One third of the variation on school level and about one fifth of the variation on student level could be attributable to students’ awareness and use of five learning strategies. It leads to conclusions that student’s learning skills and metacognitive awareness are not only individual ability, but schools do have part it developing high level thinking skills.

Teachers can be assured to contribute to their students’ success in many ways, by developing learning skills, helping students by dialogic teaching with open questions, guiding them towards developing their skills by self-reflective talk, instructing others etc. (Jones, 2007; Pennequin et al., 2010; van der Stel and Veenman, 2010; Simister, 2007; Steklàcs, 2010). It is possible to teach self-regulated learning, when teachers regularly clarify and present the use of useful reading strategies, repeatedly model and demonstrate strategies in the context of school-related or even more important real-world-related reading (Steklács, 2010).

The learning strategies explaining reading performance of different gender and school language subgroups, however did not appear to work similarly in Estonia and Finland. It could be possible that teaching how to learn successfully is differently handled in Estonia and Finland, either meeting different gender’s needs or not. In Estonia girls appeared more difficult to explain. There must be something else than learning strategies affecting their results. In Estonia the boys’ seem to be more dependent on learning strategies, and therefore their results should be more easily improvable by developing their awareness and skills of useful learning strategies. Ivinson and Murphy (2007) point out that the classroom settings only provide possibilities for action, resources and opportunities that each student individually would experience differently, and it is teachers’ work ‘to mobilize gender as a resource to open up further possibilities for students’ participation’.

The current paper revealed the complexity of how gender mediates learning. It must be admitted how unsure and hardly identifiable the individual components of achievements could be while those individuals are constantly exposed to and affected by social and cultural influences. Logan and Johnston (2010) have also highlighted the multi-faceted nature of gender differences, suggesting that all children, regardless of gender would benefit from an increased understanding of most effectives ways how to read and cognitive skills supporting its development. Everyone would benefit from obtaining metacognitive thinking and learning skills.

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