The relationship between early childhood backgrounds and reading achievement in low and high achieving countries in PIRLS 2006

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Abstract

South Africa participated in the Progress in International Reading Study (PIRLS) for the first time in the PIRLS 2006. In South Africa, pupils were assessed in two grades and the children were assessed in all of the official 11 languages. The South African Grade 5 results in the PIRLS2006 were the lowest in the study despite the fact that these were South African Grade 5 students that were being compared with grade 4 students internationally. Grade 4 achieved approximately 30 points less than the Grade 5 pupils.

The aim of this study is to explore the home contexts of high achieving European countries such as the Russian Federation and Italy and compare these factors with those of the South African context and then in relation to the respective pupils' performance. Regression analysis was applied in order to determine the effects of these factors on reading achievement.

The initial findings based on descriptive analyses suggest substantial differences between the three countries. The PIRLS 2006 data were analysed for this paper. Data from South Africa comprising more than 16 000 grade 4 pupils from 429 schools, data from the Russian Federation with more than 4000 pupils from 232 schools and more than 3000 pupils in 150 schools from Italy have been included in the analyses.

Key words: international comparative studies; reading literacy assessment; language education

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Background

The aim of this study was to explore the home contexts of high achieving European countries such as the Russian Federation and Italy with a specific focus on the language of the test; pupils' home activities; pre-school attendance; books in the home; early home learning activities; parental education, employment, occupation; attitudes to reading and perceptions of the school environment and compare these factors with those of the South African context and then in relation to the respective pupils' performance.

Of the three countries the Russian Federation has the largest population, is the most urbanised and has the lowest GNP (see Table 1). Italy has the highest life expectancy, the lowest infant mortality rate and is the richest of the three countries. In comparison South Africa is the smallest population, is the least urbanised country, has the lowest life expectancy, and the highest infant mortality.

Table 1. Population, % of urban population, life expectancy, infant mortality and GNP of Russian Federation, Italy and South Africa

| Country	Pop (Mil)	Urban	Life expectancy	Infant mortality	GNP
Russia	143	73	66	16	8950
Italy	57.6	67	80	4	26830
South Africa	48	59	46	53	10130

South African and Italy spend the same percentage of their national budget on education in their respective countries (see Table 2). South Africa has the lowest net enrolment and the highest pupil-teacher ratio of the three.

Table 2: Public expenditure, Net Enrolment and primary-pupil teacher ratio for Russian Federation, Italy and South Africa

Country	Public exp	Net Enrolment (%)	Primary pupil: teacher ratio
Russia	3	99	17
Italy	5	99	11
South Africa	5	89	35

Perspectives

The South African results in the PIRLS2006 were the lowest in the study despite the fact that these were South African Grade 5 students that were being compared with grade 4 students internationally. This paper extends Howie, 2009 and builds on previous work (Howie, Venter and Van Staden, 2007 and Van Staden, Howie & Dunne, 2009) conducted in South Africa and the work of Tiumeneva & Froumin (2009) and Kuznetsova (2009) for the Russian Federation and Netten, Luyten & Verhoeven (2009) Goy, Strietholt & Bos (2009) for other European countries. Moreover, the notion of reading socialisation presented by Wallner-Paschon (2009) and who revealed the effects of reading socialisation on reading literacy achievement for Austria as well as other countries previously. It is from this perspective in particular, in addition to the PIRLS framework that this exploration is underpinned.
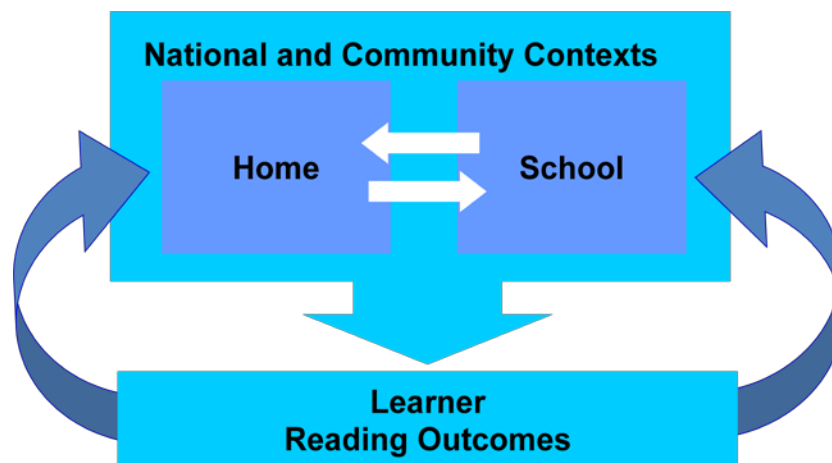
Figure 1 Conceptual framework

The PIRLS conceptual framework illustrates clearly the relationships between the broader societal context and that of the home, demonstrating the direct and

interactive linkages between activities and factors at home interacting with those at school and vice versa.

Data sources

Internationally most countries participating in PIRLS assessed pupils in one grade and in one language (Mullis et al, 2007). In South Africa, pupils were assessed in two grades (Grade 4 and Grade 5) and the children were assessed in all of the official 11 languages. Initially, South African children start their learning at school in their home language and this practice continues until grade 3. However, in the majority of schools, the languages of instruction changes and in grade 4 more than 80% of South African pupils learn in a second language.

The South African sample for PIRLS 2006 consisted of 441 schools offering schooling at Grade 4 level. A proportional allocation was done firstly by province and subsequently by language of instruction in the first three grades from 15,182 schools. From this sample, Grade 5 pupils, where available, were also included in the study. The realized sample involved only data from 434 Grade 4 schools and for Grade 5 it was 402 schools. The study generated achievement data for 16,057 Grade 4 pupils and 14,657 Grade 5 pupils, across nine provinces and 11 languages. Due to the probability sampling techniques used by PIRLS to sample pupils, and the matrix sampling methods to administer only a subset of the PIRLS 2006 assessment to individual pupils, some uncertainty exists in the statistics. These two mentioned components contribute to the uncertainty of the performance estimates and are reflected by the calculated standard errors of the means (Martin et al., 2007).

This paper uses the PIRLS 2006 South African Grade 5 data comprising about 14 657 grade 5 pupils from 402 schools. The Grade 4 data from the Russian Federation (4720 pupils from 232 schools) and Italy (3908 pupils from 150 schools) (Mullis et al, 2007) is included in the analyses.

Methods of Enquiry

Multiple regression was applied in this study in order to estimate the effects of the background variables upon achievement. A number of variables were identified from the reading socialisation model (Wallner-Paschon (2009), the PIRLS conceptual framework, and Van Staden, Howie & Dunne 2009. These included the Books in the home, pre-school attendance, home language, parental education, parental occupation and a number of indices, namely Early Home Literacy Activities, Parental attitudes towards reading, Parents' Perceptions of School Environment . This paper compares these factors across the two European countries with those of the South African data and then in relation to the respective pupils' performance.

A number of indices in the international databases were included in the regression model. These indices constitute a special type of derived variable that assigns students to one of three levels—high, medium, and low—on the basis of their responses to the component variables.

The high category of an index represents the responses that are expected to characterize aspects of a positive literacy environment, and the low category those responses that are least supportive of literacy [1](Martin et al, p.198). The indices that were included are presented in Table 3. Internationally the reliability coefficients were found to be generally high across countries with the exception of the Parents perceptions of the schools (see Appendix 1).

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[1] For example, students at the high level of the PIRLS 2006 Index of Early Home Literacy Activities had parents who reported often engaging with the student in each of six early literacy activities (read books, tell stories, sing songs, play with alphabet toys, play word games, and read aloud signs and labels) before the student began primary schooling. In contrast, students at the low level of this index had parents reporting never or almost never engaging the student in such activities.

Table 3 Indices included in the regression model

Index	Description	Computation
Early Home Literacy Activities	Categorise students according to their parents' reports about engaging in early literacy activities with the students before they began primary school. It is based on parents' reports of the frequency with which they engage with their child in the following activities prior to entry into primary school: read books, tell stories, sing songs, play with alphabet toys (e.g., blocks with letters of the alphabet), play word games, and read aloud signs and labels.	An average was computed across the six items based on a 3-point scale: *never or almost never* = 1, *sometimes* = 2, and *oft en* = 3. A high level indicates an average score of greater than 2.33 through 3. A medium level indicates an average score of 1.67 through 2.33. A low level indicates an average score of 1 to less than 1.67.
Parents' Attitudes Toward Reading	Categorises students according to their parents' reports of their own preferences for reading. The index is based on parents' agreement with the following statements: I read only if I have to, I like talking about books with other people, I like to spend my spare time reading, I read only if I need information, and reading is an important activity in my home.	An average was computed across the five items based on a 4-point scale: *disagree a lot* = 1, *disagree a little* = 2, *agree a little* = 3, and *agree a lot* = 4. Responses for negative statements were reverse-coded. A high level indicates an average of greater than 3 through 4. A medium level indicates an average of 2 through 3. A low level indicates an average of 1 to less than 2.
Parents' Perceptions of School Environment	Categorises students according to their parents' perceptions of the schools' efforts to provide a supportive learning environment. The index is based on parents' agreement with the following statements: my child's school includes me in my child's education, my child's school should make a greater eff ort to include me in my child's education, my child's school cares about my child's progress in school, and my child's school does a good job in helping my child become better in reading.	An average was computed across the four items based on a 4-point scale: *disagree a lot* = 1, *disagree a little* = 2, *agree a little* = 3, *agree a lot* = 4. Responses for negative statements were reverse-coded. A high level indicates an average of greater than 3 through 4. A medium level indicates an average of 2 through 3. A low level indicates an average of 1 to less than 2.

In total nine factors were included in the regression models. In addition to the indices listed in Table 3, there were a number of other variables included:

- Language of the test
- Pre-school attendance
- Books in the home
- Parental Highest Education
- Parental Highest Employment levels
- Parental Highest Occupational level

Multiple regression was applied to ascertain the effect of the home activities on reading achievement in the three models for comparative purposes. This was done using the IEA's IDB analyser with its regression function. This followed an examination of the descriptive statistics and the correlations. However, the sample sizes for all three countries were greatly reduced by the regression analysis (see Table 4).

Results

The initial analyses revealed in Howie, 2009 that there appeared to be substantial differences in the extent to which early childhood literacy activities are conducted in the Russian Federation and Italy compared to South Africa. However, fewer differences were found in terms of resources in the home on country level between the three countries. South Africa was however found to have larger numbers of children having very few books in the home compared to the European countries. Substantial differences were also be found regarding parental education, with fewer South African parents having higher education. Fewer South African homes were found to have both parents working and also had weaker attitudes towards reading. More than 90% of Russian and Italian children had either parent speaking the language of the test in PIRLS and this was not the case in South Africa where only 21% spoke the language of the test.

The model when applied to the South African ($R_i^2 = .39$) data explained the most variance in the data compared to Russian Federation ($R^2 = .15$) and Italy ($R^2 = .02$).
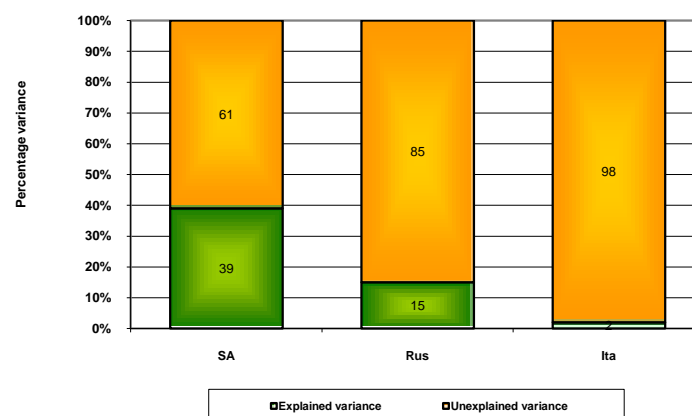

Figure 2 Explained variance from the Home background multiple regression model

Table 4. A summary of the results of the Multiple Regression analysis

Variables	PIRLS variable	ZAF N = 3904			RUS N = 3933			ITA N = 203		
		Estimate	S.E	T-test	Estimate	S.E	T-test	Estimate	S.E	T-test
Constant		615.55	21.72		640	18.06		549	37.53	
Multi RSQ		.39	-	-	.15	-	-	.02	-	-
Lang of Test	ASBHLBS1	-25.07	7.65	-3.28	-.20.30	16.19	-1.25	4.53	11.76	.39
Pre-School	ASBH0ATT	-10.17	7.48	-1.36	-4.45	-.95	4.68	-11.31	15.9	-.71
Books in home	ASBHBOOK	25.19	2.96	8.50	6.98	1.33	5.26	5.16	3.87	1.33
Index Early Home Literacy Activities	ASDHEHLA	-17.58	4.39	-4.00	-12.57	2.93	-4.3	-1.44	7.12	-.20
Parental Highest Education	ASDHEDUP	-26.62	2.92	-9.12	-.15.44	2.59	-5.85	3.76	4.82	.78
Parental Highest Employment level	ASDHPEMP	-27.76	3.10	-8.94	-3.34	2.28	-1.46	-5.57	7.95	-.70
Index Parents attitude to Reading	ASDHPATR	-29.31	4.88	-6.01	-5.49	2.38	-2.3	-3.03	9.57	-.32
Parental Highest Occupational level	ASDHOCCP	-9.61	1.45	-6.63	-2.65	1.21	-2.2	.93	2.84	.33
Parental perceptions of School Environment	ASDHPPSE	-16.78	6.65	-2.52	-3.24	2.58	-1.26	1.03	10.27	.10

The effects of the factors on reading achievement were much larger for the South African model (see Table 4). There were no common factors across all three countries as there were no significant predictors in the Italian model. Only two factors in common appeared within the top five factors (*Books in the home* and *Parental Highest Education level*) within South Africa and the Russian Federation affecting achievement. *Books in the home* was a predictor of achievement in all three countries with South Africa having the largest effect (25.19). *Parental Highest Education Level*, where there was a positive effect in South Africa and the Russian Federation. This suggested that *books in the home* is a very important predictor of reading achievement across the world which confirms previous research (Elley, 1992). This is clearly a very important factor in South Africa where more than half of the pupils have fewer than 10 books at home. The results for each of the models are discussed in brief below:

South African Model

For South Africa eight out of the nine factors were significant predictors of achievement and the attendance of pre-school was not a significant factor. The five largest effects were in rank order *Parents attitude to reading, Parental Highest Employment level, Parents highest education*, *Books in the home* and *Language of the test*. The other significant factors were *Early Literacy Activities, Parental perceptions of School Environment,* and *Parental Highest Occupational Level*. Children of parents who had positive attitudes to reading, where one or two parents were working, parents with higher education, had higher numbers of books in the home and those who wrote the test in English or Afrikaans were more likely to achieve higher scores than those who did not fit this profile.

Russian Federation model

For the Russian Federation six out of the nine variables were significant factors. *Language of the test, Parental Highest Employment level,* and *parental perceptions of school environment* were not predictors of achievement. the nine variables only explained about 15% of the variance in the scores. The most important factors were *Language of the test, Parental Highest education, Early Home Literacy Activities*, *books in the home* and *Parents attitude to Reading*. Children who wrote in Russian,

had parents with higher education, had spent quite some time on literacy activities at home before attending school and parents with positive attitudes to reading were most likely to achieve higher scores on the PIRLS test.

The Italian model

In Italy none of the factors were significant predictors of achievement.

Conclusion

PIRLS 2006 reinforced internationally that children from homes fostering literacy become better readers. Students had higher reading achievement when they were from homes where their parents enjoyed reading and read frequently, books were in abundance, and students were engaged in literacy activities – from alphabet blocks to word games – from an early age (http://www.iea.nl/pirls20060.html).

A second key finding internationally was that in both PIRLS 2001 and PIRLS 2006, parents' assessments of their children's early literacy skills were in alignment with how well their children could read at the fourth grade. According to parents, about one third of children, on average, entered school with basic literacy skills, which represented an increase in 17 countries since PIRLS 2001 (http://www.iea.nl/pirls20060.html).

These key findings were an important stimulant for this research. South Africa is at an important stage of its development in education and particularly in language in education. The language in education policy (DoE, 1997) promotes all 11 languages in education. However, significant differences have been found between language groups (see Van Staden, Howie & Dunne, 2009) and also in terms some early childhood experiences and reading socialisation. Examining high achieving countries' experiences of these factors was expected to enlighten the South African decisions regarding compulsory pre-schooling. At this stage, pre-primary is not compulsory in South Africa and it is believed that this only increases the gap between children from wealthier and poorer contexts (see Howie, 2008). Currently empirical data is much needed to inform the contemporary discussions in South Africa. What is interesting is that none of the factors had an effect on the Italian model and that these same factors

had a limited effect in the Russian Model but a fairly effect on the South Africa. Given the large variance within the South African data, the next step of the research will be to explore the extent to which children from different language groups within South Africa differ with regard to these factors and how these relate to pupils' achievement in reading literacy.

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Appendix 1

Reliability of the indices internationally

The Early Home Learning Activities index comprising six activities forms a fairly reliable scale, with a Cronbach alpha of 0.68 across all participating countries. The median multiple correlation between the six activities and student achievement was 0.28, corresponding to an R-square of 0.08 (Technical report, p.).

The Index of Parents' Attitudes Towards Reading (PATR) is composed of the five statements form a reliable scale with a Cronbach's alpha across countries of 0.78. The median multiple correlation between the five statements and student achievement was 0.24, corresponding to an R-square of 0.06.

The reliability of Parents Perceptions towards the School index, performs differently across countries. Although it is quite high in many countries (Cronbach's alpha is above 0.75 in 12 countries), it is also low in some countries. Some of the component variables appear to have different connotations in different contexts. The median multiple correlation between the component variables and student achievement was 0.17, corresponding to an R-square of 0.03.