Factors that Affect South African Reading Literacy Achievement: Evidence from prePIRLS 2011 Using Aspects of Carroll's Model of School Learning

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Abstract

This study aims to identify factors that predict reading literacy achievement among Grade 4 students in South Africa by utilising aspects of Carroll's model of school learning. The study draws on the preProgress in International Reading Literacy Study (prePIRLS) 2011 data, which places South African Grade 4 students' results substantially below the international centre point of 500 at 461 (SE=3.7). Selected items from the prePIRLS 2011 student, parent and teacher questionnaires were used in a two-level model to determine the effect of student aptitude, opportunity to learn and quality of instructional events on reading literacy achievement. The results point to the statistical significance of engaged reading and cultivating motivation for reading among students from an early age, specifically through parental involvement in introducing early literacy activities as foundation of reading literacy by school-going age. Other results provide evidence for the importance of the value of reading across the curriculum not confined to formal reading lessons only. The teaching of reading comprehension skills and strategies is identified as a significant predictor of reading literacy achievement, instruction of which should form an integral part of teaching reading in the classroom.

Keywords: Carroll's model of School Learning, contextual factors, prePIRLS 2011, reading literacy achievement

Introduction

In this study, an attempt is made to identify specific factors associated with reading literacy achievement among Grade 4 students in South Africa by utilising aspects of Carroll's Model of School Learning (1963:723-733). Reading literacy can be regarded as one of the most important abilities students acquire as they progress through their early school years. As a foundation for learning across all subjects, literacy can be used for recreation and personal growth, while simultaneously providing young children with the ability to participate more extensively in their communities and societies. For purposes of this study, reading literacy refers to

> ...the ability to understand and use those written language forms required by society and [or] valued by the individual. Young readers can construct meaning from a variety of texts. They read to learn, to participate in communities of readers and for enjoyment. (Mullis et al., 2009:11).

With this definition, as it applies to prePIRLS 2011 (Mullis, Martin, Kennedy, Trong & Sainsbury, 2009:11) reading literacy is regarded as a constructive and interactive process. According to Brinkley and Kelly (2003:6), the reader is regarded as actively constructing meaning and as knowing and applying effective reading strategies. Such readers have positive attitudes towards reading and read for the purposes of information acquisition as well as recreation. Meaning is constructed in the interaction between reader and text, in the context of a particular reading experience. Reading implies that readers bring with them and apply a repertoire of knowledge, skills, cognitive and metacognitive strategies during reading.

The current study aims to identify factors that are associated with student achievement in order to ensure that transformational goals facilitate the move beyond policy status to those being achieved at both student- and school levels. The study is reported against a background of a South African national education system that has been characterised over the last decade by transformation at various levels. At the curricular-level, change was aimed at transforming a system that predominantly consisted of mere transmission of information to a system that supports constructivist paradigms of teaching and learning (Rambuda & Fraser, 2004:10). In moving to such a system, the traditional pedagogical style of rote learning needed to be transformed to that of a student-centred style that prepares all students as democratic citizens, able to compete in an increasing competitive global economy. Some of the elements of the conceptual framework against which transformation was to take place as described by Beets and van Louw (205:178) include learning as an active process of sense making, learning as socially and culturally determined activity and classroom expectations and social norms that should foster the development of important dispositions, such as students' willingness and persistence in solving problems. Similarly, changes to assessment now include assessment as an on-going, integral part of the learning process, which is appropriately aimed at the knowledge, skills or attitudes to be assessed (Beets & van Louw, 2005:179). The aim of assessment as agent of transformation is not only as instrument against which progression is measured, but rather serves as evidence

for progress in achieving outcomes to identify areas for student support or further intervention.

Factors at student, classroom and school level that affect reading literacy achievement have been the topic of many research studies. Nationally, the work of Makgato and Mji (2006:253-266) and Maree, Aldous, Hattingh, Swanepoel and van der Linde (2006:229-252) among others, have focused on factors that affect student performance in Science and Mathematics. Internationally, Scheerens and Bosker (1997) investigated factors that contribute to educational effectiveness, while secondary analyses of large scale, international comparative studies (Netten, Droop & Verhoeven, 2011, van Staden, 2010, Wallner-Paschon, 2009, Geske, & Ozola, 2008, van Petegem, Creemers, Aelterman & Rosseel, 2008, Bos, Schwippert & Stubbe, 2007 and Gonzalez-DeHass, Willems, & Holbein, 2005) have utilised a variety of predictors and theoretical frameworks in attempts to isolate those factors that are best capable of predicting reading literacy achievement, specifically among primary school students. For purposes of this study, selected factors from Grade 4 students, their home and classroom environments are applied as predictors of reading literacy achievement.

Factors related to student reading achievement are centred on reading motivation and reading-related self-perception. For children who experience initial or continued success or difficulty in reading, relationships between reading achievement and self-perception (referring to those perceptions, values, knowledge, and beliefs individuals have about themselves as students) arise within the first year of schooling. This timing means that the student's self-perception forms in response to emerging patterns of accomplishment or difficulty with learning tasks (Chapman & Tunmer, 2003:6); so, for example, students with a low sense of efficacy for completing reading tasks tend to give up more easily, engage in off-task activities or avoid the task altogether. Resonant with research that associates student-related factors with low achievement is the work of Wallner-Paschon (2009), who refers to the process of 'reading socialization'. Important fields of socialisation for the student are the school, family and peer group, all of which in turn affect the student's motivational characteristics, such as reading attitude and reading self-concept, as well as reading achievement.

Gambrell, Palmer, Codling and Mazzoni (1996:518) refer to the work of inter alia Veenman (1984), who reported that teachers ranked motivating students to read

and creating interest in reading as amongst their primary and overriding concerns. Turner (1995:410) refers to motivation and cognitive engagement interchangeably as voluntary uses of high-level, self-regulated strategies, such as planning, paying attention, connecting ideas, judging and monitoring. Motivation is crucial to reading at any level and beliefs about reading have an important relation to understanding and engagement during reading. Schraw and Bruning (2000) state that positive beliefs about reading translate into higher levels of motivation and better understanding of what is read. This in turn is a positive consequence of cognitive engagement (Turner, 1995:420).

Literacy can be viewed as a cultural practice and young children begin to learn about reading and writing initially in their homes. It is apparent that the home environment affects children's literacy and the difference between parents of good readers and those of poorer readers has been noted in the literature as associated with literacy levels achieved in a common age grade. Martin, Mullis and Gonzalez (2004) report that for every country participating in the Progress in International Reading Literacy Study (PIRLS) 2001, a strong relationship was found between Grade 4 reading achievement and parents' reports of levels of engagement in literacy activities before their children started school.

South African students generally perform poorly in international comparative assessment studies such as PIRLS, the Trends in International Maths and Science Study (TIMSS) and the Southern and Eastern African Consortium for the Monitoring of Educational Quality (SACMEQ). Howie (2003) reports a number of factors specifically related to students' poor performance in South African classrooms in Mathematics specifically, but also in general. These factors include inadequate subject knowledge of teachers, inadequate communication ability between students and teachers in the LOLT, lack of instructional materials, difficulties for teachers to manage classroom activities effectively, pressure to complete examination driven syllabi, heavy teaching loads, overcrowded classrooms, poor communication between policy makers and practitioners and lack of support due to shortage of professional staff in the ministry of education. Such findings are reflected in the work of Passos (2009:262-332), who carried out a comparative analysis of teacher competence and its effect on Grade 6 student performance in upper primary schools in Mozambique and other SACMEQ countries. According to Passos (2009:312), the

relationship between teacher competence and student performance in reading and mathematics is influenced by cognitive, affective and behavioural factors.

Sailors, Hoffman and Matthee (2007:364-387), in their evaluation of schools that promote literacy learning in low-income communities, summarise the work of a number of researchers, such as Weber (1971) and Hoffman and Rutherford (1984), who identified common themes across effective schools that could guide reform efforts in the failing schools operating in resource-poor environments. The common themes in these schools that influenced student achievement positively included among others effective instructional leadership and practices, high expectations for students to achieve and perform at their best, ongoing curriculum improvement, maximum use of available instructional time and frequent monitoring of student progress.

Conceptualisation of the study

For purposes of this study, Carroll's Model of School Learning (1963:723-733) is used as a well-established and critically reviewed model specifically in studies of educational effectiveness. The model explains variations in school learning with reference to five classes of variables, three of which relate to time (aptitude opportunity to learn and perseverance), with the remaining two related to achievement (quality of instruction and ability to understand instruction) (Carroll, 1989). In his original work, Carroll states that the degree of learning is a function of the student's motivation to learn, aptitude, ability to learn and quality of instructional events (Carroll, 1963:723). Carroll relates motivation and availability of resources to a broader category called 'time spent in learning', while aptitude, ability to learn and quality of instructional events resorts under a category he refers to 'time needed to learn'. The time needed to learn is increased when quality of instruction and ability to understand is less than optimal (Carroll, 1989). The structure of Carroll's model is represented in Figure 1:

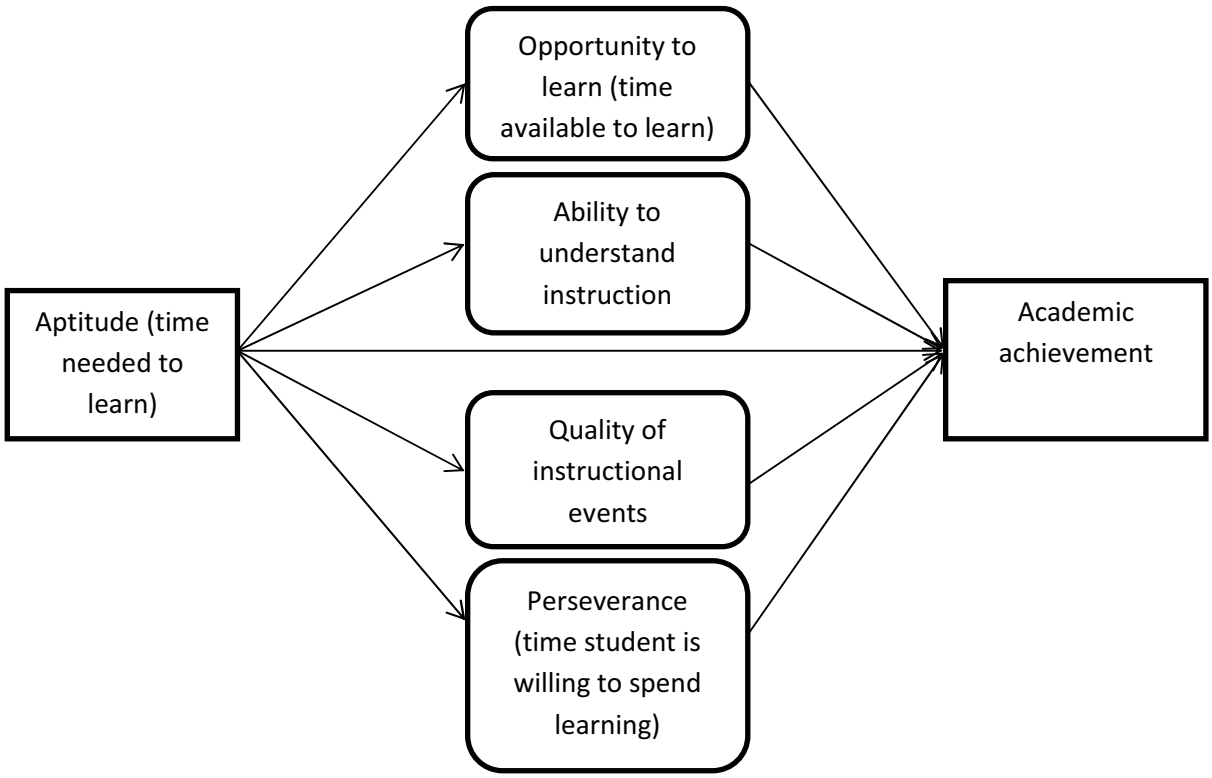

Figure 1 Carroll's Model of School Learning

Carroll's model explains why students perform differently in handling a given task (Creemers & Kyriakides, 2006: 347-366) attempting to explain the role of the time variable and its relationship to learning rate and achievement. As a time based model, Carroll describes aptitude as the capability to reach desirable levels of academic achievement provided that there is enough time, while opportunity to learn is defined as the amount of time available for learning within a school curriculum (Berliner, 1990). Opportunity to learn is also turned into an instructional time concept, where school learning is seen as deliberate attempts to teach or the duration of time allocated for instruction (Berliner, 1990).

Figure 2 illustrates how aspects of Carroll's model are utilised in the current study. With the absence of proxy measures in the prePIRLS 2011 data for perseverance (or the time a student is willing to spend on learning), the current study's focus is on factors of aptitude, opportunity to learn and quality of instructional events as predictors of reading literacy achievement in particular.

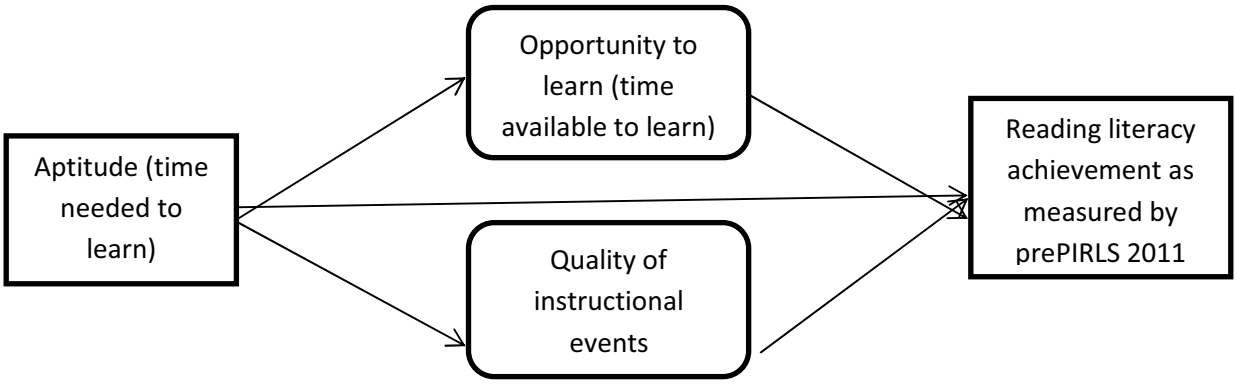

Figure 2 Aspects of aptitude, opportunity and quality of instructional events as taken from Carroll

Research questions

This study is a secondary analysis of the prePIRLS 2011 South African Grade 4 data. The main research question is: Which factors from Carroll's Model of School Learning can be associated with South African Grade 4 student performance in reading literacy?

Using aspects of Carroll's Model of School Learning, in conjunction with factors emanating from contextual questionnaires of Grade 4 students, their home and classroom environments were analysed in relation to student achievement scores on the prePIRLS 2011 reading tests. The main research question comprises the following sub-questions:

1. Which student aptitude factors affect performance in reading literacy in the overall South African model?
2. To what extent does the opportunity to learn affect reading literacy performance of Grade 4 students?
3. What is the effect of the quality of instructional events on Grade 4 student reading achievement?

Method

Participants

PrePIRLS 2011 is an international comparative assessment of reading literacy conducted with Grade 4 children. Run under the auspices of the International

Association for the Evaluation of Educational Achievement (IEA), prePIRLS 2011 offers developing countries the opportunity to test reading literacy at an easier level than PIRLS while utilising the same conception of reading literacy. A nationally representative sample of 15 744 Grade 4 students from 342 schools participated in the prePIRLS 2011 study in South Africa. The sample consisted of 7 548 girls and 8 196 boys. Students were assessed across all 11 official languages and were assessed in the Language of Learning and Teaching (LoLT) to which they were exposed in Foundation Phase. This means that students were not necessarily tested in their home language, but rather in the language they were exposed to at school. The stratification by language resulted in the assessment of 1 463 Afrikaans students, 2 205 English students, 1 393 isiNdebele students, 1 090 isiXhosa students, 1 209 isiZulu students, 1 099 Sepedi students, 1 431 Sesotho students, 1 293 Setswana students, 2 186 siSwati students, 1 187 Tshivenda students and 1 188 Xitsonga students.

Data collection instruments

Achievement tests

The prePIRLS 2011 assessment consisted of a reading literacy test in the form of two types of texts, namely reading for literary experience (or literary texts) and reading to acquire and use information (or informational texts). Reading texts were followed by a range of multiple choice questions and open response questions to a maximum of three points. All questions corresponded to any one of the four types of reading comprehension process, namely (1) focus on and retrieve explicitly stated information, (2) making straightforward inferences, (3) interpret and integrate ideas and information and (4) examine and evaluate content, language and textual elements. Reporting of reading achievement results in prePIRLS 2011 are presented in terms of achievement above or below the fixed international centre point of 500 through the use of five overall Plausible Values as derived from Item Response analyses.

Background questionnaires

Grade 4 students, their parents, teachers of the Grade 4 students and school principals responded to contextual background questionnaires that addressed a wide range of topics on aspects such as reading behaviour, attitudes, teaching reading

and school organisation. Student and parent questionnaires were administered in all 11 official languages to suit the language preference of students and parents optimally, while teachers and school questionnaires were administered in English.

Selection of variables

A number of variables were selected from the prePIRLS 2011 student, parent and teacher questionnaires. Scales were created from these variables to form factors to test the selected aspects of Carroll's model perhaps list them here before you launch into the paragraphs so the reader knows that to expect.

Aptitude: The aptitude scale was constructed from items from the student and parent questionnaires. With regards to reading motivation, students responded to the following statements *(variables ASBR09A-F that form the 'Students motivated to read' scale in the international database called ASBGSMR)*: *I like to read things that make me think, it is important to be a good reader, my parents like it when I read, I learn a lot from reading, I need to read well for my future,* and *I like it when a book helps me imagine other worlds*. Student engagement was captured by responses to statements like *I like what I read about in school, my teacher gives me interesting things to read, I know what my teacher expects me to do, I think of things not related to the lesson, my teacher is easy to understand, I am interested in what my teacher says,* and *my teacher gives me interesting things to do (variables ASBR05A-G that form the 'Students engaged in reading lessons' scale in the international database called ASBGERL)*. All the variables were measured on a Likert scale with options varying from *Agree a lot, Agree a little, Disagree a little* and *Disagree a lot.* Parental responses to student aptitude included responses to statements of what their child could do when they started Grade 1 and included aspects such as *recognising most letters of the alphabet, reading some words, reading sentences, writing letters of the alphabet* and *writing some words (variables ASBH06A-E).* Parental responses to these items were indicated as *Very well, Moderately well, Not very well* and *Not at all.*

Opportunity: Measures of opportunity was construed as time spent by the teacher on reading and reading instruction. Variables taken from the prePIRLS 2011 teacher questionnaire therefore included questions to teachers about the reported formally scheduled reading time spent in hours in the language class only *(variable ATBR02A*) and across the curriculum *(variable ATBR02B)*.

Quality of instructional events: Proxy measures for quality of instructional events were taken from the student and teacher questionnaires. Grade 4 students were asked to respond to aspects of their lessons about reading, including *attitudes to liking what they read, being given interesting things to read, being aware of teacher expectations, the extent of thinking about things not related to the lesson, finding the teacher easy to understand, finding reading lessons interesting*, and *being given interesting things to do (variables ASBR05A-G*). Grade 4 students responded to these variables on a Likert scale with options varying from *Agree a lot, Agree a little, Disagree a little* and *Disagree a lot.* Teachers were asked about the types of reading activities they do with the students, including *reading aloud to the class, asking students to read aloud, asking students to read silently on their own, giving students time to read books of their own choosing, teaching students decoding strategies and new vocabulary* and *modelling skimming or scanning strategies (variables ATBR08A-G*). Teachers were also asked about their use of strategies to develop reading comprehension skills, which included *strategies of locating, identifying, explaining, comparing and describing information, as well as making predictions and generalisations about text* and *forming own opinions (variables ATBR09A-I).* Lastly, quality of instructional events comprised teacher responses to reports of activities undertaken with students after reading was complete *(variables ATBR10A-D)* and included *writing something about what was read, answering oral questions, talking amongst themselves about what was read*, and *taking a quiz or test about what was read*. Variables from the teacher questionnaire were measured on a Likert scale with options varying from *Every day or almost every day, Once or twice a week, Once or twice a month* and *Never or almost never*. Table 1 provides a summary of the descriptive statistics for each of the variables used for purposes of this investigation:

Table 1 Summary of Descriptive Statistics

Scale	prePIRLS 2011 Source	Variable name	N	Mean	Std Deviation
Aptitude	Parent questionnaire	ASBH06A	11 514	1.8	0.9
		ASBH06B	11 514	2.0	0.9

Scale	prePIRLS 2011 Source	Variable name	N	Mean	Std Deviation
		ASBH06C	11 514	2.1	1.0
		ASBH06D	11 514	1.9	0.9
		ASBH06E	11 514	2.0	0.9
	Student questionnaire	ASBGSMR	13 121	1.5	0.7
		ASBGERL	13 956	1.6	0.6
Opportunity	Teacher questionnaire	ATBR02A	314	2.9	2.7
		ATBR02B	314	18.6	15.4
Quality of instructional events	Student questionnaire	ASBR05A	13 918	1.3	0.7
		ASBR05B	13 392	1.5	0.9
		ASBR05C	13 167	1.6	0.9
		ASBR05D	12 972	2.3	1.2
		ASBR05E	12 884	1.6	0.9
		ASBR05F	12 913	1.6	0.9
		ASBR05G	12 954	1.5	0.9
	Teacher questionnaire	ATBR08A	361	1.4	0.6
		ATBR08B	357	1.4	0.6
		ATBR08C	354	1.9	0.8
		ATBR08D	359	2.1	0.9
		ATBR08E	354	2.1	0.9
		ATBR08F	357	1.7	0.7
		ATBR08G	345	2.4	1.0
		ATBR09A	359	1.7	0.7
		ATBR09B	362	1.6	0.7
		ATBR09C	360	1.4	0.6
		ATBR09D	361	1.8	0.8
		ATBR09E	360	1.9	0.8
		ATBR09F	361	1.9	0.9

Scale	prePIRLS 2011 Source	Variable name	N	Mean	Std Deviation
		ATBR09G	360	2.1	0.9
		ATBR09H	359	2.1	0.9
		ATBR09I	356	2.4	1.0
		ATBR10A	347	2.0	0.8
		ATBR10B	345	1.5	0.6
		ATBR10C	345	1.9	0.8
		ATBR10D	345	2.2	0.8

Procedure

Scales were constructed from the selected variables using SPSS software. For purposes of scale construction, factor analysis was used and issues of reliability were addressed by means of Cronbach's Alpha. The construction of scales was followed by multi-level analysis using MLwiN software (Rasbash, Steele, Browne & Goldstein, 2009) to test for significant effects of aspects of aptitude, opportunity and quality of instructional events on reading literacy achievement. A multi-level approach was followed in the data analysis, since prePIRLS 2011 data have a hierarchical structure, where students are nested in classes and classes are nested within schools.

Results

The analysis of the scales as constructed for purposes of this study is shown below. The first overall plausible value from the prePIRLS 2011 data was used as outcome variable. Serving as predictors, statistically significant effects of the constructed scales of aptitude, opportunity and quality of instructional events on reading literacy achievement were tested. Table 2 provides a summary of results:

Table 2: Model Results for aspects of Aptitude, Opportunity and Quality of Instructional Events with Variance Components

Total Variance	7303.134
Between-group variance	3853.522
Within-group variance	3449.612

Scale	**prePIRLS 2011 Source**	**Variable name**	**Coefficient**	**SE**
Aptitude	Parent questionnaire	ASBH06A-E (aptitude)	-14.22	1.11
	Student questionnaire	ASBGSMR	5.37	0.43
		ASBGERL	7.00	0.60
Opportunity	Teacher questionnaire	ATBR02A	6.16	1.38
		ATBR02B	-0.38	0.25
Quality of instructional events	Student questionnaire	ASBR05A-G (Studentscale)	3.28	5.87
			227.09	48.9
	Teacher questionnaire	ASBR05A-G (Studentscale mean)	37.60	4
			-81.19	35.2
		ATBR08A-G (Activityscale)	-4.97	0
				37.0
		ATBR09A-I (Strategyscale)		5
				42.9
		ATBR10A-D (Afterreadingscale)		5

In the current model, *aptitude* resulted in statistically significant effects for all measured aspects. In the absence of aptitude, as measured by parental involvement in ensuring children have basic skills when entering Grade 1, reading literacy achievement can be expected to decrease by 14.22 (SE=1.11) points. Students' motivation to read increases reading literacy achievement scores by 5.37 (SE=0.43)

points, while student engagement in reading may show an increased effect on reading achievement by 7.00 points (SE=0.60).

Opportunity to read showed significant effects for teacher reports on time spent reading across the curriculum with a predicted increase in reading literacy scores of 6.16 points (SE=1.38). *Formally scheduled time for reading* resulted in a coefficient of -0.38 (SE=0.25), which is statistically of little effect.

Quality of instructional events resulted in no statistically significant effect for students' experience of the reading lesson (3.28, SE=5.87). However, when aggregating this variable at the classroom-level, a statistically significant effect of 227.09 (SE=48.94) is detected. This effect means that teachers who are able to present their classes with interesting reading lessons and clear expectations may capitalise on reading achievement scores improving in excess of 200 points. A lack of explicit reading comprehension strategy teaching by teachers decreases reading literacy achievement significantly by as much as 81.19 points (SE=37.05). Classroom activities associated with reading instruction (as measured by teacher reports of students reading aloud, reading silently, reading books of their own choosing and teachers modelling skimming and decoding strategies) proved to have no statistically significant effect (37.60, SE=35.20), a finding similar to the lack of effect found for activities undertaken after reading has taken place (-4.97, SE=42.95).

Discussion

This study utilised the prePIRLS 2011 South African results to test aspects of Carroll's model of school learning. South African student performance remains persistently poor and below internationally set standards, as evidenced by achievement of 461 (SE=3.7) in the prePIRLS 2011 study compared to the international centre point of 500. In light of this underachievement, this paper aimed to establish statistically significant relationships with reading literacy achievement as measured by the prePIRLS 2011 study. Evidence was provided for the effect of aptitude at student-level, and opportunity and quality of instructional events at classroom-level and their effect on reading literacy achievement scores of South African Grade 4 students.

The current model results can be discussed against transformation as a principal component that characterises educational systems globally in efforts to provide

equal, quality education to all. While aims for the South African education system's transformation is set out in many policy and curricula documents, no guarantees exist that teachers, parents or students have implemented the changes needed to successfully implement transformational goals. If learning is still at best regarded as a rote activity, void of the social and cultural space in which it is constructed, little transformation can be claimed to have taken place at classroom level. Where international assessment results (such as prePIRLS 2011 results) remain only as grim reminders of South African students' poor performance, assessment as integral to learning has failed, especially when assessment results should provide evidence to inform further support or intervention for students in need. Assessment should provide indicators of those systemic factors that can be changed, adapted or used as leverage against which to ensure transformation. Failing to do so, assessment as agent of transformation, may become powerless in providing such indicators of significant factors that are at work in the home, in classrooms and in schools nationwide. In applying Carroll's model of school learning as an established theoretical framework against which to test a multi-level model for purposes of this study, factors may be identified to ensure that transformational goals facilitate the move beyond policy status to those being achieved at both student- and school levels.

The importance of aptitude factors, as measured by parental involvement, student motivation and student engagement in reading has been illustrated. Opportunities for reading at classroom-level are best utilised when emphasis is placed on reading across the curriculum and not only during formally scheduled reading time for the duration of language lessons. The significant effect found for teachers' teaching of reading comprehension skills and strategies provides evidence that such skills are not mastered through incidental learning, but have to be taught as a very specific learning outcome. The timeous introduction of reading comprehension skills and strategies plays an important role, as evidenced by PIRLS 2006 results in South Africa. These results (Howie, Venter, van Staden, Zimmerman, Long, Scherman & Archer, 2009) pointed to the relative late introduction of advanced reading skills and strategies (such as making generalisations, predictions and describing text styles and features) to South African students. Reading comprehension skills and strategies should therefore not only be taught explicitly, but also be introduced at an early age, thereby providing students with the best

opportunity to successfully progress from 'learning to read' in the Foundation Phase to 'reading to learn' in the Intermediate Phase and beyond. In this regard, teachers need to bring about change in not only providing opportunities to learn, but opportunities as early as possible across the curriculum where reading is entrenched in all teaching and learning activities. In placing reading at the centre of all curricular activities, student motivation with increased engagement from parents at home can strengthen and support greater student achievement in reading literacy.

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