International Education Journal, 2006, 7(5), 632-641.
ISSN 1443-1475 © 2006 *Shannon Research Press*.
http://iej.com.au

Using regression analysis to establish the relationship between home environment and reading achievement: A case of Zimbabwe

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In this study, we report results of a study examining the relationship between home environment factors and reading achievement in Zimbabwe. The study utilised data collected by the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ). The data were submitted to linear regression analysis through structural equation modelling using AMOS 4.0. In our results, we showed that a proxy for SES was the strongest predictor of reading achievement.

Zimbabwe, reading achievement, home environment, linear regression, structural equation modelling

INTRODUCTION

Past research has indicated that a significant relationship exists between children's home environment and reading achievement. However, most such studies have been conducted in Western countries where the concept of home environment is different from that in developing countries. In developed countries, almost all students have amenities like electricity and piped water in their homes, and these factors are never thought of being influential in a student's academic performance. In the current study, the home environment factors considered among other factors were: possession of such things like piped water, electricity, refrigerator and TV. Collectively, these possessions were taken to be a measure of social economic status (SES). SES, together with several other factors were used as measures of the students' home environment. The student's score on a reading test was used as a measure of reading achievement. The study utilised a sample of 2697 sixth grade students who were randomly sampled across the schools in Zimbabwe.

Purpose of the study

The purpose of this study was to investigate the relationship among home environment variables and reading scores among Grade 6 students in Zimbabwe. The study is based on the data collected by the Southern and Eastern Africa Consortium for Monitoring Educational Quality (SACMEQ) during the period 1995 – 1998 under the auspices of the International Institute for Educational Planning (UNESCO-IIEP, 2004). The data were collected during the first educational research policy project named SACMEQ I covering seven Southern African countries, and Zimbabwe was

one of the seven countries. Specifically, the current study seeks to answer the following two major questions:

a) What family environment variables are predictive of reading achievement among Grade 6 students in Zimbabwe?

b) How strong are family environment variables at predicting reading scores among Grade 6 students in Zimbabwe?

PREVIOUS RESEARCH AND THEORETICAL FRAMEWORK

There is a considerable body of theoretical and empirical work that suggests that home environment, in general, plays a crucial role in student learning and achievement (Walberg, 1999). Research focusing on home environment variables continues to be of merit, for Parcel and Dufur (2001), in their National Longitudinal Survey of Youth (NLSY), found that parental and material resources in the home (what they termed 'capital effects') were stronger than school effects.

The theoretical mechanisms that may explain the effect of home environment on child outcomes are related and numerous. Social capital theory (Coleman, 1988; Parcel and Dufur, 2001). Thus, social capital and resources at the country or family level, provide students with advantages for being successful at school (Aru, 1998; Bradley and Corwyn, 2002; Heyneman and Loxley, 1982). Such resources also benefit students indirectly through an increased number of cultural opportunities and better health standards (Murphy et al., 1998; Neisser et al., 1996).

A causal mechanism directly discussed in the literature is socio-economic status (SES). It is no longer questioned that low income leads to negative consequences for children (Duncan and Brooks-Gunn, 1997). Children living in poverty face developmental deficits that are most likely due to the inability of high-poverty families to provide adequate food, shelter, and other material goods that foster the healthy cognitive development of children (Duncan, Brooks-Gunn, and Klebanov, 1994; Hanson, McLanahan, and Thomson, 1997; Korenman, Miller, and Sjaastad, 1995). A meta-analysis of 101 related studies (White, 1982) suggested that when home atmosphere or environment was used as an indicator of SES, relatively high correlations were found between SES and academic achievement.

Chui and Khoo (2005) found that 15-year-old students across 41 countries (N = 193,076) scored higher on tests in mathematics, reading, and science when they had more economic resources in their country, family and school. The positive log-linear effect of per capita GDP was consistent with past research showing that students in richer countries benefited from more nutritious food, books in the home, and better health care, all of which, in turn, supported higher academic performance (Alaimo, Olson, and Frongillo, 2001; Murphy et al., 1998; Neisser et al., 1996). Results were consistent with other studies in that girls scored higher in reading but lower in mathematics and science (National Center for Education Statistics, 2003; Third International Mathematics and Science Study Group, 1995).

In general, parent job status and parent education seems to have different effects (Chui and Khoo, 2005). Parents' higher job status and mother's education improved the academic performance of their child. A father's level of schooling, however, did not. These results mirror other studies showing that parents' social networks and mother's schooling affected students' academic performance more than did father's level of schooling (Stafford and Dainton, 1995).

Researchers have not only found that adolescents from lower income and less-educated families performed less well in school, but those from single-parent and large families fared less well in school than their counterparts from higher income, better-educated, two-parent and small families (Astone and McLanahan, 1991; Sputa and Paulson, 1995). Stevenson and Baker (1987) found that the educational level of parents explained more of the variability in school achievement than did

other family demographic characteristics. This might be explained by the theory that caregivers with more 'human capital' had greater education and skills, which they could draw upon to teach their children cognitive and social skills and social and cultural norms (Och, Taylor, Rudolph, and Smith, 1992; Snow, Perlmann, Berko Gleason, and Hooshyar, 1990; Swick and Broadway, 1997). Again, since mothers were the primary caregivers in many homes, their human capital generally affected their children's performances more than did the a father (Darling-Fisher and Tiedje, 1990; Emery and Tuer, 1993; Stafford and Dainton, 1995).

There are factors in the home environment that have all been found to be associated specifically with reading achievement. Not surprisingly, these include financial and material resources (Grissmer et al., 1994; Parcel and Menghan, 1990, 1994a, 1994b; Saracho, 1997a), number of children in the home (Blake, 1989; Coleman, 1988, 1990; Downey, 1995; Parcel and Menghan, 1990, 1994a, 1994b), parent education (Grissmer et al., 1994; Saracho, 1997a), mother's age (Grissmer et al., 1994), and caregiver investment in age-appropriate cognitive stimulation (Leseman and de Jong, 1998; White, 1982). The data are mixed, however, in regards to which home environment variables best predict reading success.

Several studies have demonstrated that increased numbers of children within the family lead to less favorable child outcomes, in general, probably due to resource diffusion (Blake, 1989; Downey, 1995; Parcel and Menaghan, 1990, 1994a, 1994b). Parcel and Menaghan (1993) found that children from larger families had lower levels of reading achievement. Coleman (1988, 1990) argued that even if the bond between caregiver and child was strong, it would not automatically result in improved child outcomes unless the child had access to parental resources.

Researchers at the Rand Institute on Education and Training (Grissmer et al., 1994) found a relationship between children's reading achievement and parent's level of education, family income, and the mother's age. Although parent's education, occupation, and income have been found to be related to children's reading outcomes, some suggest that the actual characteristics of the home literacy environment that was created by the caregiver might be more important (Leseman and de Jong, 1998; White, 1982).

The recent term 'home literacy environment' has generally referred to participation in literacy-related activities relegated to availability of print material and frequency of reading (Leseman and de Jong, 1998). Saracho (1997a) proposed that parent's literacy level and the availability of reading materials worked together as the primary characteristics of the home environment that related to a child's literacy development. Other research has extended the scope of the home literacy environment (Christian, Morrison, and Bryant, 1998; Griffin and Morrison, 1997; Payne, Whitehurst, and Angell, 1994) to include such variables as the age of the child when joint reading began, independent child or caregiver reading, and frequency of behaviours that interfered with reading (for example, television viewing).

A factor often overlooked in research on the home environment is that a child may not live with a parent at all or may live away from them during the school week. Stress theory holds that changes in family organisation or circumstances might cause stress in children's lives (Elder, 1974). Family events may directly increase children's stress because of changes in household composition or changes in residential location. In response to these changes, children would be alienated from or might disengage from the home environment and receive less parental nurturing and socialisation.

Greenstein originally (1954) noted that children with television in the home had higher grade point averages than their counterparts without television in the home, a phenomenon most likely related to socio-economic status. More recent research addressing the relationship between television viewing and achievement has yielded contradictory findings. For example in small-scale studies controlling for IQ, SES and parental education, no relationship has been found

between viewing and achievement (Ritchie, Price, and Roberts, 1997). However, secondary analyses using large-scale data sets have demonstrated that for adolescents, television viewing time is negatively related to achievement, particularly with regard to reading performance (Neuman and Prowda, 1982; Williams, Haertel, Haertel, and Walberg, 1982).

Home environment and reading achievement research has been largely dominated by a focus on early reading acquisition, while research on the relationship between home environments and reading success with preadolescents (Grades 4-6) has been largely overlooked. There are other limitations as well. Clarke and Kurtz-Costes (1997) argued that prior research has failed to examine the relationship between certain home environment variables and achievement of children of poverty. For example, if having a television (and television viewing) does have positive influences on children's developing academic skills, one might expect similar effects to be found in economically-disadvantaged homes where children typically have fewer educational resources available to them, such as books and other literacy materials.

Because of the large numbers of students living in poverty in the world, more data are needed to establish an understanding of the relationship between home environment and reading success, particularly for preadolescent students. Scholars have argued further that researchers should limit their conceptualisation of middle-class White Americans as the norm and should view other ethnic and social class groups only in terms of their deviance from this norm (Ogbu, 1981; Scott-Jones, 1984, 1987; Slaughter and Epps, 1987). This research seeks to examine an economically disadvantaged group as a distinct entity.

METHOD

Participants

This study utilised data collected by SACMEQ during an educational research policy project. The data consisted of 2697 sixth grade students (1329 boys and 1368 girls) who were randomly selected across Zimbabwe as part of a study undertaken during the period 1995 to 1998 to collect data on the conditions of schooling and the quality of education in seven Southern African countries. The mean age of the participants at the time of data collection was about 12 years.

Treatment of the data

The original data obtained from SACMEQ were already treated for missing values and screened for outliers. In the current study, the descriptive statistics for all the variables were examined to make sure they fell within acceptable range and skewness is one such statistic that was carefully looked at. Histograms were obtained for all the variables whose skewness statistic was greater than 1 to have a pictorial view of the distribution of the variables. Only one variable, STAY, was found to be highly skewed and its treatment is described in the section below.

Variables

The dependent variable in this study was READING SCORE and it was measured by a reading test. The independent variables were several home environment variables. These variables that were based on recommendations from previous research were selected for use in this study. Four home environment variables were combined to be a measure of SES. These variables are: (a) Possession of a TV, (b) Possession of a refrigerator, (c) Possession of piped water, and (d) Possession of electricity. Five other variables, (a) Someone makes sure you did homework, (b) Someone helps with homework, (c) Someone asks you to read to him or her, (d) Someone questions on what you read, and (e) Someone looks at school work were combined to form a variable, HOME.

The other variables considered in the present study are: GENDER, READING AT HOME, STAY, MEALS, and BOOKS.

The variable, READING AT HOME, measured whether students did any reading at home. The variable, STAY measured the place where the student stayed during school week and it was originally measured on a 4-point scale with 1 being 'stay with parents, 2 'stay with relatives', 3 'stay in a hostel', and 4 'stay by myself'. However, since the distribution was highly skewed, with more than two thirds choosing category 1, categories 2, 3, and 4 were combined, yielding two categories; 1 'with parents' and 2 'other'. The variable, MEALS, measured the number of times that the students ate breakfast, lunch and supper per week, and BOOKS measured the number of books that the students had at home. Information about the independent variables and how they were measured is provided in Table 1.

Table 1. Summary of the independent variables (student home environment variables) and how they were measured, along with sample means and standard deviation (*n* = 2697)

Variable	Scale	M	SD
Reading Score		25.60	10.05
Gender		1.51	0.50
Boys	1		
Girls	2		
Place the student stays during school week		1.25	0.43
With parents	1		
Other	2		
Reading at home		1.74	0.44
Never	1		
Sometimes	2		
SES (Combined the following)		1.24	0.35
Possession of a TV			
Possession of a refrigerator			
Possession of piped water			
Possession of electricity			
No	1		
Yes	2		
Meals (combined the following)		2.86	0.60
Breakfast			
Lunch			
Supper			
Not at all	1		
1 or 2 times per week	2		
3 or 4 days per week	3		
Everyday	4		
Home (combined the following)		1.26	0.44
Someone makes sure you did homework			
Someone helps with homework			
Someone asks you to read to him/her			
Someone questions on what you read			
Someone looks at school work			
Never	1		
Sometimes	2		
Most of the times	3		
Number of books at home		2.28	1.14

RESULTS

The following section, presents the results of this study. The results are presented according to the research questions asked in this study.

Research question 1: What home environment variables are predictive of reading achievement among Grade 6 students in Zimbabwe?

This question was answered by obtaining the regression weights and the p-values for these weights. In Table 2, the results of the regression analysis are displayed. In the table, the estimated regression weights, standard errors and p-values for all the predictors are given. GENDER was not a significant predictor of reading achievement, ($\beta = 0.03$, $p = 0.13$), so was BOOKS ($\beta = 0.02$, $p = 0.39$). However, STAY ($\beta = -0.13$, $p < 0.00$); SES ($\beta = 0.27$, $p < 0.00$); MEALS ($\beta = 0.11$, $p < 0.00$); HOME($\beta = 0.08$, $p < 0.00$), and READING AT HOME ($\beta = 0.17$, $p < 0.00$) were all significant predictors of reading achievement. The variable STAY had a negative relationship with READING SCORE. This makes sense since this variable was coded as 1- stay with parents and 2 – stay with others. Students who stayed away from parents tended to perform poorly academically.

Table 2. Regression Weights

	Estimate	S.E.	P
Reading score <-- Gender	0.52	0.34	0.13
Reading score <--Stay	-2.90	0.40	0.00
Reading score <-- SES	7.71	0.52	0.00
Reading score <-- Books	0.15	0.17	0.39
Reading score <-- Meals	1.88	0.30	0.00
Reading score <-- Home	1.50	0.34	0.00
Reading score <-- Home reading	3.74	0.44	0.00

Research question 2: How good are family environment variables at predicting reading scores among Grade 6 students in Zimbabwe?

In order to answer this question, we obtained the standardised regression weights of all the variables. The standardised regression weights give the weighted contribution of each predictor to the dependent variable. Using the standardised weights makes sense since the variables are measured in different units. Another advantage of using the standardised regression weights is that these weights can be taken as measures of effect size. The effect sizes provide an indication of the practical importance of each predictor. The larger the standardised regression weight (effect size), is that variable in predicting the dependent variable.

Besides the standardised weights, we also obtained the squared multiple correlation. The squared multiple correlation provides a measure of the contribution of all the predictors taken together. These results are displayed in Table 3. SES was the strongest predictor as indicated by its estimated standardised regression weight, ($\beta = 0.27$, $p < 0.000$). The estimated standardised regression weights show the relative importance of each predictor in the model. Collectively, all the seven predictors account for about 21% of the variance in reading achievement ($R^2 = 0.21$).

Table 3. Standardised Regression Weights

			Estimate
Reading score	<--	Gender	0.03
Reading score	<--	Stay	-0.13
Reading score	<--	SES	0.27
Reading score	<--	Books	0.02
Reading score	<--	Meals	0.11
Reading score	<--	Home	0.08
Reading score	<--	Home reading	0.17

Squared Multiple Correlations Reading score = 0.21

DISCUSSION

The home environment variables considered in this study were GENDER, STAY, READING AT HOME, BOOKS, MEALS, HOME, and SES. The results of these analyses demonstrate that, of these variables, SES – limited here to television, refrigerator, piped water, and electricity possession – was the strongest predictor of reading achievement. This is consistent with previous research that material resources in the home are associated with children's reading achievement (Grissmer et al., 1994; Parcel and Menghan, 1990, 1994a, 1994b; Sarracho, 1997a; White, 1982). In short, these findings mirror other studies that in poorer countries, this decreased financial capital is disadvantageous to children's achievement (Aru, 1998; Bradley and Corwyn, 2002: Heyneman and Loxley, 1982). Previous research also reports that a lack of resources which could provide better health standards (such as piped water), can indirectly affect children's success at school (Duncan, Brooks-Gunn, and Klebanov, 1994; Hanson, McLanahan, and Thomson, 1997; Korenman, Miller, and Sjaastand, 1995; Murphy et al., 1998; Neisser et al., 1996).

The findings revealed a negative relationship between STAY and reading achievement. This is consistent with previous research that students living with parents tend to do better than those who live with people other than their parents. These results may give credence to stress theory (Elder, 1974), concerned with children who are physically removed from parental nurturing and socialisation. The SACMEQ reading study questionnaire did not include information on the number of siblings, so we were unable to confirm findings from previous research (Astone and McLanahan, 1991; Sputa and Paulson, 1995) showing that adolescents from smaller families fare better in reading.

Overall, the contribution of home environment factors considered in this study was about 21 per cent of the variance in reading achievement. That means that home environment factors account for a fifth of the variance in reading achievement. This is an adequate proportion considering the fact that from previous studies, the greatest predictor of reading achievement is prior reading achievement. Although this may seem obvious, it is important to note that most previous studies conducted on reading achievement have been done in Western settings. The implications of the current study can never be over-emphasised. Home environment plays a critical role in influencing reading achievement in schools and SES plays an even greater role in influencing reading achievement. These findings seem to indicate that it does not matter much how SES is measured in the different cultural contexts, the results show that SES is an important predictor of achievement. We know that in Western contexts, SES is measured differently from the way it is measured in this study, but it is still a good predictor of reading achievement.

Considering the fact that more and more students in Zimbabwe are getting orphaned most family structures are being decimated by the AIDS pandemic, the impact of these findings become all too apparent. In this study, we have demonstrated the importance of having students stay with parents during school days. This is very important because parents provide the necessary monitoring that deters children from engaging in mischief and that probably channels their energy into academic pursuits. However, we are aware that this is not the whole story because in Zimbabwe, boarding schools (where students stay away from parents during school days) are some of the best schools in terms of pass rates. So on the surface, these results appear to be a contradiction with reality. However, we also know that there are many other children in Zimbabwean schools who live by themselves either because they are orphans or because they live in make-shift houses close to schools mainly because the schools are far away from their homes and their parents cannot afford boarding fees. These children have no supervision and it is only logical to assume that most of them spend very little time engaging in school work.

The contribution of certain individual predictors like BOOKS at home was surprisingly low, a finding inconsistent with previous research (Saracho, 1997a) and the general theme in the

literature that increased educational resources is an important factor in student achievement (Alaimo, Olson, and Frongillo, 2001; Grissmer et al., 1994; Murphy et al., 1998; Neisser et al., 1996; Parcel and Menghan, 1990, 1994a, 1994b). One would think that the number of books at home would be a significant predictor of reading achievement. Probably part of the reason for the weak contribution of number of books is the way the data were collected. Students were not specifically asked for the number of 'reading books', but the number of books in general. So there is a possibility that students merely indicated any books they had at home even those they would never read. So we viewed this as a limitation of the study. Another limitation of the instrument is that it was not developed to collect accurately data on the home literacy environment, a complex compilation of variables that would include the age of the child when joint reading began, independent child or caregiver reading, and the frequency of behaviours that interferes with reading (Christian, Morrison, and Bryant, 1998; Griffin and Morrison, 1997; Payne, Whitehurst, and Angell, 1994). Such data were not collected by the instrument used, nor was the full range of possible parent-child literacy-related activities considered.

CONCLUSIONS AND RECOMMENDATIONS FOR FUTURE RESEARCH

The instrument used to collect the data used in this study was not specifically developed to collect data on home literacy. Furthermore, of those instruments that were available to measure home literacy environment, they were developed to do so mainly in Western cultures. The home literacy environment for developed nations is completely different from that in less developed nations. As such, developing a culturally appropriate instrument to measure home literacy environment in less developed nations would produce more reliable results. We see this as a possibility for future research. Also, it would be important to include the full range of possible parent-child literacy-related activities if such an instrument was to provide a better picture of the influence of the home literacy environment on reading achievement.

It is also argued that, even within the same country, the use of a home literacy instrument should be considered and used with caution. In most developing nations, the differences between urban-based families and rural or farm-based families are so great that the use of the same home literacy instrument in those different environments may not produce accurate results. For example, most urban-based children are exposed to television, have electricity, and read newspapers among other things. For rural or farm-based children, all these amenities are not even imaginable for them. So the concept of the home literacy environment between the two settings is very different. Because of this, it is also recommended that the home literacy instrument should be appropriate, not only to a country, but also to the local community in which the research study is being conducted.

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