Title: **Influences of early home factors on later achievement in reading, math and science: An analysis of the Swedish data from PIRLS and TIMSS 2011**

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Abstract

The purpose is to investigate the influence from early home background factors on achievement in reading, math and science. The effect of SES on school achievement has in Sweden been shown to be fairly large and stable across studies. However, less is known about what role early educational activities at home and early skills may have on achievement differences found in grade 4. With the TIMSS and PIRLS 2011 study a unique opportunity to investigate this matter in some detail is offered, as pupils in grade 4 have been tested in the three subject domains, and their parents provide information on a wide range of early home activities, early reading and numerical skills and other potential influences from the children's homes. In this paper the data from the Swedish participation has been utilized for analyzing such relationships. A latent variable approach was adopted and the effects of early home factors were investigated in a path analysis, which allowed determination of direct and indirect effects. The results show a somewhat differential pattern of relations for math achievement as compared to science and reading. No gender differences were found in any of the factors that were related to achievement in grade 4, whilst boys were found to have a higher average performance in math and science and girls in reading.

Keywords: Home factors, Early skills, reading- science- and math-achievement, SEM

Introduction

The purpose of this study is to investigate the influence from early home background factors on achievement in reading, math and science. At the time of school start some children can to certain degree already read and count due to learning activities undertaken in the home or elsewhere during the years before school start. To what degree these initial differences are related to gender and home background factors, and to what degree such differences are related to gender and family background differences in achievement in grade 4 is the main focus in this paper.

How such initial differences emerges and continue to influence achievement throughout school and to what degree the formal school system are able to compensate for such inequalities is of the greatest interest for teachers as well as policy makers at various levels.

These issues are also of great academic interest since they are at the core of classical educational issues regarding individual differences, learning and instruction, short- and long term effects of learning activities, differentiation and so forth.

With data from TIMSS and PIRLS 2011 a unique possibility to investigate these issues is available as the study contain not only a home questionnaire with useful information about the pupils home background, early home activities and skills before school start, but also achievement scores in grade 4 from three important school domains, reading, math and science.

Although, it is well argued that causality are impossible to claim from analysis based on cross-sectional studies, structural equation modeling can determine whether a model provide a plausible fit to the data. If so, bases for making empirically-founded theoretical hypotheses and for gathering and testing longitudinal data is obtained. Thus, a theoretically founded cross-sectional model may contribute plausible explanations. The latent path model presented in this study investigates to what extent early educational activities in the home and skills obtained before school start in the numerical and the reading domain, mediates the influence of cultural capital in the home and gender on achievement in reading math and science in grade 4 in Sweden .

Theoretical framework and previous research

A positive relationship between SES and student achievement has been found in many studies and countries over the years (e.g. Coleman et al, 1966; White,1982; Yang 2003; Sirin, 2005), and it is often concluded that SES is the most influential factor at both the individual level and classroom level (e.g. Yang & Gustafsson, 2003; Yang Hansen, 2008;). Parental education is one of the key indicators of cultural capital, a construct that originates from Bourdieu's theories of habitus and capital (Bourdieu 1990, 2002; Bourdieu & Passeron, 1977). Habitus is the working mechanism for cultural reproduction, and refers to a system of shared dispositions that generate perceptions, appreciations and actions such as different kind of activities that are also intended to foster or promote educational skills of various sort. Whereas education is considered to be cultural capital in an institutionalized state, books and other cultural markers are considered as cultural capital in an objectified state. Up to this date numerous of studies have reported a firm relationship between books at home and achievement, as well with parental education (e.g Elley, 1992; Mullis et al 2003; Mullis et al 2007; Mullis et al 2012).

The current study takes its starting point in two earlier studies by Myrberg & Rosén (2008, 2009) where data from the PIRLS 2001 study was used to study the influence from parents' educational background on reading achievement in grade 3 and 4, via books at home, reading activities, and early reading skills. In the Swedish case (Myrberg & Rosén, 2009) about half of the total effect of parents' education was accounted for by the variables in a path model. However, Books at home, Early reading activities and Early reading abilities also contributed explanatory power of their own.

A similar approach has been used in the current paper, although instead of parent's educational level, books at home have been used as indicator home background. Further, more indicators of early home activities that may promote learning in reading, math and science have been utilized, and also more indicators of early reading and numerical skills. Last, but not least, gender has been included in the model in order to investigate to what degree gender differences in achievement are mediated by factors at home before school starts.

A conceptual model of the early home influences on achievement in grade 4 is presented in the figure below.

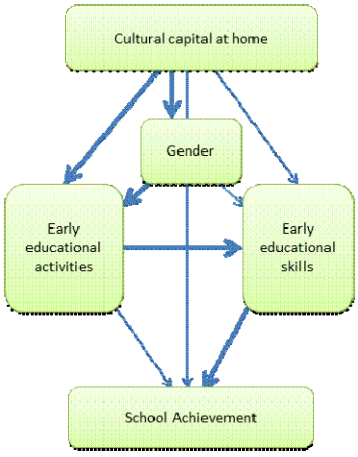

Figure 1. A conceptual model of early influences of home and gender on achievement in school

Method

We have used the Swedish grade 4-data from TIMSS and PIRLS 2011 and the analysis is primarily based on information from the home questionnaire along with the achievement variables from TIMSS and PIRLS (Mullis, Martin; Foy, Arora, & Stanco, 2013). The sample consisted of 4488 pupils. A structural equation modeling approach was used to first fit measurement models for books at home, different kind of early home activities and skills, and then include those in a path analysis to investigate their direct and indirect effects on reading, math and science achievement in grade 4.

Three questions about number of books at home were used as indicators of the family's cultural capital. The parents have responded to questions about number of books at home, and number of childrens' books at home, and the pupils have also responded to a question. From theses the latent factor *Books* was identified.

Used as indicators of early home educational activities were the 15 items in the home questionnaire that followed the stem question "Before your child began primary/elementary school, how often did you or someone else in your home do the following activities with him or her". A nested latent variable model with three latent variables, one general and two nested latent variables fitted the data quite well. The nested measurement model for early home educational activities contained three latent variables, a *General Activities* variable on which every activity item loaded, a nested *Reading Activities* variable on which items referring to early reading, singing and talking activities loaded, and finally a nested *Game Activities* variable with loading on the three items that asks about game activities that involved blocks, shapes, boards or cards.

Used as indicators of skills before school start were five questions about the child's ability to do certain early reading and writing tasks, and six items about the child's ability to perform certain numerical tasks. Two correlated latent variables were fitted to these items, labeled *Early Reading skills* and *Early Numeral skills.*

Descriptive statistics for the selected indicator variables are presented in table 1, and the correlation matrix for the used manifest variables is available in appendix 2.

Table 1. Means, Standard Deviations and Range for all manifest variables used as indicators in the path model.

Manifest variables	M	SD	Range	N
Books at home				
Hq 14. Number of books at home (0->200)	3.77	1.19	1-5	3950
Hq 15. Number of Childrens books at home (0->100)	3.76	1.12	1-5	3950
Stq G4. Number of books at home (0->200)	3.25	1.14	1-5	4380
Hq 2. Early home educational activities (Often, Sometimes, Never)				
A. Read books	2.67	0.51	1-3	3963
B. Tell stories	2.30	0.64	1-3	3957
C. Sing songs	2.38	0.67	1-3	3951
D. Play alphabet	1.95	0.66	1-3	3951
E. Talk what had done	2.78	0.44	1-3	3954
F. Book discussion	2.28	0.62	1-3	3953
G. Play word games	1.96	0.65	1-3	3938
H. Write letters words	2.36	0.61	1-3	3945
I. Read aloud signs	2.28	0.65	1-3	3951
J. Counting songs	1.90	0.70	1-3	3951
K. Number toys	1.82	0.67	1-3	3949
L. Count things	2.48	0.57	1-3	3936

M. Game with shapes	2.32	0.64	1-3	3940
N. Building blocks	2.47	0.62	1-3	3952
O. Board or card game	2.33	0.59	1-3	3950
Hq 6&7. Early reading and numerical tasks before school ?(Not at all, Not very well, Moderately well, Very well)				
6A. Recognize most of the letters of the alphabet	3.42	0.69	1-4	3955
6B. Read some words	3.08	0.89	1-4	3946
6C. Read sentences	2.45	1.01	1-4	3938
6D. Write letters of the alphabet	3.18	0.75	1-4	3943
6E. Write some words	2.92	0.86	1-4	3945
7A. Count by himself/herself	3.50	0.65	1-4	3904
7B. Recognize different shapes	3.25	0.73	1-4	3906
7C. Recognize the written numbers from 1–10	3.82	0.52	1-4	3919
7D. Write the numbers from 1–10	3.66	0.71	1-4	3780
7E. Do simple addition (No, yes)	1.84	0.37	1-2	3896
7F. Do simple subtraction (No, Yes)	1.64	0.48	1-2	3864
Achievement in grade 4				
Reading (pv1)	542	64	265-784	4488
Math (pv1)	505	66	258-756	4488
Science (pv1)	535	74	240-773	4488

Hq=Home questionnaire (parents informants), Stq=Student questionnaire (pupil informants)

The achievement scores in reading, math and science in grade 4 was used as dependent variables only in the path model, although correlated with each other.

Results and discussion

The path model of early home influences is presented in figure 2. The model combines the latent variables from three measurement models. Books is a latent variables indicated by three questionnaire items that informs about the amount of books at home, which in turn is regarded as an indicator of the cultural capital of the home. Gender is a dummy-coded variable, where girls have been given the code of 0 and boys the code of 1. Positive relations with gender thus indicate a higher value for boys, and vice versa. There is small but significant negative correlation between books and gender, which seem to be due to somewhat more childrens' books in the homes of girls.

The path-model in figure 2, joins latent variables from four measurement models with the main explanatory paths that were described in the conceptual model described above. The main path starts with Books and Gender, from which the path goes on to early activities.

The three activities factors are based on 12 indicators from the home questionnaire in a nested factor model. The General Activity factor (Gen Act) is influencing all the manifest early home activities items. One residual factor labeled Early Reading Activity (Read Act) takes care of the remaining correlation between the by the reading activities, and another residual factor, labeled Early Game Actitivty factor (Game Act), has been introduced to take care of the remaining correlations between the items that refers to various game-play activities. The measurement model for these early activities items showed an acceptable fit.

The activities factors is assumed to influence the early reading and numerial skills of the pre-school child, measured by two latent variables, Early Read and Early Num. These factors, in turn, are identified from the 11 items in the home questionnaire that indicates how well the child could

perform various reading and mathematical tasks before school start. This oblique 2 factor model also obtained an acceptable fit.

The last path in the model goes from early skills to achievement in reading, math and science in grade 4.

The two early skills variables are based on two and three indicators respectively. Books and Gender are used as independent variables. The main path is illustrated by the bold arrows in the figure below although direct and indirect effects are estimated for all possible relations. Standardized model results are available in appendix 1, whilst the model fit indices for the full path model are Chi-2= 1556.780, Df=274, CFI=0.952, TLI=0.939, RMSEA=0.032.

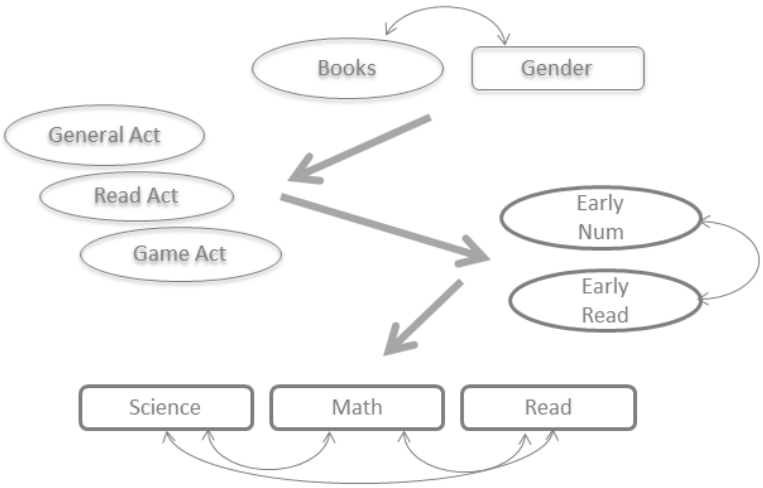

Figure 2. A structural equation model with direct and indirect effects of Books and Gender on Reading-, Math- and Science Achievement.

In the two following tables, table 2 and table 3, the summarized effects of Gender and Books on grade 4 Achievement in Reading, Math and Science is presented.

Table 2. Standardized Indirect, Direct and Total effects of Gender on Reading-, Math- and Science achievement in grade 4.(Girls=0, Boys=1)

	Reading Ach	Math Ach	Science Ach
Total direct effect	-0.040*	0.097***	0.082***
Total indirect effect	-0.041***	-0.029***	-0.026**
Total effect	-0.081***	0.068***	0.056**

*P<.05, **P<.01, ***P<.001

The table above show that the total effect of Gender on Reading in path model amount to -.081 (p<0.000), which indicates a small advantage for girls. About about half of this difference is due to the mediating factors in the model.

The total effect of Gender on Math is slightly lower .068 to the advantage of boys. However, the direct effect amounts to 0.097 which indicates that the mediating factors before school seem to have reduced girls relative disadvantage with respect to math achievement in grade 4.

A similar gender pattern can be observed for the Science achievement factor, were the total effect of Gender amounts to 0.056 (p<0.01), whereas the direct effect is larger .082 to the boys advantage, the indirect effect is negative -.026, which again indicates that the mediating factors contributes to reduce the difference to boys advantage in grade 4 science achievement.

Worth noticing is that the total direct effect from gender is much higher for math and science, than the total direct effect from gender effect on reading. This indicates that if there are factors that mediate gender differences in math and science before school, these remains to be identified.

The results of the path model of books on the three achievement variables are summarized in table 3.

Table 3. Standardized Indirect, Direct and Total effects of Books on Reading-, Math- and Science achievement in grade 4.

	Reading Ach	Math Ach	Science Ach
Total direct	0.306***	0.363***	0.410***
Total indirect effect	0.147***	0.058**	0.089***
Total effect	0.453***	0.421***	0.499***

*P<.05, **P<.01, ***P<.001

The total direct effect and indirect effects of Books on Reading amounts to .453 (p<0.000), which squared accounts for about 20 % of the variance in Reading Achievement in grade 4, which is twice as much as parental education usually account for. About 32% of this effect is mediated by the factors in the path model. A closer review of which the mediating factors are that contribute this indirect effect reveals that the main significant contributions comes via the Reading Activity factor (0.108, p=0.000) and to a lesser degree via General Activity through the Early Reading Skill factor (0.019, p=0.000)

The total effect of Books on Math achievement is .421 (p<0.000) which is similar to the effect on Reading achievement. Almost 18 % of the variance in Math is accounted for by the factors in the model. However, only 14 % of the effect was due to mediating factors. Three small but significant indirect effects were found; one via Early Math Skill (0.018, p<0.007), one via General Activity through the Early Reading Skill (0.013, p<0.000), and one via General Activity through the Early Math Skill (0.012, p<0.000).

The largest total effect of the model is found on Science Achievement, where the total direct effect and indirect effects amounts to .499 (p<0.000). About 25% of the variance in Science achievement in grade 4 is accounted for by this path model. However, the total indirect effect accounts for 18% of the total effect, which is similar with the total indirect effects on Reading and Math Achievement. The main part of this indirect effect comes from the Reading Activity factor (0.058, p<0.001), and lesser but significant via General Activity through the Early Reading Skill factor (0.016, p=0.000). The next table, table 4, shows the remaining unique contribution on achievement of each latent factor in the model after Books, Gender and successively preceding factors has been taken into account.

Table 4. Remaining Standardized Indirect, Direct and Total effects of the mediating factors controlling for Books and Gender on Reading-, Math- and Science achievement in grade 4.

	Reading Ach			Math Ach			Science Ach		
Effects of Books via	Direct	Indirect	Total	Direct	Indirect	Total	Direct	Indirect	Total
General activities	-0.021	0.102***	0.008***	-0.026	0.112***	0.086***	-0.046*	0.089***	0.042*
Reading Activities	0.197***	0.008	0.205***	0.013	0.012	0.025	0.106***	0.007	0.113***

Game Activities	-0.017	-0.017**	-0.034*	-0.009	-0.016	-0.025	0.014	-0.015**	-0.001
Early reading skills	0.230***	0.000	0.230***	0.163***	0.000	0.163***	0.194***	0.000	0.194***
Early numerical skills	0.057	0.000	0.057	0.163***	0.000	0.163***	0.057	0.000	0.057

*P<.05, **P<.01, ***P<.001

The General Activities factor appears to contribute small positive indirect effects on all three achievement scores when Books and Gender are accounted for.

Early Reading Activities have according to the table above, an additional positive direct effect on both Reading Achievement and Science Achievement.

Early Game Activities appears to contribute with small negative effects on achievement when Books and Gender are accounted for.

A unique effect from Early Reading Skills can be observed on all three achievement scores, which indicates that cultural capital indicated by books and early activities are not sufficient explanatory factors for the effects of this factor.

Conclusions

In this study we aimed to investigate the influences of early home factors and gender on achievement in reading, math and science in a latent pathmodel which included a number of mediating factors of early educational activities together early reading and numerical skills. A latent variable *Books,* based on different information about number of books at home, were used to represent the cultural capital of the home. The path model investigated the direct and indirect effects of Books and Gender on achievement in grade 4 through the mediating variables General Activities, Reading Activities and Game Activities, and Early Reading Skills and Early Numerical skills before school start.

About half of the effects of gender on reading achievement were due to the indirect effects by the mediating factors. A somewhat smaller part of the gender effect on math and science were accounted for by the mediating variables in the model. This result indicates that there may be other factors than those that mediated reading achievement that mediates gender differences in math and science. Parental expectations and values may constitute such mediating variables. Another possibility is that gender differences in these domains do not emerge until after school start.

Differences in achievement due to the families cultural capital was mainly mediated by early reading activities and early reading skills, and for math the effect were also mediated by early numerical skills. However, these three factors also contributed a unique effect on achievement after Books and Gender had been accounted for. These results also suggest that there may be mediating factors missing in the model.

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Appendix 1. Model results. Standardized solution of the path model

	Estimate	S.E.	Est./S.E.	Two-Tailed P-Value
GENDER BY				
SEX	1.000	0.000	999.000	999.000
BOOKS BY				
NBOOKC	0.666	0.014	48.759	0.000
NBOOKP	0.838	0.011	74.661	0.000
NBOOKCP	0.785	0.011	68.919	0.000
GENACT BY				
RDREAD	0.335	0.019	17.588	0.000
RDSONG	0.348	0.020	17.803	0.000
RDPALPH	0.607	0.016	37.752	0.000
RDWDGAME	0.683	0.014	50.349	0.000
RDWRWORD	0.603	0.016	36.649	0.000
RDSIGN	0.569	0.017	33.219	0.000
MASONG	0.589	0.015	38.824	0.000
MANUMTOY	0.632	0.014	45.414	0.000
MACOUNT	0.615	0.016	38.935	0.000
MASHAPES	0.515	0.018	28.647	0.000
MABLOCK	0.371	0.020	18.343	0.000
MABOARD	0.422	0.020	20.910	0.000
RTALK	0.571	0.015	37.434	0.000
READACT BY				
RDREAD	0.611	0.030	20.129	0.000
RDSONG	0.254	0.026	9.752	0.000
RTALK	0.308	0.023	13.271	0.000
GAMEACT BY				
MASHAPES	0.178	0.050	3.553	0.000
MABLOCK	1.228	0.296	4.153	0.000
MABOARD	0.062	0.031	1.997	0.046
EARLYRD BY				
SRDSENT	0.824	0.007	120.220	0.000
SRLETT	0.721	0.020	36.940	0.000
SRWORD	0.981	0.005	216.331	0.000
EARLYMA BY				
SMACOUNT	0.735	0.015	48.093	0.000
SMASHAPE	0.570	0.020	28.067	0.000
SRLETT	0.168	0.023	7.263	0.000
SMARITH	0.620	0.017	35.544	0.000
SMNUM	0.701	0.017	40.802	0.000
READ BY				
RDPV1	1.000	0.000	999.000	999.000
MATH BY				
MAPV1	1.000	0.000	999.000	999.000
SCIENCE BY				
SCPV1	1.000	0.000	999.000	999.000
GENACT ON				
GENDER	-0.085	0.023	-3.722	0.000
BOOKS	0.222	0.023	9.740	0.000
READACT ON				
GENDER	0.009	0.028	0.331	0.741
BOOKS	0.549	0.029	18.700	0.000
GAMEACT ON				
GENDER	0.233	0.056	4.134	0.000
BOOKS	0.090	0.031	2.849	0.004
EARLYRD ON				
GENDER	-0.130	0.023	-5.684	0.000
BOOKS	0.058	0.032	1.849	0.064
GENACT	0.364	0.024	14.903	0.000
READACT	0.021	0.040	0.518	0.604

GAMEACT	-0.066	0.027	-2.463	0.014
EARLYMA ON				
GENDER	0.033	0.026	1.272	0.204
BOOKS	0.111	0.038	2.961	0.003
GENACT	0.319	0.029	11.122	0.000
READACT	0.050	0.045	1.122	0.262
GAMEACT	-0.030	0.022	-1.385	0.166
READ ON				
GENDER	-0.040	0.018	-2.211	0.027
BOOKS	0.306	0.028	10.910	0.000
GENACT	-0.021	0.022	-0.948	0.343
READACT	0.197	0.033	5.906	0.000
GAMEACT	-0.017	0.014	-1.270	0.204
EARLYRD	0.230	0.028	8.360	0.000
EARLYMA	0.057	0.034	1.703	0.089
MATH ON				
GENDER	0.097	0.018	5.459	0.000
BOOKS	0.363	0.027	13.683	0.000
GENACT	-0.026	0.023	-1.115	0.265
READACT	0.013	0.032	0.401	0.689
GAMEACT	-0.009	0.013	-0.668	0.504
EARLYRD	0.163	0.027	5.967	0.000
EARLYMA	0.165	0.031	5.399	0.000
SCIENCE ON				
GENDER	0.082	0.018	4.529	0.000
BOOKS	0.410	0.026	15.985	0.000
GENACT	-0.046	0.023	-1.998	0.046
READACT	0.106	0.032	3.310	0.001
GAMEACT	0.014	0.014	0.996	0.319
EARLYRD	0.194	0.026	7.530	0.000
EARLYMA	0.057	0.032	1.800	0.072
READACT WITH				
GENACT	0.000	0.000	999.000	999.000
GAMEACT WITH				
GENACT	0.000	0.000	999.000	999.000
READACT	0.000	0.000	999.000	999.000
EARLYRD WITH				
GENACT	0.000	0.000	999.000	999.000
READACT	0.000	0.000	999.000	999.000
GAMEACT	0.000	0.000	999.000	999.000
EARLYMA WITH				
GENACT	0.000	0.000	999.000	999.000
READACT	0.000	0.000	999.000	999.000
GAMEACT	0.000	0.000	999.000	999.000
EARLYRD	0.590	0.021	28.022	0.000
READ WITH				
GENACT	0.000	0.000	999.000	999.000
READACT	0.000	0.000	999.000	999.000
GAMEACT	0.000	0.000	999.000	999.000
EARLYRD	0.000	0.000	999.000	999.000
EARLYMA	0.000	0.000	999.000	999.000
MATH WITH				
GENACT	0.000	0.000	999.000	999.000
READACT	0.000	0.000	999.000	999.000
GAMEACT	0.000	0.000	999.000	999.000
EARLYRD	0.000	0.000	999.000	999.000
EARLYMA	0.000	0.000	999.000	999.000
READ	0.480	0.016	30.428	0.000
SCIENCE WITH				
GENACT	0.000	0.000	999.000	999.000
READACT	0.000	0.000	999.000	999.000
GAMEACT	0.000	0.000	999.000	999.000
EARLYRD	0.000	0.000	999.000	999.000
EARLYMA	0.000	0.000	999.000	999.000
READ	0.526	0.014	37.405	0.000
MATH	0.731	0.009	79.582	0.000

BOOKS WITH				
GENDER	-0.057	0.020	-2.853	0.004
RDSIGN WITH				
RDWRWORD	0.185	0.023	8.079	0.000
MASONG WITH				
RDSONG	0.215	0.021	10.499	0.000
MANUMTOY WITH				
RDPALPH	0.409	0.021	19.529	0.000
MASONG	0.174	0.020	8.830	0.000
MACOUNT WITH				
RDWDGAME	-0.108	0.026	-4.148	0.000
Intercepts				
RDPV1	8.410	0.121	69.262	0.000
MAPV1	7.655	0.100	76.209	0.000
SCPV1	7.272	0.106	68.520	0.000
NBOOKC	2.847	0.034	83.124	0.000
NBOOKP	3.097	0.045	68.128	0.000
NBOOKCP	3.292	0.049	67.715	0.000
RDREAD	5.197	0.085	61.427	0.000
RDSONG	3.554	0.051	69.471	0.000
RDPALPH	2.962	0.039	76.246	0.000
RDWDGAME	2.988	0.040	75.114	0.000
RDWRWORD	3.857	0.054	71.484	0.000
RDSIGN	3.475	0.050	69.270	0.000
MASONG	2.705	0.032	83.549	0.000
MANUMTOY	2.713	0.033	83.062	0.000
MACOUNT	4.308	0.061	70.469	0.000
MASHAPES	3.611	0.056	64.245	0.000
MABLOCK	3.955	0.059	67.046	0.000
MABOARD	3.917	0.054	72.634	0.000
SRDSENT	2.416	0.031	78.593	0.000
SMACOUNT	5.353	0.095	56.607	0.000
SMASHAPE	4.412	0.067	65.469	0.000
RTALK	5.865	0.086	68.292	0.000
SRLETT	4.999	0.083	60.354	0.000
SRWORD	3.634	0.059	61.726	0.000
SMARITH	4.568	0.077	59.181	0.000
SMNUM	6.523	0.207	31.463	0.000
SEX	1.023	0.019	53.176	0.000
Variances				
GENDER	1.000	0.000	999.000	999.000
BOOKS	1.000	0.000	999.000	999.000
Residual Variances				
RDPV1	0.000	999.000	999.000	999.000
MAPV1	0.000	999.000	999.000	999.000
SCPV1	0.000	999.000	999.000	999.000
NBOOKC	0.556	0.018	30.545	0.000
NBOOKP	0.298	0.019	15.813	0.000
NBOOKCP	0.384	0.018	21.438	0.000
RDREAD	0.464	0.035	13.094	0.000
RDSONG	0.793	0.017	46.525	0.000
RDPALPH	0.632	0.019	32.426	0.000
RDWDGAME	0.534	0.019	28.828	0.000
RDWRWORD	0.637	0.020	32.114	0.000
RDSIGN	0.676	0.020	34.667	0.000
MASONG	0.653	0.018	36.532	0.000
MANUMTOY	0.600	0.018	34.067	0.000
MACOUNT	0.621	0.019	31.941	0.000
MASHAPES	0.703	0.026	27.562	0.000
MABLOCK	-0.644	999.000	999.000	999.000
MABOARD	0.818	0.017	47.738	0.000
SRDSENT	0.322	0.011	28.507	0.000
SMACOUNT	0.461	0.022	20.526	0.000
SMASHAPE	0.675	0.023	29.210	0.000
RTALK	0.536	0.019	28.802	0.000
SRLETT	0.297	0.013	23.434	0.000
SRWORD	0.037	0.009	4.116	0.000
SMARITH	0.615	0.022	28.418	0.000
SMNUM	0.509	0.024	21.114	0.000

SEX	0.000	999.000	999.000	999.000
GENACT	0.942	0.011	88.773	0.000
READACT	0.699	0.032	21.650	0.000
GAMEACT	0.940	0.030	31.484	0.000
EARLYRD	0.816	0.018	44.456	0.000
EARLYMA	0.859	0.020	42.952	0.000
READ	0.688	0.017	40.019	0.000
MATH	0.742	0.016	45.043	0.000
SCIENCE	0.696	0.016	42.788	0.000

Appendix 2. Correlations among manifest variables

		v1	v2	v3	v4	v5	v6	v7	v8	v9	v10	v11	v12	v13	v14	v15	v16	v17	v18	v19	v20	v21	v22	v23	v24	v25	v26	v27
v1	RDPV1	1.00																										
v2	MAPV1	0.60	1.00																									
v3	SCPV1	0.66	0.80	1.00																								
v4	NBOOKC	0.35	0.33	0.37	1.00																							
v5	NBOOKP	0.36	0.32	0.39	0.58	1.00																						
v6	NBOOKCP	0.36	0.32	0.39	0.49	0.66	1.00																					
v7	RDREAD	0.31	0.22	0.28	0.26	0.32	0.38	1.00																				
v8	RDSONG	0.13	0.06	0.10	0.13	0.15	0.22	0.30	1.00																			
v9	RDPALPH	0.06	0.06	0.04	0.06	0.08	0.09	0.22	0.21	1.00																		
v10	RDWDGAM	0.13	0.11	0.11	0.11	0.15	0.13	0.25	0.28	0.48	1.00																	
v11	RDWRWO	0.15	0.12	0.09	0.06	0.03	0.08	0.27	0.22	0.37	0.39	1.00																
v12	RDSIGN	0.18	0.15	0.15	0.13	0.15	0.13	0.27	0.18	0.31	0.35	0.47	1.00															
v13	MASONG	0.05	0.06	0.06	0.07	0.10	0.11	0.22	0.37	0.38	0.46	0.33	0.36	1.00														
v14	MANUMT(	0.04	0.06	0.02	0.05	0.05	0.05	0.19	0.21	0.64	0.47	0.36	0.35	0.49	1.00													
v15	MACOUNT	0.13	0.13	0.12	0.13	0.15	0.16	0.28	0.25	0.31	0.36	0.38	0.40	0.36	0.39	1.00												
v16	MASHAPES	0.10	0.09	0.07	0.12	0.10	0.12	0.24	0.21	0.35	0.29	0.28	0.25	0.27	0.37	0.34	1.00											
v17	MABLOCK	0.06	0.10	0.12	0.10	0.14	0.16	0.22	0.16	0.27	0.21	0.14	0.18	0.18	0.26	0.29	0.41	1.00										
v18	MABOARD	0.14	0.14	0.10	0.11	0.13	0.15	0.23	0.18	0.21	0.26	0.28	0.23	0.20	0.24	0.23	0.36	0.25	1.00									
v19	SRDSENT	0.29	0.24	0.22	0.12	0.05	0.05	0.14	0.06	0.20	0.20	0.35	0.26	0.10	0.18	0.12	0.10	0.00	0.15	1.00								
v20	SMACOUN	0.20	0.24	0.19	0.13	0.10	0.15	0.18	0.12	0.11	0.13	0.23	0.19	0.10	0.11	0.17	0.12	0.08	0.13	0.40	1.00							
v21	SMASHAPE	0.25	0.27	0.27	0.19	0.18	0.23	0.17	0.09	0.11	0.14	0.17	0.16	0.08	0.10	0.17	0.13	0.11	0.13	0.32	0.42	1.00						
v22	RTALK	0.23	0.16	0.18	0.17	0.24	0.22	0.43	0.33	0.34	0.45	0.33	0.38	0.37	0.34	0.37	0.33	0.28	0.28	0.16	0.13	0.17	1.00					
v23	SRLETT	0.30	0.28	0.26	0.14	0.10	0.15	0.22	0.14	0.22	0.22	0.44	0.29	0.16	0.19	0.23	0.18	0.05	0.19	0.67	0.46	0.36	0.19	1.00				
v24	SRWORD	0.33	0.29	0.26	0.14	0.11	0.13	0.21	0.12	0.22	0.22	0.42	0.31	0.14	0.20	0.21	0.16	0.03	0.20	0.81	0.45	0.35	0.20	0.81	1.00			
v25	SMARITH	0.18	0.23	0.14	0.08	0.06	0.09	0.10	0.08	0.13	0.16	0.21	0.18	0.09	0.13	0.16	0.10	0.07	0.14	0.36	0.44	0.35	0.14	0.37	0.40	1.00		
v26	SMNUM	0.15	0.18	0.13	0.07	0.05	0.06	0.13	0.06	0.11	0.11	0.24	0.18	0.05	0.11	0.13	0.11	0.06	0.12	0.36	0.53	0.39	0.12	0.46	0.44	0.44	1.00	
v27	SEX	-0.11	0.04	0.03	-0.08	-0.02	-0.06	-0.03	-0.13	-0.04	-0.07	-0.16	-0.02	-0.07	-0.03	0.00	-0.05	0.24	-0.06	-0.13	0.03	-0.01	-0.04	-0.20	-0.18	0.02	-0.04	1.00