HOW FAMILY BACKGROUND INFLUENCES STUDENT ACHIEVEMENT

Barbara Neža Brečko
Educational Research Institute, Slovenija

Abstract

A key goal of education is to ensure that every student has a chance to excel, both in school and in life. Increasingly, children's success in school determines their success as adults, determining whether and where they go to college, what professions they enter and how much they can earn. School performance in primary and secondary school does not depend on a student's mental and physical abilities alone, other factors also have an important role. Studies carried out in a wide variety of countries demonstrate that social and family background greatly influence school performance. In the study I try to establish whether there is significant correlation between social / family background and a student's school performance. Furthermore, I focus on how a student is upbringing influences the association between school performance and family and social background. In the paper I examine three populations of Slovene students – third/fourth graders and seventh/eighth graders in primary school, and students in the final year of secondary school. Using the cluster method, all three populations were assigned to five different groups according to their achievement score on mathematics and science tests. The data used for the analysis was gathered in 1995 within the international study TIMSS 1995.

INTRODUCTION

Many researchers and scientists agree that success at school is associated with social background factors (e.g., Giddens, 1997), as these factors can greatly affect young children's cognitive skills. Disadvantaged children (children with poor social background) start schooling with significantly lower cognitive skills than their more advantaged peers.

Among the main aims of schooling are: to **equally** enable all students' personal

development according to their abilities and stage of development (by balancing their cognitive, emotional and social development); to convey to them the basic knowledge and skills that will allow an independent, efficient and creative confrontation with the social and natural environment; to develop their awareness of belonging to a specific cultural tradition.

Since public school is the institution where students are (supposed to be) considered equal, regardless of their social background, it is expected that factors related to social and family background should be less associated to a student's performance as he/she progresses to higher grades.

In this paper I try to establish, whether there is a correlation between the students' social and family background and his/her school performance. I also examine if and how moving to a higher grade influences the correlation between achievement and family and social background. In the article I investigate with three populations of Slovene students – fourth graders and eighth graders in primary school, and students in the final year of secondary school.

The data used for the analysis was gathered in 1995 within the international study TIMSS 1995 (Third International Mathematics and Science Study) in which Slovenia also participated. The overall aim of TIMSS was to contribute to the improvement of teaching and learning mathematics and science in educational systems around the world. TIMSS tested students in mathematics and science and also collected contextual data from students, teachers and the principals of their schools.

Student questionnaires included some questions related (partly) to students' family and social background. These were the questions about mother's and father's education (fourth graders were not asked that question), number of books at home, some family and personal possessions, the size of a household, etc. At this point it is important to note that the TIMSS questionnaires are not too detailed regarding social background, but yet enough to make some general conclusions.

In all student responses (especially younger population) we have to take into consideration the possibility of errors (not intentional wrong answers) – we take these errors as one of nonmeasurable probability error and not as a systematic bias.

METHOD

Data from 1995 was selected because to measure and compare background factors' influence on students' performance, it was desirable to have several different populations. Data from 1995 was the most suitable since in that year three populations were tested. Those were: population 1 – students aged 9 years (n = 2566), population 2, students aged 13 years (n = 2708), and students in the final year of secondary school – population 3 (n = 3372). Analyses were done on weighted data.

The data analyzed was derived from students' background questionnaires, where students were (among other things) asked about family and social background. For the analysis of social background the variables indicating social and family background were used, and to study school performance, achievement scores (plausible values for science and math) were used. Population 3 was a bit more

complex to analyze, because students took different performance tests (according to the schooling program).

Student performance was examined using cluster analysis, and so students were grouped according to their achievement score in mathematics and science tests.

Because of the large samples the nonhierarchical method of K-means was used. This procedure attempts to identify relatively homogeneous groups based on selected characteristics, using an algorithm that can handle large numbers of cases.

Each population was clustered separately. Since achievement tests for population 3 were divided according to the schooling program, that population was clustered in several steps. Population 3 was divided into three sub-populations and each was clustered separately.

Clustering with K-means resulted in five homogenous groups of students in each population.

The first group was named "not successful" – these students achieved scores much below average. The second group was named "less successful"; these students still performed below average, yet higher than the first group. The third group was named "average" – as the name tells, those were students with average scores on tests. The fourth group was successful, i.e., they achieved better results than average, but they were not as successful as the fifth group, "very successful".

Correct classification was confirmed by regression analysis where R^2(pop1)=0.879, R^2(pop2)=0.915 and R^2(pop3 (1))= 0.838, R^2 (pop3 (2))=0.888, R2 (pop3 (3))=0.869.

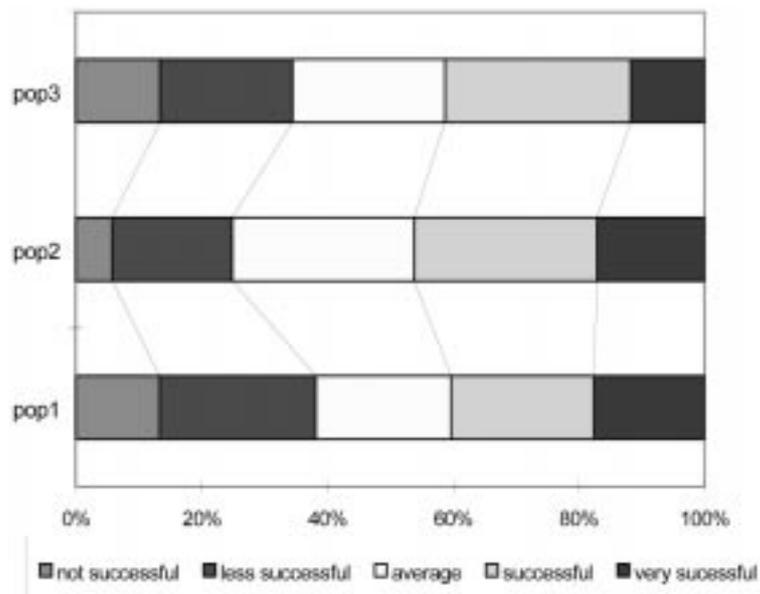*Figure 1: Groups of students in all three populations*

Figure 1 shows the distribution of students, according to their success in each population – the highest percentage of very successful students is in the fourth grade (17.6%) and the lowest in final year of secondary school (11.7%). The percentage of not successful students is the lowest in population 2 (5.8%), in population 1 and population 3 the percentage of not successful students is the same (13.3%).

Home environment

How important is the origin of a student in his/her school performance?

Since knowing and understanding the language of a test is an important factor in relation to how successful the student would be, it was supposed that students not born in the country, or not speaking the Slovene language at home, would achieve lower results at the beginning of schooling.

Figures 2, 3 and 4 show differences between two groups of students (born in country and not born in country) according to their school performance.

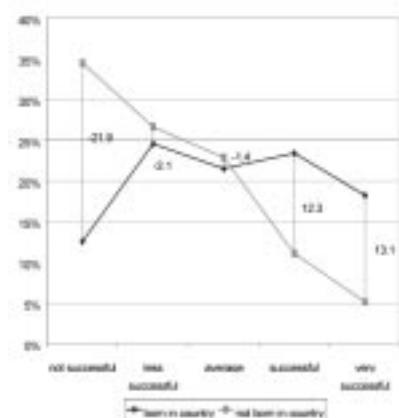*Figure 2: Fourth grade*   *Figure 3: Eighth grade*
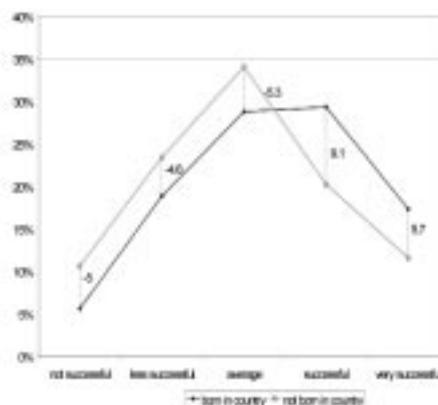

Figure 2 reveals large differences between the two groups of students in the fourth grade. In the fourth grade 96.1% students were born in the country. Students born in the county are more successful - there are 12.5% not successful students in that group in contrast to 34% not successful students in the group of those who were not born in the country. The differences between groups are statistically significant. (χ^2 = 46.907; df = 4; sig = 0.000). In the eighth grade (Figure 3) we still observe differences between the two groups but as seen from the figure, the differences tend to be lower. Still students born in Slovenia achieved better results and the differences between the two groups are significant (χ^2 = 24.008; df = 4; sig = 0.000). In the eighth grade there were 96.7% students born in the country.
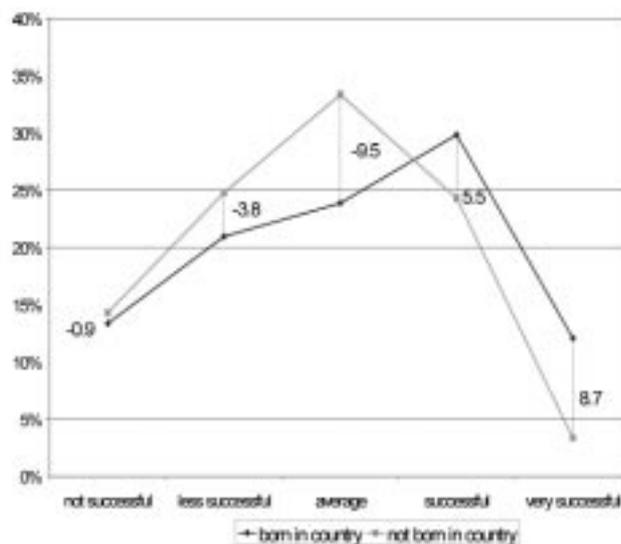
Figure 4: Final year of secondary school

Figure 4 shows differences between the two groups in the final year of secondary school. There were 95.7% students born in the country. The picture shows smaller differences in achievement regarding the place of birth. The differences between the two groups of students are smallest in the category of not successful, but still large in the category of average (-9.5) and very successful (8.7). Differences between groups of students, which are the most obvious in the fourth grade, are much smaller (but still significant) in the eighth grade, and also small (but still significant) in secondary school.

When speaking of cultural and home background we must also analyze the data referring to the language spoken at home.

Correlation of language spoken at home and success at school was described by Bernstein (1971), who claims that a child who does not know the formal language has to learn it at school, so he/she first has to focus on understanding the language that the teacher speaks before he can learn the subject.

All three populations were asked how often they speak Slovene at home. The majority of students reported always or almost always speaking Slovene at home (92.9%), 5.7% reported speaking Slovene at home sometimes, 1.8% of students reported never speaking Slovene at home.

Of course, language spoken at home is correlated with mother's and father's place of birth. If parents are not born in the country, it is more likely that students will speak other languages at home.

We observe that the variables language and belonging to the group are negatively correlated. Students who usually speak Slovene at home generally achieved better

results in mathematics and science tests than students who rarely or never speak Slovene at home. All correlations are quite low, but again they are the highest in the fourth grade (r=-0.181), lower in the eighth grade (r=- 0.125) and the lowest in the final year of secondary school (r=-0.109). All correlations are significant at the 0.01 level.

In the fourth grade there were 79% of students whose parents were born in the country, 3.8% whose mother was not born in the county, 5.6% whose father was not born in the country and 11.6% whose neither parent was born in the country.

Table 1: 4th grade-parents' place of birth

	parents born in cntry		mother not born in cntry		father not born in cntry		parents not born in cntry	
	Count	%	Count	%	Count	%	Count	%
not successful	2635	12.4	125	12.4	230	15.4	649	20.7
less successful	5032	23.7	262	25.9	373	24.9	953	30.4
average	4469	21.0	233	23.1	205	13.6	832	26.6
successful	5160	24.3	192	19.0	275	18.4	502	16.0
very successful	3947	18.6	198	19.6	417	27.8	195	6.2

As seen in Table 1, in the fourth grade the origin of parents is important to the student's success. Students whose parents (or at least one of the parents) were born in the country achieved better results compared to those whose parents were not born in the country. There are only 22.5% successful students whose parents were not born in the country, compared to 42.9% successful students in the group where both parents were born in the country.

The difference between groups is statistically significant (f=175.840; df=3; sig=0.000).

Table 2: 8th grade – parents' place of birth

	parents born in cntry		mother not born in cntry		father not born in cntry		parents not born in cntry	
	Count	%	Count	%	Count	%	Count	%
not successful	1047	5.1	102	9.5	96	5.8	264	10.4
less successful	3758	18.3	217	20.1	238	14.4	709	28.0
average	6052	29.5	219	20.3	503	30.4	688	27.2
successful	6008	29.3	352	32.5	491	29.7	601	23.7
very successful	3621	17.7	191	17.7	324	19.6	268	10.6

In the eighth grade we still observe differences between two groups of students (Table 2). We note that differences between the groups are smaller - in the group of students who reported their parents were not born in country there are 34.3% successful students and in the group where both parents were born in the country there are 47% successful students. Nevertheless, the percentage of not successful students whose parents were not born in the country (38.4%) is large, compared to students whose at least one of the parents was born in the country. Differences between groups are statistically significant (F=99.673; df=3; sig=0.000).

In the eighth grade there were 79.6% of students whose parents were born in the country, 4.2% whose mother was not born in the country, 6.4% whose father was not born in the country and 9.8% whose parents were born in another country.

Table 3: Final year of high school/ parents' place of birth

	parents born in cntry		mother not born in cntry		father not born in cntry		parents not born in cntry	
	Count	%	Count	%	Count	%	Count	%
not successful	539	13.2	28	16.4	38	12.8	37	14.1
less successful	844	20.7	30	17.3	55	18.5	80	30.9
average	991	24.3	32	18.3	80	27.1	70	27.1
successful	1203	29.5	49	28.3	96	32.5	61	23.6
very successful	495	12.2	34	19.7	27	9.1	11	4.2

It was expected that in the secondary school differences between groups of students would be smaller compared to primary school. Table 3 shows some difference between groups, but Post Hoc Tests show that only the last group of students (parents not born in the country) significantly differs from other groups (F=6.763; df=3; sig=0.000). Again, it appears that students with both parents born in another country achieved lower results compared to others.

(There were 85% of students whose parents were born in the country, 3.5% whose mother was born in another country, 6.1% whose father was born abroad, and 5.4% whose parents were not born in the country.)

Since we observe that differences tend to decrease, but still exist in the secondary school, another important factor was analyzed: parents' education. Data on parental education was collected only in populations 2 and 3; therefore only those populations were analyzed.

In the eighth grade we observe quite a high correlation between parents' education and students' success – mother's education and student's success correlate at r = 0.316; and fathers' education correlates at r = 0.323.

Next we analyze parents' education and their origin. If we take into consideration that parents' education level and a child's success are correlated, previous results become easier to interpret and understand.

Figure 5: 8ᵗʰ grade – parents' place of birth/education
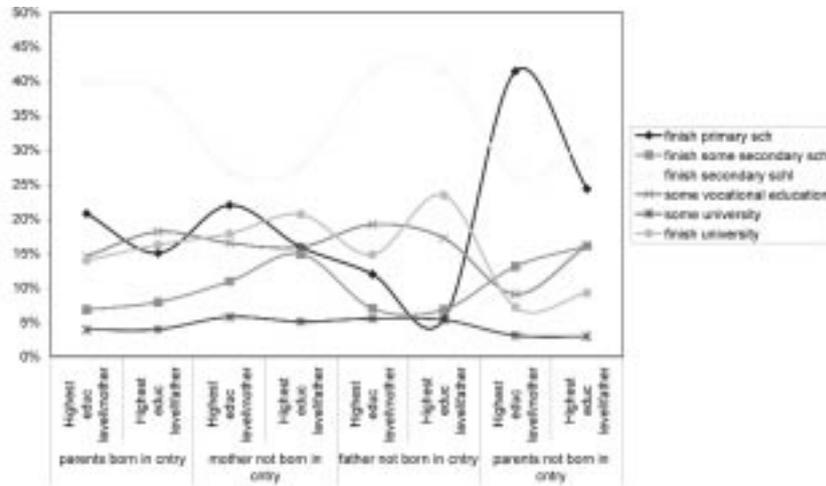
As seen in Figure 5, parents who were not born in the country achieved the lowest level of education – 41.4% of these mothers finished only primary school, and the proportion of parents with some or finished university is the lowest. We observe that in the group of parents where only the father was not born in the county, fathers' education level is the highest, compared to all other groups.

Figure 6 illustrates the same analysis for high school students. Here, the correlations between parents' education and student's success are lower compared to the eighth grade, but still significant. Mother's education and student's success correlate at r=0.207; and fathers' education correlates at r=0.224.

Figure 6: Final year of high school / parents' place of birth/education
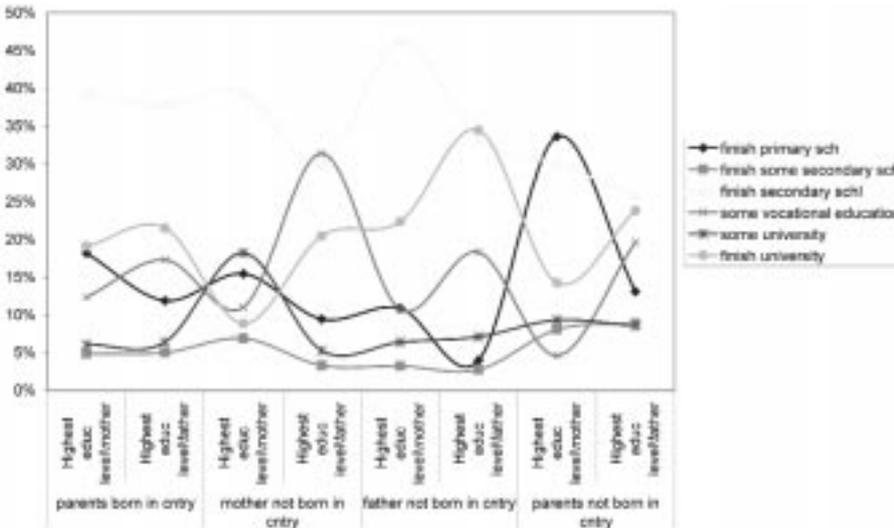
The general trend is similar, however: parents who were not born in the country achieved lower level of education – 33.6% of mothers finished only primary school, and the proportion of parents with some or finished university is the lowest. Again, in the group of parents where only father was not born in the country, fathers' education level is the highest, compared to all other groups.

Regarding students' origin and language they speaks at home, we can conclude, therefore, that these factors are most important in the beginning of schooling, as later the differences between groups of students tend to lessen, but are still quite high and significant.

Home possessions

One factor indicating socioeconomic status refers to home possessions. (The reader should take into consideration that the research was done in 1995, when some of the goods were not so easily accessible as today.) Into this category, I also take the variable number of books, although I am aware that the number of books can be more related to the factor showing cultural status. In questionnaires for all three populations students stated whether they have any of the following items at home: calculator, computer, study desk, dictionaries of foreign languages, room of his/her own, daily newspaper, garden, VCR, animal, country house, atlas of Slovenia/World, bike, cable/SAT TV, camera, wireless phone/answering machine, dictionary of Slovene literary language.

In the fourth grade the highest positive linear correlation is between achievement group and number of books at home (r=0.336); that variable is followed by negative linear correlations for the variables calculator (r=-0.271) and dictionaries of foreign languages (r=-0.249). Some other variables also correlated, but correlations were lower than r=±0.200.

Table 4 shows that in the fourth grade the most successful students have more books at home - 59.1% of the students from the very successful group reported they have at least 101 books at home, while in the group of not successful students there are only 26% such students.

Table 4: 4th grade - Number of books at home achievement group

	Achievement Group									
	not successful		less successful		average		successful		very successful	
	Count	%	Count	%	Count	%	Count	%	Count	%
0-10 books	665	18.7	627	9.4	285	4.9	115	1.9	30	.6
11-25 books	1172	33.0	1834	27.4	1314	22.9	882	14.2	247	5.1
26-100 books	904	25.4	2542	37.9	2429	42.2	2484	40.1	1698	35.2
101-200 books	336	9.5	944	14.1	955	16.6	1382	22.3	1378	28.6
more than 200 books	479	13.5	755	11.3	769	13.4	1336	21.6	1472	30.5

In eighth grade the highest correlation is again between achievement group and number of books at home (r=0.338), which is followed by negative linear correlations for personal computer (r=-0.259), and dictionaries of foreign languages (r=-0.120).

In Table 5 we see that more successful students have a higher percentage of computers. In the group of not successful students, only 25% have a personal computer at home, compared to the group of very successful students, where only 28.2% students reported not having a personal computer at home.

Table 5: 8ᵗʰ grade -Personal computer achievement group

	Achievement Group								
	not successful		*less successful*		*average*		*successful*		*very successful*
	Count	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*	*Count*	*%*
yes	374	25.1%	1687	34.5%	3008	40.6%	3852	51.5%	3168	71.8%
no	1117	74.9%	3208	65.5%	4392	59.4%	3634	48.5%	1245	28.2%

Possession of greater number of books and personal computer are also correlated with parents' education (books/edu. mother r=0.335; computer/ edu. mother r=-0.271).

In secondary school there are fewer and lower correlations than in primary school. Achievement group and number of books correlates at r=0.243, achievement group and personal computer negatively correlates at r=-0.166. In population 3, number of books at home and parents' education correlate quite highly. (Mother's education/number of books r=0,399; father's education/number of books r=0,382.)

Other variables that correlate (but correlations are lower than r= ±0,156) are: dictionaries of foreign languages, room, study desk, animal and camera.

From the data analyzed we see that home possessions have the most and the highest correlations in the fourth grade, less in the eighth grade and the least in the final year of secondary school. In all three populations the highest correlation is between number of books and achievement group.

Higher correlations were found when analyzing parents' education and home possessions.

REGRESSION ANALYSIS

To see which variables best predict student success, multiple regression analysis was done. Since we were working with categorical data, the regression for categorical data method was used. (Categorical regression quantifies categorical data by assigning numerical values to the categories, resulting in an optimal linear regression equation for the transformed variables.)

In the regression analysis achievement group was the dependent variable and independent variables were parents born in country, student born in country,

language spoken at home, no. of books at home, home possessions (calculator, computer, study desk, dictionary of foreign language, room, dictionary of Slovene language), mother - importance to do well in science, mother - importance to do well in math.

When analyzing populations 2 and 3, the variables highest education mother and highest education father were added.

If the hypothesis that older students are less influenced by home background was correct, variables used in the models for older students should explain less variance in the dependent variable.

Table 6: 4th grade- coefficients in regression model

	Standardized Coefficients		df	F	Sig.
	Beta	Std. Error			
Parents	.038	.006	3	43.965	.000
Gen\born in country	-.036	.006	1	39.293	.000
Language of test at home	-.094	.006	2	260.632	.000
No of books in student's home	.271	.006	4	1950.577	.000
Calculator	-.173	.006	1	892.427	.000
Computer	-.023	.006	1	15.270	.000
Gen\home possess\study desk	-.045	.006	1	58.756	.000
Gen\home possess\dictionary	-.131	.006	1	466.113	.000
Gen\home possess\room	-.001	.006	1	.010	.921
Gen\home possess\dictionary of slovene language	.092	.006	1	230.854	.000
Sci\mother impt\do well in science	-.102	.006	1	289.618	.000
Mat\mother impt\do well in math	-.136	.006	1	517.241	.000

Dependent Variable: Cluster Number of Case

As Table 6 reveals, all predictors except home possessions - room are statistically significant. This variable is therefore excluded from the model.

With the model we can explain 24.6% variance of the dependent variable ($R^2=0.246$) (F=440.116; df=18; sig=0.000).

To enable comparison of 4th and 8th grade, the same variables were entered in a regression model for population 2.

Table 7: 8th grade - coefficients in regression model (1)

	Standardized Coefficients		df	F	Sig.
	Beta	Std. Error			
Parents	.215	.020	3	119.822	.000
Gen\born in country	-.003	.006	1	.243	.622
Language of test at home	-.080	.006	2	161.608	.000
No. of books in student's home	.384	.009	4	2027.278	.000
Calculator	-.096	.006	1	261.136	.000
Computer	-.199	.006	1	1043.379	.000
Study desk	-.041	.006	1	44.639	.000
Dictionary	-.022	.006	1	13.447	.000
Room	.040	.006	1	42.558	.000
Dictionary of slovene language	.098	.006	1	251.996	.000
Sci\mother impt\do well in science	-.270	.018	3	217.203	.000
Mat\mother impt\do well in math	-.262	.009	3	777.974	.000

Dependent Variable: Cluster Number of Case

With the model 21.7% variance of dependent variable is explained. (R^2=0.217) (F= 288.597; df=22; sig=0.000).

We see that the variable, born in the country, which was significant in the fourth grade is no longer important in the eighth grade and therefore is excluded from the model.

Since the previous analysis revealed that parent's education has a significant influence on a student's success, another model was computed with additional two variables. Coefficients with additional variables for grade eight are shown in Table 8.

When analyzing the data for the final year of secondary school (Table 9), we observe that fewer independent variables predict the dependent variable. The model – with the same variables as in population 2 – now can explain only 13.7% variance of dependent variable. (F=22.332; df=28; sig=0.000)

The following variables were excluded from the model: mother important/ do well in math, born in country, home possession calculator and parents place of birth.

The regression models clearly show that home background has less influence on students' academic performance as the students grow up.

Table 8: 8th grade- coefficients in regression model (2)

	Standardized Coefficients		df	F	Sig.
	Beta	Std. Error			
Parents	.321	.022	3	219.581	.000
Gen\born in country	-.023	.006	1	13.319	.000
Speak language of test at home	-.075	.007	2	131.548	.000
Highest educ level\mother	.241	.010	5	553.349	.000
Highest educ level\father	.157	.007	5	440.437	.000
No of books in student's home	.447	.013	4	1130.027	.000
Calculator	-.063	.006	1	107.731	.000
Computer	-.145	.006	1	500.740	.000
Study desk	-.003	.006	1	.214	.644
Dictionary	-.020	.006	1	9.768	.002
Room	.039	.006	1	38.518	.000
Dictionary of Slovene language	.144	.006	1	502.927	.000
Sci\mother impt\do well in science	-.235	.016	3	213.814	.000
Mat\mother impt\do well in math	-.347	.013	3	745.528	.000

Dependent Variable: Cluster Number of Case

With this model, we are able to explain more variance of the dependent variable, compared to the previous model. R^2=0.275 (F=239.165; df=32; sig=0.000)

Table 9: Final year of high school- coefficients in regression model

	Standardized Coefficients		df	F	Sig.
	Beta	Std. Error			
Parents	-.026	.016	3	2.672	.046
born in country	.020	.016	1	1.496	.221
speak language of test at hone	-.112	.017	2	44.535	.000
Highest educ level\mother	.118	.017	5	46.030	.000
Highest educ level\father	.124	.017	5	50.599	.000
No. of books in student's home	.175	.017	4	110.573	.000
calculator	-.021	.015	1	1.913	.167
computer	-.085	.016	1	27.537	.000
study desk	.052	.016	1	10.595	.001
dictionary	-.092	.016	1	34.311	.000
\room	-.040	.016	1	6.320	.012
dictionary of slovene language	.122	.016	1	57.379	.000
Sci\mother impt\do well in science	-.069	.020	1	11.706	.001
Mat\mother impt\do well in math	-.010	.020	1	.259	.611

Dependent Variable: Group

CONCLUSION

As pointed out in the beginning of this article, it is difficult to draw definitive conclusions relating student performance in mathematics and science tests to the variables described. I was primarily interested in the relationship between family background variables (available from the TIMSS questionnaire) and student achievement, and I was especially interested to see how that relationship might change as students grow up.

Using the clustering method students from all three populations were divided into five groups according to their achievement score. Other independent variables, indicating students' social background were: origin of a student, origin of his/her mother and father, language spoken at home, parental education, home possessions.

The data analyzed show that the strongest relationship between family background and student success at school occurs in the fourth grade. At that level, parental origin and educational level are very significant. We observe that among those students whose parents were not born in the country, more achieved lower than average results compared to other groups. Results are similar in the eight grade. In the last year of secondary school it was expected that social background would have less influence on student success. But the differences between groups of students whose parents have different origin are still significant. Another variable is important when analyzing student success – parental education. In the eighth grade parental education correlates at $r=0.323$ (father) and $r=0.316$ (mother); in the last year of secondary school correlations are lower but still significant: $r=0.224$ (father) and $r=0.207$ (mother).

When analyzing parental education and origin, we note some differences. The highest level of education was achieved in families where the father was not born in the country; their children also achieved the highest test results. Lowest educational level was achieved in families where both parents were born in other countries; their children achieved lower results on the tests. This was the case for primary as well as secondary school.

With regression analysis it was shown that home background variables are the most predictive of student success in the fourth grade, less in the eighth grade and least in the final year of secondary school.

From the analysis we conclude that the strongest relationship between family background and student school performance is in the fourth grade. The relationship becomes weaker in the eighth grade and very weak in the final year of secondary school.

We are satisfied with the trend – that home background loses its significance as the student grows older, but we still can not say that it does not have any influence, even in the last year of secondary school.

References

Bernstein, B. (1971): *Class, Codes and Control*. Routledge, London.

Giddens, A. (1997): *Sociology*. Polity Press, Cambridge.

Mandič, S (1999) ed.: *Kakovost življenja, stanje in spremembe*. Znanstvena knjižnica FDV, Ljubljana.

Martin, M.O., & Kelly, D.l. (1996). *Timss Techical report-Volume 1: design and development*. Chestnut Hill, Ma: Boston College.

Toličič, I. & Zorman, L (1977). *Okolje in uspešnost učencev*. Državna založba Slovenije, Ljubljana.