The school climate as a predictor of the achievement in TIMSS Advanced study: a students', teachers' and principals' perspective

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Abstract

The school climate has proven to have a strong impact on the student achievement. The present study deals with a discrepancy between a principals' and teachers' perception of a school climate in Slovenia TIMSS Advanced data. The goal of the present study is to establish why principals and teachers perceive the school climate differently, which are the specific school climate characteristics that are evaluated differently by them and whose evaluation of the school climate is a better predictor of student achievement. The results of discriminant analyses show significant differences between teachers' and principals' evaluations of the school climate. The characteristics that significantly differentiate between them are: *the teachers' understanding of school's curricular goals* and *support for teachers' professional development*. To put the differences in a new perspective, a newly developed School Climate Scale (SCS) was added to the students' questionnaire on a national level. It measures four factors of the school climate: *relations–students; relations–teachers, relations–school* and *formal organization*. All three evaluations, students', teachers' and principals', were tested as predictors of maths and physics achievement. All evaluations are important predictors of maths and physics achievement with principals' evaluations being the strongest one. Results also show that a positive school climate is related to high student achievement when evaluated by teachers and principals and on the contrary with low student achievement when evaluated by students.

Keywords: *school climate, achievement, students, teachers, principals*Introduction

Introduction

In Slovenia we are dealing with a high discrepancy between principles' and teachers' evaluations of the school climate. It was reported that 9 percent of students and 25 percent of principals of the same student body that maths teachers create a very positive school climate (Japelj Pavešić, Svetlik, Kozina, & Rožman, 2008). Physics teachers evaluate 10 percent of students as having very positive school climate and 31 percent of principals of the same students reported the same (Japelj Pavešić, Svetlik, Rožman, & Kozina 2008). Since school climate has a strong impact on students' achievement in TIMSS studies (Martin, Mullis, Gonzalez, & Chrostowski, 2004; Mullis, Martin, Gonzalez, & Chrostowski, 2004; Martin, Mullis, & Foy 2008; Mullis, Martin, & Foy 2008), it is crucial to further investigate why principals and teachers in Slovenia perceive the school climate so differently and which are the specific school climate characteristics that are evaluated differently by them. To put the differences in a new perspective, a newly developed School Climate Scale (SCS) was added to the students' questionnaire on a national level. The new scale was added also to take students' perspectives into consideration. Nevertheless, the school climate is influenced by students, teachers and principals (Mullis, Martin, Ruddock, O'Sullivan, & Preuschoff, 2009).

Another part of the study deals with the prediction of students' maths and physics achievement based on evaluations of the school climate. In order to fully understand student achievement, we have to have a full understanding of the school climate and its connection with student achievement. We will compare the predictive value of principals', teachers' and students' evaluations of the school climate for maths and physics achievement. Since student achievement is influenced by variety of individual factors that are difficult to control or influence (e.g. students' cognitive abilities, the characteristics of home environment…), the school climate is in a way more open for us to influence. In the last decades, it has been assumed that individual factors have the strongest effect on achievement but Young, Reynolds and Walberg (1996) pointed out other greater effects of school variables on student achievement with school climate being the most important one.

Objectives of the study:

- To analyze the discrepancy between teachers' and principals' perceptions of the school climate by identifying characteristics that are the strongest differentiators between teachers and principals;
- To compare students', teachers' and principals' evaluations of school climate as predictors of student achievement.

Theoretical framework

In the theoretical framework we will firstly define the school climate, then the school climate as measured in TIMSS studies and finish with connections between student achievement and the school climate

The school climate

The school influences student achievement through student attachment, commitment, involvement and, most importantly, through the schools' resources and climate (Freiberg, 1999). School climate is a relatively stable aspect of the school environment (Brown, Anfara, & Roney, 2004) defined as a set of internal characteristics that distinguish one school from another and influences the behaviour of school members. These internal characteristics are most commonly referred to as the quality of interpersonal relations between students and teachers; the extent to which a school is perceived as safe and caring place; the degree to which students, parents, and staff are involved in collaborative decision making and the degree to which there are high expectations for student learning (Freiberg, 1999). Another definition states that the school climate consists of attitudes, beliefs, values and norms that underline the instructional practices, the level of academic achievement and the operation of the school (McEvoy, & Welker, 2000). Most widely we can define school climate as the psychosocial context in which teachers work and teach (Johnson, Stevens, & Zwoch, 2007). It can also be referred to by different word formulations, such as social system of shared norms and expectations, the set of norms and expectations that others have for students, students' perception of the "personality of school" and so on (Brown, Anfara, & Roney, 2004).

When evaluating the school climate, we can talk of a positive and a negative school climate. A school that has positive climate is perceived as welcoming and is characterized by respectful interactions between individuals. In these types of surroundings, students are also motivated to achieve (Lehr, 2010). A negative school climate is exactly the opposite. In TIMSS, we are referring to school climate in terms of low, medium and high, based on the calculation of the indexes of the school climate (Mullis, Martin, & Foy 2008). These indexes will be presented in detail in the section Measures.

The school climate as measured in TIMSS studies

TIMSS studies measure the school climate with a set of characteristics for which previous research showed important implications for the schools' effectiveness (Mullis, Martin, Ruddock, O'Sullivan, & Preuschoff, 2009). These characteristics, as far the teachers are concerned; cover the topics of the teachers' job satisfaction, their professional development, their understanding of and the ability to implement the school curriculum. A positive correlation between teachers' satisfaction with their workplace and student performance in mathematics was establish by Andrews and Morefiled (1991) and confirmed by Brown, Anfara and Roney (2004).

The TIMSS characteristics also cover the cooperation between school and parents. According to the research literature partnering with families is necessary for children's educational success. The family-school relationship is the foundation for clarifying rights, defining and negotiating roles and sharing responsibilities for support across environments to optimize students' learning (Gutkin, & Reynolds, 2009). Empirical support for promoting these types of cooperation is available in research literature. Significantly positive connections, ranging from 0.40 to 0.70, between parents' cooperation with school and student achievement were established by Gutkin and Reynolds (2009).

A student's perspective is in a way covered by two characteristics: a student's regard for school property and a student's desire to do well in school. Teachers' perception of students' desire to do well in school and their expectation regarding their achievement, influence student achievement levels through their effect on students' perceptions, in particular students' self-conceptions on academic abilities (McEvoy, & Welker, 2000). The work of Glasser (McEvoy, & Welker, 2000) showed that by raising expectations towards students and improving the school climate, one can increase effectiveness of low-achieving schools. The students' regard for school property is one of the aspects of violent behaviour in school. Schools with discipline policies that are clear, fair and effective tend to engage students in school and have more positive outcomes (Lehr, 2010).

The school climate and student achievement

The school climate is positively connected to student achievement as proved in research literature (Hoy, Hannum, & Tschannen-Moran, 1998; Ma, Wilkins, 2002; Brown and others, 2004; Lehr, 2010) and in previous TIMSS studies (Martin, Mullis, Gonzalez, & Chrostowski, 2004; Mullis, Martin, Gonzalez, & Chrostowski, 2004; Martin, Mullis, & Foy 2008; Mullis, Martin, & Foy 2008; Mullis, Martin, Ruddock, O'Sullivan, & Preuschoff, 2009). A more positive

school climate is connected to higher achievements. In more detail, Stewart (2008) pointed out that at school level; the sense of school cohesion is the strongest predictor of student achievement. When students have the sense of commitment and feel a sense of attachment their achievements are higher (Stewart, 2008). Students who attend schools with a more positive climate tend to have more positive attitudes towards school and school subject which lead to higher achievements (Kos, 1990; Krall, 2003; Lehr, 2010).

The school climate is often also connected to the presence of crime and violence in school and students' violent behaviour is negatively related to their school achievement (Huesmann, 1994; McEvoy, & Welker, 2000; Krall, 2003; Marjanovič Umek, & Zupančič, 2004; Schwartz, Gorman, Nakamoto, McKay, 2006). Current studies support the idea that violent behaviour and academic failure reinforce one another within the context of ineffective school practices including a negative school climate and ineffective parenting strategies (McEvoy, & Welker, 2000). The school climate also, in a way, presents the gap between students' socio-economic status and their achievement. Once it was believed that schools cannot make any differences for children who come from so-called bad homes. Current research claims the opposite. The proof lies in several schools which are situated in low socio-economic environment and are still achieving highly. These schools tend to have a more positive school climate (McEvoy, & Welker, 2000).

Method

Participants

Participants were students, teachers and principals who participated in TIMSS Advanced study in Slovenia. The target population for TIMSS Advanced study were students from the last year of secondary schools entering the university level of schooling. In Slovenia, we included students from secondary schools who were preparing for their final Matura exam. Since the target population in Slovenia is small, we had to include all the secondary schools (82 schools) of that type, all students who were preparing for the physics Matura exam (1097 students, 27 % females and 73 % males) and a sample of students preparing for the maths exam (2156 students, 60 % females and 40 % males). The maths sample covers 40.5 % of the target population and physics sample covers 7.5 % of the target population. The average age for both student samples was 19 years. The teachers and principals samples consisted of maths and physics teachers of the sampled students and the principals of the selected schools.

Measures

TIMSS Advanced Slovene data base (MSG, MST, MTG, MCG, PSG, PST, PTG and PCG) was used.

For discriminant analyses, we used variables that measured school climate in teachers' and principals' background questionnaires on a four point scale (1=*very high*, 2=*high*, 3=*low*, 4=*very low*) and were the same for teachers and for principals (*teacher's job satisfaction, teacher's understanding of the school curricular goals, teacher's degree of success in implementing the school curriculum, support for teacher's professional development, parental support for student achievement, parental involvement in school activities, student's regard for school property, student's desire to do well in school*).

For the regression analyses, we used international indexes for measuring school climate: PTSC (Index of principal's perception of school climate) and TTSC (Index of advanced mathematics and physics teacher's perception of school climate). Three categories (3=*low*, 2=*medium*, 1=*high*) were computed based on the average across nine statements measuring school climate scale (1=*very high*; 2=*high*; 3=*medium*; 4=*low*; 5=*very low*). The students were assigned to the high level if their principals and teachers rated the majority of variables measuring school climate as high and to the low level if their principals and teachers rated majority of variables measuring school climate as low. The medium group had principals and teachers with other response combinations (Mullis, Martin, Robitaille, & Foy, 2008). As we can see lower values represent more negative school climate.

We constructed a new multidimensional student climate scale (SCS) which consisted of 22 items on a five point Likert type scale (1=*totally agree*; 2=*agree*; 3=*something in between;* 4=*disagree;* 5=*totally disagree*). The target population were students. It measured four factors: *relations–school; relations–teachers*; *relations–students*, and *formal organization*. The factor *relations-school* includes the degree of connection with the school, positive feelings towards school, the feeling of safety in the school, a positive school atmosphere and understanding between members of the school. The factor *relations-teachers* includes feeling that teachers would help students if they were in trouble, that teachers take their time to be available for students, student's satisfaction with the teacher's work, students' positive experiences with school counselling service, student's perception of appropriate sanctions for misbehaviour and good relations between students and teachers in the school in general. The factor *relations-students* includes understanding and cooperation between students in the school and in the classroom. The factor school organization includes good general organization of the school and the fact that the school also provides extracurricular activities for students.

The four factors together explain 50.73 % of total variance. The scale is reliable ($0.66<\alpha>0.80$) and sensitive to the differences in students perception of school climate ($0.49<r>0.58$).

Statistical analyses

To identify psychometric properties of newly developed scale descriptive statistics (*M, SD*), exploratory factor analyses (principal axis factoring with Direkt Oblimin rotation), correlational analyses (Pearson's *r)* and reliability analyses (Cronbach's α) were used. Additionally, discriminant analyses, using SPSS (*v*.18) on weighted data (House weight), were used to identify the characteristics of school climate that differentiate between the group of teachers and the group of principals. The regression analyses, using IDB Analyzer, were used to identify whose evaluation of school climate, students', teachers' or principals', is a better predictor of students' maths and physics achievement.

Finding and Discussion

The differences in the teachers' and principals' perception of school climate

As mentioned above, we have noticed differences in the teachers' and principals' perception of the school climate. The differences in perception were further investigated with one way ANOVA and Discriminant analyses.

[Take in table 1 about here]

[Take in table 2 about here]

There are significant differences between the teachers' and principals' evaluations of the school climate. For example, both maths and physics teachers evaluated their understanding of school curricular goals higher than principals. They were also revealed as having less support for their own professional

development as principals did. Teachers evaluated parental support for student achievement lower than principals. The same goes for students' regard for school property and students' desire to do well in school. The maths and physics teachers perceive the school climate in a similar way but significantly different to principals.

In order to analyse which characteristics of the school climate best differentiate between groups, the ANOVA was followed by discriminant analyses on the maths and physics sample. The discriminant analysis is a method of classification. It derives rules for classifying an individual into one of the number of predefined groups, using the information provided by a number of variables recorded on the individual (Everitt, 1996). In our case, we tested which one of the variables that measures school climate is the best predictor for membership in the group of principals or teachers.

The data was tested for equal population co-variance matrices: Box's M=68.05; F [36.52893] =1.82; p=0.002 for math sample and box's M=71.91; F [36.24894] =1.88; p=0.001 for physics sample.

[Take in table 3 about here]

Data in both samples show one discriminant function explaining 100 percent of total variance. The function discriminates significantly amongst principals' and teachers' evaluations of school climate. Whether the individual responding to the variables is a principal or a teacher is significantly related to their evaluations. The results are congruent with our predefined groups. Additional important information in table 3 is the squared canonical correlation. Canonical correlation is equivalent to Pearson's correlation between the discriminant scores and the predefined groups. It tells us that the discriminant function is a slightly better predictor of group membership in the physics sample than in maths sample. Another measure of how well each function separates cases into groups is Wilks' lambda. It is equal to the proportion of the total variance in the discriminant scores not explained by differences amongst the groups. Smaller values of Wilks' lambda indicate greater discriminatory ability of the function. In our case the lambdas are low. We can conclude that the function discriminates significantly between groups in both the maths and physics sample and better in physics sample.

The predictors of group membership can be expressed in terms of a linear regression equation in which the standardized discriminant function coefficients are equivalent to the standardized betas in regression. These coefficients tell us the relative contribution of each variable to the discriminant function and are, for both samples, presented in table 4.

[Take in table 4 about here]

Standardized coefficients vary from -1 to 1 and therefore the greater the number in an absolute sense means the greater the contribution to the differences. Variables that, in both samples, contribute most to the discriminant function are teachers' understanding of school's curricular goals and support for teachers' professional development which is congruent with the results of one-way ANOVA. In the physics sample parental involvement in school activities and students' desire to do well in school is a good contributor also. In the maths sample, a good predictor of group membership is also students' regard for school property.

The structure matrix presented in table 5 shows us the canonical correlation coefficients between variables and discriminant function. These values are comparable to factor loadings and can be interpreted as the content of discriminant function. When some variables have high canonical function correlations while other have low ones, then the ones with high correlations contribute most to group separation.

[Take in table 5 about here]

Looking at the structure matrixes for both samples, we can see that teachers' understanding of school curricular goals is most highly related to the discriminant function in the maths sample whereas in the physics sample, it is only in 5th place when comparing characteristics by their correlations with discriminant function. Support for teachers' professional development is highly related to the discriminant function in both samples. It is in 1st place in the physics sample and in 2nd place in the maths sample when comparing characteristics by their correlations with discriminant function.

We can conclude that support for teachers' professional development is overall the stronger differentiator between principals and teacher. Since teachers' pedagogical knowledge and expertise are central to teaching effectiveness (Gettinger, & Stoiber, 2009) we have to fill this gap between teachers and principals. This could be done firstly by identifying what kind of professional development would teachers wish for and secondly try to provide it for them. This is especially important since content domain knowledge is more a powerful predictor compared to the overall education level of the teacher (Gettinger, & Stoiber, 2009).

Another characteristic that differentiates significantly between teachers and principals is teachers' understanding of school curricular goals. This one is evaluated higher by teachers than by principals. The characteristic is measuring teachers feeling of self-efficacy which is strongly connected to student achievement. Teachers who feel confident about their knowledge and about their teaching tend to focus on students' needs more and are able to accommodate students who have learning difficulties (Gettinger, & Stoiber, 2009). Therefore, the high evaluation of teachers regarding their self-efficacy is welcomed when trying to increase student achievement. However, taking what is said above about their need for professional development into consideration we can make the assumption that by providing more support for their professional development, their self-efficacy would become even higher and most importantly, the principals' evaluation would probably increase as well.

The prediction of student maths and physics achievement

To evaluate which measure of the school climate has a higher predictive value, principals', teachers' or students' evaluations, we used a linear regression. For teachers' and principals' perception of the school climate, the international indexes were used: Principals' perception of the school climate (PPSC) and teachers' perception of the school climate (TPSC). As for students' perception of the school climate, four factors of the SCS scale were used: relations–teachers; relations–students, relations–school and school organization. Lower values represent a more negative school climate.

[Take in table 6 about here]

The PPSC, TPSC and two factors of SCS (relations–school and formal organization) are significant predictors of maths and physics achievement. In the physics sample, the SCS factor relations–students is also a significant predictor of physics achievement. A more positive school climate, when measured with PPSC and TPSC, predicts higher math and physics achievement. If we increase PPSC by one unit, it means that the school climate becomes more negative, the maths achievement lowers by 54.35 points and the physics achievement by 48.33 points. Similarly, if we increase TPSC by one point, again the school climate becomes more negative, the maths achievement lowers by 41.86 points and the physics achievement lowers by 38.07 points. These results are congruent with research literature (Hoy, Hannum, & Tschannen-Moran, 1998; Ma, & Wilkins, 2002; Brown and others, 2004; Lehr, 2010).

On a contrary, if we increase the sum on the SCS factor relations–school and sum on the SCS factor formal organization, it means that the school climate becomes more negative, the maths and physics achievement increases. These findings are not congruent with research literature and with our assumptions. We assumed that higher achievement will be connected to a more positive school climate. The conclusion is that school climate that is achievement effective is perceived negatively by students. This could be connected to higher expectations of the school staff towards students which increases the pressure put on them. The more the school is organized, the more pressure is put on students and the more they perceive the school climate to be negative.

The results on the SCS factors relations–students and relations–teachers do not predict maths achievement significantly. The result on the SCS factor relations–students significantly predicts physics achievement. If we increase the result on that factor, which means that the relations amongst students become more negative, the physics achievement decreases by 4.09 points. The more connected the student feels with the school and the more understanding there is between students and the more they feel as a part of a group, the higher their physics achievement is. We can conclude that positive students' relations have positive impact on their achievement.

R2 can be used to compare whose evaluation of school climate is a better predictor of students' achievement. R2 tells us how much of achievement variance can be explained by predictors. As we can see from table 6, the principals' evaluation of the school climate is a better predictor of student maths and physics achievement when compared to teachers' and students' evaluation. It explains 12% of the achievements' variance. Teachers' evaluation of school climate explains 7% and students' evaluation explains only 5 %.

Conclusion and Implications

The study confirmed the strong connection between teachers' and principals' perception of school climate and achievement in TIMSS Advanced and highlighted important differences between teachers' and principals' evaluation of the school climate in the Slovenian sample. The characteristics that differentiate most between the group of teachers and the group of principals are: support for teachers' professional development and teachers' understanding of school's curricular goals. The strongest predictor of maths and physics achievement is the principals' evaluation of the school climate, followed by teachers' evaluation and students' evaluation being the weakest.

In research literature, there is a lot of evidence pointing to the strong connection between school climate and student achievement but less is said about

comparisons of different types of evaluations of the school climate. When analyzing the effects of the school climate on student achievement, the researchers mainly focus on teachers, principals and neglected students who are directly influenced by school climate (Gentilucci, & Muto, 2007). Present study gives attention also to the students' point of view and encourages future research to include students' evaluation of school climate together with principals' and teachers'. Since the students' perception of the school climate and its connections to their achievement is contradictory, it is necessary for us to investigate these relations in more detail. As influential sociologists Hamersley and Woods stated: "There can be little doubt that pupils' own interpretations of the school process represent the crucial link in the educational chain. Unless we understand how pupils respond to different forms of pedagogy and school organization and why they respond in the ways that they do our efforts to increase the effectiveness or to change the impact of schooling will stand little chance of success." (Gentilucci, & Mutto, 2007).

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Tables

Table 1

The differences in maths teachers' and principals' perception of characteristics measuring the school climate–results of the one way ANOVA

	teachers (*N*=2063)		principals (*N*=75)						
school climate characteristics	*M*	*SD*	*M*	*SD*	Λ	*F*	*p*	η	η^2
1	2.60	0.660	2.49	0.645	0.999	1.903	0.168	0.031	0.001
2	2.24	0.619	2.70	0.611	0.980	42.722	0.000	0.135	0.018
3	2.36	0.605	2.31	0.716	1.000	0.394	0.531	0.015	0.000
4	2.24	0.753	1.72	0.556	0.986	29.587	0.000	0.127	0.016
5	2.90	0.713	2.70	0.731	0.998	4.637	0.031	0.052	0.003
6	3.20	0.812	3.25	0.768	1.000	0.319	0.572	0.012	0.000
7	2.94	0.817	2.59	0.715	0.993	14.755	0.000	0.079	0.006
8	2.83	0.916	2.41	0.769	0.993	14.580	0.000	0.085	0.007

Notes. df_1=1, df_2=2083. 1=teachers' job satisfaction; 2=teachers' understanding of school's curricular goals; 3=teachers degree of success in implementing the school curriculum; 4=support for teachers' professional development; 5=parental support for student achievement; 6=parental involvement in school activities; 7=students' regard for school property; 8=students' desire to do well in school.

Table 2

The differences in physics teachers' and principals' perception of characteristics measuring the school climate–results of the one way ANOVA

	teachers (*N*=1072)		principals (*N*=53)						

school climate characteristics	*M*	*SD*	*M*	*SD*	*Λ*	*F*	*p*	η	η^2
1	2.68	0.657	2.54	0.641	0.998	1.851	0.174	0.046	0.002
2	2.46	0.737	2.66	0.649	0.996	4.655	0.031	0.058	0.003
3	2.43	0.700	2.31	0.755	0.999	1.433	0.232	0.036	0.001
4	2.33	0.712	1.68	0.581	0.967	37.830	0.000	0.189	0.036
5	3.00	0.661	2.58	0.770	0.985	16.468	0.000	0.130	0.017
6	3.37	0.844	3.25	0.806	0.999	0.798	0.372	0.032	0.001
7	3.07	0.741	2.51	0.724	0.973	30.286	0.000	0.157	0.025
8	2.92	0.687	2.28	0.769	0.966	38.514	0.000	0.192	0.037

Notes. df_1=1, df_2=1107. 1=teachers' job satisfaction; 2=teachers' understanding of school's curricular goals; 3=teachers' degree of success in implementing the school curriculum; 4=support for teachers' professional development; 5=parental support for student achievement; 6=parental involvement in school activities; 7=students' regard for school property; 8=students' desire to do well in school.

Table 3

Discriminant functions in maths and physics sample

function	eigenvalue	% variance	canonical R^2	Λ	χ^2	*df*	*p*
math sample							
1	0.051	100.0	0.005	0.952	102.646	8	0.000
physics sample							
1	0.102	100.0	0.009	0.908	106.832	8	0.000

Table 4

The standardized canonical discriminant function coefficients for the maths and physics sample

school climate characteristics	math sample	physics sample
1	-0.180	0.265
2	-0.792	-0.891
3	0.197	0.199
4	0.633	0.675
5	0.066	-0.006
6	-0.140	-0.366
7	0.346	0.155
8	0.059	0.554

Notes. 1=teachers' job satisfaction; 2=teachers' understanding of school's curricular goals; 3=teachers degree of success in implementing the school curriculum; 4=support for teachers' professional development; 5=parental support for student achievement; 6=parental involvement in school activities; 7=students' regard for school property; 8=students' desire to do well in school.

Table 5

Structure matrix for math and physics sample

school climate characteristics	math sample	physics sample
2	-0.637	-0.203
4	0.530	0.580
7	0.374	0.519
8	0.372	0.585
5	0.210	0.382

1	0.134	0.128
3	0.061	0.113
6	-0.055	0.084

Notes. Variables are ordered by absolute size of correlation within function for the maths sample. 1=teachers' job satisfaction; 2=teachers' understanding of school's curricular goals; 3=teachers degree of success in implementing the school curriculum; 4=support for teachers' professional development; 5=parental support for student achievement; 6=parental involvement in school activities; 7=students' regard for school property; 8=students' desire to do well in school.

Table 6

Summary of regression analyses for index of principals' perception of the school climate (PPSC), index of teachers' perception of school climate (TPSC) and SCS factors for the school climate predicting students' math and physics achievement

	constant *(SE)*	estimate (*SE*)	*t*	R^2
math achievement (*N*=2097)				
PPSC	557.30 (10,48)	-54.35 (6.07)	-8.95	0.12
TPSC	549.25 (19,27)	-41.86 (8.26)	-5.07	0.09
SCS	328.26 (23,46)			
relations–teachers		0.18 (0.77)	0.24	
relations–students		0.68 (1.08)	0.63	
relations–school		3.96 (1.06)	3.73	
formal organization		3.23 (1.11)	2.91	0.07
physics achievement (*N*=1076)				
PPSC	619.82 (5.42)	-48.33 (2.98)	-16.24	0.12
TPSC	619.79 (7.94)	-38.07 (3.50)	-10.89	0.09
SCS	463.75 (28.51)			

relations–teachers	0.21 (0.80)	0.27	
relations–students	-4.09 (1.62)	-2.53	
relations–school	6.02 (1.43)	4.22	
formal organization	2.52 (1.07)	2.36	0.05