# Negative School Factors and Their Influence on Math and Science Achievement in TIMSS 2003

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## Abstract

The aim of the presented study was to conduct an analysis of TIMSS 2003 database and to determine how negative school factors, such as aggression, are associated to the mathematical and science achievement of students. The analyses were conducted separately for national and international data. National analyses for Slovenia show significant associations between math and science achievement and the experience of aggressive behavior. Students who experienced aggressive behavior scored lower in math and science, both in the 4th and 8th grade. The results of the regression analysis show that negative factors, such as aggressive behavior, are good predictors of educational achievement in Slovenia. International analyses for the selected countries (high and low achieving countries from the whole TIMSS population) confirm that this type of finding is culturally impartial as well as valid for the level of achievement both in math and science.

**Keywords:** aggressive behavior, school, achievement, math, science

## Introduction

Aggression is considered to be one of the biggest issues of modern schools and society. Since aggressive behavior is a good predictor of future social, psychological, behavioral and educational problems (Ferris, 1996; Carr, 1998; Fossati, Maffei, Acquarini and Ceglie, 2003; Van Lier 2005; Schwartz, Nakamoto, Hopmeyer, Gorman, McKay, 2006; Crick, 2006), the scientific focus should be set on the analysis of the effects of aggressive behavior on the educational process in schools. According to the international analyses of the TIMSS study, safety in schools is central for providing an environment conducive to learning (Mullis, Martin, Gonzales, & Chrostowski, 2004). Therefore, it is essential to analyze aggressive behavior in schools and to determine the mechanisms for controlling it and consequently improving the school climate in order to achieve effective learning. The focus of our study was laid on the association between aggression and achievement in math and science.

### *On Aggression*

Aggression, as many other psychological phenomena, is an extremely complex concept, therefore it is not easy to obtain a reliable definition. The majority of existing definitions focus on the aim of aggression, its expression and factors influencing it. Causing harm or intention to cause harm to another person or oneself plays a central role in such interpretations (Lamovec, 1988). The complexity of these phenomena is evident from a variety of different types of aggression. Aggression can be classified either according to its intention or its orientation. The following classification is based on intention: instrumental aggression, constructive aggression, destructive aggression and frustration aggression. However, classification according to orientation is more commonly used. It makes a clear distinction between internally oriented and externally oriented aggression; the two groups are further

divided into direct and indirect forms.

In TIMSS background questionnaires it is possible to identify externally oriented aggression, more specifically, it is possible to identify its direct forms (being hurt by another student, being made to do things, being called names) and its indirect forms (stealing, being left out of activities). The most common types of aggression found in school settings according to Popp (2003) are physical, verbal and psychological aggression. Studies conducted in Germany (Krall, 2003) recognized verbal and physical aggression as the most frequent types. The results show that 50 to 60 percent of children displayed verbal aggression, while physical aggression was reported only by 2 percent of children. What researchers mean by verbal aggression are different forms of calling names, nicknames, and spreading rumors that lead to social stigmatism and exclusion. Another classification of aggression was made by Belser who classifies aggression in the school environment into two separate groups: latent and manifest aggression, and these are further divided according to their direction (for example, towards classmates, teachers, objects and self) (Belser, 1999; Krall 2003).

## *Aggression and School Achievement*

The association between aggression and school achievement is reported in several scientific texts. As evidence based on TIMSS background questionnaires, it is possible to identify the level of physical, verbal and psychological aggression that students are exposed to. Psychological aggression is described as forcing a student into actions he or she does not want to perform, or preventing him from joining in activities. The influence of peer rejection and maltreatment has been broadly researched by Buhs and his colleagues (2006). The study by Buhs, Ladd and Herald (2006) shows the importance of the impact of peer exclusion on students' achievement at school. Peer rejection was associated with declining classroom participation and increasing school avoidance. A child's reduced classroom participation anteceded decrements in the child's achievement (Buhs, Ladd, & Herald, 2006). The fundamental premise is that peer group acceptance or rejection influence children's development and adjustment. There is a body of empirical findings proving that peer group rejection is a cause of children's adjustment difficulties. Among the most convincing evidence there are findings that implicate peer group acceptance or rejection as an antecedent of children's school adjustment problems. Low classroom peer acceptance has been consistently linked to indicators of school disengagement (e.g., negative school attitudes, school avoidance; Ladd, 1990; Ladd, Kochenderfer, & Coleman, 1997), and, relative to other types of peer relationships, peer group rejection appears to be one of the strongest predictors of academic readiness and achievement (Buhs & Ladd, 2001; Ladd, Birch, & Buhs, 1999; Ladd et al., 1997; Vandell & Hembree, 1994).

The effects of peer rejection on children's achievement is mediated through two processes: (a) the negative behavioral treatment that rejected children receive from peers and (b) resulting changes that such treatment causes in children's classroom participation. Most commonly the process in the classroom follows a few steps. At the beginning peers express the dislike they feel toward rejected children by treating them more negatively than other classmates, and, once manifested, these negative behaviors serve as visible markers of rejection for both the larger peer group and for rejected children. Once children are labeled by maltreatment, or behavioral manifestations of rejection, they become marginalized from classroom peer activities. Marginalization occurs because, as peers become aware of children who are often targeted for maltreatment, they tend not to associate with these children or include them in classroom activities. Moreover, rejected children disengage from classroom activities as a way of avoiding further abuse. Disengagement from classroom activities negatively impacts on children's learning, which ultimately leads to lower levels of achievement. Firstly, children become less active participants in classroom activities because their opportunities to do so are increasingly restricted as a result of peer exclusion. Secondly, children who are harassed by peers seek to avoid classrooms (or the school context in general) as a means of escaping further abuse. Whereas exclusion by peers is construed as a cause of reduced participation in classroom activities, abuse is seen as

increasing children's motivation to avoid the classroom or school context (Buhs, Ladd, & Herald, 2006).

Taken together, the researchers have not only studied the associations between psychological aggression and achievement but also those between physical aggression or victimization and achievement. They found out that the link between peer exclusion and achievement is mediated through classroom participation, while the link between peer abuse and achievement is mediated through school avoidance (Buhs, Ladd, & Herald, 2006).

Results from this type of research provide additional support for the chronic stress model (see Johnson, 1988; Mechanic, 1983) by indicating that children exposed to chronic or extended periods of peer maltreatment (exclusion, abuse) are at risk of developing school adjustment problems, such as classroom disengagement and decelerating achievement (Buhs, Ladd, & Herald, 2006).

As research has shown, it is not exclusively physical aggression but all its different types that affect achievement. The consequences may have an even longer range than those of physical abuse (Buhs, Ladd, & Herald, 2006).

## *The Purpose of the Study*

The purpose of TIMSS (Trends in International Mathematics and Science Study) is to conduct large – scale comparative studies of educational achievement and to gain a better understanding of the effects of policies and practices on achievement within and across systems of education (Mullis, Martin, Gonzales, & Chrostowski, 2004). By following the same concept, the aim of our study was to investigate, using data of the TIMSS 2003 study, how negative school factors, for example aggression, affect mathematical and science achievement.

The main goal was to analyze the associations of aggressive behavior and educational achievement and find possible suggestions for decreasing aggressive behavior in schools.

Our study focuses on the following research questions:

- When students are faced with negative school factors (e.g. aggressive behavior occurring at school) is that connected to their educational achievement (in math and science)?

- Can we predict educational achievement (in math and science) on the ground of negative school factors (e.g. aggressive behavior)?

- Could these possible associations and predictions be generalized for (extended to) other European countries?

- Are the associations and predictions independent from the level of achievement (e.g. can they be generalized for high and low achieving countries) possible?

International comparative studies give us the possibility to study these relations in international context. The presented study focuses on the association of negative school factors, for example aggressive behavior, and achievement in the TIMSS 2003 study. The TIMSS study has already identified the important association between students' perception of school safety and achievement (Mullis, Martin, Gonzales, & Chrostowski, 2004). We have tested these associations in more detail using the Slovenian database, and we are going to test further the possibility to predict achievement using indexes of students' perception of school safety in Slovenia.

## Methodology

The data source was the TIMSS 2003 study, more specifically, national and international student background databases and student achievement databases. The data for analysis was derived from students' background questionnaires, where students were also asked about their experience of negative factors at school, and from students' achievement booklets. In students' achievement data plausible values for mathematics and science were used. In the TIMSS 2003 study additional indexes of school safety were calculated and further applied in additional analyses. All analyses were done for the populations of the $4^{th}$ and $8^{th}$ grade.

In accordance with our research questions several statistical methods are used. A first insight into data is presented with descriptive statistics, followed by more complex analyses of *t* – tests and regression analyses. For establishing differences in achievement between groups that experienced aggressive behavior and those who did not, *t* – tests and statistical package AM 0.06.03. were used. AM is a statistical software package for analyzing data from complex samples, especially large scale assessments developed by the American Institute for Research. Regression analyses are conducted with IDB analyzer 1.4.0.8. developed by the Data Processing Center under supervision of the International Association for the Evaluation of Educational Achievement.

## Findings and Discussion

In our findings we are focusing separately on the national and international analyses, math and science achievement and both populations. A national analysis is presented in more detail, firstly on item level, and secondly on the level of the index of students' perception of school safety. The index of students' perception of school safety was calculated on the ground of five variables measuring the perception of aggression at school. Students who answered "yes" (they were exposed to aggressive behavior at school) to all five items were placed in the low index, those who answered "no" (they were not exposed to aggressive behavior at school) were placed in the high index and those with some positive and some negative answers were placed in the medium index (Mullis, Martin, Gonzales, & Chrostowski, 2004).

### *National Analyses*

#### *- Math Achievement*

In Table 1 ($4^{th}$ grade) and Table 2 ($8^{th}$ grade) the average math score, in association with the answers in the background questionnaire regarding aggression at school, is presented. In table 3 the same score is presented in relation to the index of students' perception of school safety. The differences in math

scores were tested with *t* - tests for independent samples.

[Take in Table 1 about here]

[Take in Table 2 about here]

[Take in Table 3 about here]

4th grade students that are exposed to different types of aggression at school on average achieve lower scores in math. The t-tests indicate that the differences in achievement are significant ($p < ,01$) for all types of aggression with the exception of physical aggression ($t = 1,85$; $p = 0,068$). The same results are evident when analyzing indexes – the safer students feel at school the higher their math achievement is. Students with a low index (their perception of school safety is low) score significantly lower in math than students in the high and medium index groups. The differences between the high and the medium index group are not significant.

Similarly, 8th grade students that are exposed to aggression at school on average score lower in math, with the exception of physical and verbal aggression. The differences are significant for items connected to psychological aggression (stealing ($t = 2,57$; $p = 0,012$), rejection ($t = 2,59$; $p = 0,011$) and maltreatment ($t = 5,86$; $p = 0,000$)) and not for direct forms of verbal ($t = - 1,06$; $p = 0,012$) and physical ($t = 0,15$; $p = 0,880$) aggression. The analyses of indexes in the 8th grade do not display as clear a picture as they do in the 4th grade. Students that have the highest math scores are those who have medium perception of school safety and not those who have high perception of school safety. However, the differences between the two groups are not significant. Coincidently it is possible to argue that students with low perception of school safety achieve significantly lower scores in math than students with medium and high perception of school safety.

### - *Science Achievement*

The same analysis was also conducted for science achievement. In Table 4 (4th grade) and Table 5 (8th grade) the average science score in relation to the answers in background questionnaires regarding aggression at school is presented. In table 6 the same score is presented in relation to the index of students' perception of school safety. The differences in science scores were tested with *t* - tests for independent samples.

[Take in Table 4 about here]

[Take in Table 5 about here]

[Take in Table 6 about here]

4th grade students who reported that they were not exposed to aggression at school on average got higher science scores than those who reported experiencing aggression at school. The differences are significant ($p < ,05$) for all types of aggression. The analysis of indexes provides additional evidence for such relations – the safer students feel at school the higher their science achievement is. Students with a low index (their perception of school safety is low) achieve significantly lower in science than students in the medium and high index groups.

8th grade students that have experienced psychological aggression at school on average score lower in science than students who did not experience that type of aggression. With verbal and physical aggression as representatives of direct forms of aggression, the relation is the other way around: students who experience more direct forms of aggression on average get higher science scores. The

differences are significant ($p < ,05$), with one exception (being left out of activities by other students ($t = 1,23$; $p = 0,223$)). Students with the highest science scores are those who have medium perception of school safety and not those who have high perception of school safety. The differences between the two groups are significant. One can also conclude that students with low perception of school safety (low index) achieve significantly lower in science than students with medium and high perception of safety.

### *International Analysis*

The international database was composed of high and low achieving countries from the whole TIMSS population. Taking cultural similarities into account, additional analyses were conducted on a sample of low and high achieving countries in Europe. Countries were selected separately for math and science, and separately for the 4th and 8th grade according to their achievement in TIMSS 2003.
International analyses have already established important associations between math and science achievement and students' perception of school safety (Mullis, Martin, Gonzales, & Chrostowski, 2004). Therefore the focus of our research was laid on the regression analysis of math and science achievement on the basis of students' perception of school safety. In tables 7 and 8 results of regression analyses, separately for math and science, are presented.

[Take in Table 7 about here]

[Take in Table 8 about here]

The regression analysis on Slovenian database proved that aggressive behavior at school is a significant predictor of math and science achievement in Slovenia. In the 4th grade the prediction is significant for all types of aggressive behavior ($p < ,05$), which makes it possible to argue that, when 4th grade students are exposed to indirect or direct forms of aggression, their math and science achievement is lower. In the 8th grade the prediction is significant for indirect forms of aggression - psychological aggression ($p < ,05$). When 8th grade students are exposed to psychological aggression at school, lower math and science achievement can be expected.

In the majority of other countries selected in our sample the predictions made on the ground of students' perception of school safety are significant ($p < ,05$) as well as relevant. Students who have higher perception of school safety also score higher in math and science. The exception is South Africa as a representative of a low achieving country in 8th grade math, and Morocco as an example of a low achieving country in 4th grade science.

## Conclusions and Implications

National analyses for Slovenia show important associations of educational achievement and negative school factors. The results show significant differences in math and science achievement between the following pairs of groups: students whose things were stolen in the last month and students whose things were not stolen; those who were physically harmed and those who were not; those who were forced into activities they did not choose and those who were not; those who were called names and those who were not; those who were left out of activities and those who were not. In all of these groups students who experienced aggressive behavior scored lower in math and science, both in the 4th and 8th grade.

The regression analysis indicates the possibility to predict achievement, based on students' perception

of school safety and specific types of aggressive behavior at school. The results show that negative factors, such as aggressive behavior, are good predictors of educational achievement in Slovenia. International analyses confirm that this type of finding is culturally impartial as well as valid for the level of achievement both in math and science.

The findings are not causal, therefore it is not possible to state with certainty that aggressive behavior at school, or more precisely, that exposure to aggressive behavior at school causes students' low achievement. However, the association of the two phenomena is so strong that it gives us the opportunity to predict achievement by taking into account information about students' perception of school safety. The association is probably reciprocal and the effects are possible in both directions. Research literature offers several models that (try to) explain the relations between social functioning and academic achievement.

The first model suggests that social performance affects academic achievement. It has been argued that children's social competence and interpersonal acceptance may constitute emotional and social resources for achievement at school (e.g., Wentzel, 1991; Wentzel & Asher, 1995). For example, pro-social and cooperative behavior may help to create a classroom environment that is conducive to instruction and learning, whereas aggressive and hostile behavior may disrupt the processes of learning (Chen, Rubin, & Li, 1997). Children who are socially more skilled, are more cooperative and likely to receive requested help in their academic class work. In contrast, aggressive and socially rejected children may have fewer opportunities than others to receive assistance from peers in their schoolwork. The impact that social performance has on attitudes towards school and school work, which in turn affects academic achievement, should not be neglected. For example, children who are rejected, behaviorally disruptive and aggressive may develop negative emotions and attitudes towards school. As a result, they may become disinterested in school activities, including the learning of academic content. Evidence for this model has derived mainly from longitudinal research programs that demonstrate that children who have social and behavioral problems tend to underachieve or fail in academic areas in subsequent years (Chen, Rubin, & Li, 1997).

The second model proposes the influence in the opposite direction, indicating that academic achievement influences social behaviors and adjustment. According to this model, academic difficulties may lead to frustration, which in turn contributes to deviant social behaviors. Children who achieve poorly at school may experience difficulties in obtaining a positive social status and respect among peers, and may develop negative self-perceptions of self-worth. Consequently, these children may display socioemotional problems and eventually turn to deviant peers for support. The evidence for this model is also presented with a range of longitudinal studies (Chen, Rubin, & Li, 1997). Another proof for this model comes from school praxis. Children who receive academic support and who improve academically become more competent in their social interactions and have fewer socioemotional difficulties than those who do not receive treatment (Chen, Rubin, & Li).

Finally, it has been suggested that social functioning and academic achievement may interact with and influence each other (Hinshaw, 1992; Olweus, 1983). This model indicates that social functioning and adjustment affect academic performance and academic achievement, which in turn have a degree of influence on social adjustment.

Such analyses should also have the implications on the school policies. Schools in Slovenia should therefore consider simultaneous focus on improvement of academic achievement and social functioning in terms of controlling students' aggressive behavior. To be able to draw such conclusions internationally, the generalization of analyses should be executed on the entire TIMSS 2003 database to determine the cultural factors of association between aggressive behavior and academic achievement.

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Table 1: Math achievement in relation to the perception of aggression at school (in the last month) – 4th grade

| | Positive answer | | | Negative answer | | |
|---|---|---|---|---|---|---|
| | % (*SE*) | Math score (*SE*) | *SD* | % (*SE*) | Math score (SE) | *SD* |
| Something of mine was stolen | 17,9 (0,99) | 455,6 (3,68) | 77,40 | 82,1 (0,99) | 485,6 (2,82) | 76,78 |
| I was hit or hurt by other students (for example shoving, hitting, kicking) | 39,5 (1,47) | 476,1 (3,47) | 78,79 | 60,5 (1,47) | 482,7 (3,01) | 77,08 |
| I was made to do things I didn't want to do by other students | 13,2 (0,99) | 450,1 (5,10) | 77,16 | 86,8 (0,99) | 484,9 (2,75) | 76,87 |
| I was made fun of or called names | 36,5 (1,33) | 470,3 (3,96) | 78,05 | 63,5 (1,33) | 485,7 (2,86) | 77,21 |
| I was left out of activities by other students | 23,8 (1,13) | 465,7 (3,94) | 79,18 | 76,2 (1,13) | 484,4 (2,96) | 76,92 |

Table 2: Math achivement in relation to the perception of aggression at school (in the last month) – 8th grade

| | Positive answer | | | Negative answer | | |
|---|---|---|---|---|---|---|
| | % (*SE*) | Math score (*SE*) | *SD* | % (*SE*) | Math score (SE) | *SD* |
| Something of mine was stolen | 12,0 (0,70) | 482,8 (4,90) | 70,51 | 88,0 (0,70) | 495,2 (2,22) | 70,73 |
| I was hit or hurt by other students (for example shoving, hitting, kicking) | 26,6 (1,08) | 493,5 (3,16) | 73,04 | 73,4 (1,08) | 493,9 (2,28) | 70,01 |
| I was made to do things I didn't want to do by other students | 7,2 (0,47) | 466,6 (5,13) | 73,20 | 92,8 (0,47) | 495,9 (2,19) | 70,16 |

| | | | | | | |
|---|---|---|---|---|---|---|
| I was made fun of or called names | 26,8 (0,97) | 496,1 (2,95) | 73,18 | 73,3 (0,97) | 493,2 (2,33) | 69,80 |
| I was left out of activities by other students | 12,4 (0,68) | 483,3 (4,13) | 75,28 | 87,7 (0,68) | 495,3 (2,38) | 69,94 |

Table 3: Math achivement in relation to the index of students' perception of school safety

| | 4th grade | | | 8th grade | | |
|---|---|---|---|---|---|---|
| | % (SE) | Math score (SE) | *SD* | % (SE) | Math score (SE) | *SD* |
| High index | 39,7 (1,38) | 489,3 (3,51) | 75,67 | 52,8 (1,33) | 494,8 (2,65) | 68,86 |
| Medium index | 40,0 (1,08) | 480,8 (3,71) | 77,84 | 37,6 (1,27) | 496,6 (3,08) | 72,09 |
| Low index | 20,3 (1,22) | 460,6 (4,13) | 78,58 | 9,7 (0,56) | 478,0 (4,04) | 73,30 |

Table 4: Science achievement in relation to the perception of aggression at school (in the last month) - 4th grade

| | Positive answer | | | Negative answer | | |
|---|---|---|---|---|---|---|
| | % (SE) | Science score (SE) | *SD* | % (SE) | Science score (SE) | *SD* |
| Something of mine was stolen | 17,9 (0,99) | 468,4 (3,98) | 77,97 | 82,1 (0,99) | 496,7 (2,51) | 75,79 |
| I was hit or hurt by other students (for example shoving, hitting, kicking) | 39,5 (1,47) | 486,7 (3,42) | 78,04 | 60,5 (1,47) | 494,8 (2,52) | 76,02 |
| I was made to do things I didn't want to do by other students | 13,2 (0,99) | 466,9 (4,74) | 78,31 | 86,8 (0,99) | 495,4 (2,53) | 76,07 |
| I was made fun of or called names | 36,5 (1,33) | 483,2 (3,51) | 77,23 | 63,5 (1,33) | 496,4 (2,64) | 76,48 |

| | | | | | | |
|---|---|---|---|---|---|---|
| I was left out of activities by other students | 23,8 (1,13) | 478,2 (3,78) | 81,08 | 76,2 (1,13) | 495,7 (2,53) | 75,27 |

Table 5: Science achivement in relation to the perception of aggression at school (in the last month) – 8th grade

| | Positive answer | | | Negative answer | | |
|---|---|---|---|---|---|---|
| | % (SE) | Science score (SE) | *SD* | % (SE) | Science score (SE) | *SD* |
| Something of mine was stolen | 12,0 (0,70) | 512,5 (3,98) | 65,60 | 88,0 (0,70) | 522,3 (1,76) | 66,67 |
| I was hit or hurt by other students (for example shoving, hitting, kicking) | 26,6 (1,08) | 526,0 (3,01) | 68,92 | 73,4 (1,08) | 519,5 (1,90) | 65,48 |
| I was made to do things I didn't want to do by other students | 7,2 (0,47) | 498,2 (4,72) | 67,87 | 92,8 (0,47) | 523,0 (1,83) | 66,10 |
| I was made fun of or called names | 26,8 (0,97) | 526,1 (2,79) | 67,83 | 73,3 (0,97) | 519,5 (1,81) | 65,98 |
| I was left out of activities by other students | 12,4 (0,68) | 515,5 (5,12) | 68,93 | 87,7 (0,68) | 522,0 (1,87) | 66,21 |

Table 6: Science achivement in relation to the index of students' perception of school safety

| | 4th grade | | | 8th grade | | |
|---|---|---|---|---|---|---|
| | % (SE) | Science score (SE) | *SD* | % (SE) | Science score (SE) | *SD* |
| High index | 39,7 (1,38) | 500,7 (2,77) | 73,34 | 52,8 (1,33) | 519,7 (2,01) | 65,41 |
| Medium index | 40,0 (1,08) | 491,4 (3,25) | 77,75 | 37,6 (1,27) | 526,4 (2,76) | 66,99 |
| Low index | 20,3 | 473,7 | 79,29 | 9,7 | 509,4 | 69,02 |

| | | | | |
|---|---|---|---|---|
| | (1,22) | (4,36) | (0,56) | (4,07) |

Table 7: *Regression analyses of math achievement based on the index of students' perception of school safety*

| | *4th grade* | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | *N* | $R^2$ | *K* | *K (S.E.)* | *Beta* | *Beta (S.E.)* | *t* | *p* |
| *Slovenia* | *3022* | *0,017* | *504,500* | *5,232* | *-13,54* | *2,49* | *-5,43* | *,000* |
| *Singapore* | *6629* | *0,038* | *640,62* | *6,51* | *-22,48* | *2,67* | *-8,419* | *,000* |
| *Morocco* | *3513* | *0,004* | *369,02* | *10,88* | *-8,188* | *4,236* | *-1,933* | *,053* |
| *Latvia* | *3586* | *0,038* | *571,792* | *5,053* | *-20,255* | *2,887* | *-7,017* | *,000* |
| *Norway* | *4110* | *0,031* | *487,414* | *3,620* | *-18,921* | *1,881* | *-10,060* | *,000* |
| | *8th grade* | | | | | | | |
| | *N* | $R^2$ | *K* | *K (S.E.)* | *Beta* | *Beta (S.E.)* | *t* | *p* |
| *Slovenia* | *3519* | *0,002* | *501,135* | *4,229* | *-4,637* | *2,172* | *-2,135* | *,033* |
| *Singapore* | *6005* | *0,027* | *637,977* | *3,874* | *-19,206* | *2,070* | *-9,278* | *,000* |
| *South Africa* | *4132* | *0,000* | *335,806* | *6,600* | *-0,623* | *3,093* | *-0,201* | *,840* |
| *Belgium* | *4851* | *0,014* | *558,896* | *4,301* | *-15,089* | *2,173* | *-6,943* | *,000* |
| *Norway* | *4045* | *0,014* | *482,542* | *3,295* | *-13,621* | *2,037* | *-6,685* | *,000* |

Table 8: *Regression analyses of science achievement based on the index of students' perception of school safety*

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | *4th grade* | | | | |
| | *N* | $R^2$ | *K* | *K (S.E.)* | *Beta* | *Beta (S.E.)* | *t* | *p* |
| *Slovenia* | *3022* | *0,016* | *514,91* | *3,99* | *-12,95* | *1,96* | *-6,61* | *,000* |
| *Singapore* | *6629* | *0,030* | *607,260* | *6,563* | *-20,468* | *2,773* | *-7,381* | *,000* |
| *Morocco* | *3513* | *0,005* | *333,749* | *15,465* | *-11,996* | *6,515* | *-1,841* | *,066* |
| *Latvia* | *3586* | *0,034* | *563,935* | *3,791* | *-18,255* | *2,236* | *-8,164* | *,000* |
| *Norway* | *4110* | *0,022* | *498,622* | *3,888* | *-17,000* | *2,427* | *-7,005* | *,000* |
| | | | | *8th grade* | | | | |
| | *N* | $R^2$ | *K* | *K (S.E.)* | *Beta* | *Beta (S.E.)* | *t* | *p* |
| *Slovenia* | *3519* | *0,000* | *522,386* | *3,201* | *-0,746* | *1,885* | *-0,396* | *,692* |
| *Singapore* | *6005* | *0,019* | *609,337* | *4,907* | *-18,583* | *2,464* | *-7,541* | *,000* |
| *South Africa* | *4132* | *0,004* | *410,523* | *5,795* | *-6,409* | *2,797* | *-2,291* | *,022* |
| *Estonia* | *3935* | *0,002* | *559,618* | *3,782* | *-4,450* | *1,974* | *-2,254* | *,024* |
| *Romania* | *3976* | *0,025* | *510,586* | *7,127* | *-19,941* | *3,148* | *-6,335* | *,000* |
| | | | | | | | | |