The Effects of Self-perception on Students' Mathematics and Science Achievement in 38 Countries Based on TIMSS 1999 Data

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Abstract

Earlier studies based on the analyses of data from the Third International Mathematics and Science Study (TIMSS) identified an interesting but conflicting finding for the effects of three self–perception measures on students' achievement in the two subjects at two different levels: within–country data generally show a positive correlation between the three measures and students' actual achievement, while at the country level, the direction is just opposite. The three measures of self–perception include how much students like the two subjects, how difficult they perceive the two subjects, and how well they think they are doing with the two subjects. Because TIMSS' sample design was a two–stage stratified design, this study uses Stata's *svyreg* procedure to replicate earlier analyses. We find that on individual level, when the number of books at home, school resources and indicators of school management are controlled for, the three self–perceptions demonstrate positive effects on students' achievement for most countries; while at the school level, the picture becomes mixed; For most countries, the effect of perceived easiness of the two subjects became negative. We suggest this inconsistency reflects differences in culture and in academic standards from country to country.

Keywords: math, science, self–perceptions, cross–national.

1 Introduction

Psychologists and motivating theorists have long believed that students' positive attitude toward learning and positive self–perception of their competence have great impact on their motivation thus enhancing their academic achievement (e.g., Harter, 1981; Bandura, 1994). Many empirical studies have tested these assumptions and generally support this hypothesized feedback loop among people's self–evaluation, or self–efficacy beliefs, intrinsic interest, motivation, and accomplishment (Schunk, 1984, 1989, 1991; Brown et al., 1989; Locke & Latham, 1990; Multon et al., 1991; Zimmerman et al., 1992; Zimmerman & Bandura, 1994). However, these studies and motivating theories are basically the products of Western culture and societies. The conceptions of self may vary from culture to culture (Markus & Kitayama, 1991; Triandis, 1989). Recent years have seen empirical research in relevant fields, such as testing the relationship between self–esteem and academic achievement in non–Western society (e.g., Heine et al., 1999; Wong & Watkins, 2001). With the increase in the availability of cross–national data, it is important to test the relationship between students' academic achievement and their self–perceptions cross–nationally. This study uses linear regression for complex survey data (svyreg procedure at Stata) to examine the relationship between 8th grade students' achievement scores in mathematics and science and their self–perceptions when some determinants of achievement such as indicators of student's home background, school/classroom learning, and teaching environment are controlled for.

Under the sponsorship of the International Association for the Evaluation of Educational Achievement (IEA), the Third International Mathematics and Science Study (TIMSS) provides unprecedented opportunities for cross–national analyses of educational systems throughout the world. In 1995, TIMSS compared the mathematics and science achievement of students in 41 countries/school systems at five levels — the third, fourth, seventh, and eighth grades, and the final year of secondary school (Beaton et al., 1996a; Beaton et al., 1996b; Martin et al., 1997; Mullis et al., 1997; Mullis et al., 1998).

TIMSS 1999, also known as TIMSS–Repeat, is a replication of TIMSS at the middle–school–level — the eighth grade in most of the 38 participating countries (Martin et al., 2000b; Mullis et al., 2000). TIMSS 1999 adds to the richness of the original TIMSS data and by giving us the opportunity to compare the results between the two waves of study; similar information was collected about students' home background, teachers' background, school characteristics and instructional practices for participating countries.

Shen and Pedulla (2000) apply theory linking students' self–perceived competence with academic achievement using data from the TIMSS 1995. They found that within country data generally show a positive relationship between student achievement and self–perceived competence for both mathematics and science. However, when one examines this relationship between countries (country as the unit of analysis), the opposite relationship occurs, i.e. countries with higher student self–evaluations usually performed poorly on the TIMSS tests, and vice versa. Similarly, countries with a high proportion of students perceiving the subjects as being easy performed poorly on the TIMSS tests, and vice versa. This pattern exists for both mathematics and science, at grades 3, 4, 7 and 8. Shen and Pedulla (2000) put forward a plausible explanation for their finding: this pattern may reflect low academic expectations and standards in low performing countries and high academic expectations and standards in high performing countries. In another study, using ordinary least square (OLS) regression analyses of TIMSS data to explore possible factors accounting for the cross–national variance of students' achievement in mathematics and science, Shen (2001) found students' perceived easiness of the two subjects to be negatively correlated with students' achievement cross–nationally even when other variables are controlled. Such variables include GDP per capita, public expenditure on education as a percentage of GNP, and average number of books in students' homes.

Shen (2002) reexamined the relationship between 8th graders' mathematics and science achievement and their self–perceptions at student level and country level using TIMSS 1999 data. The sample of countries was slightly different from the TIMSS 1995 in that one more self perception measure was added: How much students like the two subjects. The basic finding, however, is the same: Within–country data, there is a generally positive relationship between students' achievement and the three measures of self-perception: how much they like the two subjects, their self–perceived competence in the subjects, and their perceived easiness of the subjects. However, on a between–country analysis (the unit of analysis being the country) the findings are opposite, i.e. there is a negative relationship between self–perceptions and achievement. Using OLS method, Shen found a consistent negative effect of students' perceived easiness in both math and science the two subjects on their actual achievement scores in the two subjects at the country level when the economic development level, literacy level, and indicators of school environment were controlled (2001b). The author suggests that this pattern may reflect high academic standards in high performing countries and low academic standards in low performing countries.

However, it is important to point out that the previously mentioned studies are not without limitations. First, bivariate correlation coefficients, no matter if they are at individual level or country level, are limited in their ability to unravel the complex phenomena as found in current study. Second, the previous studyies used multiple regression analysis with country as the unit of analysis. This is a limitation because the 40 or 38 countries (school systems) were not randomly sampled, they voluntarily participated and the *sample size* is quite small. In addition, using aggregate data ignores the tremendous variability at the school and country levels. The present study overcomes this issue by using student and school as a unit of analysis, thus incorporating the control variables used by previous studies to examine the relationship between the 8th grade students' achievement in the two subjects and their self–perceptions. In particular, considering the two–stage stratified clustering sample design, we use Stata *svy* procedure to perform the analyses. The TIMSS 1999 international achievement scores of the two subjects for the 38 school systems are listed in Table 1.

2 Hypothesis

In this study, the authors intend to test two groups of null hypotheses. The first group is based on individual student level data:

1. There is no correlation between students' mathematics and science achievement scores and the extent of how much they like the two subjects.
2. There is no correlation between students' mathematics and science achievement scores and their self-evaluation of their competence in these two subjects.
3. There is no correlation between students' mathematics and science achievement scores and their perceived easiness of the two subjects.
4. There is no correlation among the three measures of self-perception: how much students like the two subjects, their self-evaluation of their competence in the two subjects, and their perceived easiness of the two subjects.

The second group of null hypotheses is based on school level data:

5. There is no correlation between students' mean mathematics and science achievement scores and their average self-perception about how much they like the two subjects.
6. There is no correlation between students' mean mathematics and science achievement scores and their average self-evaluation level of their competence in these two areas.
7. There is no correlation between students' mean mathematics and science achievement scores and their average perceived easiness of the two subjects.
8. There is no correlation among students' average self-perceptions about how much they like the two subjects, their average self-evaluation of their competence in the two subjects, and their average perceived easiness of the two subjects.

3 Data, measurement and methods

3.1 Countries/school systems included in this study

Thirty–eight school systems participated in the TIMSS 1999 study, including twenty–six countries that had participated in TIMSS 1995. Compared with the participants in TIMSS 1995 (Beaton et al., 1996a), there is a noticeable difference in types of countries that chose to participate in the second wave. Quite a few developed European countries that participated in the 1995 study chose not to participate in TIMSS 1999. At the same time some developing countries that did not participate in TIMSS 1995 participated in TIMSS 1999. The countries (school systems) and each country's average achievement scores on the two subjects are listed in Table 1.

3.2 TIMSS sample design

The target population for the 1999 assessment was defined as "the upper of the two adjacent grades with the most 13–year–olds." In most countries this is the eighth grade.

The basic sample design for TIMSS 1999 is generally referred to as a two–stage stratified cluster sample design. The first stage consisted of a sample of schools, which may be stratified. The second stage consisted of a single mathematics classroom selected at random from the target grade in sampled schools for a total of about 3,500 eighth–grade students in each country. Since TIMSS 1999 was designed for analyses at the school and classroom levels, at least 150 schools were to be selected from the target population. The precision of multistage cluster designs are generally affected by the so–called clustering effect, which is determined by the size of the cluster (classroom) and the size of the intraclass correlation. The intraclass correlation for each country was estimated from past studies, such as TIMSS 1995, or from national assessments. To meet the precision requirements TIMSS produced a range of values of intraclass correlation and minimum cluster sizes. For example, a participant whose intraclass correlation was expected to be 0.6 and whose classroom size was 30 needed to sample a minimum of 248 schools.

The sample–selection method for the first–stage of sampling made use of a systematic probability–proportional–to–size (PPS) technique. Some measure for size of the sampling unit was needed in order to use this method. The number of students in the target grade of the school or total school enrollment was employed. As a rule, for the second stage of sampling one classroom per school was sampled. Classrooms were selected either with equal probabilities or with probabilities proportional to their size.

Weighted and unweighted response rates were computed for each participating country at the school level and at the student level. The minimum accepted school–level participation rate was set at 85%. Like the school–level participation rate, the minimum accepted student-within school participation

rate was set at 85%, too. Then the minimum accepted overall response rate was set at 75% – as the product of the weighted school–level participation rate without replacement schools and the weighted student–level participation rate. For detailed sampling design and process of TIMSS 1999, you may see TIMSS 1999 Technical Report (Martin et al., 2000a).

3.3 Survey data analysis

The dependent variables for this study are eighth grade students' mathematics and science achievement scores in participating countries. The selection of independent variables was based on both theoretical and empirical considerations. Furthermore, in order to compare our results from svy regression procedure with results from previous TIMSS studies using country as the unit of analysis (Shen 2001a, Shen 2001b), this study the same variables as utilized by Shen for his TIMSS 1995 and 1999 data analysis.

The key independent variables are the three self–perception measures. The first measure responsed to the statement: “I like mathematics (or science)” and was used as an indicator of self–perceived attitude toward the two subjects. Responses are based on a 4–point Likert scale which after recoding was: 1 = Dislike a lot, 2 = Dislike, 3 = Like, 4 = Like a lot. The second measure was a response to the statement: “I usually do well in mathematics (or science)”, was used as an indicator of self–perceived competence in mathematics and science. The third self–perception measure was the response to the statement: “Mathematics (or Science) is an easy subject”, and was used as an indicator of self–perceived rigor of the subjects. Both the second and the third measere are based on 4–point Likert scales which after recoding was: 1 = Strongly disagree, 2 = Disagree, 3 = Agree, 4 = Strongly agree. The country means and standard deviations for the three self–perception measures are listed in Table 2 and 3.

Likert scales is one of the limitations of this study because they are based on 4–point scale for measuring the three self–perceptions. In most cases, methodologists simply use a rule–of–thumb that there must be a certain minimum number of classes in the ordinal independent. Berry (1993) states five or fewer is inappropriate; others have insisted on 7 or more. However, it must be noted that use of 4–point Likert scales for independent variables in regression is not unusual in the literature.

Using the second and third measures as indicators of the two concepts — self–evaluation or self–efficacy and perceived rigor of mathematics and science also has reliability limitations. The TIMSS student questionnaire did not ask a series of questions with which we could develop scales to measure the two concepts. Scales based on multiple items would tend to provide more reliable measures of the concepts. For the first self–perception measure — how much students like the two subjects, TIMSS student questionnaire did ask two more relevant questions: the responses to the statements “Mathematics (or science) is boring” and “I enjoy learning mathematics (or science)”. So it is possible to create a scale measuring students’ attitude toward learning mathematics and science. However, in order to be consistent and comparable with the measurements of the other two self–perceptions, only the responses to the statement: “I like mathematics (or science)” are used as an indicator of students’ attitude toward mathematics and science.

Apparently, many factors may influence how students respond to the three statements, including students’ intrinsic interest, and their perceived competence in the subjects, teaching methods, design of textbooks, students’ academic goals and aspirations, their parents’ and/or teachers’ expectations, academic standards, the rigor of curriculum, and so on. As mentioned earlier, when the unit of analysis moves from the individual student to the school level and further to the country level, the connotations of these self–perception measures are affected by *cluster effect* — factors reflecting specific schools and societal contexts. Teaching and learning are cultural activities and the TIMSS study encompasses countries with very different cultural contexts, as well as different social, economic and historical backgrounds. Moreover, TIMSS curriculum analysis reveals substantial differences cross–nationally as well in spite of the similarities (Schmidt, et al. 1997a, 1997b). Tremendous variance exists among sampled schools within a country. Even if schools share the same intended curriculum, due to various reasons the implemented and attained curriculum may differ substantially. All these cross–national and cross–school differences should be taken into account when examining the relationship between students' achievement and the three self–perception measures used in the present study. Therefore, caution must be taken when drawing conclusions from cross–school and cross–national comparisons based on these items.

The TIMSS student questionnaire had two forms: one was a non–specialized version (i.e. it assumed that science is taught as one integrated subject) and 23 out of 38 countries/school systems administered this version (Martin et al., 2000a, p. 309). The other version was a specialized version (i.e. it assumed that science is taught as specialized subjects, specifically biology, earth science, chemistry and physics); the remaining 15 countries/school systems administered this version. Therefore, for the first measure of self–perception for science there were five possible variables: "I like science (integrated)", "I like biology", "I like earth science", "I like physics", and "I like chemistry". For the second measure of self–perception for science, there were four possible variables: "I usually do well in science (integrated)", "I usually do well in biology", "I usually do well in earth science", and "I usually do well in physical science" (this included both physics and chemistry). For the third measure of self–perception for science, there were five possible variables: "Science (integrated) is an easy subject", "Biology is an easy subject", "Earth science is an easy subject", "Chemistry is an easy subject", and "Physics is an easy subject". Students in any particular country responded to either version 1 (integrated) or version 2 (specialized). Students in countries that used the specialized version only answered the items that pertained to the subjects they were studying that year. In other words, if a student was only studying biology, he/she would only answer the items about biology and would leave the other items as missing. If a student was studying earth science and chemistry, he/she would respond to the relevant items for these areas but would not respond about biology and physics.

In order to utilize both versions, a value in the one–to–four range for each student had to be computed regardless of which version he/she filled out. For students in those countries using version 1, the process was straightforward: the actual response to the single item was used. For countries that used the specialized version, the mean of the responses to the relevant items was computed, i.e. the items with non–missing values. In this way it was possible to make full use of the data available for all countries.

Our research methods can be divided into two stages. For the first stage of the study, correlation analyses were employed at three levels. Thirty eight correlation analyses were conducted at the student level for each of the 38 participating countries for TIMSS 1999 to examine the relationship between students' achievement in the two subjects and the three measures of students' self perceptions: how much they like the two subjects; how they perceive their competence in the two subjects, and how easy they perceive the two subjects to be. Similar correlation analyses at the school level were conducted for the two subjects separately. Finally, correlation analyses at the country level were conducted for the aggregated data for the two subjects separately.

For the second stage of the study, linear regression analyses were performed at two levels using svy estimator in Stata for complex survey data, because OLS estimator results in the inaccurate point estimates and/or inaccurate estimates of standard errors. Due to the fact that the three self–perception measures are highly correlated with each other, the effect of each self–perception was tested individually with the same control variables. Our general econometric models take the form

$$Score_i = \beta_0 + \beta_1 Like_i + \sum_{c=1}^{36} \gamma_c D_{c,i} + \sum_{j=1}^{36} \delta_j D_{j,i} * Like_i + \epsilon_i \tag{1}$$

$$Score_i = \beta_0 + \beta_1 Easy_i + \sum_{c=1}^{37} \gamma_c D_{c,i} + \sum_{j=1}^{37} \delta_j D_{j,i} * Easy_i + \epsilon_i \tag{2}$$

$$Score_i = \beta_0 + \beta_1 Good_i + \sum_{c=1}^{37} \gamma_c D_{c,i} + \sum_{j=1}^{37} \delta_j D_{j,i} * Good_i + \epsilon_i \tag{3}$$

where $Score_i$ is students mathematics achievement score; $Like_i$, $Good_i$ and $Easy_i$ are indicators that represents how a student i likes mathematics, finds it easy and does good in mathematics; $D_{c,i}$ is a dummy variable equal to 1 if student i is from country c or 0 otherwise; finally, $D_{j,i} * Like_i$ is an interaction term.

Moreover, six control variables we use to control for robustness of our results: interruption (*bsbmrupt*), student mobility(*mobil*), percentage of students repeating the same grade (*repeat*), percentage of absenteeism (*bcbabst*), school resources(*mresou*) and number of books at student's home (*bsbgbook*). The rational for including the control variables in the two sets of regression analysis follows.

TIMSS school questionnaire asked school principal to what extent the school's capacity to provide instructions was affected by the shortage or inadequacy of 23 items including qualified teachers, computer equipment, library facilities, and special equipment for handicapped students. We anticipate positive association between school resourses index and students' achievements scores.

Frequent absenteeism is a reflection of students' sloppy habits, poor attitude toward schooling, and ineffective classroom management, which are major contributors to low academic standards and unsatisfactory character formation (Wray, 1999, p. 14). If students take study seriously and if the school's climate is conducive to teaching and learning, the percentage of absenteeism should be very low, percentage of absenteeism on a typical school day is an indicator of students' attitude toward schooling.

The frequency of teachers getting interrupted by messages, visitors etc. in mathematics and science classes is included as an indicator of classroom environment and school management and to the fact that frequent interruption during classes has apparent negative effect on teaching and learning. The aggregate data of this variable can be a measure of the seriousness of schools and teachers toward teaching and learning. It is a four-point scale with 1 = Never, 2 = Once in a while, 3 = Pretty often, and 4 = almost always. Based on a cross–national analysis of the TIMSS 1999 data, Shen (2001b) found that this classroom environment measure has significant detrimental effect on students' achievement in the two subjects at the country level.[1]

[1] Lithuania has no data for interruption and we use international mean for this country.

Student mobility — transferring from one school to another due to various reasons during a school year–has long been recognized as a serious problem for student learning and school management (Ingersoll et al., 1989; Alexander et al., 1994; Kerbow, 1993, 1996). The existing studies on the effect of the stability of the student body at a school on achievement tend to indicate that a generalized decline in achievement is associated with mobility (Johnson & Lindblad, 1991; Schuler 1990; Wood et al., 1993). To investigate the stability of the student bodies, TIMSS asked the principals of the participating schools about the percentage of students leaving before the end of the school year. Although mobility of student body is largely rooted in social mobility, yet in societies where schooling is highly regarded, people try to avoid such mobility and if they have to move, they try to minimize the possible negative effect, by moving after the end of the school year.

While high percentage of students repeating the same grade is associated with the educational policy of a school system, region and/or a specific school, it is also a reflection of ineffective school management and student's poor attitude toward schooling and students' efforts. The empirical research on the effect of the mobility of the student body at a school on achievement tends to indicate that a generalized decline in achievement is associated with mobility (Johnson & Lindblad, 1991; Schuler 1990; Wood et al., 1993). High mobility may disrupt students' learning and classroom management, most notably when students enter classrooms that are at a different point in the curriculum from where their previous schools were, and also in decentralized school systems.

The number of books at a student's home has been used substantially as a good indicator of student's academic home background. At the aggregate level, the IEA Reading Literacy Study (Elley, 1994, p. 226) revealed that countries with many books in homes were mostly high–performing countries because homes with plentiful source books apparently provided more advantages for children's literacy development in all countries.

Altogether, twelve regression analyses were conducted. 1. Students' mathematic achievement scores were regressed on how much they like mathematics when the six covariates and 36 dummy variables and interaction terms were controlled[2]; 2. The same dependent and independent variables at the school level were employed for the second regression analysis, and the results were reported side by side with the first student level analysis. Both the dependent and independent variables were aggregated to the school level. Analyses number 3 and 4 repeat the number 1 and 2, but how easy they perceive mathematics takes the place of how much they like mathematics. Similarly, analyses number 5 and 6 repeat the first analysis, but how well the students think they do with mathematics takes the place of how much they like mathematics. Analyses number 7 through 12 repeat the first 6 analyses, but the dependent variable is science score, rather than mathematics score.

After running every regression we estimated the slope coefficient for each country using *lincom* Stata command.[3]

[2]The Netherlands does not have score for like mathematics and like science, that is why we include 36 dummies in models with *like* and 37 dummies in models with *good* and *easy*.

[3]For every country i we tested against zero the sum of coefficient near independent variable and

4 Results

We first report the correlation analysis results at the three levels–student level, school level, and country level.

4.1 Results from correlation analysis at the student level

It is noted that due to the large sample size for each participating country (ranging from over 2,000 students for Lithuania to around 9,000 for the United States), the correlation coefficients are likely to be significant. Therefore, the significance level is not reported. Readers are advised to look at the magnitude of the correlation coefficients.

As shown in Table 4, out of the 113 Pearson's correlation coefficients between mathematics score and the three self–perceptions for 38 countries, seven are negative and all the rest are positive. It appears that the largest correlation coefficients are found in the third column, the correlation between mathematics score and how well the students perceived they were doing with mathematics. The correlation coefficients on column 4 to 6 are for the three measures of self–perception themselves. It is noted that out of 112 coefficients only two are negative and the size of Pearson's r is generally much larger than those found in column 1 to 3, indicating that students who like the subject are likely to think they are doing well and perceive the subject as being easy. The self–efficacy theory and motivation theory are supported from Table 4 data. Table 5 shows the correlation coefficients for science score at the student level.

According to Table 5, out of the 113 Pearson's correlation coefficients between science score and the three self–perceptions for 38 countries, 23 are negative; most being found between science score and perceived easiness of science. The correlation coefficients on column 4 to 6 are for the three measures of self–perception themselves. Again, out of 112 coefficients only two are negative and the size of Pearson's r is generally much larger than those found in column 1 through 3, indicating that students who like the subject are likely to think they are doing well and perceive the subject as being easy. Overall, science data also support the self–efficacy theory and motivation theory.

4.2 Results from correlation analysis at the school level and country level

Using school weight, school level data were computed for both mathematics and science scores and all the independent variables. Table 6 shows the correlation coefficients of average school mathematics score and the three school level measures of self–perception.

As shown in Table 6, compared with correlation coefficients from Table 4 (student level data), more negative signs were found (32 out of 113). We can probably still claim a positive pattern for the relationship between school level mathematics score

coefficient new interaction term, e.g. lincom _b[scigood]+ _b[_IidcXscia36].

and the three self–perceptions. For the correlation coefficients among the three measures of self–perception at the school level, again, out of 112 coefficients, only two are negative. It is noted that the magnitude of these coefficients is substantially higher than those found at the student level.

At the bottom of Table 6, the correlation coefficients at the country level are listed. These are consistent with previous findings (Shen and Pedulla, 2000; Shen, 2001a; 2001b; 2002) in that at the country level, there is a significant negative correlation between country level score and aggregate level of the three self–perceptions. At the same time, it is noted that the three self–perceptions are highly correlated with each other at the country level, indicating that countries with a high proportion of students liking mathematics are likely to be those countries with high proportion of students of high self–evaluation, and perceiving the subject as being easy. However, these countries are likely to be poor performing countries in terms of mathematic achievement scores. It is noted that the magnitude of the correlation coefficients at the country level is even higher than the average of those at the school level.

Table 7 shows the correlation coefficients at the school and country level for science score. The story based on Table 7 is basically the same as for Table 6. The most obvious difference lies in the more negative coefficients between science scores and students' perceived easiness of science. Out of 38 coefficients, only 9 are positive. But the other two measures of self–perception at the school level still demonstrate a positive relationship. Again, the three self–perception measures are positively correlated with each other with some coefficients being as high as 0.70 to 0.80. Similarly to the country level correlation coefficients reported in Table 6 for mathematics, at the country level, there is a significant negative correlation between country level science score and aggregate level of the three self–perceptions. Also, again, high correlations are found among the three self–perceptions themselves.

4.3 Regression results from *svy* procedure at the student level and school level

4.3.1 The effect of students' liking mathematics

Table 8 contains the regression analysis results using *svy* procedure for the two models. For the first model, the dependent variable is mathematic scores at individual level and the predictor is how much the student likes mathematics with the presence of six covariates, 36 dummy variables and 36 interactions terms. The statistics in the first column are the unstandardized regression coefficients for how much students like mathematics followed by the relevant t–value, while the coefficients for the six covariates are reported at the bottom of the table. The equivalent results for the second model — school level data — are reported in the next two columns with the same dummy variables and covariates.

First, let us examine the effects of the six covariates. Consistent with findings from previous research, the number of books at home demonstrates a strong significant positive effect on mathematic scores with the presence of all other variables in the model. Also, as expected, the school resource index shows a positive effect and all other four indicators of school and classroom management problems demonstrate significantly negative effects on achievement score. In terms of our key predictor — how much students like mathematics — all countries except for Moldova show a positive effect even if the effect for South Africa is not significant. Some differences are found at the school level. For 6 countries, the effect of liking mathematics became negative in addition to Moldova. The coefficients for the six covariates became a little weaker in terms of the magnitude of t–value and for three of them the effect lost significance even though all the sign remain the same.

4.3.2 The effect of students' perceived easiness of mathematics

Table 9 reports the effect of how easy the student perceives mathematics with six covariates and 37 dummy variables. Out of 38 regression coefficients, four are negative and all the rest are positive when the six covariates are controlled. Again, the six covariates demonstrate effects in the expected direction and all are statistically significant at the student level. Their magnitude and the size of relevant t–values are pretty similar to those found in Table 8. In terms of the effect of the perceived easiness of mathematics, out of 38 coefficients, four are negative. For the school level model, 18 out of 38 demonstrate a negative effect with the presence of the six covariates — which are similar to those found in Table 8, with 3 remaining significant (class interruption, absenteeism, and number of books at home).

4.3.3 The effect of students' self–evaluation of their competence in mathematics

Table 10 reports the effect of how well the student thinks he/she is doing with mathematics when six covariates and 37 dummy variables are included in the equation. Out of 38 regression coefficients, two poor performing countries (Indonesia and South Africa) have negative coefficients when the six covariates are controlled. As in the previous models, the six covariates affect in the expected direction and all are statistically significant. However, once again, the same three covariates lost their significance at the school level model. For the effect of student's self–evaluation, only two coefficients (Indonesia and South Africa) are negative but not significant and all the rest demonstrate a significant and positive effect on mathematics score. At the school level, 6 out of 38 demonstrate a negative effect with the presence of the six covariates, which are similar to those found in Table 8 and Table 9, with 3 remaining significant.

To summarize the results of the effects of three self–perception measures on mathematic achievement at the student level, there is a generally positive effect on mathematic scores with the presence of the six covariates, which demonstrate consistent significant effects as expected. At the school level however, the effects of the covariates became weaker, with school resource, grade repeating rate and student mobility losing their original significance. For the three self–perception measures, the number of countries with negative effects increases to 7 for liking mathematics, 18 for perceived easiness of mathematics, and 6 for self–evaluation of their competency in mathematics. Now we shall switch to science score as the dependent variable.

4.3.4 The effect of students liking science

Table 11 contains the regression analysis results using svy procedure based on two models when science score is the dependent variable. For the student level model, the predictor is how much the student likes science with six covariates and 36 dummy variables representing the 37 countries. Similarly, the statistics in the first column are the unstandardized regression coefficients followed by the relevant t–value, while the coefficients for the six covariates are reported at the bottom of the table. Again, let us examine the effects of the six covariates first. They are all significant for both models: at individual level and school level even if the magnitude became weaker at the school level. In terms of our key predictor — how much students like science — all countries except for Indonesia and Moldova show a positive effect even if a few are not significant. For the school level model, 10 more countries demonstrate a negative effect.

4.3.5 The effect of students' perceived easiness of science

Table 12 reports the effect of how easy the student perceives science with the presence of six covariates and 37 dummy variables in the equation. For the covariates, the magnitudes of the coefficients and their relevant t values are quite similar to those found in Table 11. Only the school resource index for science instruction lost its significance at the school level. In terms of the perceived easiness of science, out of 38 regression coefficients, 16 are negative with the presence of the six covariates, compared with 4 for mathematics shown in Table 11.

The school level model shows a more negative picture from the average of students' perceived easiness of science. Twenty seven countries show a negative effect compared with 18 for mathematics data in Table 9. Again we see a tendency of getting more negative effects when the unit of analysis moves from individual to school level.

4.3.6 The effect of students' self–evaluation of their competence in science

Table 13 reports the effect of how well the student thinks he/she is doing with science with six covariates and 37 dummy variables in the model. The effects of the six covariates demonstrate significant effects as expected for both student level model and school level model even if the magnitude of the coefficients became somewhat weaker at the school level. In terms of the effect of student's self–evaluation of their competency in science, out of 38 regression coefficients, only Indonesia has a negative coefficient when the six covariates are controlled for. When the unit of analysis moves from student to school, 9 countries demonstrate negative effect with the presence of the covariates.

To summarize the results of the effects of the three self–perception measures on science achievement, at both student level and school level, how much students like science and how well they think they are doing with science demonstrate a generally positive effect on science score with the presence of the six covariates, which demonstrate consistent significant effects as expected. However, for students' perceived easiness of science, the effect is mixed: at student level, for more than half the participating countries, the effect is positive; while at the school level, a more negative

effect is identified.

5 Conclusion and Discussion

The general positive effects of students' liking the two subjects and their self–evaluation of their competence in the two subjects at the student level support the existing motivation and self–efficacy theories: There is a positive feedback loop among students' academic achievement, their self–evaluation, and their intrinsic interest in the subjects. The mixed effect of students' perceived easiness of the two subjects could be explained from two perspectives. First, students who do well with the subjects are likely to think the subjects as being easy, which lead to a positive correlation between perceived easiness and the actual achievement scores. On the other hand, the perceived easiness of the subjects also may reflect the actual challenging level of the program or curriculum. In other words, if students of a country or a school are likely to perceive a subject as being easy, it may reveal an undemanding program and a low academic standard placed on the students. The inconsistency of the effect of perceived easiness of the subjects on actual testing scores cross–nationally reflect the differences of various aspects of school systems, including students' values, academic standards, the design of textbooks, the teaching style and capability of teachers, and so on.

In summary, we have found a trend for both mathematics and science when the unit of analysis moves from individual to school level: the effects of the six covariates become somewhat weaker even if the signs remain in the expected direction; for the three measures of self–perception, more negative effects are found for school level data than for student level data even if two self–perceptions — how much students like the subjects and how well they think they are doing with the subjects — generally demonstrate positive effects on actual achievement scores for the two subjects. The trend of effect becoming negative when the analysis moves from individual level to school level is specially pronounced for students' perceived easiness of the two subjects.

This trend extends to the country level. As shown in Table 6 and 7 (at the bottom), we found consistent negative correlations between aggregate achievement scores in the two subjects and the three measures of students' self–perception at the country level, and the strong positive correlations among the three self–perception measures themselves. This finding is consistent with findings from previous studies on TIMSS data (Shen and Pedulla, 2000; Shen, 2001a; 2001b; 2002). This pattern suggests that cross–nationally, countries that perform relatively poorly on TIMSS tests have students who are likely to say they like the two subjects, who have relatively high self–perceptions about doing well in mathematics and science, and who tend to perceive the two subjects as being easy. Conversely, countries that perform relatively well on TIMSS tests have students who are likely to say they less like the two subjects, who have relatively low self–perceptions of their competence, and who tend to perceive mathematics and science as being hard.

The positive–to–negative trend accompanies the change of the unit of analysis from student to school, then to the country. We perceive a generally positive relationship at the student level to somewhat mixed at the school level especially for perceived easiness of the two subjects, and generally negative at the country level between students' achievement scores and the three measures of students' self–perceptions.

The school system of a country, the philosophy of education of the society, the rigor of the programs and academic standards of the system, the expectation of the society on their students, the importance of schooling for the adolescents, the way in which students perceive these expectations as well as the academic standards are all products of the historical, cultural and societal environment of a specific country. As shown in Table 2 and Table 3, countries with high scores on the three measures of self–perception are likely to be poor performing countries such as South Africa, Morocco, Iran and Indonesia; while countries with relatively low scores on the self–perception measures such as Japan and South Korea are just high–performing countries. The aggregate measures of students' self–perceptions have transcended individual characteristics and reflect a specific country's educational, cultural, and social contexts, which have gradually created individual's attitudes, values, and beliefs.

This trend may reflect the cluster effect within countries and within schools alike. The cluster effect is easier to identify at the country level than at the school level. A country and a school as a sampling unit constitutes a cluster of students who tend to be more like each other than like other members of the population. The intraclass correlation is a measure of this cluster effect.

The inconsistency of the effects of self–perception at the student level and school level is at least partly due to the school level intraclass correlation — the cluster effect over and above the individual level which influences students perceptions collectively. This trend is also affected by the *school culture* which includes the rigor of the program, the implementation of the curricula, the discipline of the school, the extent of the conducive climate for teaching and learning: because students of a specific school may have similar perceptions, values and learning practices. Due to the large number of schools for the 38 countries, we cannot present the school level counterparts in Table 2 and 3 data thus presenting only means and standard deviations for the three self–perceptions for each participating country. Countries whose regression coefficients of self–perception changes from positive at the student level to negative at the school level may have relatively large school intraclass correlation in terms of student self perceptions. A less rigorous program or undemanding implemented curricula of the school may lead to a false belief that mathematics and science are easy subjects and students feel they are doing well with the subjects. This false belief may reflect a low academic standard for the school.

As mentioned at the beginning of the paper, it is widely assumed that a positive self–regard is an important motivating force and helps to enhance people's achievement. However some researchers, based on cross–cultural study, argue that the need for self–regard is culturally variant because the construction of self–regard itself differs across cultures. For example, Heine et al. (1999) observed that anthropological, sociological, and psychological analyses revealed that many elements of Japanese culture are incongruent with such motivations and a self–critical focus is more characteristics of Japanese, while the need for positive self–regard is rooted in significant aspects of North American culture.

Overall, the policy implication yielded from this study should point to the necessity to gradually raise the academic standards for the poor performing countries and schools. However, the academic standards and curriculum of a country have been shaped by a country's specific historical and cultural context. Therefore, we cannot imagine simply copying the rigorous curriculum will improve the achievement without understanding the actions, beliefs and attitudes related to education in a specific society and culture.

This study, together with other research based on secondary data analysis from TIMSS project, makes us see the value of cross–national comparative studies. In a world of rapid globalization with tougher and tougher competition, educators as well as parents, and policymakers should consider their educational standards and pedagogical practice in an international context so that expectations of students are not confined just within a local city, district or country. One of the values of comparative research is that it makes what one takes for granted problematic (Romberg, 1999). Only when compared with higher performing countries, can people in lower performing school systems realize their problems: Lower expectations and standards result in grades that are artificially high, leading students to believe their achievement is better than it really is. These students would have less motivation and set lower goals to improve their performance than their high performing foreign counterparts, since they perceive their performance to be of a high caliber already. If they believe that they are doing well and that mathematics and science are easy for them, they would see no need to study harder in these areas or to invest greater effort in them. Studies such as TIMSS help educators, parents, and students from low performing systems to free from the misperception and see the necessity to raise their academic standards as one of the important measures to improve the achievement.

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Table 1: National Average Scores for TIMSS 1999 School Systems (N=38)

Country/school system	Mathematics score[a]	Science score[b]
Singapore	604 (6.3)	568 (8.0)
Korea, Rep.of	587 (2.0)	549 (2.6)
Chinese, Taipei	585 (4.0)	569 (4.4)
Hong Kong, SAR	582 (4.3)	530 (3.7)
Japan	579 (1.7)	550 (2.2)
Belgium (Flemish)	558 (3.3)	535 (3.1)
Netherlands	540 (7.1)	545 (6.9)
Slovak Republic	534 (4.0)	535 (3.3)
Hungary	532 (3.7)	552 (3.7)
Canada	531 (2.5)	533 (2.1)
Slovenia	530 (2.8)	533 (3.2)
Russian Federation	526 (5.9)	529 (6.4)
Australia	525 (4.8)	540 (4.4)
Finland	520 (2.7)	535 (3.5)
Czech Republic	520 (4.2)	539 (4.2)
Malaysia	519 (4.4)	492 (4.4)
Bulgaria	511 (5.8)	518 (5.4)
Latvia (LSS)	505 (3.4)	503 (4.8)
United States	502 (4.0)	515 (4.6)
England	496 (4.1)	538 (4.8)
New Zealand	491 (5.2)	510 (4.9)
Lithuania	482 (4.3)	488 (4.1)
Italy	479 (3.8)	493 (3.9)
Cyprus	476 (1.8)	460 (2.4)
Romania	472 (5.8)	472 (5.8)
Moldova	469 (3.9)	459 (4.0)
Thailand	467 (5.1)	482 (4.0)
Israel	466 (3.9)	468 (4.9)
Tunisia	448 (2.4)	430 (3.4)
Macedonia, Rep. of	447 (4.2)	458 (5.2)
Turkey	429 (4.3)	433 (4.3)
Jordan	428 (3.6)	450 (3.8)
Iran, Islamic Rep.	422 (3.4)	448 (3.8)
Indonesia	403 (4.9)	435 (4.5)
Chile	392 (4.4)	420 (3.7)
Philippines	345 (6.0)	345 (7.5)
Morocco	337 (2.6)	323 (4.3)
South Africa	275 (6.8)	245 (7.8)

[a] Source: TIMSS 1999 International Mathematics Report (Mullis et al., 2000).
[b] Source: TIMSS 1999 International Science Report (Martin et al., 2000b).

The numbers in parentheses are standard errors

Table 2: Average self-perception scores on math by country

Country	"I like math"†	"Math is easy"	"I do well in math"
Australia	2.74 ± 0.85	2.24 ± 0.75	3.08 ± 0.67
Belgium	2.80 ± 0.88	2.07 ± 0.79	2.77 ± 0.83
Bulgaria	2.78 ± 0.87	2.15 ± 0.88	2.92 ± 0.83
Canada	2.88 ± 0.89	2.51 ± 0.88	3.20 ± 0.73
Chile	2.92 ± 0.84	2.37 ± 0.89	2.98 ± 0.77
Chinese, Taipei	2.60 ± 0.88	2.24 ± 0.78	2.52 ± 0.78
Cyprus	2.99 ± 0.88	2.41 ± 0.86	3.08 ± 0.78
Czech Republic	2.58 ± 0.84	2.09 ± 0.77	2.78 ± 0.73
England	2.95 ± 0.80	2.16 ± 0.70	3.20 ± 0.58
Finland	2.72 ± 0.85	2.29 ± 0.80	2.87 ± 0.77
Hong Kong, SAR	2.93 ± 0.78	2.22 ± 0.74	2.49 ± 0.74
Hungary	2.68 ± 0.81	2.14 ± 0.76	2.88 ± 0.69
Indonesia	3.11 ± 0.57	2.45 ± 0.71	3.07 ± 0.62
Iran, Islamic Rep.	3.13 ± 0.82	2.72 ± 0.90	3.06 ± 0.71
Israel	2.95 ± 0.89	2.32 ± 0.89	3.34 ± 0.71
Italy	2.88 ± 0.95	2.29 ± 0.81	2.95 ± 0.81
Japan	2.42 ± 0.84	1.84 ± 0.67	2.39 ± 0.73
Jordan	3.15 ± 0.88	2.71 ± 0.95	3.34 ± 0.72
Korea, Rep.of	2.58 ± 0.80	2.05 ± 0.64	2.35 ± 0.70
Latvia (LSS)	2.64 ± 0.76	2.05 ± 0.66	2.68 ± 0.71
Lithuania	2.84 ± 0.74	2.09 ± 0.68	2.75 ± 0.74
Macedonia, Rep. of	3.06 ± 0.80	2.49 ± 0.90	3.10 ± 0.80
Malaysia	3.37 ± 0.59	2.70 ± 0.71	2.94 ± 0.65
Moldova	2.63 ± 0.91	2.30 ± 0.80	2.78 ± 0.72
Morocco	3.39 ± 0.78	2.76 ± 1.01	3.10 ± 0.82
Netherlands	.	2.25 ± 0.82	3.11 ± 0.83
New Zealand	2.86 ± 0.82	2.26 ± 0.75	3.02 ± 0.69
Philippines	3.22 ± 0.64	2.65 ± 0.84	3.21 ± 0.70
Romania	2.85 ± 0.81	2.19 ± 0.81	2.86 ± 0.77
Russian Federation	2.97 ± 0.72	2.19 ± 0.73	2.84 ± 0.77
Singapore	3.04 ± 0.83	2.27 ± 0.79	2.70 ± 0.78
Slovak Republic	2.81 ± 0.77	2.32 ± 0.76	3.01 ± 0.69
Slovenia	2.61 ± 0.84	2.04 ± 0.80	2.88 ± 0.77
South Africa	3.32 ± 0.82	2.83 ± 1.00	3.20 ± 0.85
Thailand	2.90 ± 0.64	2.21 ± 0.65	2.74 ± 0.72
Tunisia	2.99 ± 0.90	2.39 ± 0.93	2.99 ± 0.84
Turkey	2.97 ± 0.83	2.47 ± 0.82	2.79 ± 0.80
United States	2.83 ± 0.92	2.41 ± 0.90	3.19 ± 0.74

Notes:
Response to "I like mathematics": 1 = Dislike a lot; 2 = Dislike; 3 = Like; 4 = Like a lot.
Response to "Mathematics is an easy subject": 1 = Strongly disagree; 2 = Disagree; 3 = Agree; 4 = Strongly agree.
Response to "I usually do well in mathematics": 1 = Strongly disagree; 2 = Disagree; 3 = Agree; 4 = Strongly agree.

† The Netherlands has no data for this variable.

Table 3: Average self-perception scores on science by country

Country	"I like science"‡	"Science is easy"	"I do well in science"
Australia	2.72 ± 0.88	2.31 ± 0.75	3.00 ± 0.70
Belgium	2.66 ± 0.64	2.35 ± 0.57	2.76 ± 0.60
Bulgaria	2.96 ± 0.57	2.57 ± 0.64	3.09 ± 0.57
Canada	2.81 ± 0.86	2.45 ± 0.80	3.10 ± 0.69
Chile	3.19 ± 0.69	2.86 ± 0.82	3.22 ± 0.65
Chinese, Taipei	2.81 ± 0.78	2.44 ± 0.72	2.64 ± 0.71
Cyprus	2.90 ± 0.84	2.48 ± 0.82	3.02 ± 0.75
Czech Republic	2.75 ± 0.49	2.34 ± 0.49	3.02 ± 0.48
England	3.07 ± 0.74	2.20 ± 0.66	3.15 ± 0.57
Finland	2.78 ± 0.62	2.44 ± 0.54	2.83 ± 0.57
Hong Kong, SAR	2.91 ± 0.73	2.36 ± 0.70	2.56 ± 0.69
Hungary	2.64 ± 0.52	2.29 ± 0.47	2.90 ± 0.50
Indonesia	3.24 ± 0.51	2.58 ± 0.67	3.12 ± 0.60
Iran, Islamic Rep.	3.31 ± 0.71	2.98 ± 0.78	3.21 ± 0.64
Israel	2.80 ± 0.91	2.57 ± 0.87	3.20 ± 0.76
Italy	2.92 ± 0.84	2.52 ± 0.75	2.99 ± 0.73
Japan	2.54 ± 0.83	2.02 ± 0.68	2.40 ± 0.72
Jordan	3.26 ± 0.80	2.84 ± 0.91	3.36 ± 0.73
Korea, Rep.of	2.55 ± 0.75	2.03 ± 0.61	2.30 ± 0.65
Latvia (LSS)	2.72 ± 0.52	2.28 ± 0.48	2.76 ± 0.51
Lithuania	2.66 ± 0.52	2.14 ± 0.48	2.80 ± 0.54
Macedonia, Rep. of	3.30 ± 0.51	2.97 ± 0.61	3.38 ± 0.55
Malaysia	3.34 ± 0.57	2.64 ± 0.70	2.90 ± 0.61
Moldova	2.42 ± 0.58	2.65 ± 0.58	2.97 ± 0.54
Morocco	3.08 ± 0.66	2.86 ± 0.81	2.93 ± 0.71
Netherlands	.	2.44 ± 0.55	3.19 ± 0.57
New Zealand	2.81 ± 0.84	2.26 ± 0.73	2.90 ± 0.68
Philippines	3.30 ± 0.65	2.80 ± 0.81	3.25 ± 0.71
Romania	2.82 ± 0.54	2.58 ± 0.56	2.97 ± 0.54
Russian Federation	3.05 ± 0.50	2.40 ± 0.55	3.04 ± 0.56
Singapore	3.13 ± 0.71	2.37 ± 0.75	2.78 ± 0.67
Slovak Republic	2.82 ± 0.52	2.48 ± 0.49	3.14 ± 0.52
Slovenia	2.75 ± 0.54	2.22 ± 0.54	3.03 ± 0.56
South Africa	3.28 ± 0.86	2.99 ± 0.97	3.17 ± 0.88
Thailand	3.07 ± 0.56	2.40 ± 0.66	2.84 ± 0.67
Tunisia	3.29 ± 0.71	2.95 ± 0.83	3.30 ± 0.68
Turkey	3.15 ± 0.74	2.69 ± 0.81	2.98 ± 0.73
United States	2.87 ± 0.89	2.61 ± 0.85	3.19 ± 0.72

Notes:
Response to "I like science": 1 = Dislike a lot; 2 = Dislike; 3 = Like; 4 = Like a lot.
Response to "Science is an easy subject": 1 = Strongly disagree; 2 = Disagree; 3 = Agree; 4 = Strongly agree.
Response to "I usually do well in science": 1 = Strongly disagree; 2 = Disagree; 3 = Agree; 4 = Strongly agree.

‡ The Netherlands has no data for this variable.

Table 4: Correlations of self-perceptions and math score at the student level by country

Country	score/like	score/easy	score/good	like/easy	like/good	easy/good
Australia	0.19	0.22	0.38	0.43	0.49	0.46
Belgium	0.31	0.14	0.33	0.44	0.65	0.52
Bulgaria	0.23	0.06	0.30	0.44	0.52	0.37
Canada	0.31	0.37	0.49	0.51	0.55	0.56
Chile	0.20	0.12	0.25	0.47	0.56	0.40
Chinese, Taipei	0.46	0.30	0.43	0.61	0.64	0.56
Cyprus	0.33	0.22	0.42	0.55	0.60	0.47
Czech Republic	0.29	0.22	0.40	0.52	0.55	0.49
England	0.13	0.05	0.25	0.35	0.47	0.33
Finland	0.28	0.41	0.51	0.56	0.58	0.62
Hong Kong, SAR	0.31	0.18	0.26	0.50	0.53	0.47
Hungary	0.31	0.20	0.43	0.47	0.56	0.43
Indonesia	0.12	-0.10	-0.07	0.37	0.38	0.32
Iran, Islamic Rep.	0.24	0.15	0.30	0.54	0.47	0.38
Israel	0.08	0.09	0.22	0.43	0.42	0.35
Italy	0.33	0.15	0.37	0.47	0.61	0.39
Japan	0.38	0.26	0.52	0.51	0.54	0.38
Jordan	0.16	0.05	0.20	0.50	0.26	0.21
Korea, Rep.of	0.42	0.27	0.55	0.49	0.61	0.44
Latvia (LSS)	0.25	0.14	0.39	0.43	0.55	0.38
Lithuania	0.28	0.15	0.45	0.36	0.54	0.35
Macedonia, Rep. of	0.04	-0.08	0.16	0.50	0.56	0.40
Malaysia	0.22	0.04	0.26	0.46	0.43	0.37
Moldova	-0.17	-0.00	0.17	-0.12	-0.25	0.32
Morocco	0.15	0.01	0.13	0.31	0.46	0.31
Netherlands	.	0.15	0.28	.	.	0.53
New Zealand	0.21	0.17	0.39	0.43	0.49	0.45
Philippines	0.17	-0.12	0.08	0.21	0.27	0.20
Romania	0.28	0.09	0.29	0.42	0.49	0.31
Russian Federation	0.26	0.10	0.39	0.35	0.51	0.32
Singapore	0.22	0.13	0.20	0.56	0.63	0.54
Slovak Republic	0.30	0.23	0.43	0.54	0.50	0.44
Slovenia	0.28	0.27	0.46	0.46	0.55	0.43
South Africa	-0.01	-0.12	-0.05	0.35	0.43	0.38
Thailand	0.26	0.01	0.12	0.36	0.37	0.28
Tunisia	0.28	0.16	0.28	0.53	0.59	0.45
Turkey	0.23	0.09	0.28	0.43	0.52	0.38
United States	0.19	0.15	0.33	0.53	0.55	0.51

Table 5: Correlations of self-perceptions and science score at the student level by country

Country	score/like	score/easy	score/good	like/easy	like/good	easy/good
Australia	0.22	0.17	0.35	0.39	0.52	0.43
Belgium	0.15	0.10	0.27	0.42	0.60	0.47
Bulgaria	0.07	-0.08	0.18	0.39	0.45	0.27
Canada	0.19	0.21	0.34	0.41	0.46	0.41
Chile	0.03	-0.03	0.14	0.35	0.44	0.32
Chinese, Taipei	0.29	0.14	0.30	0.52	0.57	0.46
Cyprus	0.31	0.21	0.41	0.51	0.55	0.42
Czech Republic	0.10	-0.02	0.22	0.36	0.43	0.30
England	0.16	0.06	0.25	0.25	0.46	0.26
Finland	0.21	0.23	0.36	0.51	0.55	0.51
Hong Kong, SAR	0.21	0.02	0.19	0.42	0.49	0.38
Hungary	0.15	0.01	0.31	0.39	0.47	0.30
Indonesia	-0.06	-0.27	-0.16	0.29	0.38	0.28
Iran, Islamic Rep.	0.07	-0.04	0.13	0.46	0.38	0.34
Israel	0.09	0.10	0.21	0.39	0.43	0.32
Italy	0.19	-0.04	0.31	0.31	0.43	0.19
Japan	0.35	0.18	0.48	0.47	0.51	0.33
Jordan	0.11	-0.04	0.19	0.43	0.26	0.19
Korea, Rep.of	0.36	0.23	0.51	0.47	0.55	0.39
Latvia (LSS)	0.12	-0.08	0.19	0.35	0.47	0.25
Lithuania	0.10	-0.02	0.29	0.33	0.43	0.27
Macedonia, Rep. of	-0.01	-0.17	0.12	0.40	0.49	0.28
Malaysia	0.14	-0.02	0.14	0.40	0.35	0.32
Moldova	-0.14	-0.12	0.12	-0.00	-0.12	0.20
Morocco	0.14	-0.03	0.07	0.29	0.44	0.23
Netherlands	.	0.13	0.35	.	.	0.38
New Zealand	0.10	0.02	0.24	0.35	0.48	0.34
Philippines	0.19	-0.08	0.07	0.20	0.27	0.18
Romania	0.04	-0.15	0.11	0.43	0.43	0.23
Russian Federation	0.14	-0.09	0.24	0.21	0.43	0.13
Singapore	0.23	0.03	0.18	0.44	0.55	0.44
Slovak Republic	0.12	-0.00	0.33	0.46	0.38	0.24
Slovenia	0.08	0.01	0.30	0.31	0.47	0.29
South Africa	0.03	-0.10	0.01	0.37	0.47	0.37
Thailand	0.21	-0.02	0.10	0.30	0.31	0.23
Tunisia	0.04	0.01	0.10	0.42	0.43	0.32
Turkey	0.09	-0.05	0.10	0.39	0.44	0.34
United States	0.18	0.12	0.30	0.45	0.49	0.44

Table 6: Correlations of self-perceptions and math score at the school level by country

Country	score/like	score/easy	score/good	like/easy	like/good	easy/good
Australia	0.22	0.19	0.49	0.55	0.54	0.66
Belgium	0.52	-0.12	0.34	0.33	0.69	0.53
Bulgaria	0.30	0.06	0.45	0.62	0.62	0.49
Canada	0.20	0.20	0.38	0.57	0.65	0.69
Chile	-0.04	-0.20	0.01	0.70	0.71	0.60
Chinese, Taipei	0.65	0.41	0.60	0.72	0.77	0.73
Cyprus	0.39	0.29	0.47	0.80	0.73	0.65
Czech Republic	0.24	0.05	0.35	0.66	0.66	0.64
England	0.13	-0.06	0.19	0.50	0.54	0.45
Finland	0.20	0.35	0.44	0.64	0.60	0.70
Hong Kong, SAR	0.63	0.24	0.33	0.63	0.72	0.63
Hungary	0.23	0.02	0.44	0.58	0.61	0.47
Indonesia	-0.19	-0.54	-0.54	0.66	0.65	0.73
Iran, Islamic Rep.	0.04	-0.04	0.07	0.72	0.75	0.64
Israel	-0.23	-0.35	-0.03	0.50	0.51	0.43
Italy	0.14	-0.13	0.08	0.59	0.64	0.57
Japan	0.31	0.17	0.19	0.54	0.52	0.44
Jordan	0.05	-0.17	0.21	0.75	0.30	0.30
Korea, Rep.of	0.59	0.45	0.59	0.63	0.70	0.62
Latvia (LSS)	0.21	0.00	0.37	0.59	0.67	0.50
Lithuania	0.42	0.14	0.55	0.53	0.71	0.47
Macedonia, Rep. of	-0.45	-0.47	-0.25	0.73	0.70	0.58
Malaysia	0.25	-0.16	0.38	0.61	0.56	0.38
Moldova	-0.38	-0.13	0.14	-0.15	-0.36	0.53
Morocco	0.06	-0.18	-0.01	0.41	0.62	0.46
Netherlands	.	-0.14	0.29	.	.	0.66
New Zealand	0.19	-0.17	0.48	0.39	0.61	0.30
Philippines	0.13	-0.49	-0.06	0.37	0.31	0.35
Romania	0.25	0.01	0.27	0.56	0.57	0.38
Russian Federation	0.35	-0.07	0.38	0.38	0.66	0.32
Singapore	0.23	-0.03	0.12	0.67	0.74	0.76
Slovak Republic	0.19	0.07	0.39	0.61	0.50	0.51
Slovenia	0.06	0.17	0.21	0.47	0.50	0.61
South Africa	-0.35	-0.66	-0.44	0.62	0.75	0.73
Thailand	0.37	-0.14	0.03	0.45	0.53	0.47
Tunisia	0.37	0.08	0.28	0.73	0.77	0.69
Turkey	0.13	-0.21	0.08	0.61	0.66	0.57
United States	0.10	-0.00	0.38	0.62	0.63	0.64
Country Level	-0.67	-0.72	-0.59	0.86	0.60	0.64

Table 7: Correlations of self-perceptions and science score at the school level by country

Country	score/like	score/easy	score/good	like/easy	like/good	easy/good
Australia	0.40	0.16	0.56	0.50	0.71	0.61
Belgium	0.28	0.28	0.42	0.59	0.78	0.74
Bulgaria	-0.02	-0.21	0.27	0.62	0.57	0.35
Canada	0.13	0.24	0.25	0.48	0.58	0.57
Chile	-0.05	-0.32	0.06	0.63	0.63	0.58
Chinese, Taipei	0.47	0.12	0.43	0.64	0.74	0.63
Cyprus	0.41	0.29	0.45	0.71	0.75	0.74
Czech Republic	-0.02	-0.34	0.19	0.49	0.51	0.23
England	0.13	-0.25	0.09	0.11	0.52	0.15
Finland	0.25	0.29	0.39	0.64	0.64	0.62
Hong Kong, SAR	0.37	-0.21	0.14	0.52	0.77	0.66
Hungary	0.01	-0.30	0.26	0.53	0.50	0.36
Indonesia	-0.49	-0.78	-0.67	0.70	0.80	0.77
Iran, Islamic Rep.	-0.09	-0.26	-0.10	0.76	0.71	0.73
Israel	-0.35	-0.29	-0.22	0.64	0.65	0.61
Italy	0.16	-0.25	0.15	0.43	0.52	0.31
Japan	0.33	0.24	0.24	0.58	0.59	0.53
Jordan	0.05	-0.22	0.21	0.65	0.43	0.40
Korea, Rep.of	0.49	0.43	0.59	0.73	0.75	0.70
Latvia (LSS)	0.01	-0.29	0.11	0.48	0.57	0.31
Lithuania	0.10	-0.18	0.44	0.44	0.48	0.25
Macedonia, Rep. of	-0.42	-0.52	-0.19	0.61	0.55	0.44
Malaysia	0.20	-0.27	0.20	0.66	0.48	0.42
Moldova	-0.30	-0.22	0.00	0.08	-0.14	0.44
Morocco	0.08	-0.07	0.12	0.39	0.56	0.23
Netherlands	.	-0.07	0.56	.	.	0.37
New Zealand	0.01	-0.24	0.28	0.40	0.59	0.26
Philippines	0.35	-0.33	0.04	0.30	0.49	0.43
Romania	-0.07	-0.28	0.01	0.65	0.46	0.26
Russian Federation	0.15	-0.28	0.22	0.27	0.47	0.14
Singapore	0.30	-0.43	0.07	0.53	0.77	0.69
Slovak Republic	0.00	-0.27	0.49	0.64	0.42	0.20
Slovenia	-0.14	-0.11	0.07	0.26	0.55	0.39
South Africa	-0.06	-0.42	-0.13	0.71	0.88	0.76
Thailand	0.30	-0.20	0.04	0.46	0.64	0.50
Tunisia	-0.09	-0.18	0.13	0.79	0.74	0.68
Turkey	0.07	-0.27	-0.08	0.64	0.66	0.67
United States	0.15	0.00	0.45	0.60	0.73	0.66
Country Level	-0.56	-0.74	-0.43	0.73	0.59	0.70

Table 8: Regression coefficients of liking math on math score at the student level and the school level

Country	like: student	t–value	like: school	t–value
Australia	18.5262	7.51	31.7173	19.39
Belgium	21.9360	9.54	41.1214	20.88
Bulgaria	21.4169	6.87	36.2083	30.71
Canada	24.2363	16.22	13.6138	5.67
Chile	18.4752	11.53	9.5785	4.63
Chinese, Taipei	48.6261	31.35	92.3017	10.36
Cyprus	25.0105	10.83	59.2294	16.69
Czech Republic	30.7523	10.58	27.2776	13.04
England	14.4666	3.81	33.5513	9.78
Finland	20.0306	10.28	11.7707	10.89
Hong Kong, SAR	25.1799	14.22	115.8930	35.32
Hungary	34.4634	13.13	47.2281	21.50
Indonesia	22.0499	4.54	-70.7455	-19.41
Iran, Islamic Rep.	22.2291	13.26	-18.6292	-4.01
Israel	6.2775	2.29	-34.9400	-17.05
Italy	28.4212	15.62	22.0672	20.34
Japan	35.4673	27.34	26.5037	14.49
Jordan	20.4438	9.45	19.8994	8.18
Korea, Rep.of	36.7644	28.32	64.3757	6.92
Latvia (LSS)	23.1636	9.62	4.2048	4.13
Lithuania	26.4927	9.37	16.8238	2.23
Macedonia, Rep. of	9.0388	3.19	-48.5465	-24.81
Malaysia	26.6387	10.11	66.6063	5.84
Moldova	-11.8306	-4.08	-74.0875	-39.82
Morocco	17.1701	5.91	34.3070	6.90
New Zealand	22.6220	8.78	43.9309	20.27
Philippines	25.0488	8.67	37.1030	4.04
Romania	28.2017	10.06	18.8361	3.88
Russian Federation	25.9658	10.49	27.4832	23.36
Singapore	20.9637	11.10	60.5641	46.76
Slovak Republic	27.4044	11.52	22.1979	19.61
Slovenia	25.5842	12.12	-7.3936	-4.95
South Africa	2.7382	1.11	-40.5417	-12.65
Thailand	33.3752	11.90	123.0021	71.92
Tunisia	17.9646	15.94	11.8274	6.05
Turkey	24.3869	10.25	37.8427	14.83
United States	16.3800	10.07	10.9251	2.06
bsbmrupt	-8.6053	-20.08	-38.6614	-3.47
mresou	8.9993	6.74	4.1017	1.18
bcbgabst	-1.1638	-4.84	-1.0258	-3.26
repeat	-1.5769	-7.19	-0.1685	-0.42
mobil	-1.4522	-6.35	-1.5241	-1.84
bsbgbook	16.4680	44.04	35.7019	4.76

Table 9: Regression coefficients of perceived easiness of math on math score at the student level and the school level

Country	easy: student	t–value	easy: school	t–value
Australia	22.1610	8.90	35.8146	12.02
Belgium	6.8275	1.93	3.0738	1.45
Bulgaria	8.5272	3.07	57.5108	5.18
Canada	27.5875	13.19	11.4719	7.30
Chile	11.2915	6.58	-9.7255	-3.43
Chinese, Taipei	35.9477	21.62	75.4281	6.18
Cyprus	17.6732	7.93	36.9145	13.18
Czech Republic	29.6905	11.12	38.0507	13.65
England	10.8387	2.67	-13.3415	-7.47
Finland	30.4703	16.69	29.6112	21.13
Hong Kong, SAR	15.8055	7.25	78.3289	38.22
Hungary	25.2118	10.52	41.3086	20.77
Indonesia	-7.6024	-1.78	-105.2637	-60.96
Iran, Islamic Rep.	13.3591	8.26	-2.4927	-2.03
Israel	6.2391	1.77	-68.8642	-29.68
Italy	16.1286	7.96	-7.3827	-2.78
Japan	30.4666	16.66	36.5721	46.77
Jordan	8.1259	3.49	-8.6888	-2.84
Korea, Rep.of	29.0102	15.77	88.6177	5.87
Latvia (LSS)	15.7641	4.69	-38.9764	-27.36
Lithuania	16.5707	7.02	-0.2941	-0.12
Macedonia, Rep. of	-4.3451	-1.79	-60.0437	-31.42
Malaysia	3.1996	1.34	-59.6879	-55.14
Moldova	3.3321	1.05	23.4762	7.80
Morocco	0.8456	0.41	0.0635	0.02
Netherlands	13.4778	2.82	-22.7061	-8.23
New Zealand	22.1725	8.82	21.0591	2.98
Philippines	-10.9602	-4.33	-46.3550	-7.51
Romania	13.6022	5.17	34.2316	8.49
Russian Federation	11.0260	5.19	-10.5596	-2.26
Singapore	12.2551	7.15	-11.0673	-6.72
Slovak Republic	20.3848	8.29	-3.4398	-2.14
Slovenia	28.2722	14.72	16.4895	4.25
South Africa	-9.1730	-3.99	-82.2311	-15.78
Thailand	3.3378	1.14	49.6364	11.82
Tunisia	9.6395	8.03	-3.8912	-2.29
Turkey	9.4528	3.74	6.3955	1.43
United States	15.4684	9.52	8.6538	2.39
bsbmrupt	-9.0571	-20.92	-38.2633	-3.64
mresou	9.0468	6.77	3.6927	0.99
bcbgabst	-1.1567	-4.81	-1.1750	-4.63
repeat	-1.5769	-7.02	-0.2053	-0.57
mobil	-1.4529	-6.35	-1.5054	-1.87
bsbgbook	17.3314	46.34	34.6196	4.47

Table 10: Regression coefficients of self-evaluation of competence in math on math score at the student level and the school level

Country	good: student	t–value	good: school	t–value
Australia	42.8026	13.47	80.7563	20.79
Belgium	24.3572	9.38	29.8962	9.71
Bulgaria	26.1938	8.33	64.3351	40.80
Canada	45.4463	24.42	44.2153	18.91
Chile	24.9360	14.09	6.0669	3.53
Chinese, Taipei	50.7171	26.91	95.5431	7.50
Cyprus	38.8159	16.87	60.3219	9.49
Czech Republic	47.1065	17.95	55.6684	16.82
England	39.0964	8.38	108.0370	12.25
Finland	40.6405	21.59	30.9208	10.20
Hong Kong, SAR	21.8093	10.02	61.8186	12.78
Hungary	52.1324	24.18	70.7503	6.22
Indonesia	-7.3496	-1.61	-135.8048	-66.12
Iran, Islamic Rep.	32.5715	14.81	-14.3148	-2.35
Israel	23.4598	7.37	-33.0713	-10.02
Italy	36.7749	17.81	33.5385	6.55
Japan	56.0676	40.32	52.5428	18.85
Jordan	29.2355	11.93	39.4482	21.99
Korea, Rep.of	55.5905	32.24	80.0404	5.44
Latvia (LSS)	40.5513	13.84	47.4215	7.11
Lithuania	41.2124	16.50	39.1725	8.32
Macedonia, Rep. of	20.4433	8.36	-37.9342	-9.91
Malaysia	28.4115	8.39	67.0807	13.55
Moldova	15.0652	4.88	57.3594	27.11
Morocco	14.3777	5.68	11.8136	11.00
Netherlands	23.3527	5.50	50.9015	55.02
New Zealand	42.6782	15.79	84.2042	9.10
Philippines	10.9882	3.48	-18.4882	-4.77
Romania	29.6537	10.57	19.8169	2.27
Russian Federation	37.6805	14.62	6.1919	1.92
Singapore	19.0008	9.00	30.1727	22.78
Slovak Republic	44.6581	20.75	46.5889	14.04
Slovenia	47.2875	24.75	25.8329	5.79
South Africa	-2.1257	-0.83	-49.1858	-16.77
Thailand	13.3134	4.29	-54.3707	-19.82
Tunisia	18.3500	13.57	11.6505	6.35
Turkey	29.9811	10.05	14.2213	3.51
United States	33.9601	19.44	34.3261	7.24
bsbmrupt	-8.8156	-21.07	-38.0144	-3.40
mresou	8.8280	6.69	3.2087	0.88
bcbgabst	-1.1205	-4.66	-1.1379	-4.18
repeat	-1.5276	-6.88	-0.1602	-0.39
mobil	-1.4149	-6.27	-1.4752	-1.82
bsbgbook	15.4165	41.25	34.2016	4.72

Table 11: Regression coefficients of liking science on science score at the student level and the school level

Country	like: student	t–value	like: school	t–value
Australia	19.3082	8.38	42.8718	10.67
Belgium	10.8245	3.35	-5.8999	-0.57
Bulgaria	18.9727	4.16	63.0099	4.12
Canada	15.2269	7.13	-7.2290	-2.33
Chile	2.5639	1.09	-8.8090	-1.40
Chinese, Taipei	27.4552	14.84	50.1312	4.38
Cyprus	28.1015	10.73	28.7665	5.86
Czech Republic	20.4375	5.53	-26.3107	-6.34
England	14.1551	3.89	12.8214	5.32
Finland	26.1634	6.69	31.0511	10.91
Hong Kong, SAR	16.7728	8.09	56.9239	9.45
Hungary	21.6302	6.18	0.8904	0.11
Indonesia	-12.0311	-2.08	-119.5596	-43.95
Iran, Islamic Rep.	6.1866	2.67	-2.5008	-0.74
Israel	5.1270	1.37	-58.3942	-18.49
Italy	15.8702	7.49	18.9647	5.42
Japan	31.8400	22.80	45.3624	25.38
Jordan	11.4597	4.64	9.8667	5.08
Korea, Rep.of	38.5493	23.74	36.5593	5.94
Latvia (LSS)	13.4110	3.62	22.1622	3.29
Lithuania	12.8018	2.99	1.5764	0.86
Macedonia, Rep. of	2.2532	0.53	-93.8863	-8.59
Malaysia	17.4348	6.05	56.3121	8.45
Moldova	-15.8482	-4.30	-17.9606	-2.05
Morocco	23.7698	7.37	57.8735	12.13
New Zealand	9.5412	4.22	-3.5508	-0.98
Philippines	30.5535	7.95	142.2754	15.77
Romania	15.7209	3.32	44.9665	8.14
Russian Federation	22.1637	4.55	4.9318	0.36
Singapore	28.9433	10.51	88.8405	24.37
Slovak Republic	20.8872	6.50	23.4224	11.49
Slovenia	10.3913	2.90	-38.8234	-7.34
South Africa	4.4549	1.11	22.6836	5.45
Thailand	23.9141	8.91	-9.4172	-1.84
Tunisia	3.4748	1.85	-1.2369	-0.80
Turkey	9.7774	5.01	34.4976	8.80
United States	18.0611	9.95	-10.8545	-4.50
sinterr	-11.9108	-24.44	-48.2102	-3.04
sresou	7.7840	5.40	3.9041	2.06
bcbgabst	-1.2099	-3.98	-1.3471	-5.87
repeat	-1.9718	-7.77	-0.8246	-2.32
mobil	-1.4436	-5.72	-1.7003	-2.60
bsbgbook	17.7889	44.13	33.1875	2.83

Table 12: Regression coefficients of perceived easiness of science on science score at the student level and the school level

Country	easy: student	t–value	easy: school	t–value
Australia	16.8545	6.18	33.0777	12.35
Belgium	8.6492	3.36	19.9487	8.22
Bulgaria	2.2555	0.48	43.3188	1.59
Canada	17.3035	12.67	31.2173	10.11
Chile	0.2968	0.19	-17.0623	-3.20
Chinese, Taipei	13.8087	6.46	14.8363	3.02
Cyprus	20.6791	9.42	23.1867	2.72
Czech Republic	10.8727	2.60	-10.1887	-1.10
England	8.8754	2.48	-68.1058	-7.47
Finland	27.8820	7.17	24.7082	9.72
Hong Kong, SAR	1.6955	0.77	-24.3767	-31.86
Hungary	7.6488	1.81	-19.5461	-0.91
Indonesia	-30.4075	-7.77	-145.5076	-56.69
Iran, Islamic Rep.	-2.7474	-1.27	-11.1560	-1.21
Israel	9.5031	2.69	-70.8727	-25.36
Italy	-2.8684	-1.16	-13.7342	-5.54
Japan	20.6693	10.47	47.4461	18.95
Jordan	-3.9455	-1.66	-14.2470	-3.04
Korea, Rep.of	29.3821	12.73	59.8613	7.51
Latvia (LSS)	-16.1062	-3.49	-45.0609	-8.18
Lithuania	-3.2672	-0.73	-29.3832	-2.64
Macedonia, Rep. of	-19.9319	-6.16	-71.2385	-5.30
Malaysia	-1.5313	-0.69	-72.6927	-16.89
Moldova	-14.9599	-2.95	-19.1986	-1.91
Morocco	-3.0163	-1.01	-19.6422	-6.04
Netherlands	4.9225	0.57	-96.0396	-10.84
New Zealand	5.3191	2.55	-11.5877	-1.79
Philippines	-6.6938	-2.04	-37.4899	-2.57
Romania	-16.3679	-2.91	23.0695	2.14
Russian Federation	-9.4976	-2.46	-48.4210	-2.44
Singapore	5.2209	1.46	-121.5666	-23.75
Slovak Republic	3.7607	1.05	-14.0668	-2.02
Slovenia	0.0998	0.03	-29.6686	-12.86
South Africa	-13.4742	-3.59	-50.5349	-8.09
Thailand	-1.2999	-0.55	-25.4596	-4.88
Tunisia	1.6645	1.04	-9.6041	-3.31
Turkey	-3.3828	-1.23	-1.4300	-0.15
United States	15.4854	6.80	7.8853	1.41
sinterr	-11.9314	-24.78	-45.8863	-2.98
sresou	7.6400	5.34	2.9935	1.36
bcbgabst	-1.1997	-3.91	-1.4518	-5.03
repeat	-1.9702	-7.85	-0.8994	-2.14
mobil	-1.4127	-5.70	-1.5602	-2.37
bsbgbook	18.3512	46.16	28.8156	2.14

Table 13: Regression coefficients of self-evaluation of competence in science on science score at the student level and the school level

Country	good: student	t–value	good: school	t–value
Australia	35.1889	12.11	81.3385	16.23
Belgium	23.6986	9.83	-5.4431	-0.66
Bulgaria	24.2374	6.03	98.5152	63.10
Canada	35.9699	18.58	32.3150	16.16
Chile	14.5436	6.64	4.0330	1.67
Chinese, Taipei	31.0500	16.91	62.2254	4.25
Cyprus	40.4451	15.09	48.1512	7.06
Czech Republic	39.4975	9.86	9.9759	4.68
England	38.2469	10.46	72.0347	12.08
Finland	42.3077	12.45	10.9071	1.62
Hong Kong, SAR	16.4806	6.91	22.2501	6.03
Hungary	49.3856	14.66	34.4846	28.41
Indonesia	-21.1843	-5.92	-136.8115	-49.77
Iran, Islamic Rep.	13.4683	4.65	-20.2265	-4.48
Israel	20.1154	5.38	-76.1632	-37.21
Italy	30.0422	12.46	14.8317	2.05
Japan	49.5771	28.05	61.5877	62.24
Jordan	23.2381	9.22	17.9988	4.61
Korea, Rep.of	62.1428	37.44	46.6322	3.35
Latvia (LSS)	24.8369	6.73	18.8592	7.22
Lithuania	37.2991	9.32	29.7667	19.24
Macedonia, Rep. of	22.3203	5.85	-86.7173	-8.94
Malaysia	16.2776	4.89	28.4227	8.92
Moldova	15.7736	2.83	14.2151	1.55
Morocco	14.6831	4.34	23.2290	7.76
Netherlands	43.5493	6.23	91.4580	8.70
New Zealand	28.1818	11.29	49.8208	6.18
Philippines	10.9806	3.12	43.0842	6.98
Romania	19.0313	4.74	-12.7445	-1.11
Russian Federation	34.1737	8.47	-12.7497	-4.30
Singapore	24.1385	7.92	20.2315	7.11
Slovak Republic	42.0778	12.81	64.3979	9.38
Slovenia	41.4335	15.61	-0.6637	-0.72
South Africa	0.4373	0.10	-8.5132	-1.63
Thailand	8.8016	3.59	-44.0658	-12.50
Tunisia	8.3015	4.10	0.9667	0.35
Turkey	13.6397	6.04	14.3087	2.23
United States	34.5041	15.08	26.2239	13.62
sinterr	-11.9112	-24.34	-48.7774	-3.03
sresou	7.7214	5.37	3.5376	1.96
bcbgabst	-1.1677	-3.83	-1.3940	-5.52
repeat	-1.9935	-7.84	-0.9410	-2.39
mobil	-1.3906	-5.53	-1.5660	-2.26
bsbgbook	16.8488	41.68	31.8798	3.02