

## CHAPTER 15

# Creating and Interpreting the TIMSS Advanced 2015 Context Questionnaire Scales

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### Overview

As described in [Chapter 2: Developing the TIMSS Advanced 2015 Context Questionnaires](#), many of the TIMSS Advanced 2015 context questionnaire items were developed to be combined into scales measuring a single underlying latent construct. For reporting, the scales were constructed using item response theory (IRT) scaling methods, specifically the Rasch partial credit model (Masters and Wright, 1997). As a parallel to the TIMSS Advanced International Benchmarks of achievement, each context scale allowed students to be classified into regions corresponding to high, middle, and low values on the construct. To facilitate interpretation of the regions, the cutpoints delimiting the regions were defined in terms of combinations of response categories.

This chapter describes the procedures for constructing, interpreting, and validating scales based on responses to student, teacher, and school questionnaires.

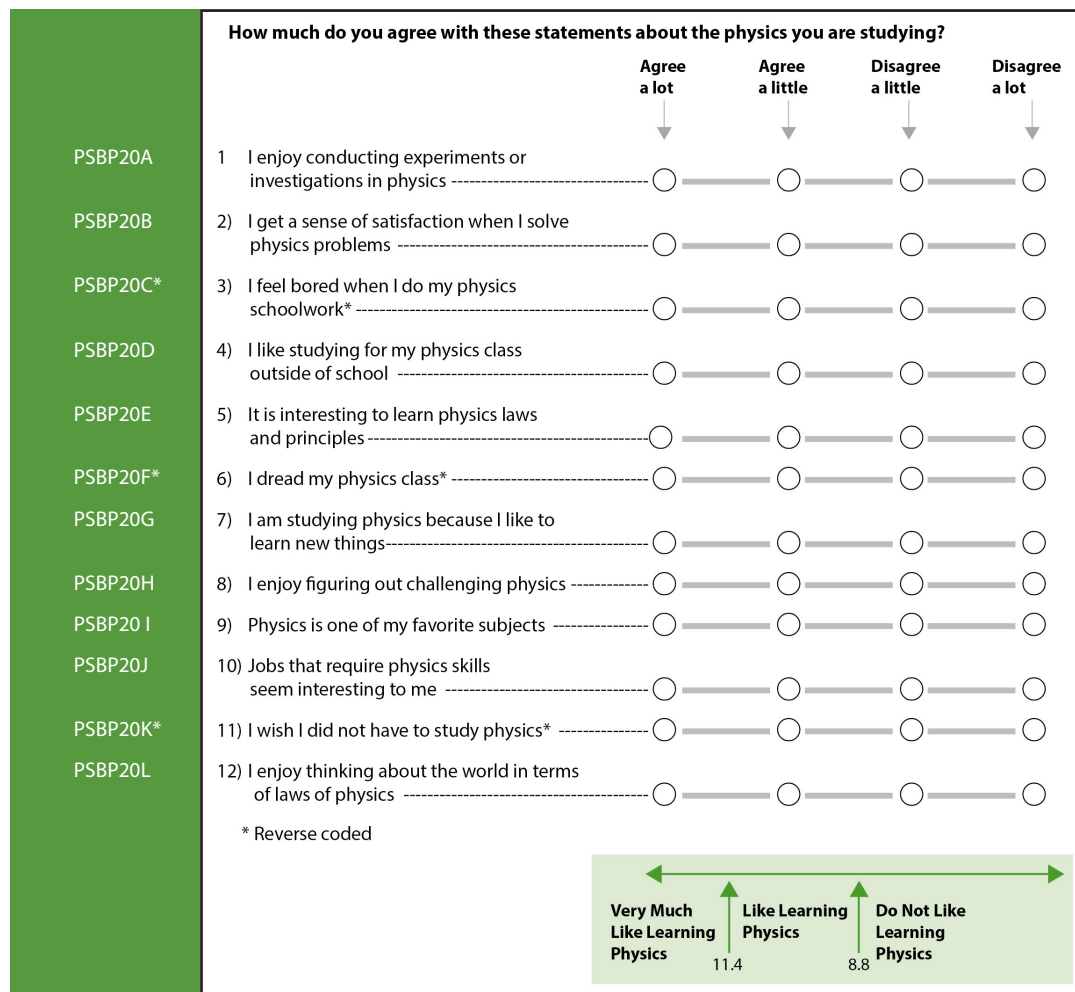
### Reporting TIMSS Advanced 2015 Context Questionnaire Scales

As an example illustrating the TIMSS Advanced approach to reporting context questionnaire data, Exhibit 15.1 presents the TIMSS Advanced 2015 [Students Like Learning Physics](#) scale. As the name suggests, this scale seeks to measure students' feelings towards learning physics. For each of the twelve statements, students were asked to indicate the degree of their agreement with the statement: agree a lot, agree a little, disagree a little, or disagree a lot. Using IRT partial credit scaling, the data



from student responses were placed on a scale constructed so that the scale centerpoint of 10 was located at the mean score across all TIMSS Advanced countries. The units of the scale were chosen so that 2 scale score points corresponded to the standard deviation across all countries. Statements expressing negative sentiment were reverse coded during the scaling (statements 3, 6, and 11). Students who Very Much Like Learning Physics had a scale score greater than or equal to the point on the scale, 11.4 in this case, corresponding to agreeing a lot, on average, with six of the twelve statements and agreeing a little with six of the statements. Students who Do Not Like Learning Physics had a score no higher than the point (8.8) on the scale corresponding to disagreeing a little with six of the statements, on average, and agreeing a little with six of them.

**Exhibit 15.1: Items in the TIMSS Advanced 2015 Students Like Learning Physics Scale**



## Scaling Procedure

Partial credit IRT scaling is based on a statistical model that relates the probability that a person will choose a particular response to an item to that person's location on the underlying construct. In the TIMSS Advanced 2015 *Students Like Learning Physics* scale, the underlying construct is students' attitudes towards learning physics, and students who agree in general with the twelve statements are assumed to have more interest in learning physics while students who disagree with the statements are assumed to have less interest.

The partial credit model is shown below:

$$P_{x_i}(\theta_n) = \frac{e^{\sum_{j=0}^{x_i} (\theta_n - \delta_i + \tau_{ij})}}{\sum_{h=0}^{m_i} e^{\sum_{j=0}^{x_i} (\theta_n - \delta_i + \tau_{ij})}} \quad x_i = 0, 1, \dots, m_i$$

where  $P_{x_i}(\theta_n)$  denotes the probability that person  $n$  with location  $\theta_n$  on the latent construct would choose response level  $x_i$  to item  $i$  out of the  $m_i$  possible response levels for the item. The item parameter  $\delta_i$  gives the location of the item on the latent construct and  $\tau_{ij}$  denotes step parameters for the response levels. For each scale, the scaling procedure involves first estimating the  $\delta_i$  and  $\tau_{ij}$  item parameters, and then using the model with these parameters to estimate  $\theta_n$ , the score on the latent construct, for each on the  $n$  respondents. Depending on the scale, respondents may be students, teachers, or school principals.

The TIMSS Advanced 2015 context questionnaire scaling was conducted using the ConQuest 2.0 software (Wu, Adams, Wilson, & Haldane, 2007).

In preparation for the context questionnaire scaling effort, the TIMSS & PIRLS International Study Center developed a system of production programs that could effectively calibrate the items on each scale using ConQuest and produce scale scores for each scale respondent. Each TIMSS Advanced assessment population (advanced mathematics, physics) consisted of approximately 30,000 students, as well as their teachers and school principals. The estimation of the item parameters, a procedure also known as item calibration, was conducted on the combined data from all countries, with each country contributing equally to the calibration. This was achieved by assigning weights that sum to 500 for each country's student data. Exhibit 15.2 shows the international item parameters for the *Students Like Learning Physics* scale. For each item, the delta parameter  $\delta_i$  shows the estimated overall location of the item on the scale, and the tau parameters  $\tau_{ij}$  show the location of the steps, expressed as deviations from delta. Also, included in the right column is the Rasch infit item statistic, which is a measure of how well the data matches the model, with values above 1.3 indicating unexpected response patterns. As can be seen in this exhibit, the data seemed to match the model well for the twelve items of the *Like Learning Physics* scale.

**Exhibit 15.2: Item Parameters for the TIMSS Advanced 2015 *Students Like Learning Physics* Scale**

Item	delta	tau_1	tau_2	tau_3	Infit
PSBP20A	-0.51423	-1.07025	-0.41990	1.49015	1.15
PSBP20B	-0.90801	-0.86799	-0.43946	1.30745	1.10
PSBP20C*	0.51315	-1.69256	-0.14245	1.83501	1.23
PSBP20D	1.03682	-1.72677	-0.08320	1.80997	1.11
PSBP20E	-0.21380	-1.38699	-0.26425	1.65124	0.90
PSBP20F*	-0.39443	-1.02035	0.04349	0.97686	1.82
PSBP20G	-0.18466	-1.35598	-0.31080	1.66678	0.81
PSBP20H	0.04092	-1.36190	-0.07935	1.44125	0.85
PSBP20I	0.54534	-0.86829	-0.06458	0.93287	0.75
PSBP20J	0.17389	-0.97760	-0.33432	1.31192	0.94
PSBP20K*	-0.07291	-0.60736	-0.22268	0.83004	1.02
PSBP20L	-0.02208	-1.18389	-0.23501	1.41890	1.02

\* Reverse Coded

Once the calibration was completed and international item parameters were estimated, individual scores for each respondent (students, teachers, or principals) were generated using weighted maximum likelihood estimation (Warm, 1989). All cases with valid responses to at least two items on a scale were included in the calibration and scoring processes.

The scale scores produced by the weighted likelihood estimation are in the logit metric with measured values ranging from approximately -5 to +5. To convert to a more convenient reporting metric, a linear transformation was applied to the international distribution of logit scores for each scale, so that the resulting distribution across all countries had a mean of 10 and a standard deviation of 2. Exhibit 15.3 presents the scale transformation constants applied to the international distribution of logit scores for the *Students Like Learning Physics* scale to transform them to the (10, 2) reporting metric.

**Exhibit 15.3: Scale Transformation Constants for the TIMSS Advanced 2015 *Students Like Learning Physics* Scale**

Scale Transformation Constants	
A = 8.81822	Transformed Scale Score = 8.81822 + 1.464843 • Logit Scale Score
B = 1.464843	

To provide an approach to reporting the context questionnaire scales analogous to the TIMSS Advanced International Benchmarks for the TIMSS Advanced achievement scales, a method was developed to divide each scale into high, middle, and low regions and provide a content-referenced interpretation for these regions. For the TIMSS Advanced achievement scales, the Intermediate,

High, and Advanced International Benchmarks are specific reference points on the scale that can be used to monitor progress in student achievement. Using a [scale anchoring procedure](#), student performance at each Benchmark is described in terms of the advanced mathematics and physics (depending on the subject) that students reaching that Benchmark know and can do. The percentage of students reaching each of these International Benchmarks can serve as a profile of student achievement in a country.

For the high, middle, and low regions of the context questionnaire scales, the interpretation is content-referenced to the extent that the boundaries of the regions were defined in terms of identifiable combinations of response categories. The particular response combinations that defined the regions boundaries, or cutpoints, were based on a judgment of what constituted a high or low region on each individual scale. For example, based on a consideration of the questions making up the *Students Like Learning Physics* scale, it was determined that in order to be in the high region of the scale and labeled “Very Much Like Learning Physics,” a student would have to agree a lot, on average, to at least six of the twelve statements and agree a little to the other six. Similarly, it was determined that a student who, on average, at most agreed a little with six of the statements and disagreed a little with the other six would be labeled “Do Not Like Learning Physics.”

The scale region cutpoints were quantified by assigning a numeric value to each response category, such that each respondent’s responses to the scale’s questions could be expressed as a “raw score.” Assigning 0 to “Disagree a lot,” 1 to “Disagree a little,” 2 to “Agree a little,” and 3 to “Agree a lot,” results in raw scores on the *Students Like Learning Physics* scale ranging from 0 (disagree a lot with all twelve statements) to 36 (agree a lot to all twelve). A student who agreed a lot with six of the statements and agreed a little with the other six would have a raw score of 30 ( $6 \times 3 + 6 \times 2$ ). Following this approach, a student with a raw score of 30 or more would be in the “Very Much Like Learning Physics” region of the scale. Similarly, agreeing a little with six statements and disagreeing a little with six statements would result in a raw score of 18 ( $6 \times 2 + 6 \times 1$ ), so that a student with a raw score less than or equal to 18 would be in the “Do Not Like Learning Physics” region.

A property of a Rasch scale is that each raw score has a unique scale score associated with it. Exhibit 15.4 presents a raw score-scale score equivalence table for the *Students Like Learning Physics* scale. From this table, it can be seen that a raw score of 18 corresponds to a scale score of 8.8 (rounding up) and a raw score of 30 corresponds to a scale score of 11.4 (rounding down).<sup>1</sup> These scale scores were the cutpoints used to divide the scale into the three regions.

<sup>1</sup> The reason for rounding was to facilitate reporting, and it was decided that the highest cutpoint would be rounded down to ensure that those with an unrounded scale score (e.g., 11.42601 for the *Like Learning Physics* scale) at the cutpoint were included within the highest region. For a similar reason, the lower cutpoint was rounded up.

**Exhibit 15.4: Equivalence Table of the Raw Score and the Transformed Scale Score for the TIMSS Advanced 2015 *Students Like Learning Physics* Scale**

Raw Score	Transformed Scale Score	Cutpoint
0	2.29834	
1	3.92594	
2	4.70005	
3	5.22580	
4	5.63169	
5	5.97016	
6	6.26389	
7	6.52678	
8	6.76750	
9	6.99121	
10	7.20367	
11	7.40630	
12	7.60136	
13	7.79069	
14	7.97591	
15	8.15835	
16	8.33926	
17	8.51979	
18	8.70102	8.8
19	8.88404	
20	9.06991	
21	9.25980	
22	9.45491	
23	9.65655	
24	9.86615	
25	10.08468	
26	10.31566	
27	10.56116	
28	10.82464	
29	11.11077	
30	11.42601	11.4
31	11.77922	
32	12.18651	
33	12.67364	
34	13.29295	
35	14.17455	
36	15.92718	

## Validating the TIMSS Advanced 2015 Context Questionnaire Scales

As evidence that the context questionnaire scales provide comparable measurement across countries, reliability coefficients were computed for each scale for every country and benchmarking participant, and a principal components analysis of the scale items was conducted. Exhibit 15.5 presents the results of this analysis for the *Students Like Learning Physics* scale. The Cronbach's Alpha reliability coefficients generally were at an acceptable level, with all above 0.8 and many above 0.9. The exhibit also shows the percentage of variance among the scale items accounted for by the first principal component in each country. In most cases this was acceptably high, indicating that the items could be adequately represented by a single scale. The component loadings of each questionnaire item from the principal components analysis are positive and substantial, indicating a strong correlation between each item and the scale in every country.

**Exhibit 15.5: Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the TIMSS Advanced 2015 *Students Like Learning Physics* Scale**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item											
			PSBP20A	PSBP20B	PSBP20C*	PSBP20D	PSBP20E	PSBP20F*	PSBP20G	PSBP20H	PSBP20I	PSBP20J	PSBP20K*	PSBP20L
France	0.89	47	0.59	0.50	0.63	0.70	0.78	0.30	0.78	0.75	0.83	0.69	0.80	0.66
Italy	0.90	49	0.62	0.54	0.60	0.78	0.78	0.33	0.81	0.79	0.82	0.77	0.75	0.64
Lebanon	0.83	39	0.67	0.59	0.34	0.48	0.70	0.16	0.75	0.72	0.81	0.73	0.51	0.67
Norway	0.89	47	0.44	0.35	0.69	0.67	0.78	0.44	0.78	0.79	0.85	0.74	0.77	0.68
Portugal	0.89	47	0.58	0.67	0.61	0.70	0.76	0.40	0.78	0.78	0.82	0.68	0.73	0.66
Russian Federation	0.92	53	0.53	0.78	0.63	0.76	0.82	0.38	0.79	0.81	0.85	0.82	0.67	0.70
Slovenia	0.87	41	0.50	0.59	0.48	0.57	0.70	0.49	0.72	0.77	0.80	0.73	0.59	0.64
Sweden	0.91	51	0.52	0.61	0.69	0.72	0.79	0.51	0.79	0.81	0.84	0.74	0.78	0.69
United States	0.92	52	0.63	0.61	0.55	0.66	0.82	0.63	0.78	0.80	0.85	0.75	0.75	0.78

\* Reverse Coded

As indicators of effective environments for learning, a positive relationship with achievement is an important aspect of validity for the TIMSS Advanced context questionnaire scales. For the *Students Like Learning Physics* scale, Exhibit 15.6 presents the Pearson correlation with physics achievement in TIMSS Advanced 2015 for each country, together with *r*-squared—the proportion of variance in achievement attributable to the *Students Like Learning Physics* scale. These figures show a moderate relationship with achievement across participating countries. Also shown is

the proportion of variance in achievement attributable to differences between the regions of the *Students Like Learning Physics* scale. This is very similar to the proportion of variance explained by the scale as a whole, indicating that dividing the scale into regions has little effect on its power to account for achievement differences.

**Exhibit 15.6: Relationship Between the TIMSS Advanced 2015 *Students Like Learning Physics* Scale and TIMSS Advanced 2015 Physics Achievement**

Country	Pearson's Correlation with Physics Achievement		Variance in Physics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	( $r^2$ )	
France	0.46	0.22	0.18
Italy	0.39	0.15	0.13
Lebanon	0.22	0.05	0.04
Norway	0.50	0.25	0.22
Portugal	0.43	0.18	0.17
Russian Federation	0.38	0.15	0.13
Slovenia	0.44	0.20	0.15
Sweden	0.44	0.20	0.16
United States	0.41	0.17	0.16
<b>International Median</b>	<b>0.43</b>	<b>0.18</b>	<b>0.16</b>

Item parameter estimates and item and scale statistics similar to those above are available in Appendix 15A or each of the TIMSS Advanced 2015 advanced mathematics context questionnaire scales and in Appendix 15B for each of the physics context questionnaire scales.

## References

- Masters, G.N., & Wright, B.D. (1997). The partial credit model. In M.J. van der Linden & R.K. Hambleton (Eds.), *Handbook of modern item response theory*. Berlin: Springer.
- Warm, T.A. (1989). Weighted likelihood estimation of ability in item response theory. *Psychometrika*, 54(3), 427–450.
- Wu, M.L., Adams, R.J, Wilson, M.R., & Haldane, S. (2007). Conquest 2.0 [computer software]. Camberwell, Australia: Australian Council for Educational Research.



# Appendix 15A: TIMSS Advanced 2015 Context Questionnaire Scales, Advanced Mathematics

## Home Educational Resources Scale, Advanced Mathematics

The Home Educational Resources (HER) scale was created based on students' responses concerning the availability of four resources described below.

### Items in the TIMSS Advanced 2015 Home Educational Resources Scale, Advanced Mathematics

MSBG04	<p><b>Number of books in the home:</b></p> <ul style="list-style-type: none"> <li>1) 0-10</li> <li>2) 11-25</li> <li>3) 26-100</li> <li>4) 101-200</li> <li>5) More than 200</li> </ul>	<p><b>Highest level of education of either parent:</b></p> <ul style="list-style-type: none"> <li>1) Finished some primary or lower secondary or did not go to school</li> <li>2) Finished lower secondary</li> <li>3) Finished upper secondary</li> <li>4) Finished post-secondary education</li> <li>5) Finished university or higher</li> </ul>	MSDGEDUP <sup>1</sup>
MSDG06S <sup>1</sup>	<p><b>Number of home study supports:</b></p> <ul style="list-style-type: none"> <li>1) None</li> <li>2) Study desk/table or own room</li> <li>3) Both</li> </ul>		
MSDGOCCP <sup>1</sup>	<p><b>Highest level of occupation of either parent:</b></p> <ul style="list-style-type: none"> <li>1) Has never worked outside home for pay, general laborer, or semi-professional (skilled agricultural or fishery worker, craft or trade worker, plant or machine operator)</li> <li>2) Clerical (clerk or service or sales worker)</li> <li>3) Small business owner</li> <li>4) Professional (corporate manager or senior official, professional, or technician or associate professional)</li> </ul>		

<sup>1</sup> Derived variable. For more details, see Supplement 3 of the TIMSS Advanced 2015 User Guide for the [International Database](#).

**Item Parameters for the TIMSS Advanced 2015 Home Educational Resources Scale, Advanced Mathematics**

Item	delta	tau_1	tau_2	tau_3	tau_4	Infit
MSBG04	0.63886	-0.93281	-0.47613	0.80516	0.60378	1.10
MSDG06S	-0.97302	-0.28994	0.28994			1.27
MSDGEDUP	-0.07938	-0.66004	-0.41662	0.85158	0.22508	0.96
MSDGOCCP	0.41354	-0.67697	1.24010	-0.56313		0.97

\*Reverse coded

**Scale Transformation Constants for the TIMSS Advanced 2015 Home Educational Resources Scale, Advanced Mathematics**

Scale Transformation Constants

A = 7.705317

B = 2.192074

Transformed Scale Score = 7.705317 + 2.192074 • Logit Scale Score

**Equivalence Table of the Raw Score and the Transformed Scale Score for the TIMSS Advanced 2015 Home Educational Resources Scale, Advanced Mathematics**

Raw Score	Transformed Scale Score	Cutpoint
0	1.48945	
1	3.86046	
2	5.08504	
3	5.98800	6.0
4	6.72756	
5	7.36772	
6	7.93623	
7	8.46945	
8	8.98566	
9	9.51161	
10	10.07874	
11	10.73945	
12	11.62325	11.6
13	13.29245	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 Home Educational Resources Scale, Advanced Mathematics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item			
			MSB604	MSD606S	MSD6EDUP	MSD6CCCP
France	0.59	46	0.66	0.24	0.83	0.81
Italy	0.62	48	0.69	0.27	0.84	0.82
Lebanon	0.53	42	0.62	0.38	0.77	0.74
Norway	0.54	44	0.68	0.33	0.79	0.75
Portugal	0.69	52	0.77	0.18	0.87	0.84
Russian Federation	0.41	38	0.62	0.07	0.76	0.75
Russian Federation 6hr+	0.40	38	0.62	0.25	0.75	0.72
Slovenia	0.53	42	0.67	0.17	0.80	0.76
Sweden	0.61	48	0.72	0.47	0.77	0.76
United States	0.53	43	0.66	0.57	0.79	0.58
International Avg.	0.56	45	0.68	0.30	0.80	0.76

**Relationship Between the TIMSS Advanced 2015 Home Educational Resources Scale, Advanced Mathematics, and TIMSS Advanced 2015 Advanced Mathematics Achievement**

Country	Pearson's Correlation with Advanced Mathematics Achievement		Variance in Advanced Mathematics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.32	0.10	0.07
Italy	0.30	0.09	0.06
Lebanon	0.22	0.05	0.03
Norway	0.28	0.08	0.05
Portugal	0.24	0.06	0.05
Russian Federation	0.18	0.03	0.02
Russian Federation 6hr+	0.23	0.05	0.03
Slovenia	0.21	0.04	0.04
Sweden	0.34	0.11	0.08
United States	0.25	0.06	0.04
International Median	0.25	0.06	0.05

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

# Safe and Orderly School-Teachers' Reports Scale, Advanced Mathematics

The Safe and Orderly School-Teachers' Reports (SOS) scale was created based on teachers' degree of agreement with the eight statements described below.

## Items in the TIMSS Advanced 2015 Safe and Orderly School-Teachers' Reports Scale, Advanced Mathematics<sup>1</sup>

Thinking about your current school, indicate the extent to which you agree or disagree with each of the following statements.

	Agree a lot	Agree a little	Disagree a little	Disagree a lot
MTBG07A 1) This school is located in a safe neighborhood -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MTBG07B 2) I feel safe at this school -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MTBG07C 3) This school's security policies and practices are sufficient -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MTBG07D 4) The students behave in an orderly manner -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MTBG07E 5) The students are respectful of the teachers -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MTBG07F 6) The students respect school property -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MTBG07G 7) This school has clear rules about student conduct -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MTBG07H 8) This school's rules are enforced in a fair and consistent manner -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Very Safe and Orderly      9.9      Safe and Orderly      6.5      Less than Safe and Orderly

<sup>1</sup> For the purpose of scaling, categories in which there were very few respondents were combined. The categories "Disagree a little" and "Disagree a lot" were combined for all variables. The scale statistics that are reported herein reflect analysis of the items following collapsing.

**Item Parameters for the TIMSS Advanced 2015 Safe and Orderly Schools - Teachers' Reports Scale, Advanced Mathematics**

Item	delta	tau_1	tau_2	Infit
MTBG07A	-0.82109	-1.51458	1.51458	1.15
MTBG07B	-1.74585	-1.72523	1.72523	0.92
MTBG07C	-0.33658	-1.56042	1.56042	1.04
MTBG07D	0.39769	-1.95319	1.95319	0.83
MTBG07E	0.19117	-2.14541	2.14541	0.85
MTBG07F	1.15478	-2.08336	2.08336	0.94
MTBG07G	0.17538	-1.48879	1.48879	1.10
MTBG07H	0.98450	-1.53824	1.53824	1.05

**Scale Transformation Constants for the TIMSS Advanced 2015 Safe and Orderly Schools - Teachers' Reports Scale, Advanced Mathematics**

Scale Transformation Constants

$$A = 8.173896$$

$$B = 0.95666$$

$$\text{Transformed Scale Score} = 8.173896 + 0.95666 \cdot \text{Logit Scale Score}$$

**Equivalence Table of the Raw Score and the Transformed Scale Score for the TIMSS Advanced 2015 Safe and Orderly Schools - Teachers' Reports Scale, Advanced Mathematics**

Raw Score	Transformed Scale Score	Cutpoint
0	3.37625	
1	4.67674	
2	5.40155	
3	5.94826	
4	6.41573	6.5
5	6.84650	
6	7.26412	
7	7.68378	
8	8.11417	
9	8.55968	
10	9.01824	
11	9.48591	
12	9.96410	9.9
13	10.46579	
14	11.02538	
15	11.73354	
16	12.98778	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015



**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 Safe and Orderly Schools - Teachers' Reports Scale, Advanced Mathematics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item							
			MTBG007A	MTBG007B	MTBG007C	MTBG007D	MTBG007E	MTBG007F	MTBG007G	MTBG007H
France	0.90	59	0.70	0.71	0.78	0.84	0.80	0.71	0.77	0.79
Italy	0.85	49	0.60	0.67	0.69	0.81	0.79	0.75	0.57	0.68
Lebanon	0.84	48	0.50	0.62	0.56	0.71	0.74	0.74	0.80	0.82
Norway	0.84	48	0.50	0.64	0.52	0.74	0.77	0.80	0.76	0.75
Portugal	0.88	54	0.62	0.68	0.81	0.80	0.77	0.75	0.70	0.75
Russian Federation	0.83	47	0.50	0.69	0.74	0.83	0.81	0.68	0.73	0.43
Russian Federation 6hr+	0.78	41	0.70	0.55	0.59	0.76	0.72	0.62	0.70	0.41
Slovenia	0.91	61	0.74	0.75	0.83	0.79	0.82	0.78	0.75	0.80
Sweden	0.80	43	0.50	0.54	0.63	0.83	0.76	0.76	0.51	0.66
United States	0.90	61	0.54	0.70	0.81	0.85	0.85	0.86	0.78	0.83
International Avg.	0.86	52	0.58	0.67	0.71	0.80	0.79	0.76	0.71	0.72

**Relationship Between the TIMSS Advanced 2015 Safe and Orderly Schools - Teachers' Reports Scale, and TIMSS Advanced 2015 Advanced Mathematics Achievement**

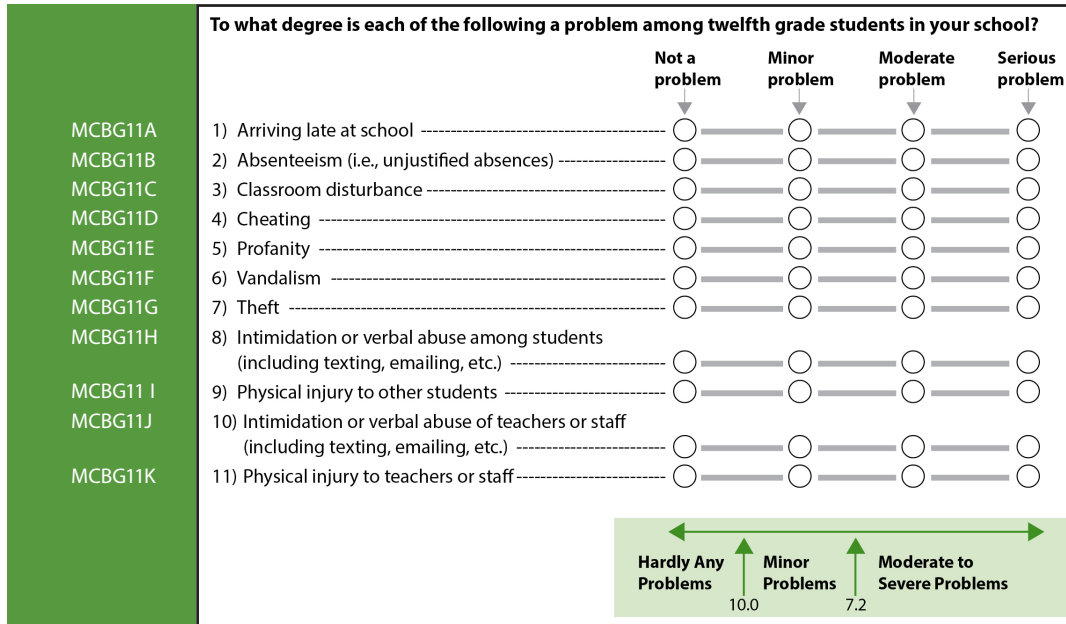
Country	Pearson's Correlation with Advanced Mathematics Achievement		Variance in Advanced Mathematics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.16	0.02	0.02
Italy	0.07	0.00	0.03
Lebanon	0.13	0.02	0.00
Norway	0.07	0.01	0.01
Portugal	0.04	0.00	0.00
Russian Federation	0.14	0.02	0.03
Russian Federation 6hr+	0.17	0.03	0.05
Slovenia	0.17	0.03	0.03
Sweden	0.08	0.01	0.01
United States	0.03	0.00	0.02
International Median	0.08	0.01	0.02

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

# School Discipline Problems–Principals’ Reports Scale, Advanced Mathematics

The School Discipline Problems–Principals’ Reports (DAS) scale was created based on principals’ responses concerning the eleven potential school problems described below.

## Items in the TIMSS Advanced 2015 School Discipline Problems–Principals’ Reports Scale, Advanced Mathematics



**Item Parameters for the TIMSS Advanced 2015 School Discipline Problems - Principals' Reports Scale, Advanced Mathematics**

Item	delta	tau_1	tau_2	tau_3	Infit
MCBG11A	1.17742	-3.15684	-0.15587	3.31271	1.32
MCBG11B	1.45295	-2.15166	-0.29819	2.44985	1.30
MCBG11C	0.19376	-1.84784	-0.67552	2.52336	0.88
MCBG11D	0.54002	-2.57666	-0.59148	3.16814	1.15
MCBG11E	-0.23367	-1.81279	-0.33749	2.15028	0.87
MCBG11F	-0.49122	0.42442	-1.36426	0.93984	0.69
MCBG11G	-0.42249	0.12894	-1.20999	1.08105	0.69
MCBG11H	0.03725	-0.81699	-1.25629	2.07328	0.78
MCBG11I	-0.61113	0.68322	-1.40198	0.71876	0.61
MCBG11J	-0.63015	0.69434	-1.66531	0.97097	0.74
MCBG11K	-1.01274	1.42144	-0.55467	-0.86677	0.56

**Scale Transformation Constants for the TIMSS Advanced 2015 School Discipline Problems - Principals' Reports Scale, Advanced Mathematics**

Scale Transformation Constants

A = 7.71961

B = 0.975134

Transformed Scale Score = 7.71961 + 0.975134 • Logit Scale Score



**Equivalence Table of the Raw Score and the Transformed Scale Score  
for the TIMSS Advanced 2015 School Discipline Problems - Principals'  
Reports Scale, Advanced Mathematics**

Raw Score	Transformed Scale Score	Cutpoint
0	3.51299	
1	4.63283	
2	5.15247	
3	5.48517	
4	5.72627	
5	5.91593	
6	6.07244	
7	6.20925	
8	6.33188	
9	6.44442	
10	6.55006	
11	6.65149	
12	6.75093	
14	6.95014	
15	7.05580	
16	7.16645	7.2
17	7.28461	
18	7.41311	
19	7.55522	
20	7.71471	
21	7.89534	
22	8.10206	
23	8.33660	
24	8.60078	
25	8.89568	
26	9.22471	
27	9.59087	
28	10.00271	10.0
29	10.47049	
30	11.00615	
31	11.62931	
32	12.40529	
33	13.73050	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015



**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 School Discipline Problems - Principals' Reports Scale, Advanced Mathematics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item										
			MCBG1A	MCBG1B	MCBG1C	MCBG1D	MCBG1E	MCBG1F	MCBG1G	MCBG1H	MCBG1I	MCBG1J	MCBG1K
France	0.94	65	0.61	0.65	0.79	0.70	0.88	0.89	0.80	0.88	0.91	0.87	0.85
Italy	0.96	72	0.49	0.77	0.87	0.72	0.74	0.94	0.95	0.91	0.95	0.94	0.92
Lebanon	0.98	84	0.84	0.88	0.90	0.87	0.94	0.95	0.96	0.91	0.94	0.93	0.94
Norway	0.85	46	0.65	0.74	0.67	0.58	0.78	0.72	0.66	0.63	0.74	0.69	0.61
Portugal	0.93	62	0.50	0.75	0.81	0.71	0.75	0.86	0.86	0.86	0.88	0.85	0.72
Russian Federation	0.75	34	0.56	0.67	0.65	0.58	0.73	0.52	0.48	0.56	0.58	0.39	-
Russian Federation 6hr+	0.77	34	0.65	0.66	0.72	0.60	0.70	0.56	0.50	0.54	0.57	0.05	-
Slovenia	0.76	37	0.26	0.27	0.53	0.53	0.66	0.68	0.66	0.58	0.80	0.64	0.83
Sweden	0.78	32	0.52	0.54	0.59	0.41	0.53	0.71	0.68	0.67	0.58	0.62	0.20
United States	0.88	47	0.55	0.56	0.79	0.62	0.78	0.77	0.78	0.74	0.73	0.65	0.47
International Avg.	0.87	53	0.55	0.65	0.73	0.64	0.75	0.78	0.76	0.75	0.79	0.73	0.69

A dash (-) indicates comparable data not available.

**Relationship Between the TIMSS Advanced 2015 School Discipline Problems - Principals' Reports Scale, and TIMSS Advanced 2015 Advanced Mathematics Achievement**

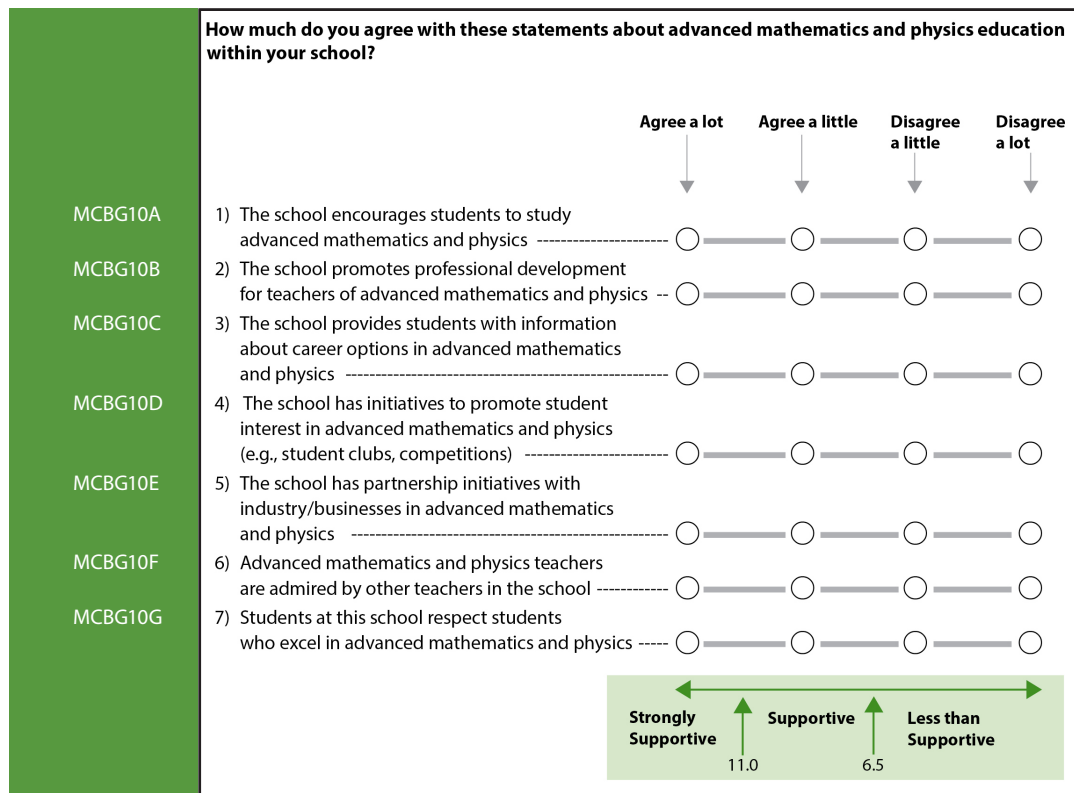
Country	Pearson's Correlation with Advanced Mathematics Achievement		Variance in Advanced Mathematics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.10	0.01	0.00
Italy	0.21	0.04	0.06
Lebanon	0.10	0.01	0.01
Norway	0.18	0.03	0.01
Portugal	0.03	0.00	0.00
Russian Federation	0.15	0.02	0.00
Russian Federation 6hr+	0.02	0.00	0.00
Slovenia	0.25	0.06	0.03
Sweden	0.09	0.01	0.01
United States	0.16	0.03	0.02
International Median	0.15	0.02	0.01

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

# School Supports Advanced Mathematics and Physics Education—Principal Version Scale, Advanced Mathematics

The School Supports Advanced Mathematics and Physics Education—Principal Version (SMP) scale was created based on principals’ responses characterizing the seven aspects described below.

## Items in the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education—Principal Version Scale, Advanced Mathematics<sup>1</sup>



<sup>1</sup> For the purpose of scaling, categories in which there were very few respondents were combined. The categories “Disagree a little” and “Disagree a lot” were combined for all variables. The scale statistics that are reported herein reflect analysis of the items following collapsing.

**Item Parameters for the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Principal Version Scale, Advanced Mathematics**

Item	delta	tau_1	tau_2	Infit
MCBG10A	-0.97501	-1.02632	1.02632	0.90
MCBG10B	-0.49096	-1.21322	1.21322	0.96
MCBG10C	-0.81296	-1.29416	1.29416	0.94
MCBG10D	-0.54344	-1.00501	1.00501	0.95
MCBG10E	1.78310	-0.57696	0.57696	1.06
MCBG10F	1.03554	-0.58860	0.58860	0.94
MCBG10G	0.00373	-0.96389	0.96389	0.97

**Scale Transformation Constants for the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Principal Version Scale, Advanced Mathematics**

Scale Transformation Constants

$$A = 8.749167$$

$$B = 1.410095$$

$$\text{Transformed Scale Score} = 8.749167 + 1.410095 \cdot \text{Logit Scale Score}$$

**Equivalence Table of the Raw Score and the Transformed Scale Score for the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Principal Version Scale, Advanced Mathematics**

Raw Score	Transformed Scale Score	Cutpoint
0	2.89865	
1	4.69620	
2	5.68613	
3	6.45357	6.5
4	7.12107	
5	7.73084	
6	8.30187	
7	8.84425	
8	9.36982	
9	9.89666	
10	10.43956	
11	11.02451	11.0
12	11.71058	
13	12.61631	
14	14.32251	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015



**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Principal Version Scale, Advanced Mathematics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item							
			MCBGT0A	MCBGT0B	MCBGT0C	MCBGT0D	MCBGT0E	MCBGT0F	MCBGT0G	
France	0.66	34	0.70	0.60	0.62	0.56	0.50	0.60	0.46	
Italy	0.73	40	0.81	0.73	0.68	0.60	0.67	0.31	0.46	
Lebanon	0.75	41	0.61	0.64	0.73	0.76	0.56	0.60	0.56	
Norway	0.65	35	0.34	0.56	0.70	0.49	0.40	0.79	0.73	
Portugal	0.73	39	0.55	0.66	0.58	0.69	0.49	0.69	0.66	
Russian Federation	0.72	40	0.55	0.58	0.58	0.71	0.55	0.77	0.66	
Russian Federation 6hr+	0.69	41	0.71	0.78	0.65	0.65	0.52	0.62	0.53	
Slovenia	0.69	36	0.62	0.64	0.63	0.64	0.63	0.51	0.49	
Sweden	0.71	37	0.78	0.60	0.62	0.58	0.60	0.52	0.51	
United States	0.78	44	0.57	0.63	0.71	0.77	0.60	0.67	0.70	
International Avg.	0.71	38	0.62	0.63	0.65	0.64	0.56	0.61	0.58	

**Relationship Between the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Principal Version Scale, and TIMSS Advanced 2015 Advanced Mathematics Achievement**

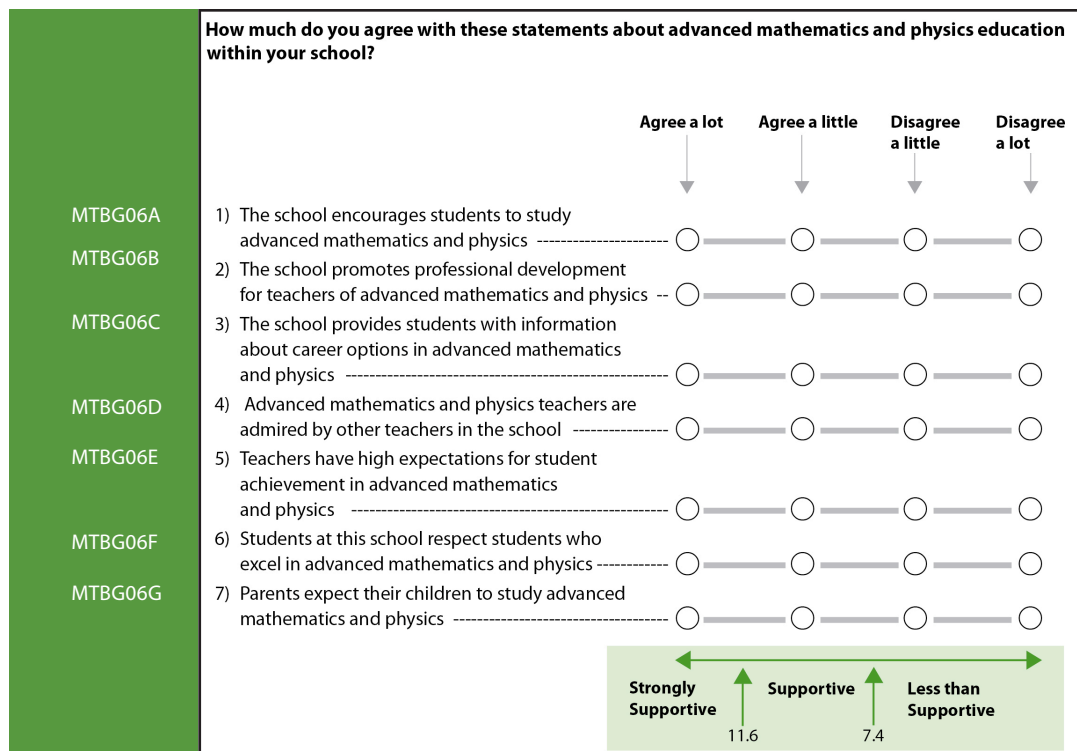
Country	Pearson's Correlation with Advanced Mathematics Achievement		Variance in Advanced Mathematics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.02	0.00	0.00
Italy	0.06	0.00	0.00
Lebanon	0.10	0.01	0.00
Norway	0.17	0.03	0.05
Portugal	0.03	0.00	0.01
Russian Federation	0.16	0.03	0.01
Russian Federation 6hr+	0.21	0.04	0.02
Slovenia	0.29	0.09	0.04
Sweden	0.06	0.00	0.00
United States	0.10	0.01	0.01
International Median	0.10	0.01	0.01

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

# School Supports Advanced Mathematics and Physics Education—Teacher Version Scale, Advanced Mathematics

The School Supports Advanced Mathematics and Physics Education—Teacher Version (SMP) scale was created based on teachers’ responses characterizing the seven aspects described below.

## Items in the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education—Teacher Version Scale, Advanced Mathematics<sup>1</sup>



<sup>1</sup> For the purpose of scaling, categories in which there were very few respondents were combined. The categories “Disagree a little” and “Disagree a lot” were combined for all variables. The scale statistics that are reported herein reflect analysis of the items following collapsing.

**Item Parameters for the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Teacher Version Scale, Advanced Mathematics**

Item	delta	tau_1	tau_2	Infit
MTBG06A	-0.83359	-1.13874	1.13874	0.90
MTBG06B	0.36769	-0.90518	0.90518	1.09
MTBG06C	0.01503	-1.05692	1.05692	0.98
MTBG06D	0.90364	-0.63126	0.63126	0.93
MTBG06E	-0.28192	-1.24591	1.24591	0.98
MTBG06F	-0.41669	-1.02854	1.02854	1.09
MTBG06G	0.24584	-1.19301	1.19301	1.10

**Scale Transformation Constants for the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Teacher Version Scale, Advanced Mathematics**

Scale Transformation Constants

A = 9.498786

B = 1.425402

Transformed Scale Score = 9.498786 + 1.425402 • Logit Scale Score

**Equivalence Table of the Raw Score and the Transformed Scale Score for the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Teacher Version Scale, Advanced Mathematics**

Raw Score	Transformed Scale Score	Cutpoint
0	3.88749	
1	5.67991	
2	6.64185	
3	7.36800	7.4
4	7.98333	
5	8.54226	
6	9.06318	
7	9.56156	
8	10.04970	
9	10.54426	
10	11.05900	
11	11.62342	11.6
12	12.28865	
13	13.18972	
14	14.91360	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Teacher Version Scale, Advanced Mathematics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item						
			MTBC006A	MTBC006B	MTBC006C	MTBC006D	MTBC006E	MTBC006F	MTBC006G
France	0.58	29	0.47	0.41	0.47	0.52	0.58	0.73	0.52
Italy	0.72	38	0.69	0.59	0.70	0.66	0.62	0.40	0.62
Lebanon	0.72	38	0.74	0.72	0.65	0.52	0.61	0.48	0.56
Norway	0.72	38	0.70	0.52	0.60	0.77	0.67	0.62	0.34
Portugal	0.72	38	0.66	0.71	0.64	0.59	0.62	0.41	0.64
Russian Federation	0.83	50	0.65	0.81	0.74	0.72	0.57	0.76	0.66
Russian Federation 6hr+	0.75	42	0.62	0.76	0.77	0.66	0.59	0.54	0.55
Slovenia	0.66	33	0.64	0.71	0.63	0.56	0.55	0.51	0.34
Sweden	0.66	33	0.63	0.38	0.70	0.48	0.63	0.61	0.53
United States	0.78	44	0.68	0.60	0.74	0.70	0.52	0.70	0.68
International Avg.	0.71	38	0.65	0.60	0.65	0.61	0.60	0.58	0.54

**Relationship Between the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Teacher Version Scale, and TIMSS Advanced 2015 Advanced Mathematics Achievement**

Country	Pearson's Correlation with Advanced Mathematics Achievement		Variance in Advanced Mathematics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.06	0.00	0.00
Italy	0.13	0.02	0.02
Lebanon	0.04	0.00	0.01
Norway	0.08	0.01	0.02
Portugal	0.06	0.00	0.00
Russian Federation	0.22	0.05	0.03
Russian Federation 6hr+	0.15	0.02	0.01
Slovenia	0.24	0.06	0.03
Sweden	0.07	0.00	0.00
United States	0.01	0.00	0.01
International Median	0.07	0.00	0.01

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015



# Students Like Learning Advanced Mathematics Scale

The Students Like Learning Advanced Mathematics (SLM) scale was created based on students' degree of agreement with the twelve statements described below.

## Items in the TIMSS Advanced 2015 Students Like Learning Advanced Mathematics Scale

How much do you agree with these statements about the mathematics you are studying?					
	Agree a lot	Agree a little	Disagree a little	Disagree a lot	
MSBM20A	1) When I do mathematics problems, I sometimes get completely absorbed -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM20B	2) I get a sense of satisfaction when I solve mathematics problems -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM20C*	3) I feel bored when I do my mathematics schoolwork* -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM20D	4) I like studying for my mathematics class outside of school -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM20E	5) It is interesting to learn mathematics theory -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM20F*	6) I dread my mathematics class* -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM20G	7) I am studying mathematics because I like to learn new things -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM20H	8) I enjoy figuring out challenging mathematics -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM20I	9) Mathematics is one of my favorite subjects -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM20J	10) Jobs that require advanced mathematics skills seem interesting to me -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM20K*	11) I wish I did not have to study mathematics* -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM20L	12) I enjoy thinking about the world in terms of mathematical relationships -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

\* Reverse coded

Very Much Like Learning Advanced Mathematics 11.8      Like Learning Advanced Mathematics 9.1      Do Not Like Learning Advanced Mathematics

**Item Parameters for the TIMSS Advanced 2015 Students Like Learning Advanced Mathematics Scale**

Item	delta	tau_1	tau_2	tau_3	Infit
MSBM20A	-0.59588	-1.40851	-0.22921	1.63772	1.28
MSBM20B	-1.08963	-0.57708	-0.49790	1.07498	1.10
MSBM20C*	0.39039	-1.70328	-0.19453	1.89781	1.30
MSBM20D	0.79348	-1.59115	-0.11154	1.70269	1.13
MSBM20E	0.39789	-1.25999	-0.18804	1.44803	1.03
MSBM20F*	-0.55711	-1.10780	0.07358	1.03422	2.03
MSBM20G	0.00711	-1.53161	-0.11150	1.64311	0.89
MSBM20H	-0.16988	-1.21083	-0.10307	1.31390	0.85
MSBM20I	0.21802	-0.68925	-0.03127	0.72052	0.73
MSBM20J	0.15044	-0.99874	-0.14656	1.14530	0.95
MSBM20K*	-0.28490	-0.61660	-0.08438	0.70098	1.31
MSBM20L	0.74007	-1.30692	0.04757	1.25935	1.11

\*Reverse coded

**Scale Transformation Constants for the TIMSS Advanced 2015 Students Like Learning Advanced Mathematics Scale**

Scale Transformation Constants

A = 9.128252

B = 1.556567

Transformed Scale Score = 9.128252 + 1.556567 • Logit Scale Score

**Equivalence Table of the Raw Score and the Transformed Scale Score  
for the TIMSS Advanced 2015 Students Like Learning Advanced  
Mathematics Scale**

Raw Score	Transformed Scale Score	Cutpoint
0	2.17529	
1	3.91526	
2	4.74499	
3	5.30942	
4	5.74558	
5	6.11032	
6	6.42755	
7	6.71198	
8	6.97262	
9	7.21536	
10	7.44367	
11	7.66218	
12	7.87192	
13	8.07472	
14	8.27223	
15	8.46589	
16	8.65702	
17	8.84686	
18	9.03665	9.1
19	9.22759	
20	9.42092	
21	9.61793	
22	9.82004	
23	10.02874	
24	10.24570	
25	10.47196	
26	10.71137	
27	10.96623	
28	11.24022	
29	11.53811	
30	11.86658	11.8
31	12.23465	
32	12.65864	
33	13.16494	
34	13.80785	
35	14.72417	
36	16.55930	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 Students Like Learning Advanced Mathematics Scale**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item											
			MSBM20A	MSBM20B	MSBM20C*	MSBM20D	MSBM20E	MSBM20F*	MSBM20G	MSBM20H	MSBM20I	MSBM20J	MSBM20K*	MSBM20L
France	0.88	45	0.71	0.46	0.61	0.68	0.76	0.32	0.76	0.76	0.83	0.65	0.76	0.56
Italy	0.85	46	-0.47	0.41	0.64	0.78	0.66	0.39	0.81	0.80	0.85	0.79	0.76	0.63
Lebanon	0.74	30	0.47	0.59	0.33	0.45	0.63	0.08	0.68	0.66	0.72	0.67	0.30	0.62
Norway	0.89	45	0.66	0.42	0.66	0.68	0.75	0.41	0.76	0.79	0.84	0.67	0.69	0.59
Portugal	0.90	47	0.64	0.57	0.64	0.73	0.70	0.48	0.74	0.76	0.83	0.69	0.78	0.61
Russian Federation	0.91	51	0.65	0.75	0.59	0.67	0.74	0.42	0.80	0.84	0.84	0.82	0.62	0.68
Russian Federation 6hr+	0.91	51	0.69	0.76	0.57	0.67	0.73	0.43	0.78	0.85	0.85	0.81	0.60	0.68
Slovenia	0.90	47	0.71	0.44	0.51	0.67	0.52	0.65	0.78	0.82	0.84	0.78	0.76	0.65
Sweden	0.91	49	0.66	0.57	0.69	0.72	0.79	0.43	0.78	0.80	0.85	0.71	0.73	0.60
United States	0.91	50	0.68	0.58	0.58	0.63	0.74	0.66	0.76	0.79	0.82	0.76	0.70	0.71
International Avg.	0.87	46	0.52	0.53	0.58	0.67	0.70	0.43	0.76	0.78	0.82	0.73	0.68	0.63

\*Reverse coded

**Relationship Between the TIMSS Advanced 2015 Students Like Learning Advanced Mathematics Scale, and TIMSS Advanced 2015 Advanced Mathematics Achievement**

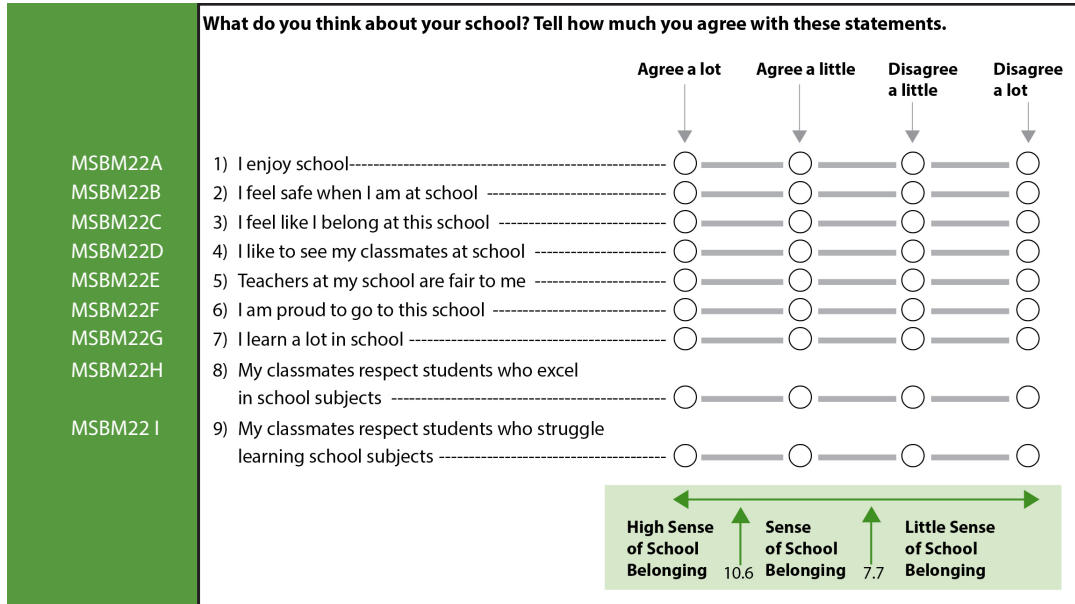
Country	Pearson's Correlation with Advanced Mathematics Achievement		Variance in Advanced Mathematics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.51	0.26	0.21
Italy	0.35	0.13	0.10
Lebanon	0.29	0.08	0.06
Norway	0.48	0.23	0.20
Portugal	0.50	0.25	0.21
Russian Federation	0.37	0.13	0.12
Russian Federation 6hr+	0.37	0.14	0.13
Slovenia	0.52	0.27	0.24
Sweden	0.54	0.29	0.24
United States	0.38	0.14	0.12
International Median	0.48	0.23	0.20

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

# Students' Sense of School Belonging Scale, Advanced Mathematics

The Students' Sense of School Belonging (SSB) scale was created based on students' degree of agreement with the nine statements described below.

## Items in the TIMSS Advanced 2015 Students' Sense of School Belonging Scale, Advanced Mathematics



**Item Parameters for the TIMSS Advanced 2015 Students' Sense of School Belonging Scale, Advanced Mathematics**

Item	delta	tau_1	tau_2	tau_3	Infit
MSBM22A	0.39975	-1.19908	-0.58547	1.78455	1.12
MSBM22B	-0.15512	-0.80900	-0.70858	1.51758	1.03
MSBM22C	0.28834	-1.11210	-0.31747	1.42957	0.95
MSBM22D	-0.80465	-0.67223	-0.64404	1.31627	1.22
MSBM22E	0.00294	-1.42359	-0.45338	1.87697	1.11
MSBM22F	0.41761	-1.13239	-0.45103	1.58342	0.95
MSBM22G	-0.24169	-1.34822	-0.66654	2.01476	1.01
MSBM22H	-0.10713	-1.24202	-0.52085	1.76287	1.10
MSBM22I	0.19995	-1.32373	-0.51026	1.83399	1.33

**Scale Transformation Constants for the TIMSS Advanced 2015 Students' Sense of School Belonging Scale, Advanced Mathematics**

Scale Transformation Constants

$$A = 7.993523$$

$$B = 1.272937$$

$$\text{Transformed Scale Score} = 7.993523 + 1.272937 \cdot \text{Logit Scale Score}$$

**Equivalence Table of the Raw Score and the Transformed Scale Score for the TIMSS Advanced 2015 Students' Sense of School Belonging Scale, Advanced Mathematics**

Raw Score	Transformed Scale Score	Cutpoint
0	2.80092	
1	4.17041	
2	4.81527	
3	5.25552	
4	5.59943	
5	5.88979	
6	6.14726	
7	6.38344	
8	6.60565	
9	6.81902	
10	7.02747	
11	7.23422	
12	7.44214	
13	7.65463	7.7
14	7.87272	
15	8.10081	
16	8.34184	
17	8.59861	
18	8.87410	
19	9.17103	
20	9.49135	
21	9.83727	
22	10.21291	
23	10.62626	10.6
24	11.09778	
25	11.66982	
26	12.45741	
27	13.98330	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 Students' Sense of School Belonging Scale, Advanced Mathematics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item									
			MSBM22A	MSBM22B	MSBM22C	MSBM22D	MSBM22E	MSBM22F	MSBM22G	MSBM22H	MSBM22I	
France	0.81	40	0.72	0.67	0.67	0.58	0.56	0.73	0.63	0.56	0.56	
Italy	0.83	43	0.71	0.71	0.76	0.53	0.62	0.79	0.68	0.52	0.53	
Lebanon	0.85	45	0.63	0.79	0.76	0.57	0.63	0.73	0.67	0.64	0.59	
Norway	0.84	45	0.73	0.70	0.78	0.67	0.58	0.72	0.66	0.60	0.56	
Portugal	0.82	42	0.73	0.69	0.73	0.58	0.52	0.77	0.67	0.54	0.56	
Russian Federation	0.89	55	0.79	0.76	0.81	0.69	0.66	0.82	0.71	0.69	0.70	
Russian Federation 6hr+	0.89	54	0.78	0.74	0.81	0.70	0.65	0.79	0.72	0.68	0.70	
Slovenia	0.85	45	0.71	0.68	0.78	0.57	0.61	0.78	0.74	0.58	0.53	
Sweden	0.85	48	0.79	0.70	0.80	0.65	0.58	0.75	0.69	0.61	0.60	
United States	0.86	48	0.71	0.66	0.78	0.70	0.65	0.79	0.72	0.66	0.56	
International Avg.	0.85	46	0.73	0.71	0.76	0.61	0.60	0.76	0.69	0.60	0.58	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

**Relationship Between the TIMSS Advanced 2015 Students' Sense of School Belonging Scale, and TIMSS Advanced 2015 Advanced Mathematics Achievement**

Country	Pearson's Correlation with Advanced Mathematics Achievement		Variance in Advanced Mathematics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	( $r^2$ )	
France	0.20	0.04	0.04
Italy	0.05	0.00	0.01
Lebanon	0.08	0.01	0.01
Norway	0.16	0.03	0.02
Portugal	0.07	0.00	0.01
Russian Federation	0.12	0.02	0.01
Russian Federation 6hr+	0.09	0.01	0.01
Slovenia	0.22	0.05	0.04
Sweden	0.20	0.04	0.04
United States	0.07	0.01	0.01
International Median	0.12	0.02	0.01

# Students Value Advanced Mathematics Scale

The Students Value Advanced Mathematics (SVM) scale was created based on students' degree of agreement with the nine statements described below.

## Items in the TIMSS Advanced 2015 Students Value Advanced Mathematics Scale

		How much do you agree with these statements about the mathematics you are studying?			
		Agree a lot	Agree a little	Disagree a little	Disagree a lot
MSBM21A	1) Learning mathematics will help me get ahead in the world-----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM21B	2) It is important to do well in my mathematics class -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM21C*	3) The mathematics I am studying is not useful for my future* -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM21D	4) My parents are pleased that I am taking advanced mathematics -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM21E	5) Doing well in mathematics will help me get into the university of my choice -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM21F*	6) Learning advanced mathematics does not seem to be a worthwhile exercise* -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM21G	7) My parents think that it is important that I do well in my mathematics class-----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM21H	8) I like telling people I am studying advanced mathematics -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
MSBM21 I	9) Learning advanced mathematics will give me more job opportunities -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Reverse coded					



**Item Parameters for the TIMSS Advanced 2015 Students Value Advanced Mathematics Scale**

Item	delta	tau_1	tau_2	tau_3	Infit
MSBM21A	0.07051	-1.13081	-0.21324	1.34405	0.94
MSBM21B	-0.33686	-1.13710	-0.21075	1.34785	0.84
MSBM21C*	0.58705	-1.02374	-0.04630	1.07004	1.35
MSBM21D	-0.34160	-0.88413	-0.47165	1.35578	0.93
MSBM21E	-0.16646	-0.40870	-0.14215	0.55085	0.90
MSBM21F*	0.03347	-0.91420	-0.19645	1.11065	1.57
MSBM21G	-0.65475	-0.83420	-0.49183	1.32603	0.93
MSBM21H	0.90365	-1.13939	0.07749	1.06190	1.25
MSBM21I	-0.09501	-0.78067	-0.26783	1.04850	0.81

\*Reverse coded

**Scale Transformation Constants for the TIMSS Advanced 2015 Students Value Advanced Mathematics Scale**

Scale Transformation Constants

A = 8.202488

B = 1.658016

Transformed Scale Score = 8.202488 + 1.658016 • Logit Scale Score

**Equivalence Table of the Raw Score and the Transformed Scale Score for the TIMSS Advanced 2015 Students Value Advanced Mathematics Scale**

Raw Score	Transformed Scale Score	Cutpoint
0	1.74486	
1	3.54182	
2	4.39260	
3	4.97121	
4	5.42447	
5	5.80430	
6	6.13612	
7	6.44041	
8	6.72231	
9	6.98816	
10	7.24296	
11	7.49073	
12	7.73488	
13	7.97837	8.0
14	8.22472	
15	8.47440	
16	8.73231	
17	9.00052	
18	9.28212	
19	9.57930	
20	9.89879	
21	10.24631	
22	10.63156	
23	11.07036	11.0
24	11.58834	
25	12.24488	
26	13.18781	
27	15.09728	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 Students Value Advanced Mathematics Scale, Advanced Mathematics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item									
			MSBM21A	MSBM21B	MSBM21C*	MSBM21D	MSBM21E	MSBM21F*	MSBM21G	MSBM21H	MSBM21I	
France	0.81	41	0.65	0.62	0.63	0.59	0.68	0.65	0.58	0.58	0.75	
Italy	0.85	46	0.79	0.74	0.63	0.61	0.69	0.69	0.53	0.58	0.79	
Lebanon	0.67	32	0.41	0.71	0.42	0.67	0.64	0.31	0.63	0.45	0.65	
Norway	0.73	35	0.69	0.68	0.39	0.63	0.67	0.65	0.52	0.35	0.62	
Portugal	0.83	44	0.76	0.68	0.64	0.64	0.67	0.70	0.55	0.50	0.76	
Russian Federation	0.83	45	0.72	0.76	0.36	0.75	0.75	0.51	0.73	0.58	0.78	
Russian Federation 6hr+	0.82	45	0.74	0.77	0.30	0.75	0.76	0.50	0.72	0.52	0.80	
Slovenia	0.73	34	0.72	0.44	0.46	0.70	0.57	0.08	0.63	0.60	0.77	
Sweden	0.76	36	0.73	0.54	0.64	0.60	0.61	0.68	0.44	0.39	0.67	
United States	0.81	42	0.74	0.73	0.60	0.63	0.66	0.62	0.58	0.48	0.76	
International Avg.	0.78	39	0.69	0.66	0.53	0.65	0.66	0.54	0.58	0.50	0.73	

\*Reverse coded

**Relationship Between the TIMSS Advanced 2015 Students Value Advanced Mathematics Scale, and TIMSS Advanced 2015 Advanced Mathematics Achievement**

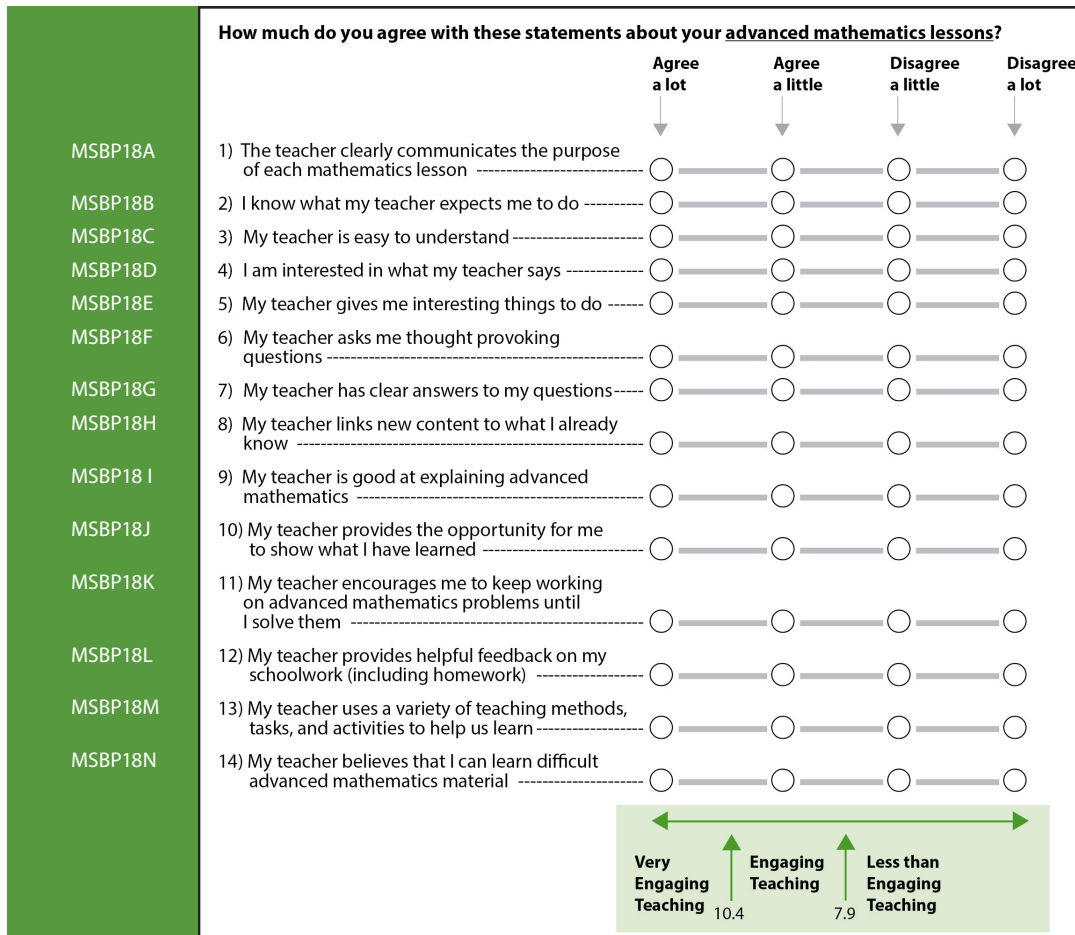
Country	Pearson's Correlation with Advanced Mathematics Achievement		Variance in Advanced Mathematics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.36	0.13	0.11
Italy	0.24	0.06	0.05
Lebanon	0.25	0.06	0.04
Norway	0.23	0.05	0.04
Portugal	0.36	0.13	0.11
Russian Federation	0.29	0.08	0.07
Russian Federation 6hr+	0.28	0.08	0.08
Slovenia	0.40	0.16	0.14
Sweden	0.24	0.06	0.04
United States	0.24	0.06	0.05
International Median	0.25	0.06	0.05

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

# Students' Views on Engaging Teaching in Advanced Mathematics Lessons Scale

The Students' Views on Engaging Teaching in Advanced Mathematics Lessons (EML) scale was created based on students' degree of agreement with the fourteen statements described below.

## Items in the TIMSS Advanced 2015 Students' Views on Engaging Teaching in Advanced Mathematics Lessons Scale



**Item Parameters for the TIMSS Advanced 2015 Students' Views on Engaging Teaching in Advanced Mathematics Lessons Scale, Advanced Mathematics**

Item	delta	tau_1	tau_2	tau_3	Infit
MSBM18A	-0.27752	-1.49392	-0.31185	1.80577	0.88
MSBM18B	-0.52469	-1.55270	-0.46138	2.01408	1.13
MSBM18C	0.02085	-1.52655	-0.20957	1.73612	0.83
MSBM18D	0.15229	-1.49964	-0.38439	1.88403	1.21
MSBM18E	0.83288	-1.83818	-0.20095	2.03913	0.96
MSBM18F	0.32078	-1.44837	-0.23359	1.68196	1.18
MSBM18G	-0.08348	-1.31458	-0.29135	1.60593	0.96
MSBM18H	-0.47204	-1.41178	-0.47480	1.88658	1.03
MSBM18I	-0.40869	-1.16049	-0.28104	1.44153	0.79
MSBM18J	-0.25862	-1.91696	-0.35479	2.27175	1.06
MSBM18K	-0.07877	-1.57597	-0.14124	1.71721	1.07
MSBM18L	0.30429	-1.59816	-0.19349	1.79165	1.12
MSBM18M	0.53568	-1.70713	-0.02321	1.73034	1.14
MSBM18N	-0.06296	-1.38459	-0.35309	1.73768	1.20

**Scale Transformation Constants for the TIMSS Advanced 2015 Students' Views on Engaging Teaching in Advanced Mathematics Lessons Scale, Advanced Mathematics**

Scale Transformation Constants

A = 8.028837

B = 1.168415

Transformed Scale Score = 8.028837 + 1.168415 • Logit Scale Score

**Equivalence Table of the Raw Score and the Transformed Scale Score  
for the TIMSS Advanced 2015 Students' Views on Engaging Teaching in  
Advanced Mathematics Lessons Scale, Advanced Mathematics**

Raw Score	Transformed Scale Score	Cutpoint
0	2.25920	
1	3.58079	
2	4.21671	
3	4.65055	
4	4.98578	
5	5.26436	
6	5.50518	
7	5.71976	
8	5.91528	
9	6.09775	
10	6.26742	
11	6.42988	
12	6.58608	
13	6.73753	
14	6.88552	
15	7.03109	
16	7.17519	
17	7.31924	
18	7.46246	
19	7.60644	
20	7.75182	
21	7.89911	7.9
22	8.04905	
23	8.20155	
24	8.35759	
25	8.51741	
26	8.68135	
27	8.84974	
28	9.02315	
29	9.20196	
30	9.38677	
31	9.57837	
32	9.77786	
33	9.98680	
34	10.20742	
35	10.44289	10.4
36	10.69789	
37	10.97836	
38	11.29738	
39	11.67448	
40	12.15065	
41	12.82864	
42	14.19398	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 Students' Views on Engaging Teaching in Advanced Mathematics Lessons Scale, Advanced Mathematics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item													
			M5BM18A	M5BM18B	M5BM18C	M5BM18D	M5BM18E	M5BM18F	M5BM18G	M5BM18H	M5BM18I	M5BM18J	M5BM18K	M5BM18L	M5BM18M	M5BM18N
France	0.91	46	0.69	0.65	0.77	0.64	0.70	0.63	0.75	0.61	0.80	0.63	0.66	0.63	0.64	0.66
Italy	0.92	52	0.81	0.58	0.83	0.51	0.68	0.70	0.79	0.69	0.82	0.76	0.74	0.77	0.74	0.54
Lebanon	0.91	46	0.68	0.57	0.75	0.64	0.70	0.59	0.71	0.68	0.69	0.69	0.70	0.68	0.71	0.65
Norway	0.91	45	0.69	0.68	0.79	0.59	0.70	0.58	0.73	0.70	0.78	0.68	0.59	0.70	0.59	0.58
Portugal	0.93	52	0.79	0.66	0.80	0.57	0.73	0.62	0.78	0.69	0.81	0.70	0.75	0.74	0.73	0.66
Russian Federation	0.92	50	0.77	0.64	0.76	0.76	0.75	0.56	0.75	0.63	0.79	0.64	0.65	0.76	0.75	0.65
Russian Federation 6hr+	0.90	46	0.73	0.60	0.72	0.73	0.73	0.57	0.70	0.59	0.74	0.60	0.66	0.73	0.70	0.62
Slovenia	0.92	51	0.79	0.71	0.80	0.59	0.72	0.69	0.77	0.73	0.83	0.66	0.56	0.70	0.73	0.63
Sweden	0.93	53	0.75	0.65	0.82	0.68	0.77	0.74	0.75	0.75	0.81	0.71	0.71	0.74	0.64	0.60
United States	0.94	57	0.81	0.72	0.82	0.70	0.74	0.71	0.79	0.77	0.85	0.75	0.75	0.74	0.69	0.70
International Avg.	0.92	50	0.75	0.65	0.79	0.63	0.72	0.65	0.76	0.69	0.80	0.69	0.68	0.72	0.69	0.63

**Relationship Between the TIMSS Advanced 2015 Students' Views on Engaging Teaching in Advanced Mathematics Lessons Scale, and TIMSS Advanced 2015 Advanced Mathematics Achievement**

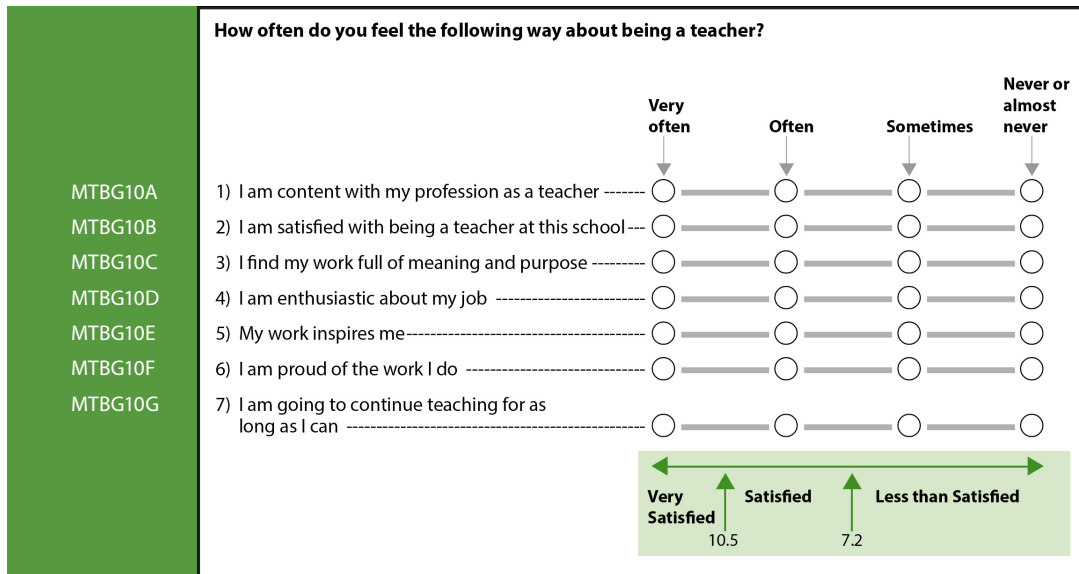
Country	Pearson's Correlation with Advanced Mathematics Achievement		Variance in Advanced Mathematics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.26	0.07	0.05
Italy	0.09	0.01	0.01
Lebanon	0.11	0.01	0.02
Norway	0.26	0.07	0.06
Portugal	0.22	0.05	0.06
Russian Federation	0.29	0.08	0.07
Russian Federation 6hr+	0.19	0.04	0.03
Slovenia	0.31	0.09	0.09
Sweden	0.30	0.09	0.08
United States	0.20	0.04	0.04
International Median	0.26	0.07	0.06

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

# Teacher Job Satisfaction Scale, Advanced Mathematics

The Teacher Job Satisfaction (TJS) scale was created based on how often teachers responded positively to the seven statements described below.

## Items in the TIMSS Advanced 2015 Teacher Job Satisfaction Scale, Advanced Mathematics<sup>1</sup>



<sup>1</sup> For the purpose of scaling, categories in which there were very few respondents were combined. The categories “Sometimes” and “Never or almost never” were combined for all variables. The scale statistics that are reported herein reflect analysis of the items following collapsing.

**Item Parameters for the TIMSS Advanced 2015 Teacher Job Satisfaction Scale, Advanced Mathematics**

Item	delta	tau_1	tau_2	Infit
MTBG10A	0.02623	-1.95127	1.95127	0.88
MTBG10B	-0.43330	-1.84194	1.84194	1.13
MTBG10C	-0.61209	-1.77591	1.77591	1.01
MTBG10D	0.27416	-1.46188	1.46188	0.86
MTBG10E	0.59966	-1.80856	1.80856	0.82
MTBG10F	-0.16519	-1.70772	1.70772	1.04
MTBG10G	0.31053	-1.31610	1.31610	1.30

**Scale Transformation Constants for the TIMSS Advanced 2015 Teacher Job Satisfaction Scale, Advanced Mathematics**

Scale Transformation Constants

$$A = 8.820804$$

$$B = 0.846688$$

$$\text{Transformed Scale Score} = 8.820804 + 0.846688 \cdot \text{Logit Scale Score}$$

**Equivalence Table of the Raw Score and the Transformed Scale Score for the TIMSS Advanced 2015 Teacher Job Satisfaction Scale, Advanced Mathematics**

Raw Score	Transformed Scale Score	Cutpoint
0	4.98060	
1	6.05555	
2	6.65040	
3	7.11867	7.2
4	7.54548	
5	7.96186	
6	8.39462	
7	8.84453	
8	9.28947	
9	9.70621	
10	10.10676	
11	10.51404	10.5
12	10.96709	
13	11.54630	
14	12.61485	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015



**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 Teacher Job Satisfaction Scale, Advanced Mathematics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item							
			MTBG10A	MTBG10B	MTBG10C	MTBG10D	MTBG10E	MTBG10F	MTBG10G	
France	0.92	69	0.85	0.82	0.85	0.88	0.82	0.78	0.81	
Italy	0.90	63	0.84	0.75	0.75	0.87	0.82	0.83	0.67	
Lebanon	0.82	51	0.77	0.69	0.78	0.76	0.66	0.65	0.66	
Norway	0.93	70	0.86	0.76	0.86	0.87	0.91	0.83	0.76	
Portugal	0.87	56	0.79	0.67	0.68	0.84	0.79	0.76	0.70	
Russian Federation	0.91	66	0.83	0.80	0.77	0.83	0.84	0.82	0.79	
Russian Federation 6hr+	0.90	62	0.81	0.76	0.77	0.82	0.81	0.78	0.76	
Slovenia	0.92	68	0.82	0.75	0.82	0.91	0.88	0.82	0.74	
Sweden	0.89	61	0.78	0.72	0.70	0.83	0.87	0.78	0.78	
United States	0.92	68	0.85	0.81	0.85	0.88	0.88	0.75	0.73	
International Avg.	0.90	63	0.82	0.75	0.78	0.85	0.83	0.78	0.74	

**Relationship Between the TIMSS Advanced 2015 Teacher Job Satisfaction Scale, and TIMSS Advanced 2015 Advanced Mathematics Achievement**

Country	Pearson's Correlation with Advanced Mathematics Achievement		Variance in Advanced Mathematics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.05	0.00	0.00
Italy	0.04	0.00	0.01
Lebanon	-0.01	0.00	0.00
Norway	0.18	0.03	0.04
Portugal	0.06	0.00	0.00
Russian Federation	0.22	0.05	0.03
Russian Federation 6hr+	0.08	0.01	0.00
Slovenia	0.13	0.02	0.02
Sweden	0.05	0.00	0.00
United States	-0.03	0.00	0.00
International Median	0.05	0.00	0.00

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

# Appendix 15B: TIMSS Advanced 2015 Context Questionnaire Scales, Physics

## Home Educational Resources Scale, Physics

The Home Educational Resources (HER) scale was created based on students' responses concerning the availability of four resources described below.

### Items in the TIMSS Advanced 2015 Home Educational Resources Scale, Physics

PSBG04	<p><b>Number of books in the home:</b></p> <p>1) 0-10</p> <p>2) 11-25</p> <p>3) 26-100</p> <p>4) 101-200</p> <p>5) More than 200</p>	<p><b>Highest level of education of either parent:</b></p> <p>1) Finished some primary or lower secondary or did not go to school</p> <p>2) Finished lower secondary</p> <p>3) Finished upper secondary</p> <p>4) Finished post-secondary education</p> <p>5) Finished university or higher</p>	PSDGEDUP <sup>1</sup>
PSDG06S <sup>1</sup>	<p><b>Number of home study supports:</b></p> <p>1) None</p> <p>2) Study desk/table or own room</p> <p>3) Both</p>		
PSDGOCCP <sup>1</sup>	<p><b>Highest level of occupation of either parent:</b></p> <p>1) Has never worked outside home for pay, general laborer, or semi-professional (skilled agricultural or fishery worker, craft or trade worker, plant or machine operator)</p> <p>2) Clerical (clerk or service or sales worker)</p> <p>3) Small business owner</p> <p>4) Professional (corporate manager or senior official, professional, or technician or associate professional)</p>		

<sup>1</sup> Derived variable. For more details, see Supplement 3 of the TIMSS Advanced 2015 User Guide for the [International Database](#).

**Item Parameters for the TIMSS Advanced 2015 Home Educational Resources Scale, Physics**

Item	delta	tau_1	tau_2	tau_3	tau_4	Infit
PSBG04	0.64929	-0.89914	-0.53587	0.86039	0.57462	1.09
PSDG06S	-0.90816	-0.25972	0.25972			1.11
PSDGEDUP	-0.11749	-0.59426	-0.48752	0.88533	0.19645	1.01
PSDGOCCP	0.37636	-0.64586	1.24705	-0.60119		0.99

**Scale Transformation Constants for the TIMSS Advanced 2015 Home Educational Resources Scale, Physics**

Scale Transformation Constants	
A = 7.525439	Transformed Scale Score = 7.525439 + 2.234962 • Logit Scale Score
B = 2.234962	

**Equivalence Table of the Raw Score and the Transformed Scale Score for the TIMSS Advanced 2015 Home Educational Resources Scale, Physics**

Raw Score	Transformed Scale Score	Cutpoint
0	1.31964	
1	3.68097	
2	4.88859	
3	5.77587	5.8
4	6.50614	
5	7.14369	
6	7.71485	
7	8.25370	
8	8.77829	
9	9.31522	
10	9.89707	
11	10.57858	
12	11.48758	11.4
13	13.18946	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 Home Educational Resources Scale, Physics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item			
			PSB604	PSD606S	PSD6EDJP	PSD60CCP
France	0.60	47	0.65	0.31	0.84	0.81
Italy	0.59	46	0.66	0.22	0.84	0.81
Lebanon	0.51	40	0.60	0.40	0.73	0.75
Norway	0.51	43	0.67	0.28	0.79	0.75
Portugal	0.67	51	0.75	0.08	0.87	0.84
Russian Federation	0.41	38	0.60	0.17	0.78	0.74
Slovenia	0.55	44	0.67	0.14	0.83	0.77
Sweden	0.58	46	0.70	0.42	0.76	0.77
United States	0.52	43	0.73	0.50	0.81	0.51
International Avg.	0.55	44	0.67	0.28	0.80	0.75

**Relationship Between the TIMSS Advanced 2015 Home Educational Resources Scale, and TIMSS Advanced 2015 Physics Achievement**

Country	Pearson's Correlation with Physics Achievement		Variance in Physics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.33	0.11	0.07
Italy	0.14	0.02	0.01
Lebanon	0.19	0.04	0.02
Norway	0.26	0.07	0.05
Portugal	0.31	0.09	0.07
Russian Federation	0.15	0.02	0.01
Slovenia	0.21	0.04	0.04
Sweden	0.36	0.13	0.10
United States	0.32	0.10	0.08
International Median	0.26	0.07	0.05

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

# Safe and Orderly School-Teachers' Reports Scale, Physics

The Safe and Orderly School-Teachers' Reports (SOS) scale was created based on teachers' degree of agreement with the eight statements described below.

## Items in the TIMSS Advanced 2015 Safe and Orderly School-Teachers' Reports Scale, Physics<sup>1</sup>

Thinking about your current school, indicate the extent to which you agree or disagree with each of the following statements.

	Agree a lot	Agree a little	Disagree a little	Disagree a lot
PTBG07A 1) This school is located in a safe neighborhood	○	○	○	○
PTBG07B 2) I feel safe at this school	○	○	○	○
PTBG07C 3) This school's security policies and practices are sufficient	○	○	○	○
PTBG07D 4) The students behave in an orderly manner	○	○	○	○
PTBG07E 5) The students are respectful of the teachers	○	○	○	○
PTBG07F 6) The students respect school property	○	○	○	○
PTBG07G 7) This school has clear rules about student conduct	○	○	○	○
PTBG07H 8) This school's rules are enforced in a fair and consistent manner	○	○	○	○

<sup>1</sup> For the purpose of scaling, categories in which there were very few respondents were combined. The categories "Disagree a little" and "Disagree a lot" were combined for all variables. The scale statistics that are reported herein reflect analysis of the items following collapsing.

**Item Parameters for the TIMSS Advanced 2015 Safe and Orderly School - Teachers' Reports Scale, Physics**

Item	delta	tau_1	tau_2	Infit
PTBG07A	-0.79213	-1.28024	1.28024	1.62
PTBG07B	-1.54669	-1.28512	1.28512	0.91
PTBG07C	-0.40475	-1.47335	1.47335	0.97
PTBG07D	0.38110	-1.85404	1.85404	0.82
PTBG07E	0.25303	-2.01362	2.01362	0.81
PTBG07F	1.12283	-2.06225	2.06225	0.88
PTBG07G	0.11548	-1.62992	1.62992	1.02
PTBG07H	0.87113	-1.60812	1.60812	0.95

**Scale Transformation Constants for the TIMSS Advanced 2015 Safe and Orderly School - Teachers' Reports Scale, Physics**

Scale Transformation Constants	
A = 8.10253	Transformed Scale Score = 8.10253 + 0.992158 • Logit Scale Score
B = 0.992158	

**Equivalence Table of the Raw Score and the Transformed Scale Score for the TIMSS Advanced 2015 Safe and Orderly School - Teachers' Reports Scale, Physics**

Raw Score	Transformed Scale Score	Cutpoint
0	3.45082	
1	4.70451	
2	5.37921	
3	5.89100	
4	6.33230	6.4
5	6.74144	
6	7.14044	
7	7.54539	
8	7.96637	
9	8.41273	
10	8.88463	
11	9.37552	
12	9.88022	9.8
13	10.40751	
14	10.99267	
15	11.73382	
16	13.03341	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 Safe and Orderly School - Teachers' Reports Scale, Physics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item							
			PTB6D7A	PTB6D7B	PTB6D7C	PTB6D7D	PTB6D7E	PTB6D7F	PTB6D7G	PTB6D7H
France	0.85	50	0.58	0.68	0.64	0.81	0.80	0.68	0.71	0.70
Italy	0.87	52	0.62	0.67	0.69	0.79	0.77	0.74	0.65	0.80
Lebanon	0.82	46	0.33	0.48	0.65	0.82	0.75	0.77	0.70	0.74
Norway	0.84	49	0.60	0.66	0.68	0.82	0.79	0.70	0.62	0.69
Portugal	0.84	49	0.34	0.63	0.67	0.76	0.84	0.80	0.71	0.73
Russian Federation	0.77	40	0.48	0.59	0.57	0.76	0.79	0.72	0.67	0.29
Slovenia	0.91	63	0.83	0.79	0.82	0.85	0.83	0.77	0.73	0.73
Sweden	0.83	48	0.42	0.59	0.75	0.79	0.80	0.76	0.58	0.76
United States	0.90	59	0.42	0.69	0.77	0.89	0.85	0.83	0.79	0.81
International Avg.	0.85	51	0.51	0.64	0.69	0.81	0.81	0.75	0.69	0.70

**Relationship Between the TIMSS Advanced 2015 Safe and Orderly School - Teachers' Reports Scale, and TIMSS Advanced 2015 Physics Achievement**

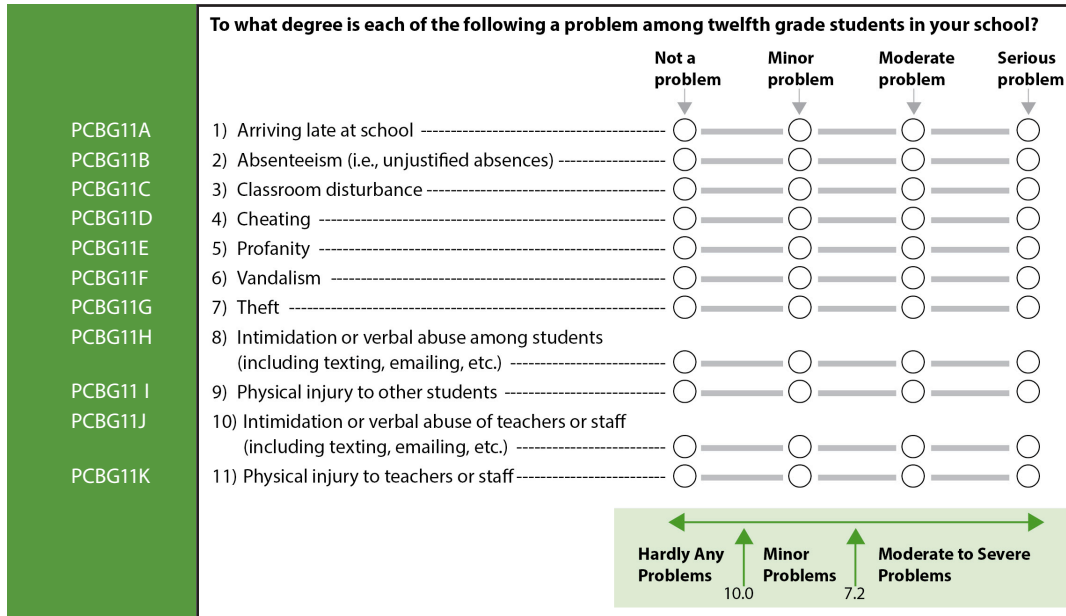
Country	Pearson's Correlation with Physics Achievement		Variance in Physics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.08	0.01	0.01
Italy	0.03	0.00	0.00
Lebanon	0.07	0.00	0.01
Norway	0.11	0.01	0.02
Portugal	0.04	0.00	0.01
Russian Federation	0.03	0.00	0.00
Slovenia	0.19	0.04	0.04
Sweden	0.12	0.01	0.02
United States	0.25	0.06	0.12
International Median	0.08	0.01	0.01

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

# School Discipline Problems–Principals’ Reports Scale, Physics

The School Discipline Problems–Principals’ Reports (DAS) scale was created based on principals’ responses concerning the eleven potential school problems described below.

## Items in the TIMSS Advanced 2015 School Discipline Problems–Principals’ Reports Scale, Physics





**Item Parameters for the TIMSS Advanced 2015 School Discipline Problems - Principals' Reports Scale, Physics**

Item	delta	tau_1	tau_2	tau_3	Infit
PCBG11A	1.17877	-3.21012	-0.16690	3.37702	1.21
PCBG11B	1.46046	-2.19399	-0.42850	2.62249	1.13
PCBG11C	0.18891	-1.99828	-0.62084	2.61912	0.93
PCBG11D	0.80313	-2.53161	-0.66242	3.19403	1.11
PCBG11E	-0.22664	-1.90441	-0.40045	2.30486	0.84
PCBG11F	-0.50647	0.20063	-1.22273	1.02210	0.76
PCBG11G	-0.43015	-0.05140	-1.18166	1.23306	0.69
PCBG11H	-0.06170	-1.19025	-1.00895	2.19920	0.75
PCBG11I	-0.69241	0.65883	-1.47382	0.81499	0.64
PCBG11J	-0.67545	0.54715	-1.66947	1.12232	0.67

**Scale Transformation Constants for the TIMSS Advanced 2015 School Discipline Problems - Principals' Reports Scale, Physics**

Scale Transformation Constants	
A = 7.709439	Transformed Scale Score = 7.709439 + 0.955134 • Logit Scale Score
B = 0.955134	

**Equivalence Table of the Raw Score and the Transformed Scale Score for the TIMSS Advanced 2015 School Discipline Problems - Principals' Reports Scale, Physics**

Raw Score	Transformed Scale Score	Cutpoint
0	3.54143	
1	4.62379	
2	5.12325	
3	5.44481	
4	5.68073	
5	5.86766	
6	6.02294	
7	6.15980	
8	6.28303	
10	6.50367	
11	6.60698	
12	6.70877	
14	6.91459	
15	7.02423	
16	7.13973	7.2
17	7.26373	
18	7.39914	
19	7.54913	
20	7.71713	
21	7.90633	
22	8.12018	
23	8.35907	
24	8.62458	
25	8.91866	
26	9.24592	
27	9.61214	
28	10.02711	10.0
29	10.50216	
30	11.04762	
31	11.67530	
32	12.44148	
33	13.73438	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 School Discipline Problems - Principals' Reports Scale, Physics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item										
			PCBG11A	PCBG11B	PCBG11C	PCBG11D	PCBG11E	PCBG11F	PCBG11G	PCBG11H	PCBG11I	PCBG11J	PCBG11K
France	0.94	65	0.61	0.65	0.79	0.70	0.88	0.89	0.80	0.88	0.91	0.87	0.85
Italy	0.96	72	0.51	0.76	0.85	0.72	0.80	0.94	0.91	0.91	0.95	0.93	0.93
Lebanon	0.98	84	0.84	0.88	0.90	0.87	0.94	0.95	0.96	0.91	0.94	0.93	0.94
Norway	0.82	41	0.56	0.55	0.54	0.60	0.68	0.80	0.74	0.50	0.75	0.74	0.53
Portugal	0.95	66	0.55	0.77	0.84	0.72	0.77	0.90	0.89	0.87	0.89	0.87	0.81
Russian Federation	0.77	37	0.55	0.61	0.61	0.54	0.70	0.67	0.54	0.70	0.56	-	-
Slovenia	0.76	36	0.15	0.40	0.61	0.67	0.64	0.54	0.66	0.59	0.74	0.58	0.74
Sweden	0.84	42	0.50	0.54	0.61	0.59	0.67	0.77	0.70	0.68	0.69	0.78	0.50
United States	0.87	46	0.69	0.66	0.74	0.67	0.77	0.55	0.71	0.76	0.59	0.78	0.41
International Avg.	0.88	54	0.55	0.65	0.72	0.68	0.76	0.78	0.77	0.76	0.78	0.81	0.71

A dash (-) indicates comparable data not available.

**Relationship Between the TIMSS Advanced 2015 School Discipline Problems - Principals' Reports Scale, and TIMSS Advanced 2015 Physics Achievement**

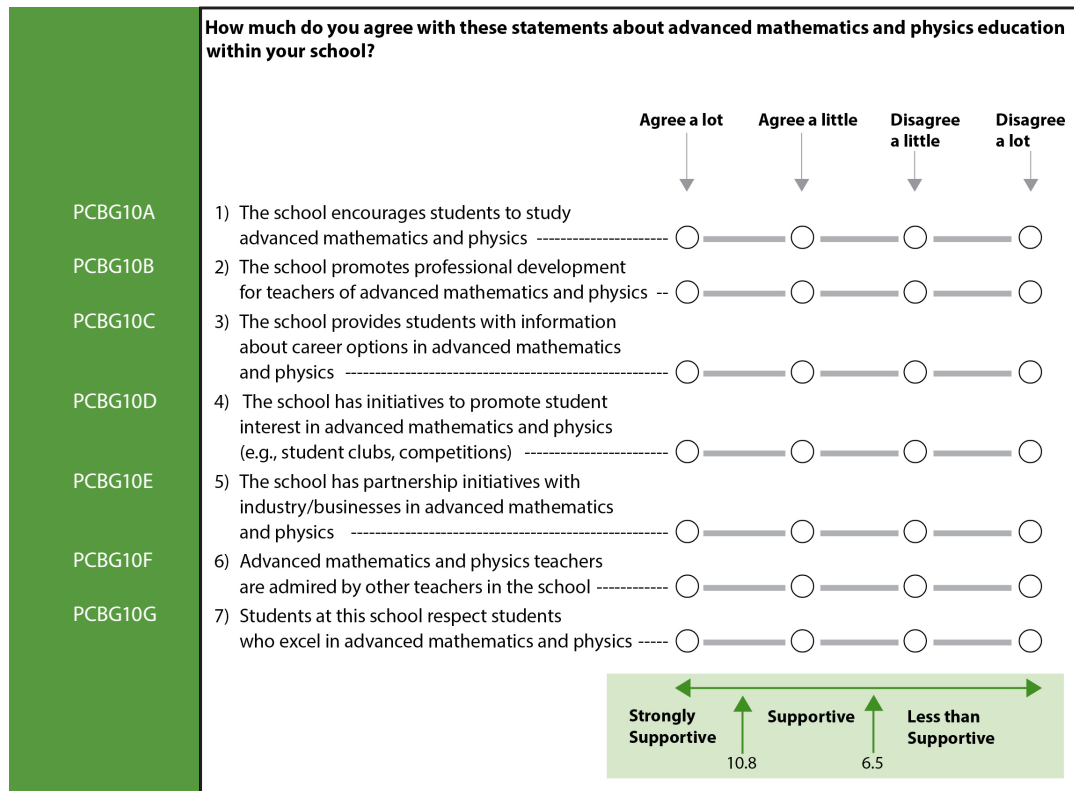
Country	Pearson's Correlation with Physics Achievement		Variance in Physics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.12	0.01	0.00
Italy	0.23	0.05	0.03
Lebanon	0.07	0.00	0.00
Norway	0.07	0.00	0.01
Portugal	0.05	0.00	0.00
Russian Federation	0.05	0.00	0.01
Slovenia	0.18	0.03	0.03
Sweden	0.18	0.03	0.02
United States	0.16	0.03	0.01
International Median	0.12	0.01	0.01

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

# School Supports Advanced Mathematics and Physics Education—Principal Version Scale, Physics

The School Supports Advanced Mathematics and Physics Education—Principal Version (SMP) scale was created based on principals’ responses characterizing the seven aspects described below.

## Items in the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education—Principal Version Scale, Physics<sup>1</sup>



<sup>1</sup> For the purpose of scaling, categories in which there were very few respondents were combined. The categories “Disagree a little” and “Disagree a lot” were combined for all variables. The scale statistics that are reported herein reflect analysis of the items following collapsing.

**Item Parameters for the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Principal Version Scale, Physics**

Item	delta	tau_1	tau_2	Infit
PCBG10A	-0.96174	-1.03132	1.03132	0.84
PCBG10B	-0.48986	-1.17668	1.17668	0.91
PCBG10C	-0.82638	-1.18249	1.18249	0.91
PCBG10D	-0.45940	-0.92144	0.92144	0.92
PCBG10E	1.76069	-0.59088	0.59088	1.05
PCBG10F	1.04013	-0.61623	0.61623	1.03
PCBG10G	-0.06344	-0.95292	0.95292	1.08

**Scale Transformation Constants for the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Principal Version Scale, Physics**

Scale Transformation Constants

$$A = 8.69507$$

$$B = 1.384086$$

$$\text{Transformed Scale Score} = 8.69507 + 1.384086 \cdot \text{Logit Scale Score}$$

**Equivalence Table of the Raw Score and the Transformed Scale Score for the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Principal Version Scale, Physics**

Raw Score	Transformed Scale Score	Cutpoint
0	3.03255	
1	4.78821	
2	5.74762	
3	6.48485	6.5
4	7.12106	
5	7.70041	
6	8.24387	
7	8.76353	
8	9.27161	
9	9.78476	
10	10.31709	
11	10.89611	10.8
12	11.57031	
13	12.46547	
14	14.14715	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Principal Version Scale, Physics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item							
			PCBG10A	PCBG10B	PCBG10C	PCBG10D	PCBG10E	PCBG10F	PCBG10G	
France	0.66	34	0.70	0.60	0.62	0.56	0.50	0.60	0.46	
Italy	0.77	42	0.81	0.71	0.75	0.61	0.66	0.47	0.46	
Lebanon	0.75	41	0.61	0.65	0.74	0.76	0.56	0.60	0.57	
Norway	0.70	37	0.65	0.47	0.47	0.70	0.56	0.69	0.67	
Portugal	0.76	41	0.53	0.68	0.62	0.65	0.58	0.73	0.67	
Russian Federation	0.67	40	0.57	0.73	0.70	0.63	0.36	0.62	0.73	
Slovenia	0.73	39	0.60	0.70	0.66	0.71	0.72	0.47	0.45	
Sweden	0.73	40	0.76	0.79	0.78	0.75	0.44	0.21	0.40	
United States	0.80	47	0.64	0.69	0.74	0.78	0.50	0.69	0.73	
International Avg.	0.73	40	0.65	0.67	0.68	0.68	0.54	0.56	0.57	

**Relationship Between the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Principal Version Scale, and TIMSS Advanced 2015 Physics Achievement**

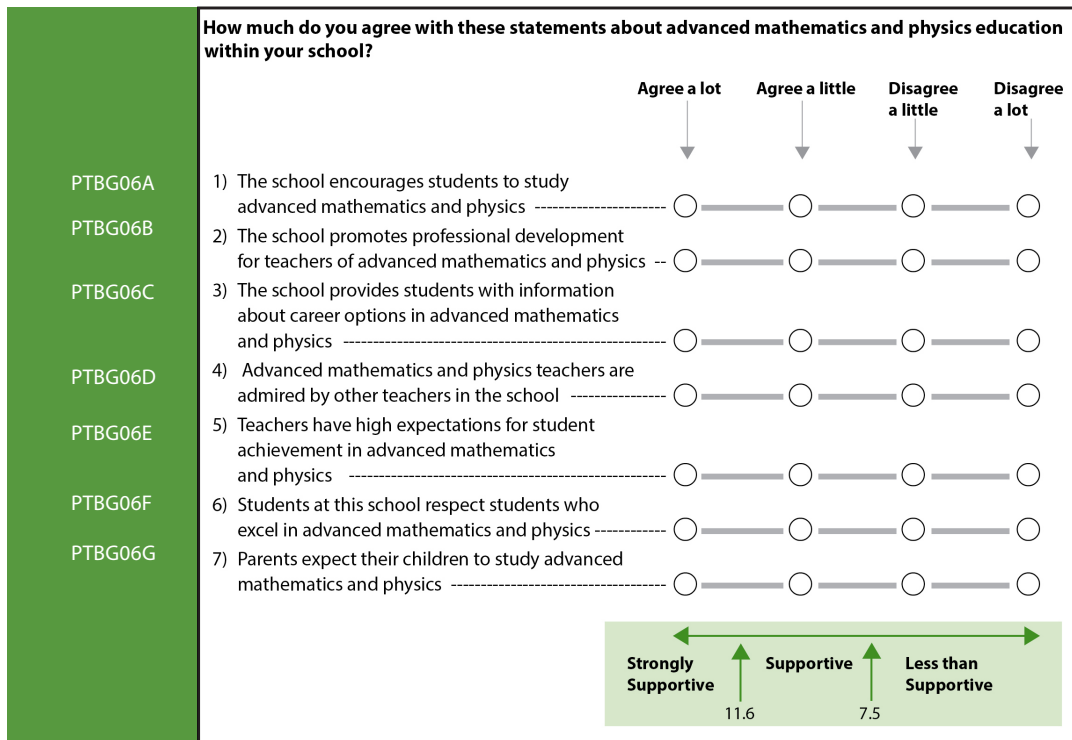
Country	Pearson's Correlation with Physics Achievement		Variance in Physics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.03	0.00	0.00
Italy	0.05	0.00	0.01
Lebanon	0.04	0.00	0.01
Norway	0.07	0.01	0.00
Portugal	-0.02	0.00	0.00
Russian Federation	0.19	0.04	0.06
Slovenia	0.25	0.06	0.04
Sweden	0.14	0.02	0.02
United States	0.01	0.00	0.00
International Median	0.05	0.00	0.01

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

# School Supports Advanced Mathematics and Physics Education—Teacher Version Scale, Physics

The School Supports Advanced Mathematics and Physics Education—Teacher Version (SMP) scale was created based on teachers’ responses characterizing the seven aspects described below.

## Items in the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education—Teacher Version Scale, Physics<sup>1</sup>



<sup>1</sup> For the purpose of scaling, categories in which there were very few respondents were combined. The categories “Disagree a little” and “Disagree a lot” were combined for all variables. The scale statistics that are reported herein reflect analysis of the items following collapsing.

**Item Parameters for the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Teacher Version Scale, Physics**

Item	delta	tau_1	tau_2	Infit
PTBG06A	-0.69327	-1.09016	1.09016	0.87
PTBG06B	0.42027	-0.81515	0.81515	1.05
PTBG06C	-0.23350	-1.24334	1.24334	0.96
PTBG06D	0.88624	-0.64947	0.64947	0.99
PTBG06E	-0.40883	-1.40288	1.40288	0.93
PTBG06F	-0.39632	-1.00752	1.00752	1.16
PTBG06G	0.42541	-1.28652	1.28652	1.01

**Scale Transformation Constants for the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Teacher Version Scale, Physics**

Scale Transformation Constants	
A = 9.52146	Transformed Scale Score = 9.52146 + 1.382519 • Logit Scale Score
B = 1.382519	

**Equivalence Table of the Raw Score and the Transformed Scale Score for the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Teacher Version Scale, Physics**

Raw Score	Transformed Scale Score	Cutpoint
0	4.00781	
1	5.74570	
2	6.68506	
3	7.40122	7.5
4	8.01543	
5	8.57240	
6	9.09310	
7	9.58929	
8	10.07291	
9	10.56143	
10	11.06907	
11	11.62470	11.6
12	12.28126	
13	13.16777	
14	14.85545	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Teacher Version Scale, Physics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item						
			PTB606A	PTB606B	PTB606C	PTB606D	PTB606E	PTB606F	PTB606G
France	0.63	32	0.56	0.47	0.42	0.51	0.65	0.66	0.62
Italy	0.78	44	0.72	0.60	0.70	0.64	0.73	0.51	0.70
Lebanon	0.77	43	0.64	0.73	0.65	0.51	0.68	0.65	0.71
Norway	0.60	31	0.69	0.38	0.62	0.66	0.52	0.60	0.26
Portugal	0.72	38	0.71	0.71	0.66	0.48	0.51	0.61	0.57
Russian Federation	0.77	44	0.76	0.79	0.65	0.61	0.54	0.73	0.48
Slovenia	0.70	36	0.71	0.70	0.57	0.69	0.65	0.38	0.40
Sweden	0.70	35	0.73	0.70	0.56	0.47	0.57	0.57	0.51
United States	0.84	51	0.66	0.80	0.78	0.69	0.68	0.58	0.80
International Avg.	0.72	39	0.69	0.65	0.62	0.58	0.62	0.59	0.56

**Relationship Between the TIMSS Advanced 2015 School Supports Advanced Mathematics and Physics Education - Teacher Version Scale, and TIMSS Advanced 2015 Physics Achievement**

Country	Pearson's Correlation with Physics Achievement		Variance in Physics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.05	0.00	0.00
Italy	-0.01	0.00	0.00
Lebanon	-0.03	0.00	0.00
Norway	0.02	0.00	0.00
Portugal	0.01	0.00	0.01
Russian Federation	0.08	0.01	0.02
Slovenia	0.23	0.05	0.03
Sweden	0.10	0.01	0.00
United States	0.23	0.05	0.01
International Median	0.05	0.00	0.00

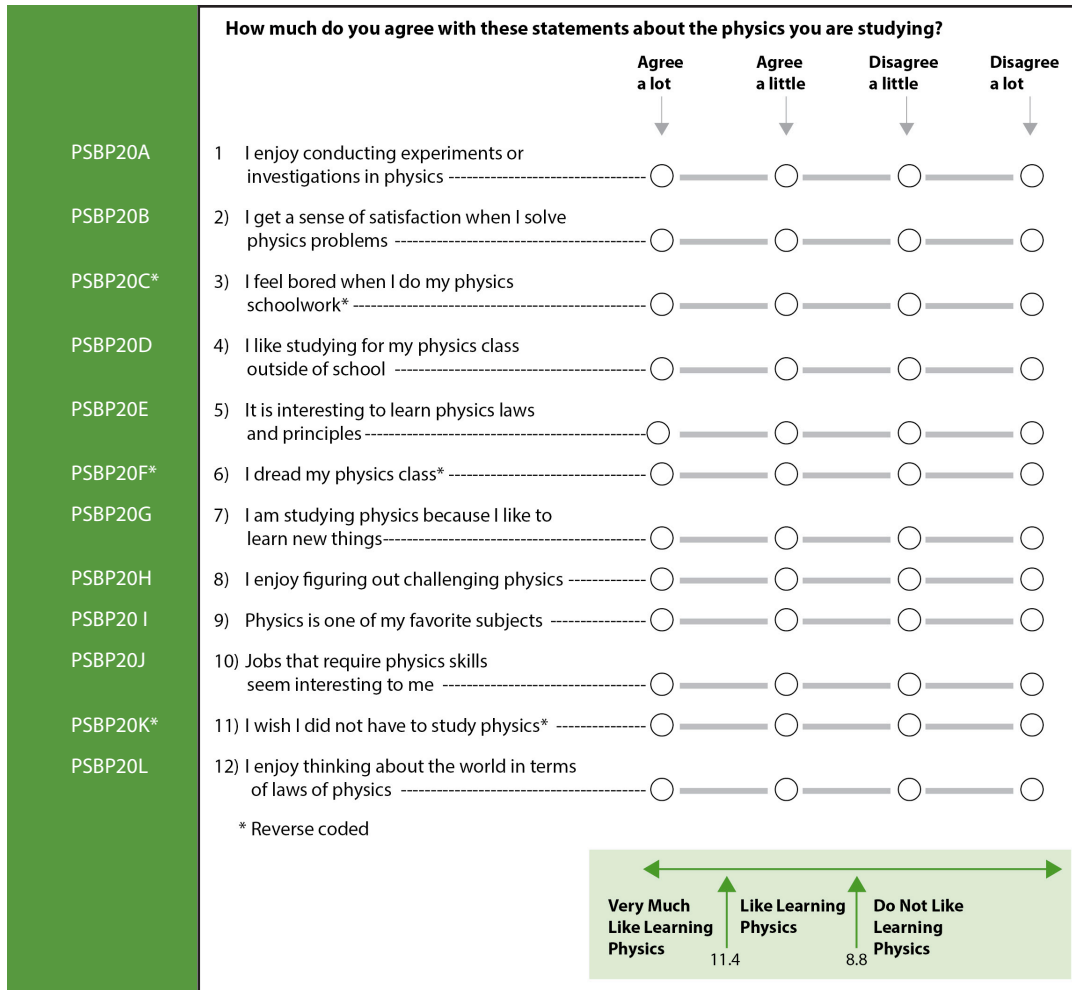
SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015



# Students Like Learning Physics Scale

The Students Like Learning Physics (SLP) scale was created based on students' degree of agreement with the twelve statements described below.

## Items in the TIMSS Advanced 2015 Students Like Learning Physics Scale



**Item Parameters for the TIMSS Advanced 2015 Students Like Learning Physics Scale, Physics**

Item	delta	tau_1	tau_2	tau_3	Infit
PSBP20A	-0.51423	-1.07025	-0.41990	1.49015	1.15
PSBP20B	-0.90801	-0.86799	-0.43946	1.30745	1.10
PSBP20C*	0.51315	-1.69256	-0.14245	1.83501	1.23
PSBP20D	1.03682	-1.72677	-0.08320	1.80997	1.11
PSBP20E	-0.21380	-1.38699	-0.26425	1.65124	0.90
PSBP20F*	-0.39443	-1.02035	0.04349	0.97686	1.82
PSBP20G	-0.18466	-1.35598	-0.31080	1.66678	0.81
PSBP20H	0.04092	-1.36190	-0.07935	1.44125	0.85
PSBP20I	0.54534	-0.86829	-0.06458	0.93287	0.75
PSBP20J	0.17389	-0.97760	-0.33432	1.31192	0.94
PSBP20K*	-0.07291	-0.60736	-0.22268	0.83004	1.02
PSBP20L	-0.02208	-1.18389	-0.23501	1.41890	1.02

\* Reverse coded

**Scale Transformation Constants for the TIMSS Advanced 2015 Students Like Learning Physics Scale, Physics**

Scale Transformation Constants	
A = 8.81822	Transformed Scale Score = 8.81822 + 1.464843 • Logit Scale Score
B = 1.464843	

**Equivalence Table of the Raw Score and the Transformed Scale Score  
for the TIMSS Advanced 2015 Students Like Learning Physics Scale,  
Physics**

Raw Score	Transformed Scale Score	Cutpoint
0	2.29834	
1	3.92594	
2	4.70005	
3	5.22580	
4	5.63169	
5	5.97016	
6	6.26389	
7	6.52678	
8	6.76750	
9	6.99121	
10	7.20367	
11	7.40630	
12	7.60136	
13	7.79069	
14	7.97591	
15	8.15835	
16	8.33926	
17	8.51979	
18	8.70102	8.8
19	8.88404	
20	9.06991	
21	9.25980	
22	9.45491	
23	9.65655	
24	9.86615	
25	10.08468	
26	10.31566	
27	10.56116	
28	10.82464	
29	11.11077	
30	11.42601	11.4
31	11.77922	
32	12.18651	
33	12.67364	
34	13.29295	
35	14.17455	
36	15.92718	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 Students Like Learning Physics Scale, Physics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item											
			PSBP20A	PSBP20B	PSBP20C*	PSBP20D	PSBP20E	PSBP20F*	PSBP20G	PSBP20H	PSBP20I	PSBP20J	PSBP20K*	PSBP20L
France	0.89	47	0.59	0.50	0.63	0.70	0.78	0.30	0.78	0.75	0.83	0.69	0.80	0.66
Italy	0.90	49	0.62	0.54	0.60	0.78	0.78	0.33	0.81	0.79	0.82	0.77	0.75	0.64
Lebanon	0.83	39	0.67	0.59	0.34	0.48	0.70	0.16	0.75	0.72	0.81	0.73	0.51	0.67
Norway	0.89	47	0.44	0.35	0.69	0.67	0.78	0.44	0.78	0.79	0.85	0.74	0.77	0.68
Portugal	0.89	47	0.58	0.67	0.61	0.70	0.76	0.40	0.78	0.78	0.82	0.68	0.73	0.66
Russian Federation	0.92	53	0.53	0.78	0.63	0.76	0.82	0.38	0.79	0.81	0.85	0.82	0.67	0.70
Slovenia	0.87	41	0.50	0.59	0.48	0.57	0.70	0.49	0.72	0.77	0.80	0.73	0.59	0.64
Sweden	0.91	51	0.52	0.61	0.69	0.72	0.79	0.51	0.79	0.81	0.84	0.74	0.78	0.69
United States	0.92	52	0.63	0.61	0.55	0.66	0.82	0.63	0.78	0.80	0.85	0.75	0.75	0.78
International Avg.	0.89	47	0.56	0.58	0.58	0.67	0.77	0.41	0.78	0.78	0.83	0.74	0.71	0.68

\* Reverse coded

**Relationship Between the TIMSS Advanced 2015 Students Like Learning Physics Scale, and TIMSS Advanced 2015 Physics Achievement**

Country	Pearson's Correlation with Physics Achievement		Variance in Physics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.46	0.22	0.18
Italy	0.39	0.15	0.13
Lebanon	0.22	0.05	0.04
Norway	0.50	0.25	0.22
Portugal	0.43	0.18	0.17
Russian Federation	0.38	0.15	0.13
Slovenia	0.44	0.20	0.15
Sweden	0.44	0.20	0.16
United States	0.41	0.17	0.16
International Median	0.43	0.18	0.16

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

# Students' Sense of School Belonging Scale, Physics

The Students' Sense of School Belonging (SSB) scale was created based on students' degree of agreement with the nine statements described below.

## Items in the TIMSS Advanced 2015 Students' Sense of School Belonging Scale, Physics

What do you think about your school? Tell how much you agree with these statements.

	Agree a lot	Agree a little	Disagree a little	Disagree a lot
PSBP22A 1) I enjoy school-----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PSBP22B 2) I feel safe when I am at school -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PSBP22C 3) I feel like I belong at this school -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PSBP22D 4) I like to see my classmates at school -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PSBP22E 5) Teachers at my school are fair to me -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PSBP22F 6) I am proud to go to this school -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PSBP22G 7) I learn a lot in school -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PSBP22H 8) My classmates respect students who excel in school subjects -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PSBP22 I 9) My classmates respect students who struggle learning school subjects -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

High Sense of School Belonging    10.5    Sense of School Belonging    7.6    Little Sense of School Belonging

**Item Parameters for the TIMSS Advanced 2015 Students' Sense of School Belonging Scale, Physics**

Item	delta	tau_1	tau_2	tau_3	Infit
PSBP22A	0.42482	-1.13862	-0.66108	1.79970	1.06
PSBP22B	-0.19651	-0.90823	-0.65897	1.56720	0.94
PSBP22C	0.27155	-1.09791	-0.37350	1.47141	0.87
PSBP22D	-0.77499	-0.66078	-0.69906	1.35984	1.04
PSBP22E	0.02649	-1.36739	-0.55367	1.92106	1.10
PSBP22F	0.36287	-1.16971	-0.42176	1.59147	0.93
PSBP22G	-0.30178	-1.41507	-0.65833	2.07340	0.98
PSBP22H	-0.08185	-1.20393	-0.55128	1.75521	1.09
PSBP22I	0.26940	-1.37985	-0.44086	1.82071	1.29

**Scale Transformation Constants for the TIMSS Advanced 2015 Students' Sense of School Belonging Scale, Physics**

Scale Transformation Constants

A = 7.921577

B = 1.242992

Transformed Scale Score = 7.921577 + 1.242992 • Logit Scale Score

**Equivalence Table of the Raw Score and the Transformed Scale Score for the TIMSS Advanced 2015 Students' Sense of School Belonging Scale, Physics**

Raw Score	Transformed Scale Score	Cutpoint
0	2.83834	
1	4.17439	
2	4.80361	
3	5.23192	
4	5.56897	
5	5.85267	
6	6.10445	
7	6.33561	
8	6.55328	
9	6.76244	
10	6.96690	
11	7.16980	
12	7.37399	
13	7.58285	7.6
14	7.79734	
15	8.02192	
16	8.25960	
17	8.51313	
18	8.78559	
19	9.07945	
20	9.39640	
21	9.73823	
22	10.10871	
23	10.51544	10.5
24	10.97845	
25	11.53918	
26	12.31006	
27	13.80166	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 Students' Sense of School Belonging Scale, Physics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item								
			PSBP22A	PSBP22B	PSBP22C	PSBP22D	PSBP22E	PSBP22F	PSBP22G	PSBP22H	PSBP22I
France	0.82	42	0.72	0.68	0.69	0.59	0.54	0.73	0.65	0.59	0.58
Italy	0.83	43	0.73	0.73	0.76	0.51	0.64	0.79	0.68	0.51	0.48
Lebanon	0.87	49	0.68	0.78	0.80	0.64	0.65	0.76	0.70	0.66	0.61
Norway	0.83	44	0.70	0.69	0.79	0.65	0.56	0.71	0.64	0.62	0.56
Portugal	0.83	43	0.74	0.68	0.74	0.55	0.56	0.78	0.67	0.60	0.57
Russian Federation	0.89	54	0.79	0.74	0.79	0.70	0.66	0.81	0.72	0.67	0.70
Slovenia	0.86	47	0.69	0.67	0.80	0.60	0.67	0.81	0.77	0.62	0.50
Sweden	0.85	47	0.80	0.69	0.80	0.67	0.58	0.76	0.69	0.56	0.58
United States	0.87	49	0.67	0.69	0.79	0.68	0.64	0.79	0.71	0.71	0.62
International Avg.	0.85	47	0.73	0.70	0.77	0.62	0.61	0.77	0.69	0.62	0.58

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

**Relationship Between the TIMSS Advanced 2015 Students' Sense of School Belonging Scale, and TIMSS Advanced 2015 Physics Achievement**

Country	Pearson's Correlation with Physics Achievement		Variance in Physics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.25	0.06	0.05
Italy	0.06	0.00	0.01
Lebanon	0.02	0.00	0.00
Norway	0.16	0.03	0.03
Portugal	0.11	0.01	0.02
Russian Federation	0.07	0.01	0.00
Slovenia	0.22	0.05	0.05
Sweden	0.19	0.04	0.05
United States	0.09	0.01	0.01
International Median	0.11	0.01	0.02

# Students Value Physics Scale

The Students Value Physics (SVP) scale was created based on students' degree of agreement with the nine statements described below.

## Items in the TIMSS Advanced 2015 Students Value Physics Scale

		How much do you agree with these statements about the physics you are studying?			
		Agree a lot	Agree a little	Disagree a little	Disagree a lot
PSBP21A	1) Learning physics will help me get ahead in the world-----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PSBP21B	2) It is important to do well in my physics class -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PSBP21C*	3) The physics I am studying is not useful for my future* -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PSBP21D	4) My parents are pleased that I am taking physics -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PSBP21E	5) Doing well in physics will help me get into the university of my choice ----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PSBP21F*	6) Learning physics does not seem to be a worthwhile exercise*-----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PSBP21G	7) My parents think that it is important that I do well in my physics class -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PSBP21H	8) I like telling people I am studying physics -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PSBP21 I	9) Learning physics will give me more job opportunities -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
*Reverse coded					



**Item Parameters for the TIMSS Advanced 2015 Students Value Physics Scale, Physics**

Item	delta	tau_1	tau_2	tau_3	Infit
PSBP21A	0.12198	-1.22089	-0.28221	1.50310	0.91
PSBP21B	-0.11136	-1.22137	-0.16984	1.39121	1.07
PSBP21C*	0.21349	-0.87936	-0.23886	1.11822	1.30
PSBP21D	-0.34054	-1.18074	-0.59829	1.77903	1.02
PSBP21E	0.03096	-0.41265	-0.17841	0.59106	0.97
PSBP21F*	-0.16915	-0.85167	-0.33674	1.18841	1.43
PSBP21G	-0.43055	-0.94318	-0.50789	1.45107	1.05
PSBP21H	0.64924	-1.21577	-0.07682	1.29259	1.16
PSBP21I	0.03593	-0.88494	-0.30990	1.19484	0.88

\*Reverse coded

**Scale Transformation Constants for the TIMSS Advanced 2015 Students Value Physics Scale, Physics**

**Scale Transformation Constants**

$$A = 8.418724$$

$$B = 1.650896$$

$$\text{Transformed Scale Score} = 8.418724 + 1.650896 \cdot \text{Logit Scale Score}$$

**Equivalence Table of the Raw Score and the Transformed Scale Score for the TIMSS Advanced 2015 Students Value Physics Scale, Physics**

Raw Score	Transformed Scale Score	Cutpoint
0	1.91155	
1	3.71438	
2	4.57065	
3	5.15343	
4	5.60982	
5	5.99212	
6	6.32606	
7	6.63211	
8	6.91547	
9	7.18258	
10	7.43842	
11	7.68700	
12	7.93169	
13	8.17550	8.2
14	8.42143	
15	8.67212	
16	8.93095	
17	9.20112	
18	9.48621	
19	9.78912	
20	10.11722	
21	10.47668	
22	10.87750	
23	11.33535	11.3
24	11.87577	
25	12.55759	
26	13.52803	
27	15.46562	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 Students Value Physics Scale, Physics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item									
			PSBP21A	PSBP21B	PSBP21C*	PSBP21D	PSBP21E	PSBP21F*	PSBP21G	PSBP21H	PSBP21I	
France	0.83	43	0.70	0.57	0.69	0.58	0.75	0.67	0.52	0.61	0.77	
Italy	0.85	46	0.79	0.73	0.58	0.61	0.70	0.68	0.57	0.63	0.77	
Lebanon	0.73	36	0.58	0.70	0.31	0.66	0.69	0.20	0.67	0.59	0.74	
Norway	0.77	37	0.75	0.70	0.49	0.63	0.65	0.69	0.46	0.46	0.56	
Portugal	0.83	43	0.76	0.67	0.63	0.63	0.64	0.65	0.60	0.57	0.73	
Russian Federation	0.86	51	0.76	0.79	0.42	0.80	0.82	0.43	0.79	0.61	0.83	
Slovenia	0.63	29	0.68	0.44	0.20	0.67	0.45	-0.02	0.67	0.57	0.73	
Sweden	0.79	38	0.75	0.57	0.66	0.59	0.62	0.67	0.49	0.48	0.66	
United States	0.85	45	0.78	0.69	0.64	0.69	0.67	0.62	0.52	0.62	0.79	
International Avg.	0.79	41	0.73	0.65	0.51	0.65	0.67	0.51	0.59	0.57	0.73	

\*Reverse coded

**Relationship Between the TIMSS Advanced 2015 Students Value Physics Scale, and TIMSS Advanced 2015 Physics Achievement**

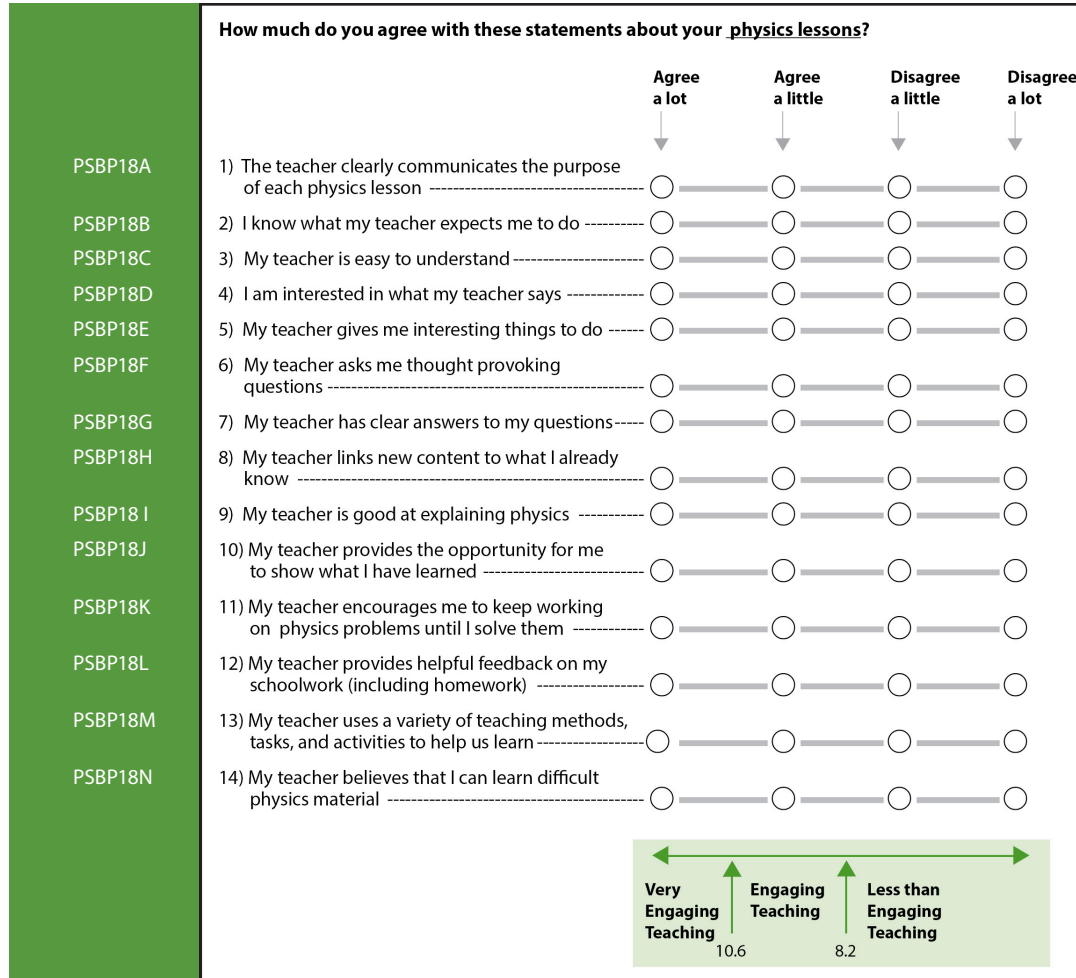
Country	Pearson's Correlation with Physics Achievement		Variance in Physics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.38	0.14	0.10
Italy	0.28	0.08	0.07
Lebanon	0.19	0.04	0.03
Norway	0.28	0.08	0.08
Portugal	0.30	0.09	0.08
Russian Federation	0.31	0.10	0.10
Slovenia	0.22	0.05	0.03
Sweden	0.26	0.07	0.06
United States	0.33	0.11	0.10
International Median	0.28	0.08	0.08

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

# Students' Views on Engaging Teaching in Physics Lessons Scale

The Students' Views on Engaging Teaching in Physics Lessons (EPL) scale was created based on students' degree of agreement with the fourteen statements described below.

## Items in the TIMSS Advanced 2015 Students' Views on Engaging Teaching in Physics Lessons Scale



**Item Parameters for the TIMSS Advanced 2015 Students' Views on Engaging Teaching in Physics Lessons Scale, Physics**

Item	delta	tau_1	tau_2	tau_3	Infit
PSBP18A	-0.14831	-1.38275	-0.35811	1.74086	0.87
PSBP18B	-0.43649	-1.60005	-0.45229	2.05234	1.13
PSBP18C	0.13061	-1.48920	-0.24496	1.73416	0.83
PSBP18D	-0.05456	-1.45103	-0.42519	1.87622	1.16
PSBP18E	0.63636	-1.76934	-0.24144	2.01078	1.02
PSBP18F	0.13739	-1.39531	-0.27005	1.66536	1.13
PSBP18G	0.14795	-1.29217	-0.29296	1.58513	0.95
PSBP18H	-0.32221	-1.50071	-0.42276	1.92347	1.00
PSBP18I	-0.19384	-1.15279	-0.30087	1.45366	0.79
PSBP18J	-0.27918	-1.98442	-0.36623	2.35065	1.06
PSBP18K	-0.01635	-1.57874	-0.18354	1.76228	1.16
PSBP18L	0.36382	-1.67707	-0.16971	1.84678	1.10
PSBP18M	0.21519	-1.60597	-0.15229	1.75826	1.13
PSBP18N	-0.18038	-1.41620	-0.42459	1.84079	1.34

**Scale Transformation Constants for the TIMSS Advanced 2015 Students' Views on Engaging Teaching in Physics Lessons Scale, Physics**

Scale Transformation Constants

A = 8.247393

B = 1.153149

Transformed Scale Score = 8.247393 + 1.153149 • Logit Scale Score

**Equivalence Table of the Raw Score and the Transformed Scale Score  
for the TIMSS Advanced 2015 Students' Views on Engaging Teaching in  
Physics Lessons Scale, Physics**

Raw Score	Transformed Scale Score	Cutpoint
0	2.56831	
1	3.87485	
2	4.50403	
3	4.93321	
4	5.26459	
5	5.53959	
6	5.77697	
7	5.98812	
8	6.18044	
9	6.35812	
10	6.52518	
11	6.68393	
12	6.83632	
13	6.98389	
14	7.12790	
15	7.26945	
16	7.40948	
17	7.54955	
18	7.68865	
19	7.82857	
20	7.96996	
21	8.11342	8.2
22	8.25966	
23	8.40883	
24	8.56179	
25	8.71883	
26	8.88033	
27	9.04665	
28	9.21823	
29	9.39540	
30	9.57861	
31	9.76853	
32	9.96608	
33	10.17267	
34	10.39036	
35	10.62218	10.6
36	10.87268	
37	11.14749	
38	11.45962	
39	11.82813	
40	12.29340	
41	12.95657	
42	14.29669	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015



**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 Students' Views on Engaging Teaching in Physics Lessons Scale, Physics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item													
			P3BP18A	P3BP18B	P3BP18C	P3BP18D	P3BP18E	P3BP18F	P3BP18G	P3BP18H	P3BP18I	P3BP18J	P3BP18K	P3BP18L	P3BP18M	P3BP18N
France	0.92	49	0.76	0.68	0.79	0.62	0.68	0.65	0.77	0.69	0.82	0.63	0.66	0.67	0.69	0.66
Italy	0.93	52	0.82	0.57	0.82	0.54	0.65	0.74	0.79	0.72	0.84	0.72	0.73	0.77	0.74	0.53
Lebanon	0.93	54	0.80	0.60	0.79	0.74	0.74	0.71	0.79	0.76	0.81	0.74	0.73	0.66	0.76	0.64
Norway	0.91	46	0.72	0.71	0.79	0.60	0.71	0.53	0.72	0.72	0.77	0.68	0.53	0.70	0.61	0.58
Portugal	0.94	55	0.82	0.67	0.83	0.64	0.76	0.65	0.81	0.76	0.84	0.72	0.75	0.71	0.73	0.60
Russian Federation	0.92	51	0.78	0.64	0.77	0.78	0.77	0.58	0.77	0.63	0.81	0.63	0.67	0.79	0.73	0.58
Slovenia	0.92	51	0.78	0.75	0.78	0.61	0.72	0.72	0.72	0.75	0.81	0.64	0.64	0.69	0.68	0.62
Sweden	0.92	50	0.75	0.65	0.82	0.66	0.75	0.70	0.75	0.74	0.83	0.66	0.66	0.69	0.65	0.58
United States	0.94	55	0.81	0.73	0.81	0.71	0.75	0.74	0.79	0.77	0.83	0.71	0.65	0.76	0.73	0.60
International Avg.	0.93	51	0.78	0.67	0.80	0.65	0.73	0.67	0.77	0.73	0.82	0.68	0.67	0.72	0.70	0.60

**Relationship Between the TIMSS Advanced 2015 Students' Views on Engaging Teaching in Physics Lessons Scale, and TIMSS Advanced 2015 Physics Achievement**

Country	Pearson's Correlation with Physics Achievement		Variance in Physics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.24	0.06	0.05
Italy	0.12	0.01	0.01
Lebanon	0.08	0.01	0.02
Norway	0.25	0.06	0.06
Portugal	0.04	0.00	0.00
Russian Federation	0.20	0.04	0.04
Slovenia	0.31	0.10	0.10
Sweden	0.24	0.06	0.06
United States	0.16	0.03	0.04
International Median	0.20	0.04	0.04

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015

# Teacher Job Satisfaction Scale, Physics

The Teacher Job Satisfaction (TJS) scale was created based on how often teachers responded positively to the seven statements described below.

## Items in the TIMSS Advanced 2015 Teacher Job Satisfaction Scale, Physics<sup>1</sup>

		How often do you feel the following way about being a teacher?			
		Very often	Often	Sometimes	Never or almost never
PTBG10A	1) I am content with my profession as a teacher -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PTBG10B	2) I am satisfied with being a teacher at this school ---	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PTBG10C	3) I find my work full of meaning and purpose -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PTBG10D	4) I am enthusiastic about my job -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PTBG10E	5) My work inspires me-----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PTBG10F	6) I am proud of the work I do -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
PTBG10G	7) I am going to continue teaching for as long as I can -----	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

←	→
Satisfied	Somewhat Satisfied
10.6	7.4
	Less Than Satisfied

<sup>1</sup> For the purpose of scaling, categories in which there were very few respondents were combined. The categories "Sometimes" and "Never or almost never" were combined for all variables. The scale statistics that are reported herein reflect analysis of the items following collapsing.

**Item Parameters for the TIMSS Advanced 2015 Teacher Job Satisfaction Scale, Physics**

Item	delta	tau_1	tau_2	Infit
PTBG10A	0.15383	-1.80976	1.80976	1.02
PTBG10B	-0.38606	-1.52386	1.52386	1.29
PTBG10C	-0.60185	-1.68715	1.68715	0.93
PTBG10D	0.30247	-1.45516	1.45516	0.87
PTBG10E	0.45983	-1.54534	1.54534	0.86
PTBG10F	-0.15541	-1.45758	1.45758	1.03
PTBG10G	0.22719	-1.16800	1.16800	1.47

**Scale Transformation Constants for the TIMSS Advanced 2015 Teacher Job Satisfaction Scale, Physics**

Scale Transformation Constants

A = 9.030432

B = 0.897591

Transformed Scale Score = 9.030432 + 0.897591 • Logit Scale Score

**Equivalence Table of the Raw Score and the Transformed Scale Score for the TIMSS Advanced 2015 Teacher Job Satisfaction Scale, Physics**

Raw Score	Transformed Scale Score	Cutpoint
0	5.13977	
1	6.27326	
2	6.89329	
3	7.37441	7.4
4	7.80316	
5	8.21352	
6	8.62591	
7	9.04442	
8	9.46026	
9	9.86512	
10	10.26699	
11	10.68423	10.6
12	11.15621	
13	11.76054	
14	12.88244	

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015



**Cronbach's Alpha Reliability Coefficient and Principal Components Analysis of the Items in the TIMSS Advanced 2015 Teacher Job Satisfaction Scale, Physics**

Country	Cronbach's Alpha Reliability Coefficient	Percent of Variance Explained	Component Loadings for Each Item						
			PTBG10A	PTBG10B	PTBG10C	PTBG10D	PTBG10E	PTBG10F	PTBG10G
France	0.91	66	0.83	0.70	0.85	0.84	0.86	0.84	0.74
Italy	0.90	63	0.84	0.70	0.72	0.89	0.86	0.84	0.67
Lebanon	0.91	65	0.77	0.74	0.81	0.85	0.81	0.83	0.82
Norway	0.90	63	0.83	0.76	0.80	0.84	0.90	0.75	0.66
Portugal	0.84	52	0.80	0.70	0.77	0.78	0.71	0.57	0.68
Russian Federation	0.90	64	0.84	0.81	0.77	0.83	0.85	0.81	0.68
Slovenia	0.89	61	0.79	0.62	0.82	0.84	0.91	0.81	0.63
Sweden	0.88	59	0.80	0.68	0.72	0.85	0.84	0.79	0.67
United States	0.92	69	0.84	0.77	0.83	0.88	0.87	0.84	0.77
International Avg.	0.89	62	0.81	0.72	0.79	0.85	0.85	0.79	0.70

**Relationship Between the TIMSS Advanced 2015 Teacher Job Satisfaction Scale, and TIMSS Advanced 2015 Physics Achievement**

Country	Pearson's Correlation with Physics Achievement		Variance in Physics Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ )
	(r)	(r <sup>2</sup> )	
France	0.02	0.00	0.00
Italy	-0.09	0.01	0.02
Lebanon	-0.02	0.00	0.01
Norway	0.01	0.00	0.00
Portugal	0.02	0.00	0.01
Russian Federation	0.07	0.00	0.00
Slovenia	0.20	0.04	0.06
Sweden	0.03	0.00	0.00
United States	0.11	0.01	0.03
International Median	0.02	0.00	0.01

SOURCE: IEA's Trends in International Mathematics and Science Study – TIMSS 2015