

# Teachers Emphasize Science Investigation Scale, Fourth Grade

The Teachers Emphasize Science Investigation (ESI) scale was created based on teachers' responses to how often they used the eight instructional activities described below.

## Items in the TIMSS 2015 Teachers Emphasize Science Investigation Scale, Fourth Grade<sup>1</sup>

|         |  | In teaching science to the students in this class, how often do you ask them to do the following? |                        |                       |                       |
|---------|--|---|------------------------|-----------------------|-----------------------|
|         |  | Every or almost every lesson  | About half the lessons | Some lessons          | Never                 |
| ATBS03B | 1) Observe natural phenomena such as the weather or a plant growing and describe what they see ----- | <input type="radio"/>   | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| ATBS03C | 2) Watch me demonstrate an experiment or investigation ---   | <input type="radio"/>   | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| ATBS03D | 3) Design or plan experiments or investigations -----  | <input type="radio"/>   | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| ATBS03E | 4) Conduct experiments or investigations -----   | <input type="radio"/>   | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| ATBS03F | 5) Present data from experiments or investigations -----   | <input type="radio"/>   | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| ATBS03G | 6) Interpret data from experiments or investigations-----  | <input type="radio"/>   | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| ATBS03H | 7) Use evidence from experiments or investigations to support conclusions -----                      | <input type="radio"/>   | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |
| ATBS03K | 8) Do field work outside the class -----   | <input type="radio"/>   | <input type="radio"/>  | <input type="radio"/> | <input type="radio"/> |

11.3

<sup>1</sup> For the purpose of scaling, categories in which there were very few respondents were combined. The categories "Some Lessons" and "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 2015 Teachers Emphasize Science Investigation Scale, Fourth Grade**

| Item    | delta    | tau_1    | tau_2   | Infit |
|---------|----------|----------|---------|-------|
| ATBS03B | -0.97859 | -1.00917 | 1.00917 | 1.54  |
| ATBS03C | -0.43524 | -0.63501 | 0.63501 | 1.34  |
| ATBS03D | 0.08764  | -0.94529 | 0.94529 | 0.86  |
| ATBS03E | -0.19774 | -0.99274 | 0.99274 | 0.81  |
| ATBS03F | 0.14498  | -0.92496 | 0.92496 | 0.72  |
| ATBS03G | 0.00719  | -0.96463 | 0.96463 | 0.73  |
| ATBS03H | -0.34379 | -0.92870 | 0.92870 | 0.92  |
| ATBS03K | 1.71555  | -0.79925 | 0.79925 | 1.40  |

**Scale Transformation Constants for the TIMSS 2015 Teachers Emphasize Science Investigation Scale, Fourth Grade**

Scale Transformation Constants

$$A = 11.370579$$

$$B = 1.031391$$

$$\text{Transformed Scale Score} = 11.370579 + 1.031391 \cdot \text{Logit Scale Score}$$

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



**Equivalence Table of Raw and Transformed Scale Scores for the TIMSS  
2015 Teachers Emphasize Science Investigation Scale, Fourth Grade**

| Raw Score | Transformed Scale Score | Cutpoint |
|-----------|-------------------------|----------|
| 0         | 7.29951                 |          |
| 1         | 8.55692                 |          |
| 2         | 9.20866                 |          |
| 3         | 9.68367                 |          |
| 4         | 10.07397                |          |
| 5         | 10.42134                |          |
| 6         | 10.74105                |          |
| 7         | 11.04610                |          |
| 8         | 11.34471                | 11.3     |
| 9         | 11.64792                |          |
| 10        | 11.95987                |          |
| 11        | 12.29081                |          |
| 12        | 12.65106                |          |
| 13        | 13.06204                |          |
| 14        | 13.56297                |          |
| 15        | 14.24746                |          |
| 16        | 15.54731                |          |

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 2015 Teachers Emphasize Science Investigation Scale, Fourth Grade**

| Country                          | Cronbach's Alpha Reliability Coefficient | Percent of Variance Explained | Component Loadings for Each Item |         |         |         |         |         |         |         |
|----------------------------------|--|-------------------------------|----------------------------------|---------|---------|---------|---------|---------|---------|---------|
|                                  |  |                               | ATBS02B                          | ATBS02C | ATBS02D | ATBS02E | ATBS02F | ATBS02G | ATBS02H | ATBS02K |
| Australia                        | 0.89                                     | 58                            | 0.63                             | 0.58    | 0.83    | 0.86    | 0.88    | 0.88    | 0.75    | 0.64    |
| Bahrain                          | 0.83                                     | 47                            | 0.46                             | 0.42    | 0.75    | 0.80    | 0.83    | 0.83    | 0.80    | 0.43    |
| Belgium (Flemish)                | 0.90                                     | 64                            | 0.58                             | 0.70    | 0.90    | 0.93    | 0.93    | 0.91    | 0.88    | 0.41    |
| Bulgaria                         | 0.85                                     | 53                            | 0.64                             | 0.63    | 0.80    | 0.87    | 0.85    | 0.81    | 0.55    | 0.62    |
| Canada                           | 0.85                                     | 49                            | 0.56                             | 0.44    | 0.72    | 0.80    | 0.84    | 0.86    | 0.82    | 0.40    |
| Chile                            | 0.90                                     | 62                            | 0.56                             | 0.76    | 0.83    | 0.89    | 0.87    | 0.83    | 0.75    | 0.74    |
| Chinese Taipei                   | 0.89                                     | 57                            | 0.59                             | 0.60    | 0.78    | 0.84    | 0.89    | 0.90    | 0.88    | 0.40    |
| Croatia                          | 0.90                                     | 62                            | 0.67                             | 0.66    | 0.84    | 0.91    | 0.92    | 0.91    | 0.64    | 0.64    |
| Cyprus                           | 0.81                                     | 48                            | 0.32                             | 0.25    | 0.83    | 0.85    | 0.86    | 0.88    | 0.85    | 0.22    |
| Czech Republic                   | 0.87                                     | 57                            | 0.54                             | 0.65    | 0.84    | 0.88    | 0.90    | 0.87    | 0.79    | 0.40    |
| Denmark                          | 0.84                                     | 50                            | 0.39                             | 0.53    | 0.73    | 0.72    | 0.82    | 0.85    | 0.80    | 0.71    |
| England                          | 0.86                                     | 53                            | 0.43                             | 0.55    | 0.81    | 0.85    | 0.88    | 0.86    | 0.88    | 0.31    |
| Finland                          | 0.82                                     | 52                            | 0.48                             | 0.55    | 0.78    | 0.87    | 0.88    | 0.87    | 0.73    | 0.45    |
| France                           | 0.85                                     | 50                            | 0.53                             | 0.26    | 0.78    | 0.89    | 0.88    | 0.89    | 0.84    | 0.14    |
| Georgia                          | 0.86                                     | 56                            | 0.50                             | 0.68    | 0.87    | 0.89    | 0.90    | 0.86    | 0.61    | 0.53    |
| Germany                          | 0.88                                     | 55                            | 0.65                             | 0.51    | 0.78    | 0.88    | 0.87    | 0.88    | 0.84    | 0.37    |
| Hong Kong SAR                    | 0.89                                     | 58                            | 0.66                             | 0.77    | 0.87    | 0.79    | 0.87    | 0.85    | 0.81    | 0.30    |
| Hungary                          | 0.76                                     | 46                            | 0.53                             | 0.41    | 0.81    | 0.81    | 0.84    | 0.73    | 0.70    | 0.40    |
| Indonesia                        | 0.92                                     | 63                            | 0.68                             | 0.78    | 0.80    | 0.86    | 0.87    | 0.86    | 0.80    | 0.64    |
| Iran, Islamic Rep. of            | 0.87                                     | 53                            | 0.52                             | 0.62    | 0.79    | 0.84    | 0.84    | 0.84    | 0.76    | 0.56    |
| Ireland                          | 0.81                                     | 45                            | 0.37                             | 0.41    | 0.69    | 0.75    | 0.81    | 0.84    | 0.85    | 0.41    |
| Italy                            | 0.91                                     | 63                            | 0.67                             | 0.67    | 0.84    | 0.87    | 0.90    | 0.86    | 0.86    | 0.59    |
| Japan                            | 0.84                                     | 49                            | 0.64                             | 0.59    | 0.65    | 0.76    | 0.80    | 0.83    | 0.82    | 0.45    |
| Jordan                           | -  | -                             | -                                | -       | -       | -       | -       | -       | -       | -       |
| Kazakhstan                       | 0.90                                     | 59                            | 0.55                             | 0.77    | 0.84    | 0.86    | 0.85    | 0.78    | 0.71    | 0.71    |
| Korea, Rep. of                   | 0.84                                     | 50                            | 0.54                             | 0.45    | 0.73    | 0.85    | 0.86    | 0.89    | 0.80    | 0.35    |
| Kuwait                           | 0.87                                     | 53                            | 0.59                             | 0.65    | 0.71    | 0.79    | 0.85    | 0.85    | 0.81    | 0.51    |
| Lithuania                        | 0.90                                     | 64                            | 0.67                             | 0.77    | 0.92    | 0.92    | 0.91    | 0.82    | 0.75    | 0.61    |
| Morocco                          | 0.85                                     | 49                            | 0.49                             | 0.48    | 0.74    | 0.83    | 0.85    | 0.85    | 0.76    | 0.38    |
| Netherlands                      | 0.82                                     | 51                            | 0.66                             | 0.56    | 0.86    | 0.87    | 0.67    | 0.85    | 0.82    | -0.08   |
| New Zealand                      | 0.85                                     | 50                            | 0.48                             | 0.49    | 0.78    | 0.81    | 0.84    | 0.84    | 0.83    | 0.43    |
| Northern Ireland                 | 0.87                                     | 54                            | 0.46                             | 0.64    | 0.87    | 0.87    | 0.89    | 0.86    | 0.80    | 0.17    |
| Norway (5)                       | 0.85                                     | 50                            | 0.70                             | 0.48    | 0.74    | 0.81    | 0.83    | 0.83    | 0.70    | 0.48    |
| Oman                             | 0.84                                     | 48                            | 0.44                             | 0.59    | 0.77    | 0.80    | 0.80    | 0.81    | 0.79    | 0.37    |
| Poland                           | 0.92                                     | 67                            | 0.61                             | 0.75    | 0.89    | 0.88    | 0.88    | 0.91    | 0.91    | 0.66    |
| Portugal                         | 0.89                                     | 59                            | 0.63                             | 0.68    | 0.82    | 0.88    | 0.87    | 0.86    | 0.85    | 0.43    |
| Qatar                            | 0.89                                     | 58                            | 0.49                             | 0.58    | 0.82    | 0.86    | 0.89    | 0.87    | 0.87    | 0.61    |
| Russian Federation               | 0.91                                     | 63                            | 0.60                             | 0.68    | 0.86    | 0.92    | 0.90    | 0.90    | 0.85    | 0.54    |
| Saudi Arabia                     | 0.84                                     | 47                            | 0.45                             | 0.40    | 0.71    | 0.76    | 0.88    | 0.85    | 0.76    | 0.54    |
| Serbia                           | 0.90                                     | 62                            | 0.66                             | 0.71    | 0.84    | 0.86    | 0.86    | 0.87    | 0.81    | 0.63    |
| Singapore                        | 0.86                                     | 51                            | 0.63                             | 0.60    | 0.75    | 0.78    | 0.83    | 0.84    | 0.64    | 0.61    |
| Slovak Republic                  | 0.90                                     | 61                            | 0.57                             | 0.70    | 0.86    | 0.90    | 0.91    | 0.90    | 0.77    | 0.52    |
| Slovenia                         | 0.89                                     | 59                            | 0.57                             | 0.61    | 0.80    | 0.91    | 0.93    | 0.90    | 0.79    | 0.49    |
| South Africa (5)                 | -  | -                             | -                                | -       | -       | -       | -       | -       | -       | -       |
| Spain                            | 0.87                                     | 55                            | 0.54                             | 0.65    | 0.85    | 0.84    | 0.84    | 0.82    | 0.77    | 0.55    |
| Sweden                           | 0.83                                     | 50                            | 0.25                             | 0.44    | 0.84    | 0.86    | 0.81    | 0.88    | 0.85    | 0.37    |
| Turkey                           | 0.88                                     | 57                            | 0.64                             | 0.59    | 0.82    | 0.82    | 0.90    | 0.88    | 0.83    | 0.41    |
| United Arab Emirates             | 0.88                                     | 56                            | 0.56                             | 0.59    | 0.82    | 0.85    | 0.88    | 0.86    | 0.84    | 0.46    |
| United States                    | 0.90                                     | 60                            | 0.73                             | 0.66    | 0.79    | 0.88    | 0.90    | 0.89    | 0.78    | 0.52    |
| <b>Benchmarking Participants</b> |  |                               |                                  |         |         |         |         |         |         |         |
| Buenos Aires, Argentina          | 0.91                                     | 61                            | 0.70                             | 0.72    | 0.85    | 0.87    | 0.87    | 0.87    | 0.83    | 0.42    |
| Ontario, Canada                  | 0.86                                     | 51                            | 0.52                             | 0.51    | 0.80    | 0.76    | 0.84    | 0.85    | 0.82    | 0.50    |
| Quebec, Canada                   | 0.81                                     | 45                            | 0.47                             | 0.51    | 0.61    | 0.81    | 0.84    | 0.87    | 0.78    | 0.16    |
| Norway (4)                       | 0.77                                     | 44                            | 0.58                             | 0.71    | 0.79    | 0.77    | 0.78    | 0.76    | 0.43    | 0.33    |
| Abu Dhabi, UAE                   | 0.90                                     | 60                            | 0.65                             | 0.65    | 0.85    | 0.86    | 0.89    | 0.83    | 0.84    | 0.57    |
| Dubai, UAE                       | 0.87                                     | 56                            | 0.59                             | 0.49    | 0.81    | 0.87    | 0.89    | 0.88    | 0.84    | 0.44    |
| Florida, US                      | 0.91                                     | 65                            | 0.78                             | 0.64    | 0.87    | 0.91    | 0.93    | 0.92    | 0.77    | 0.53    |

A dash (-) indicates comparable data not available.

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

**Relationship Between the TIMSS 2015 Teachers Emphasize Science Investigation Scale, Fourth Grade, and TIMSS 2015 Science Achievement**

| Country                          | Pearson's Correlation with Science Achievement |             | Variance in Science Achievement Accounted for by Difference Between Regions of the Scale ( $\eta^2$ ) |
|----------------------------------|--|-------------|---|
|                                  | (r)  | ( $r^2$ )   |   |
| Australia                        | 0.05   | 0.00        | 0.00  |
| Bahrain                          | 0.05   | 0.00        | 0.01  |
| Belgium (Flemish)                | -0.07  | 0.00        | 0.01  |
| Bulgaria                         | -0.05  | 0.00        | 0.00  |
| Canada                           | -0.04  | 0.00        | 0.00  |
| Chile                            | -0.08  | 0.01        | 0.01  |
| Chinese Taipei                   | 0.01   | 0.00        | 0.00  |
| Croatia                          | -0.01  | 0.00        | 0.00  |
| Cyprus                           | -0.01  | 0.00        | 0.00  |
| Czech Republic                   | 0.02   | 0.00        | 0.00  |
| Denmark                          | -0.04  | 0.00        | 0.01  |
| England                          | 0.05   | 0.00        | 0.00  |
| Finland                          | -0.04  | 0.00        | 0.00  |
| France                           | 0.05   | 0.00        | 0.00  |
| Georgia                          | 0.02   | 0.00        | 0.00  |
| Germany                          | 0.05   | 0.00        | 0.00  |
| Hong Kong SAR                    | 0.05   | 0.00        | 0.01  |
| Hungary                          | -0.03  | 0.00        | 0.00  |
| Indonesia                        | 0.07   | 0.00        | 0.00  |
| Iran, Islamic Rep. of            | 0.05   | 0.00        | 0.00  |
| Ireland                          | 0.08   | 0.01        | 0.01  |
| Italy                            | -0.01  | 0.00        | 0.00  |
| Japan                            | 0.02   | 0.00        | 0.00  |
| Jordan                           | -  | -           | -   |
| Kazakhstan                       | 0.04   | 0.00        | 0.01  |
| Korea, Rep. of                   | -0.01  | 0.00        | 0.00  |
| Kuwait                           | -0.06  | 0.00        | 0.00  |
| Lithuania                        | -0.04  | 0.00        | 0.00  |
| Morocco                          | 0.05   | 0.00        | 0.01  |
| Netherlands                      | 0.02   | 0.00        | 0.00  |
| New Zealand                      | 0.06   | 0.00        | 0.00  |
| Northern Ireland                 | -0.02  | 0.00        | 0.00  |
| Norway (5)                       | -0.02  | 0.00        | 0.00  |
| Oman                             | 0.01   | 0.00        | 0.00  |
| Poland                           | -0.02  | 0.00        | 0.00  |
| Portugal                         | -0.03  | 0.00        | 0.00  |
| Qatar                            | -0.13  | 0.02        | 0.02  |
| Russian Federation               | -0.03  | 0.00        | 0.00  |
| Saudi Arabia                     | 0.12   | 0.02        | 0.01  |
| Serbia                           | 0.04   | 0.00        | 0.00  |
| Singapore                        | 0.04   | 0.00        | 0.00  |
| Slovak Republic                  | 0.07   | 0.00        | 0.01  |
| Slovenia                         | 0.01   | 0.00        | 0.00  |
| South Africa (5)                 | -  | -           | -   |
| Spain                            | 0.03   | 0.00        | 0.00  |
| Sweden                           | 0.02   | 0.00        | 0.00  |
| Turkey                           | 0.09   | 0.01        | 0.01  |
| United Arab Emirates             | 0.10   | 0.01        | 0.01  |
| United States                    | 0.01   | 0.00        | 0.00  |
| <b>International Median</b>      | <b>0.02</b>                                    | <b>0.00</b> | <b>0.00</b>   |
| <b>Benchmarking Participants</b> |  |             |   |
| Buenos Aires, Argentina          | -0.07  | 0.01        | 0.01  |
| Ontario, Canada                  | -0.03  | 0.00        | 0.00  |
| Quebec, Canada                   | 0.02   | 0.00        | 0.00  |
| Norway (4)                       | 0.03   | 0.00        | 0.00  |
| Abu Dhabi, UAE                   | 0.09   | 0.01        | 0.01  |
| Dubai, UAE                       | -0.03  | 0.00        | 0.00  |
| Florida, US                      | 0.02   | 0.00        | 0.00  |

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

A dash (-) indicates comparable data not available.