



Scaling procedures and construct validation of context questionnaire data

Introduction	290
Scaling methodology and construct validation	290
School Questionnaire derived variables	321
Educational Career Questionnaire	327
ICT Familiarity Questionnaire	328
Parent Questionnaire	331
Teacher Questionnaires	335
The PISA index of economic, social and cultural status (ESCS)	339

The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law.



INTRODUCTION

The PISA 2015 Context Questionnaires are based on the questionnaire framework (OECD, 2017), described in Chapter 3 of this report. The questionnaires include numerous indicators for reporting over time (trend indicators) or were designed to be used in analyses as single items (for example, gender). However, many questionnaire items were designed to be combined in some way in order to measure latent constructs that cannot be observed directly (e.g., a student's achievement motivation or economic, social and cultural background). To these items, transformations or scaling procedures were applied to construct meaningful indices.

In the following, these indices are referred to as 'derived variables'. Many derived variables were taken from previous PISA cycles without change as part of the trend content. This chapter describes derived variables based on one or more items that were constructed and validated for all questionnaires administered in PISA 2015.

In analogy to previous PISA surveys, three different kinds of derived variables can be distinguished:

- simple questionnaire indices constructed through the arithmetical transformation or recoding of one or more items
- derived variables based on IRT scaling (see section "Scaling procedures" in this chapter)
- ESCS composite scores (see section "The PISA index of economic, social and cultural status (ESCS)" in this chapter).

As described in Chapter 3, the PISA 2015 Context Questionnaires included a broad scope of context factors assessed with different questionnaire instruments. While student and school context questionnaires were mandatory in all countries, many countries also administered the optional questionnaire to parents of the tested students. In addition, countries could choose to administer the international options *Information and Communication Technology (ICT) Familiarity Questionnaire* and the *Educational Career Questionnaire* to students. Moreover, several countries chose to participate in the *Teacher Questionnaire* option including questionnaires for science and non-science teachers (See Chapter 17 for an overview of participation in international options).

This chapter (i) describes the methodology used for scaling and construct validation including trend scales, (ii) presents an overview of all derived variables (simple indices, IRT-based scales) per questionnaire, and (iii) illustrates the computation of the *PISA index of economic, social and cultural status (ESCS)*.

SCALING METHODOLOGY AND CONSTRUCT VALIDATION

Scaling procedures

As in previous cycles of PISA, one subset of the derived variables was constructed using IRT (*item response theory*) scaling methodology. In the IRT framework, a number of different models can be distinguished with the generalised partial credit model (see below) being the one used for constructing derived variables in the PISA 2015 Context Questionnaires.

For each item, item responses are modelled as a function of the latent construct, θ_j . With the one-parameter model (*Rasch model*; Rasch, 1960) for dichotomous items, the probability of person j selecting category 1 instead of 0 is modelled as:

16.1

$$P(X_{ji} = 1 | \theta_j, \beta_i) = \frac{\exp(\theta_j - \beta_i)}{1 + \exp(\theta_j - \beta_i)}$$

where $P(X_{ji} = 1)$ is the probability of person j to score 1 on item i , θ_j is the estimated latent trait of person j and β_i the estimated location or difficulty of item i on this dimension¹. In the case of items with more than two (m) categories (e.g., Likert-type items), this model can be generalised to the *Partial Credit Model* (Masters and Wright, 1997), which takes the form of:

16.2

$$P(X_{ji} = k | \theta_j, \beta_i, d_{ir}) = \frac{\exp\left(\sum_{r=0}^k \theta_j - (\beta_i + d_{ir})\right)}{\sum_{u=0}^{m_i} \exp\left(\sum_{r=0}^u \theta_j - (\beta_i + d_{ir})\right)}$$



where $P(X_{ji} = k)$ denotes the probability of person j to score k on item i out of the m_i possible scores on the item. θ_j denotes the person's latent trait, the item parameter β_i gives the general location or difficulty of the item on the latent continuum and d_{ir} denote additional step parameters. This model has been used throughout previous cycles of PISA for scaling derived variables of the context questionnaires. However, research literature (especially, Glass and Jehangir, 2014) suggests that a generalisation of this model, the *generalised partial credit model* (GPCM) (Muraki, 1992), is more appropriate in the context of PISA since it allows for the item discrimination to vary between items within any given scale. This model takes the form of:

16.3

$$P(X_{ji} = k | \theta_j, \beta_i, \alpha_i, d_i) = \frac{\exp\left(\sum_{r=0}^k \alpha_i (\theta_j - (\beta_i + d_{ir}))\right)}{\sum_{u=0}^{m_i} \exp\left(\sum_{r=0}^u \alpha_i (\theta_j - (\beta_i + d_{ir}))\right)}$$

in which the additional discrimination parameter α_i allows for the items of a scale to contribute with different weights to the measurement of the latent construct.

Most of the scales were analysed based on 2015 data only (see section “Regular scales”) and other, mostly science-related scales were analysed to allow for comparisons with the weighted likelihood estimates (WLE; Warm, 1989) obtained in PISA 2006 (see section “Trend scales”).

Regular scales (PISA 2015)

For the regular scales, international item and person parameters were obtained from a GPCM (see formula 16.3) in a single analysis based on data from all persons in all countries using the *mdltm* software (von Davier, 2008). For each scale, only persons with a minimum number of three valid responses were included. Students were weighted using the final student weight (W_FSTUWT), and all countries contributed equally to the estimation. Additional analyses on the invariance of item parameters across countries and languages were conducted and unique parameters were assigned if necessary (see section “Cross-country comparability” in this chapter). Once this process was finished, weighted likelihood estimates (WLE; Warm, 1989) were used as individual participant scores and transformed to an international metric with an OECD mean of zero and an OECD standard deviation of one². The transformation was achieved by applying formula 16.4:

16.4

$$\theta'_j = \frac{\theta_j - \bar{\theta}_{OECD}}{\sigma_{\theta(OECD)}}$$

where θ'_j are the WLE scores in the final metric, θ_j the original WLEs in logits, $\bar{\theta}_{OECD}$ is the OECD mean of logit scores with equally weighted country samples, and $\sigma_{\theta(OECD)}$ is the corresponding OECD standard deviation of the original WLEs. OECD means and standard deviations (S.D.) used for the transformation into the final metric are displayed in Table 16.1.

[Part 1/2]

Table 16.1 OECD mean and standard deviation (S.D.) for the untransformed WLEs of regular scales in the different PISA 2015 context questionnaires

Derived variable	N	Mean	S.D.
Student-level indices			
ADINST	149 283	-0.12	1.18
ANXTEST	174 845	0.05	1.03
AUTICT	137 606	0.56	1.31
BELONG	169 366	0.74	1.09
COMPICT	137 619	0.70	1.42
COOPERATE	174 239	0.78	0.99
CPSVALUE	174 095	0.63	1.13
CULTPOSS	174 162	0.05	0.99
DISCLISCI	156 129	0.53	1.30
EMOSUPS	170 303	1.61	1.26
ENTUSE	142 249	-0.01	0.49

[Part 2/2]

Table 16.1 OECD mean and standard deviation (S.D.) for the untransformed WLEs of regular scales in the different PISA 2015 context questionnaires

Derived variable	N	Mean	S.D.
EPIST	161 707	0.78	1.22
HEDRES	176 212	1.13	0.78
HOMEPOS	177 199	0.66	0.53
HOMESCH	139 325	-0.56	0.83
IBTEACH	154 036	-0.26	0.82
ICTRES	176 248	0.47	0.79
INTBRSCI	162 260	-0.09	1.11
INTICT	138 858	0.63	1.02
MOTIVAT	174 489	0.81	1.09
PERFEED	151 719	-0.78	1.53
SOIAICT	136 493	-0.01	1.33
TDTEACH	152 358	0.12	1.07
TEACHSUP	154 354	0.75	1.24
USESCH	139 842	-0.83	0.83
WEALTH	176 453	0.70	0.64
School-level indices			
EDUSHORT	168 744	-0.61	1.44
LEAD	167 885	0.32	0.58
LEADCOM	167 632	0.08	0.78
LEADINST	164 939	0.26	0.74
LEADPD	164 777	0.77	0.87
LEADTCH	164 740	0.54	0.90
STAFFSHORT	168 178	-0.72	0.81
STUBEHA	167 746	-0.69	0.97
TEACHBEHA	167 674	-0.96	0.97
Teacher-level indices			
COLSCIT	127 795	0.89	1.27
EXCHT	246 628	0.40	0.64
SATJOB	374 474	1.56	1.45
SATTEACH	375 540	0.99	1.22
SECONT	115 562	1.61	1.13
SETEACH	115 569	1.41	1.14
TCEDUSHORT	372 293	-0.63	1.48
TCLEAD	246 604	0.87	1.72
TCSTAFFSHORT	370 074	-0.74	0.89
Parent-level indices			
CURSUPP	472 202	0.06	0.54
EMOSUPP	469 931	2.31	1.14
PASCHPOL	465 559	0.53	1.15
PRESUPP	470 030	-0.69	0.68

Note: N reflects the sample size after senate weights were applied. Senate weights were constructed to sum up to the target sample size of 5 000 within each country.

Trend scales (PISA 2006 - PISA 2015)

For those scales administered in both PISA 2006 and PISA 2015, scale scores in PISA 2015 were constructed to allow for comparisons with those reported in PISA 2006 using a *common calibration linking procedure*. This procedure consists of two phases: calibration and linking phase.

In the calibration phase, international item and person parameters were obtained from a generalised partial credit model (see formula 16.3) in a single analysis based on data from all persons in all countries from both cycles (2006 and 2015) using the *mdltm* software (von Davier, 2008). For each scale, only persons with a minimum number of three valid responses were included. Students were weighted using the final student weight, and each country in each cycle contributed equally to the estimation. Additional analyses on the invariance of item parameters across countries, languages and cycles were conducted and unique parameters were assigned if necessary (see section “Cross-country comparability” in this chapter). WLEs resulting from this concurrent calibration were derived for examinees from both cycles ($WLE_{2006.new}$, WLE_{2015}).

In the linking phase, the 2015 WLEs obtained in the calibration phase (WLE_{2015}) were linked to the 2006 metric to obtain final WLEs (WLE^*_{2015}) by a linear transformation of the following form:

16.5

$$WLE^*_{2015} = A \times WLE_{2015} + B$$



The linking constants (A , B) were calculated based on the mean and standard deviation of the newly derived and original WLEs of the 2006 data:

16.6

$$A = \frac{SD_{WLE_{2006.original}}}{SD_{WLE_{2006.new}}}$$

16.7

$$B = M_{WLE_{2006.original}} - A \times M_{WLE_{2006.new}}$$

Table 16.2 shows both the transformation constants (A , B) and the correlations between the original and newly derived WLEs for PISA 2006 $r(WLE_{2006.original}, WLE_{2006.new})$. They indicate that original and transformed scales are highly consistent both with respect to distributional characteristics and rank order of individuals, indicating that all scales could be recovered well. This is particularly noteworthy as the scaling model changed from the partial credit model in previous cycles of PISA to the generalised partial credit model in 2015.

Table 16.2 **Scaling constants (A , B) and correlations between original and newly derived 2006 WLEs for trend scales in 2015**

Derived variable	B	A	$r(WLE_{2006.original}, WLE_{2006.new})$
Student-level indices			
ENVAWARE	1.05	-0.52	0.991
ENVOPT	1.22	0.66	0.998
INSTSCIE	0.56	-0.19	0.999
JOYSCIE	0.58	-0.12	0.998
SCIEACT	0.85	1.29	0.997
SCIEEFF	1.34	-0.33	1.000
Parent-level indices			
PQENPERC	1.64	-2.34	0.999
PQENVOPT	1.11	1.00	0.999
PQGENSCI	0.77	-1.11	0.996
PQSCHOOL	0.82	-0.69	0.995

Interpreting results from IRT scaling

Interpreting person parameters

As in previous cycles of PISA, in PISA 2015 categorical items from the context questionnaires were scaled using IRT modelling. WLEs for the latent dimensions were transformed to scales with a mean of 0 and a standard deviation of 1 across OECD countries (with equally weighted countries), meaning that the average OECD student would have an index value of zero and about two-thirds of the OECD student population would be between the values of -1 and 1.

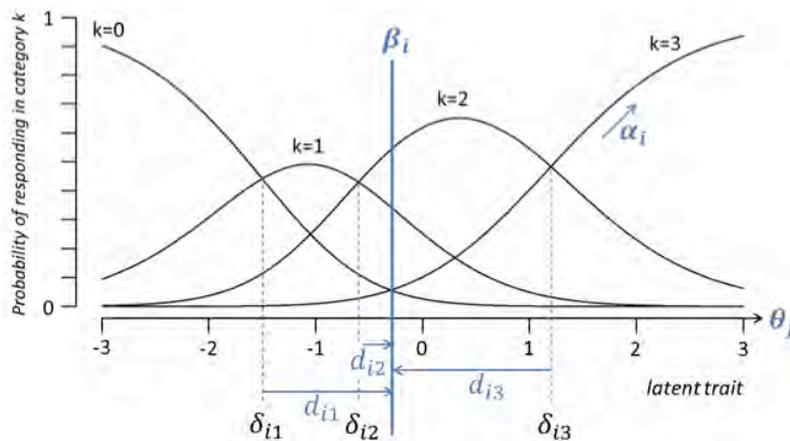
It is possible to interpret these scores by comparing individual scores or group mean scores to the OECD mean, but the individual scores do not reveal anything about the actual item responses and it is impossible to determine from scale score values to what extent respondents endorsed the items used for the measurement of the latent construct. Negative values on the index do not imply that students responded negatively to the underlying question. Rather, students with negative scores are those who responded less positively than the average student across OECD countries. Likewise, students with positive scores are those who responded more positively than the average student in OECD countries.

Interpreting item parameters

The generalised partial credit model (see formula 16.3) contains three kinds of item parameters: one relating to the general location or difficulty of the item (β), one relating to the deviance of each of the single response categories from this location parameter (d), and one relating to the item's discrimination or slope (a). Figure 16.1 displays the category characteristic curves of a four-category item (e.g., a Likert-type item with response categories "strongly disagree", "disagree", "agree", and "strongly agree"). The three kinds of generalised partial credit model item parameters were included in this representation, and each will be discussed in detail below.

■ Figure 16.1 ■

Item characteristic curves for a four-category item under the generalised partial credit model (GPCM)
Model parameters are highlighted in blue



The overall item location or difficulty parameter, β , can be regarded as the item's location on the latent continuum of the construct to be measured. The $m-1$ threshold parameters, d , of an m -category item represent deviations from this general location. Thus, the threshold parameters' means equal 0. This parameterization has also been referred to as the *expanded parametrisation* (Penfield, Myers and Wolfe, 2008) and was reported throughout previous cycles of PISA. Combining the location parameter and the m threshold parameters leads to a reduced parameterization that might be more familiar to some users (e.g. Muraki, 1992). Threshold parameters, d , and step parameters, δ , can easily be converted into each other by:

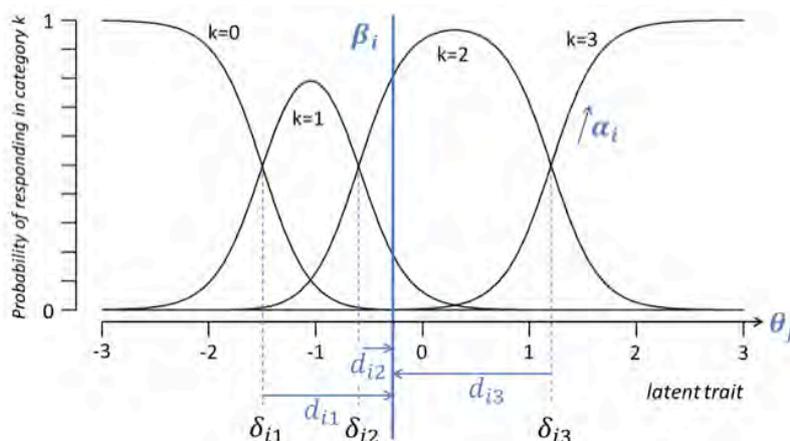
16.8

$$\delta_k = \beta - d_k$$

These step parameters, δ , signify the intersections between two neighbouring category characteristic curves and thus, the point on the latent continuum at which a response in the higher category becomes more likely. The slope parameter, α , signifies the slope of the category characteristic curves, thus indicating how well a response in a certain category discriminates between persons on the latent continuum. Figure 16.2 contains category characteristic curves for which only the slope has been increased while holding all other model parameters identical with the model displayed in Figure 16.1. The same increment on the latent continuum leads to a better prediction of the given response.

■ Figure 16.2 ■

Illustration of an increase of the slope parameter, α , on category response curves for a four-category item under the generalised partial credit model (GPCM)





The respective estimates for all three kinds of parameters will be reported along with each item's wording in the subsequent sections. The model parameters can be used to compare the items of a scale with each other: items with a higher overall difficulty are less often "solved", meaning that persons tended to respond in lower categories, and the step parameters shed light on the relative difficulty of the response categories. Items with a higher slope can be seen as better indicators of the latent construct, and, thus, are more represented in the meaning of the scale score (WLE).

In general, the item difficulty parameters of an IRT model can be interpreted with respect to the person parameter, θ , and vice versa. Please note that this is not possible in this context, because instead of the original θ estimates (WLEs) either standardised values are reported (in case of regular scales) or scores are linked to another scale (in case of trend scales) so that the WLEs are no longer on their original metric.

Construct validation

The development of comparable measures of student background, practices, attitudes and perceptions is a major goal of PISA. Cross-country validity of these constructs is of particular importance as measures derived from questionnaires are often used to predict differences in student performance within and across countries and are, thus, potential sources of policy-relevant information about ways of improving educational systems. Different methodological approaches for validating questionnaire constructs have been developed. The two approaches implemented for context questionnaires in PISA 2015 are introduced below.

Internal consistency

Cronbach's alpha was used to check the internal consistency of each scale within the countries and to compare it between the countries. The coefficient ranges between 0 and 1, with higher values indicating higher internal consistency. Commonly accepted cut-off values are 0.9 to signify excellent, 0.8 for good, and 0.7 for acceptable internal consistency. For some scales, some countries opted to delete one or two items. Strictly speaking, this constituted a different scale and, therefore, a footnote was added in the tables to note which item had been deleted.

Cross-country comparability

Cross-country validity of the constructs requires a thorough and closely monitored process of translation (see Chapter 5 for a description of the translation process in PISA 2015) and standardised administration. It also makes assumptions about having measured the same construct in different national and cultural contexts. All of the indicators are based on self-reports. Such measures can suffer from various measurement errors, for instance, students are asked to report their behaviour retrospectively. Cultural differences in attitudes towards self-enhancement can influence country-level results in examinees' self-reported beliefs, behaviours and attitudes (Bempechat, Jimenez and Boulay, 2002). The literature consistently shows that response biases, such as social desirability, acquiescence and extreme response choice, are more common in countries with lower socio-economic development, compared with more affluent countries. Within countries, these response styles differ between gender and across socio-economic status levels (Buckley, 2009).

Psychometric techniques can be used to analyse the extent to which the measurement of the latent constructs is consistent across participating countries, thus indicating whether the measured construct can be compared across countries. In PISA 2015, cross-country comparability was investigated via two different approaches:

- For each scale in each country, the **internal consistency** was calculated (see above).
- For each item and scale, analyses on the **invariance of item parameters** across countries and languages within a country were conducted.

Internal consistency. The Cronbach's alpha coefficient of internal consistency will be reported for each country along with each scaled construct in the different questionnaire sections in this chapter. Similar and high values across countries are a good indication about having measured reliably across countries.

Invariance of item parameters. PISA 2015 implemented an innovative approach to test whether equal (*invariant*) item parameters can be assumed across groups of participating countries and language groups therein. In a first step, groups were defined whereas every country or multiple, sufficiently large samples of examinees taking the same questionnaire language version within the country formed one group each. For regular scales, groups are based on country-by-language combinations; for trend scales, groups are based on cycle-by-country-by-language combinations. A senate-weighted sample size of at least 300 cases was considered sufficiently large to form one group. In a second step, international item and person parameters were estimated based on all examinees across all groups (see section "Scaling procedures").

Based on this estimation, the root mean square deviance (*RMSD*) item-fit statistic was calculated for each group and item by:

16.9

$$RMSD = \sqrt{\int (P_o(\theta) - P_e(\theta))^2 f(\theta) d\theta}$$

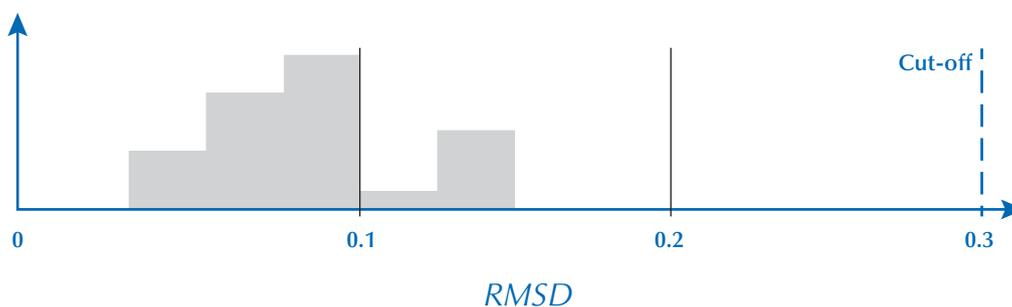
quantifying the difference between the *observed item characteristic curve*³ ($P_o(\theta)$) with the *model-based ICC* ($P_e(\theta)$). The *RMSD* statistic is sensitive to the group-specific deviations of both the item difficulty parameters and item slope parameters from the international parameters. Values close to zero indicate good item fit, meaning that the model with international item parameters describes the responses in this group very well. A value of 0.3 was set as a cut-off criterion, with larger values indicating that the international item parameters are not appropriate for this group. Instead, a flagged group was allowed to receive group-specific (*unique*) item parameters and steps 2 and 3 were repeated until all items exhibited *RMSD* values smaller than 0.3.⁴ The final distribution of *RMSD* values across groups will be reported for each item along with each of the scales. (For an explanation of the graphical representation, see section “*Evaluating cross-country comparability*” below.)

Evaluating cross-country comparability of latent constructs

PISA 2015 adopted a new approach to evaluating the invariance of latent constructs across groups. The *RMSD* statistic quantifies how well the international parameters describe a group’s observed data, and its distribution across groups indicates the international item parameters’ fit, i.e., how well the international item parameters function across groups. The histogram of this distribution will be referred to as *RMSD*-plot and will be reported along with each item’s wording and parameters in the subsequent sections in which each scale is presented individually. Figure 16.3 gives an example of such a plot.

■ Figure 16.3 ■

Example of an *RMSD*-plot: distribution of the *RMSD* statistic across groups

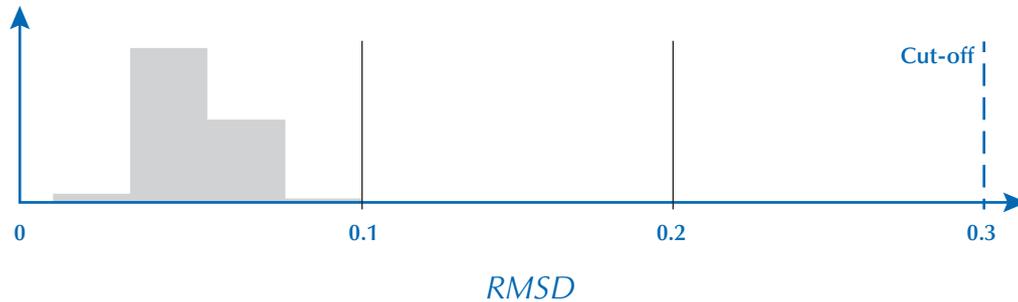


The histogram shows the distribution of *RMSD* values for a sample item across all groups. Blue elements were added for illustration but will be omitted from the plots reported along with each item in the subsequent sections. The x-axis is held constant for all plots, ranging from its theoretical minimum to maximum. The theoretical minimum ($RMSD=0$) indicates perfect fit of the international item parameters for this group. A value of $RMSD=0.3$ was chosen as the cut-off criterion for assigning group-specific parameters, thus indicating the possible maximum of *RMSD*. Vertical lines in black signify *RMSD* values of 0.1 and 0.2, respectively. Figure 16.3 would therefore indicate good item fit in most groups, with only very few groups exhibiting values larger than 0.1. Figure 16.4, in comparison, would indicate very good fit in all countries, thus signifying high cross-country comparability of the construct.



■ Figure 16.4 ■

**Example of an RMSD-distribution for a very well fitting item across all groups:
All RMSD values are less than 0.1**



Annex H contains the complete documentation of RMSD values for each construct's items and each group.

STUDENT QUESTIONNAIRE DERIVED VARIABLES

The Student Questionnaire features 54 derived variables, both simple questionnaire indices as well as scaled variables. Moreover, information from the Student Questionnaire was used to calculate the ESCS composite scores. The derived variables are shown in Table 16.3 and will be described in the following. Simple questionnaire indices are preceded by those that are based on IRT scaling.

[Part 1/2]

Table 16.3 Derived variables in the PISA 2015 Student Questionnaire

DV Name	Description	Question no.	Trend to PISA 2006	IRT scaling
GRADE	Grade compared to modal grade in country	ST001		
AGE	Age	ST003		
MISCED	Mother's education (ISCED)	ST005, ST006		
HISCED	Highest education of parents (ISCED)	ST005, ST006, ST007, ST008		
FISCED	Father's education (ISCED)	ST007, ST008		
PARED	Highest education of parents in years	ST005, ST006, ST007, ST008		
CULTPOSS	Cultural possessions at home	ST011, ST012		YES
HEDRES	Home educational resources	ST011		YES
WEALTH	Family wealth	ST011, ST012		YES
ICTRES	ICT Resources	ST011, ST012		YES
HOMEPOS	Home possessions	ST011, ST012, ST013		YES
ESCS	Index of economic, social and cultural status	ST005, ST006, ST007, ST008, ST011, ST012, ST013, ST014, ST015		
BFMJ2	ISEI of father	ST015		
BMMJ1	ISEI of mother	ST014		
HISEI	Highest parental occupational status	ST014, ST015		
IMMIG	Immigration status	ST019		
COBN_F	Country of birth national categories – father	ST019Q01TA		
COBN_M	Country of birth national categories – mother	ST019Q01TB		
COBN_S	Country of birth national categories – student	ST019Q01TC		
LANGN	Language at home	ST022Q01TA		
BELONG	Sense of Belonging to School	ST034		YES
beingbullied	Being Bullied	ST038		
unfairteacher	Teacher Fairness	ST039		
LMINS	Learning time (minutes per week) – <test language>	ST059, ST061		
MMINS	Learning time (minutes per week) – <mathematics>	ST059, ST061		
SMINS	Learning time (minutes per week) – <science>	ST059, ST061		
TMINS	Learning time (minutes per week) – in total	ST060, ST061		
OUTHOURS	Out-of-school study time per week	ST071		
COOPERATE	Enjoy cooperation	ST082		YES
CPSVALUE	Value cooperation	ST082		YES
ENVAWARE	Environmental awareness	ST092	YES	YES
ENVOPT	Environmental optimism	ST093	YES	YES
JOYSCIE	Enjoyment of science	ST094	YES	YES
INTBRSCI	Interest in broad science topics	ST095		YES
DISCLISCI	Disciplinary climate in science classes	ST097		YES
IBTEACH	Inquiry-based science teaching and learning practices	ST098		YES

[Part 2/2]

Table 16.3 Derived variables in the PISA 2015 Student Questionnaire

DV Name	Description	Question no.	Trend to PISA 2006	IRT scaling
TEACHSUP	Teacher support in a science classes	ST100		YES
TDTEACH	Teacher-directed science instruction	ST103		YES
PERFEED	Perceived feedback	ST104		YES
ADINST	Adaption of instruction	ST107		YES
INSTSCIE	Instrumental motivation	ST113	YES	YES
BSMJ	Students' expected occupational status (SEI)	ST114		
ANXTEST	Test anxiety	ST118		YES
MOTIVAT	Achieving motivation	ST119		YES
EMOSUPS	Parents emotional support	ST123		YES
DURECEC	Duration in early childhood education and care	ST125, ST126		
REPEAT	Grade repetition	ST127		
SCIEEFF	Science self-efficacy	ST129	YES	YES
EPIST	Epistemological beliefs	ST131		YES
SCIEACT	Science activities	ST146	YES	YES
ISCEDD	ISCED designation	ST (SPT)		
ISCEDL	ISCED level	ST (SPT)		
ISCEDO	ISCED orientation	ST (SPT)		
PROGN	Unique national study programme code	ST002		

Grade

The relative grade index (GRADE) was computed to capture between-country variation. It indicates whether students are in the country's a modal grade i (value of 0) or whether they are below or above the modal grade (+ x grades, - x grades). The information about the students' grade level was taken from the Student Questionnaire (ST001) whereas the modal grade was defined by the country and documented in the student tracking form.

Student age

The age of a student (AGE) was calculated as the difference between the year and month of the testing and the year and month of a student's birth. Data on student's age were obtained from both the questionnaire (ST003) and the student tracking forms. If the month of testing was not known for a particular student, the median month for that country was used in the calculation. The formula for computing AGE was:

$$AGE = (100 + T_y - S_y) + (T_m - S_m)/12$$

where T_y and S_y are the year of the test and the year of the students' birth, respectively in two-digit format (for example "06" or "92"), and T_m and S_m are the month of the test and month of the students' birth, respectively. The result is rounded to two decimal places.

Educational level of parents

Students' responses on questions ST005, ST006, ST007, and ST008 regarding parental education were classified using ISCED 1997 (OECD, 1999). Indices on parental education were constructed by recoding educational qualifications into the following categories: (0) None, (1) ISCED 1 (primary education), (2) ISCED 2 (lower secondary), (3) ISCED Level 3B or 3C (vocational/pre-vocational upper secondary), (4) ISCED 3A (general upper secondary) and/or ISCED 4 (non-tertiary post-secondary), (5) ISCED 5B (vocational tertiary) and (6) ISCED 5A and/or ISCED 6 (theoretically oriented tertiary and post-graduate). Indices with these categories were provided for a student's mother (MISCED) and father (FISCED). In addition, the index of highest educational level of parents (HISCED) corresponds to the higher ISCED level of either parent. The index of highest educational level of parents was also recoded into estimated number of years of schooling (PARED).⁵

Highest occupational status of parents

Occupational data for both the student's father and student's mother were obtained from responses to open-ended questions. The responses were coded to four-digit ISCO codes and then mapped to the international socio-economic index of occupational status (ISEI) (Ganzeboom and Treiman, 2003). In PISA 2015, the new ISCO and ISEI in their 2008 version were used. Three indices were calculated based on this information: father's occupational status (BFMJ2); mother's occupational status (BMMJ1); and the highest occupational status of parents (HISEI) which corresponds to the



higher ISEI score of either parent or to the only available parent's ISEI score. For all three indices, higher ISEI scores indicate higher levels of occupational status.

Immigration background

The PISA database contains three country-specific variables relating to the students' country of birth, their mother and father (COBN_S, COBN_M, and COBN_F). The items ST019Q01TA, ST019Q01TB and ST019Q01TC were recoded into the following categories: (1) country of birth is the same as country of assessment and (2) other. The index of immigrant background (IMMIG) was calculated from these variables with the following categories: native students (those students who had at least one parent born in the country), (2) second-generation students (those born in the country of assessment but whose parent(s) were born in another country) and (3) first-generation students (those students born outside the country of assessment and whose parents were also born in another country). Students with missing responses for either the student or for both parents were assigned missing values for this variable.

Language spoken at home

Students indicated what language they usually speak at home (ST022), and the database includes a derived variable (LANGN) containing a country-specific code for each language. In addition, an internationally comparable variable was derived from this information with the following categories: (1) language at home is the same as the language of assessment for that student and (2) language at home is another language.

School climate regarding fairness and bullying

PISA 2015 included two new questions on being bullied (ST038) and teacher fairness (ST039) asking students about how often in the past 12 months they had experienced bullying behaviour of other students or unfair treatment by teachers. The questions used a four-point scale distinguishing the answer categories "never or almost never", "a few times a year", "a few times a month", "once a week or more". The derived variable TEACHFAIR reports a mean for each scale. However, as the data for ST038 showed a strongly skewed distribution, no scale was built. Results should be used with caution and cross-country comparability needs to be investigated further.

Learning time

Learning time in test language (LMINS) was computed by multiplying the number of minutes on average in the test language class by number of test language class periods per week (ST061 and ST059). Comparable indices were computed for mathematics (MMINS) and science (SMINS). Learning time in total (TMINS) was computed using information about the average minutes in a <class period> (ST061) in relation to information about the number of class periods per week attended in total (ST060).

Out-of-school study time

Students were asked in a slider-format question how much time they spent studying in addition to their required school schedule (ST071). The index OUTHOURS was computed by summing the time spent studying for different school subjects.

Expected occupational status

As in previous cycles of PISA, students were asked to report their expected occupation at age 30 and a description of this job. The responses were coded to four-digit ISCO codes and then mapped to the ISEI index (Ganzeboom et al., 2003). Recoding of ISCO codes into ISEI index results in scores for the students' expected occupational status (BSMJ), where higher scores of ISEI indicate higher levels of expected occupational status.

Early childhood education and care

Questions ST125 and ST126 measure the starting age in ISCED 1 and ISCED 0. A difference score of the two thus indicates the number of years a student spent in early childhood education and care. This indicator is called DURECEC.

Grade repetition

The grade repetition variable (REPEAT) was computed by recoding variables ST127Q01TA, ST127Q02TA, and ST127Q03TA. REPEAT took the value of "1" if the student had repeated a grade in at least one ISCED level and the value of "0" if "no, never" was chosen at least once, given that none of the repeated grade categories were chosen. The index is assigned a missing value if none of the three categories were ticked in any levels.

Study programme indices

PISA collects data on study programmes available to 15-year old students in each country. This information is obtained through the student tracking form and the Student Questionnaire. In the final database, all national programmes are included in a separate derived variable (PROGN) where the first six digits represent the National Centre code, and the last two digits are the nationally specific programme code. All study programmes were classified using the International Standard Classification of Education (ISCED 1997)⁶. The following indices were derived from the data on study programmes: programme level (ISCEDL) indicates whether students were at the lower or upper secondary level (ISCED 2 or ISCED 3); programme designation (ISCEDD) indicates the designation of the study programme (A = general programmes designed to give access to the next programme level, B = programmes designed to give access to vocational studies at the next programme level, C = programmes designed to give direct access to the labour market, M = modular programmes that combine any or all of these characteristics); and programme orientation (ISCEDO) indicates whether the programme's curricular content was general, pre-vocational or vocational.

Derived variables based on IRT Scaling

The PISA 2015 Student Questionnaire provided data for 25 scaled indices which will be presented along with the item content and parameters in the following.

Household possessions

In PISA 2015, students reported the availability of 16 household items at home (ST011) including three country-specific household items that were seen as appropriate measures of family wealth within the country's context. In addition, students reported the amount of possessions and books at home (ST012, ST013). Five indices were derived from these items: i) family wealth possessions (WEALTH), ii) cultural possessions (CULTPOSS), iii) home educational resources (HEDRES), iv) ICT resources (ICTRES) and v) home possessions (HOMEPOS). Table 16.4 gives an overview of the indicator items for each of these five indices.

Table 16.4 Indicators of household possessions and home background indices

Item	Description	Item is used to measure index				
		HOMEPOS	WEALTH	CULTPOSS	HEDRES	ICTRES
ST011Q01TA	A desk to study at	X			X	
ST011Q02TA	A room of your own	X	X			
ST011Q03TA	A quiet place to study	X			X	
ST011Q04TA	A computer you can use for school work	X			X	
ST011Q05TA	Educational software	X			X	X
ST011Q06TA	A link to the Internet	X	X			X
ST011Q07TA	Classic literature (e.g. <Shakespeare>)	X		X		
ST011Q08TA	Books of poetry	X		X		
ST011Q09TA	Works of art (e.g. paintings)	X		X		
ST011Q10TA	Books to help with your school work	X			X	
ST011Q11TA	<Technical reference books>	X			X	
ST011Q12TA	A dictionary	X			X	
ST011Q16NA	Books on art, music, or design	X		X		
ST011Q17TA	<Country-specific wealth item 1>	X	X			
ST011Q18TA	<Country-specific wealth item 2>	X	X			
ST011Q19TA	<Country-specific wealth item 3>	X	X			
ST012Q01TA	Televisions	X	X			
ST012Q02TA	Cars	X	X			
ST012Q03TA	Rooms with a bath or shower	X	X			
ST012Q05NA	<Cell phones> with Internet access (e.g. smartphones)	X	X			X
ST012Q06NA	Computers (desktop computer, portable laptop, or notebook)	X	X			X
ST012Q07NA	<Tablet computers> (e.g. <iPad®>, <BlackBerry® PlayBook™>)	X	X			X
ST012Q08NA	E-book readers (e.g. <Kindle™>, <Kobo>, <Bookeen>)	X	X			X
ST012Q09NA	Musical instruments (e.g. guitar, piano)	X		X		
ST013Q01TA	How many books are there in your home?	X				



Tables 16.5 and 16.6 provide information on the reliabilities (Cronbach's Alpha coefficients) in OECD countries and partner countries and economies, respectively.

Table 16.5 Scale reliabilities for Household possessions indices in OECD countries

	HOMEPOS	CULTPOSS	HEDRES	WEALTH	ICTRES
Australia	0.734	0.575	0.647	0.640	0.481
Austria	0.728	0.586	0.507	0.664	0.478
Belgium	0.731	0.624	0.524	0.667	0.523
Canada	0.730	0.584	0.629	0.649	0.520
Chile	0.809	0.571	0.541	0.750	0.626
Czech Republic	0.715	0.626	0.550	0.628	0.480
Denmark	0.684	0.597	0.504	0.559	0.371
Estonia	0.741	0.576	0.493	0.682	0.477
Finland	0.706	0.643	0.544	0.558	0.427
France	0.712	0.657	0.496	0.634	0.487
Germany	0.714	0.601	0.522	0.624	0.501
Greece	0.752	0.581	0.498	0.699	0.562
Hungary	0.780	0.650	0.555	0.711	0.516
Iceland	0.693	0.530	0.581	0.630	0.400
Ireland	0.730	0.582	0.550	0.608	0.465
Israel ¹	0.737	0.634	0.587	0.696	0.545
Italy	0.732	0.557	0.491	0.651	0.523
Japan	0.698	0.588	0.472	0.565	0.524
Korea	0.779	0.631	0.552	0.627	0.482
Latvia	0.723	0.584	0.420	0.646	0.503
Luxembourg	0.761	0.610	0.556	0.698	0.526
Mexico	0.867	0.601	0.574	0.847	0.739
Netherlands	0.678	0.574	0.498	0.570	0.424
New Zealand	0.748	0.561	0.653	0.673	0.549
Norway	0.726	0.621	0.608	0.636	0.445
Poland	0.748	0.598	0.456	0.690	0.496
Portugal	0.771	0.598	0.478	0.672	0.550
Slovak Republic	0.780	0.618	0.675	0.695	0.548
Slovenia	0.720	0.620	0.472	0.634	0.477
Spain	0.755	0.598	0.510	0.656	0.555
Sweden	0.748	0.611	0.608	0.653	0.473
Switzerland	0.702	0.587	0.529	0.616	0.492
Turkey	0.855	0.641	0.650	0.773	0.673
United Kingdom	0.748	0.631	0.629	0.638	0.501
United States	0.802	0.593	0.660	0.692	0.578

1. In Israel, items ST011Q02TA and ST012Q03TA were not included.

HOMEPOS is a summary index of all household and possession items (ST011, ST012 and ST013). HOMEPOS is also one of three components in the construction of the PISA index of economic, social and cultural status (or ESCS; see the section on ESCS index construction later in this chapter). The home possessions scale for PISA 2015 was computed differently than in the previous cycles. The IRT model has changed for all cognitive and non-cognitive scales for the purpose of cross-cultural comparability (See section "Cross-country comparability" in this chapter). Categories for the number of books in the home are unchanged in PISA 2015. The ST011-items (1="yes", 2="no") were reverse-coded so that a higher level indicates the presence of the indicator. Please note that items ST011Q17- ST011Q19 represent national indicators of home possessions (see Annex E) and thus differ in meaning across countries. Item parameters were therefore allowed to vary across countries during calibration and are provided in Tables 16.7 and 16.8 for OECD countries and partner countries and economies, respectively.

Table 16.6 Scale reliabilities for Household possessions indices in partner countries and economies

	HOMEPOS	CULTPOSS	HEDRES	WEALTH	ICTRES
Albania	0.782	0.431	0.598	0.766	0.715
Algeria	0.811	0.572	0.689	0.744	0.662
Argentina	0.810	0.595	0.587	0.726	0.584
B-S-J-G (China)*	0.868	0.658	0.650	0.814	0.713
Brazil	0.832	0.515	0.586	0.797	0.660
Bulgaria	0.784	0.573	0.580	0.740	0.581
Colombia	0.863	0.575	0.584	0.817	0.727
Costa Rica	0.859	0.603	0.584	0.814	0.676
Croatia	0.744	0.623	0.463	0.656	0.470
Cyprus ¹	0.780	0.602	0.600	0.713	0.606
Dominican Republic	0.861	0.560	0.591	0.835	0.721
FYROM	0.775	0.570	0.558	0.689	0.574
Georgia	0.809	0.604	0.510	0.735	0.625
Hong Kong (China)	0.800	0.605	0.583	0.697	0.516
Indonesia	0.855	0.582	0.621	0.806	0.752
Jordan	0.848	0.624	0.709	0.798	0.699
Kazakhstan	0.794	0.564	0.598	0.701	0.514
Kosovo	0.774	0.498	0.522	0.713	0.611
Lebanon ²	0.798	0.576	0.559	0.700	0.542
Lithuania	0.775	0.635	0.504	0.696	0.515
Macao (China)	0.787	0.596	0.570	0.714	0.484
Malaysia ³	0.804	0.543	0.562	0.756	0.680
Malta	0.726	0.570	0.624	0.632	0.515
Moldova	0.823	0.566	0.609	0.779	0.681
Montenegro	0.798	0.588	0.602	0.752	0.619
Peru	0.869	0.513	0.622	0.852	0.735
Qatar	0.791	0.567	0.694	0.788	0.617
Romania	0.785	0.501	0.545	0.706	0.544
Russia	0.760	0.535	0.521	0.716	0.573
Singapore	0.795	0.627	0.614	0.704	0.558
Chinese Taipei	0.785	0.678	0.597	0.648	0.527
Thailand	0.843	0.556	0.632	0.811	0.689
Trinidad and Tobago	0.805	0.553	0.616	0.756	0.695
Tunisia	0.866	0.607	0.622	0.834	0.719
United Arab Emirates	0.795	0.592	0.636	0.791	0.593
Uruguay	0.830	0.634	0.575	0.754	0.632
Viet Nam	0.823	0.610	0.569	0.787	0.664

* B-S-J-G (China) refers to the four PISA-participating China provinces: Beijing, Shanghai, Jiangsu and Guangdong.

1. Note by Turkey: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the "Cyprus issue".

Note by all the European Union Member States of the OECD and the European Union: The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.

2. In Lebanon, item ST012Q07NA was not included.

3. In Malaysia, item ST012Q08NA was not included.



Table 16.7 Item parameters for national home possession indicators in OECD countries

	ST011Q17TA		ST011Q18TA		ST011Q19TA	
	beta	alpha	beta	alpha	beta	alpha
Australia	1.638	0.717	1.039	0.710	0.970	1.200
Austria	-0.136	1.341	-0.730	0.674	1.187	1.250
Belgium (Flemish)	0.606	0.864	0.890	1.159	0.844	1.801
Belgium (French)	-0.238	0.720	0.505	0.812	0.902	1.712
Canada	-0.715	1.250	0.858	0.869	-0.041	0.845
Chile	0.988	0.749	0.085	1.701	-0.654	1.198
Czech Republic	N/A		N/A		N/A	
Denmark	0.847	2.910	N/A		N/A	
Estonia	0.118	1.448	-0.083	1.901	0.582	1.616
Finland	-0.012	2.205	0.314	0.870	N/A	
France	-0.169	0.918	0.036	1.428	-0.230	1.423
Germany	N/A		1.443	-0.556	0.752	2.359
Greece	0.165	1.687	-0.027	1.118	0.828	1.410
Hungary	0.058	0.718	0.156	1.134	-0.025	2.355
Iceland	0.820	1.245	1.438	1.217	1.375	0.718
Ireland	-0.223	1.138	-0.186	0.812	-1.646	0.831
Israel	1.270	0.865	0.859	1.409	1.066	1.052
Italy	0.610	1.254	0.810	1.134	0.286	1.068
Japan	-0.444	1.934	-2.544	0.724	-0.170	1.010
Korea	-0.195	1.373	0.893	1.488	0.774	1.624
Latvia	-0.616	1.768	-0.371	1.258	2.291	0.497
Luxembourg	-0.645	0.617	0.584	1.317	-1.044	0.329
Mexico	0.235	1.089	-0.377	1.254	-0.479	1.362
Netherlands	0.752	0.783	1.117	2.825	0.204	1.102
New Zealand	0.271	0.893	1.686	0.854	1.603	1.307
Norway	0.084	1.875	-0.360	0.915	N/A	
Poland	0.463	1.802	-0.093	2.369	0.066	2.315
Portugal	-1.156	0.705	-0.393	1.267	1.027	1.201
Slovak Republic	0.053	1.290	-0.044	2.296	N/A	
Slovenia	-0.887	0.604	0.421	1.834	0.326	1.529
Spain	-0.350	1.588	0.348	0.716	1.115	0.867
Sweden	1.099	1.572	1.487	0.826	0.857	0.916
Switzerland	0.532	2.438	-0.736	0.630	0.003	1.416
Turkey	-0.121	1.107	-0.236	1.735	0.902	1.487
United Kingdom (excl. Scotland)	-0.938	0.442	-0.865	0.940	-0.282	1.389
United Kingdom (Scotland)	N/A		0.639	1.619	1.900	1.472
United States	0.901	0.871	-0.197	1.392	0.469	1.258

Notes:

– N/A indicates that no data on the item were available for calibration.

– Both Belgium (Flemish and French) and United Kingdom (excl. Scotland) and United Kingdom (Scotland) were treated as two separate entities each during calibration and are therefore listed twice each.

Table 16.8 Item parameters for national home possession indicators in partner countries and economies

	ST011Q17TA		ST011Q18TA		ST011Q19TA	
	beta	alpha	beta	alpha	beta	alpha
Albania	-0.898	1.362	-0.723	1.465	-1.174	1.004
Algeria	N/A		N/A		N/A	
Argentina	0.484	0.346	0.035	1.244	-1.125	1.783
Brazil	0.443	1.403	-0.063	1.230	0.782	1.493
B-S-J-G (China)	0.450	2.111	0.018	2.436	-0.082	1.335
Bulgaria	-0.282	2.199	0.001	2.175	0.236	1.363
Colombia	-0.129	1.721	N/A		-0.877	0.915
Costa Rica	-0.759	1.278	0.034	1.592	0.757	1.225
Croatia	-0.087	0.935	0.209	1.117	0.342	1.535
Cyprus*	1.123	1.046	1.760	1.340	1.031	1.370
Dominican Republic	-0.139	1.330	0.302	1.710	-0.539	1.282
FYROM	0.956	1.212	1.419	0.979	N/A	
Georgia	0.704	1.073	0.933	1.225	1.596	1.228
Hong Kong (China)	-0.090	1.255	0.660	2.111	0.672	0.796
Indonesia	0.017	1.459	-1.723	1.063	0.168	2.101
Jordan	0.219	0.916	0.017	1.281	0.117	1.650
Kazakhstan	-0.006	2.677	0.000	2.047	-0.495	1.169
Kosovo	-1.289	1.342	-0.562	1.459	0.126	1.876
Lebanon	-0.388	1.407	-0.641	1.397	-1.654	0.680
Lithuania	0.053	2.357	0.572	1.141	0.202	1.783
Macao (China)	0.651	2.051	-0.095	2.325	0.206	1.803
Malaysia	-3.237	0.737	-2.647	0.821	0.203	1.550
Malta	1.282	1.241	1.499	0.847	1.809	1.167
Moldova	-0.070	1.910	N/A		N/A	
Montenegro	-0.500	2.070	-0.122	2.063	0.010	2.284
Peru	0.310	1.438	-0.641	1.875	-0.105	2.037
Qatar	0.223	0.897	0.064	1.556	0.020	1.227
Romania	-0.759	1.192	-1.342	0.788	0.068	1.899
Russia	1.183	2.220	0.714	1.667	0.701	1.464
Singapore	-0.049	1.836	1.109	1.471	N/A	
Chinese Taipei	0.560	2.208	-0.232	1.333	-0.187	1.744
Thailand	0.238	2.405	1.625	1.304	0.180	1.981
Trinidad and Tobago	-0.559	1.159	-1.388	0.813	-0.793	0.536
Tunisia	-0.410	1.679	-0.068	1.912	-1.374	1.295
United Arab Emirates	0.185	1.389	0.205	1.297	0.157	1.432
Uruguay	-0.088	0.487	-1.176	1.585	-0.072	2.496
Viet Nam	0.087	2.643	-2.239	0.989	0.566	2.121

* See note under Table 16.6.

Note: N/A indicates that no data on the item were available for calibration.

Tables 16.9, 16.10, 16.11, 16.12 and 16.13 show the item wording, international item parameters and item fit for each of the five scales, respectively. Please note that all items of question ST011 are dichotomous, resulting in a 2PL model with only two item parameters: one referring to item difficulty (β) and one referring to item discrimination (α). No threshold parameters (d) are necessary.

Table 16.9 Item parameters for Home possessions (HOMEPOS)

Item	Description	Parameter estimates						
		beta	d_1	d_2	d_3	d_4	d_5	alpha
ST011	Which of the following are in your home?							
ST011Q01TA	A desk to study at	-0.99622						0.99603
ST011Q02TA	A room of your own	-0.81525						0.76710
ST011Q03TA	A quiet place to study	-1.13652						0.81346
ST011Q04TA	A computer you can use for school work	-0.34469						2.02990
ST011Q05TA	Educational software ¹	0.34028						0.95189
ST011Q06TA	A link to the Internet	-0.41684						2.44836
ST011Q07TA	Classic literature (e.g. <Shakespeare>)	*						*
ST011Q08TA	Books of poetry	*						*
ST011Q10TA	Books to help with your school work ²	-1.22602						0.59293
ST011Q11TA	<Technical reference books>	0.18772						0.88643
ST011Q12TA	A dictionary	-1.74582						0.70110
ST011Q16NA	Books on art, music, or design ³	-1.02696						1.25556
ST011Q17TA	<Country-specific wealth item 1>	*						*
ST011Q18TA	<Country-specific wealth item 2>	*						*
ST011Q19TA	<Country-specific wealth item 3>	*						*
ST012	How many of these are there at your home?							
ST012Q01TA	Televisions	-0.73991	1.90507	-0.71847	-1.18659			0.62294
ST012Q02TA	Cars	0.56249	0.74369	-0.05607	-0.68762			0.97934
ST012Q03TA	Rooms with a bath or shower	0.43739	1.35552	-0.41649	-0.93904			0.98154
ST012Q05NA	<Cell phones> with Internet access (e.g. smartphones)	-0.45208	0.36189	-0.50701	0.14512			0.83810
ST012Q06NA	Computers (desktop computer, portable laptop, or notebook)	0.20563	0.63235	-0.16855	-0.46379			1.69130
ST012Q07NA	<Tablet computers> (e.g. <iPad™>, <BlackBerry® PlayBook™>)	0.81206	0.48676	-0.30489	-0.18187			0.87564
ST012Q08NA	E-book readers (e.g. <Kindle™>, <Kobo>, <Bookeen>)	1.79575	-0.24104	-0.25426	0.49529			0.64692
ST012Q09NA	Musical instruments (e.g. guitar, piano)	0.88257	0.12460	-0.30754	0.18294			0.65086
ST013Q01TA	How many books are there in your home?	0.84015	0.67861	0.82937	-0.54141	-0.28625	-0.68033	0.49389

* All groups received group-specific (unique) item parameters.

1. For item ST011Q05TA, group-specific (unique) item parameters were assigned for Japan: beta = 1.08454 and alpha = 1.76169.

2. For item ST011Q10TA, group-specific (unique) item parameters were assigned for Puerto Rico: beta = 0.27360 and alpha = 1.09664.

3. For item ST011Q16NA, group-specific (unique) item parameters were assigned for Albania: beta = -1.02696 and alpha = 1.2555.

**Table 16.10 Item parameters for Family wealth (WEALTH)**

Item		Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST011Q02TA	A room of your own	-1.18794				0.59067
ST011Q06TA	A link to the Internet	-0.64913				1.85772
ST012Q01TA	Televisions	-0.79254	1.98967	-0.70424	-1.28543	0.65754
ST012Q02TA	Cars	0.56392	0.85004	-0.06279	-0.78725	0.99954
ST012Q03TA	Rooms with a bath or shower	0.42688	1.57095	-0.46515	-1.10579	0.89156
ST012Q06NA	Computers (desktop computer, portable laptop, or notebook)	0.13353	0.77663	-0.21262	-0.56402	1.32688
ST012Q07NA	<Tablet computers> (e.g. <iPad®>, <BlackBerry® PlayBook™>)	0.84143	0.57964	-0.29950	-0.28014	0.91206
ST012Q08NA	E-book readers (e.g. <Kindle™>, <Kobo>, <Bookeen>)	2.19905	-0.35458	-0.32916	0.68374	0.48155

Table 16.11 Item parameters for Cultural possessions at home (CULTPOSS)

Item		Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST011Q07TA	Classic literature (e.g. <Shakespeare>)	-0.08572				1.48509
ST011Q08TA	Books of poetry	-0.01282				1.61409
ST011Q09TA	Works of art (e.g. paintings)	-0.42053				0.73223
ST011Q16NA	Books on art, music, or design	-0.24687				0.92627
ST012Q09NA	Musical instruments (e.g. guitar, piano)	0.94172	-0.03097	-0.77936	0.81034	0.24232

Table 16.12 Item parameters for Home educational resources (HEDRES)

Item		Parameter estimates	
		beta	alpha
ST011Q01TA	A desk to study at	-0.38085	1.09535
ST011Q03TA	A quiet place to study	-0.53925	0.84215
ST011Q04TA	A computer you can use for school work	0.09232	1.74465
ST011Q05TA	Educational software	1.03471	1.03415
ST011Q10TA	Books to help with your school work	-0.36705	0.71414
ST011Q11TA	<Technical reference books>	0.84302	0.87760
ST011Q12TA	A dictionary	-1.21037	0.69196

Table 16.13 Item parameters for ICT Resources (ICTRES)

Item		Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST011Q05TA	Educational software ¹	0.02534				0.60517
ST011Q06TA	A link to the Internet	-0.95801				1.88514
ST012Q05NA	<Cell phones> with Internet access (e.g. smartphones)	-0.96009	0.52775	-0.61056	0.08281	0.70661
ST012Q06NA	Computers (desktop computer, portable laptop, or notebook)	-0.11449	0.82147	-0.19140	-0.63006	1.56852
ST012Q07NA	<Tablet computers> (e.g. <iPad®>, <BlackBerry® PlayBook™>)	0.64927	0.64903	-0.33429	-0.31474	0.80477
ST012Q08NA	E-book readers (e.g. <Kindle™>, <Kobo>, <Bookeen>)	2.16928	-0.39790	-0.37063	0.76852	0.42979

1. For item ST011Q05TA, group-specific (unique) item parameters were assigned for Japan: beta=1.12478 and alpha=1.76169.

Sense of belonging

PISA 2015 asked students about their sense of belonging to school (ST034) using six trend items previously used in PISA 2012 (ID in 2012: ST87). The answering format was a four-point Likert scale with the answering categories “strongly agree”, “agree”, “disagree”, and “strongly disagree”; the derived IRT scale is named BELONG. Items ST034Q02TA, ST034Q03TA and ST034Q05TA were reverse-coded so that higher WLEs and higher difficulty correspond to higher level of sense of belonging on all items.

Tables 16.14 and 16.15 contain the scale’s reliabilities (Cronbach’s Alpha) across all participating OECD and partner countries and economies, respectively.

Table 16.14 Scale reliabilities for BELONG in OECD countries

	BELONG
Australia	0.856
Austria	0.881
Belgium	0.795
Canada	0.850
Chile	0.839
Czech Republic	0.802
Denmark	0.862
Estonia	0.826
Finland	0.863
France	0.709
Germany	0.853
Greece	0.825
Hungary	0.848
Iceland	0.902
Ireland	0.858
Israel	N/A
Italy	0.812
Japan	0.809
Korea	0.795
Latvia	0.842
Luxembourg	0.823
Mexico	0.872
Netherlands	0.846
New Zealand	0.831
Norway	0.861
Poland	0.836
Portugal	0.830
Slovak Republic	0.808
Slovenia	0.847
Spain	0.876
Sweden	0.897
Switzerland	0.826
Turkey	0.851
United Kingdom	0.843
United States	0.857

Note: N/A indicates that the question has not been administered in the country.

Table 16.15 Scale reliabilities for BELONG in partner countries and economies

	BELONG
Albania	0.602
Algeria	0.649
Argentina	0.687
B-S-J-G (China)	0.792
Brazil	0.832
Bulgaria	0.801
Colombia	0.849
Costa Rica	0.891
Croatia	0.860
Cyprus*	0.828
Dominican Republic	0.858
FYROM	0.689
Georgia	0.665
Hong Kong (China)	0.782
Indonesia	0.597
Jordan	0.656
Kazakhstan	0.721
Kosovo	0.562
Lebanon	0.610
Lithuania	0.817
Macao (China)	0.762
Malaysia	0.759
Malta	0.768
Moldova	0.704
Montenegro	0.781
Peru	0.767
Qatar	0.776
Romania	0.695
Russia	0.834
Singapore	0.841
Chinese Taipei	0.867
Thailand	0.713
Trinidad and Tobago	0.741
Tunisia	0.579
United Arab Emirates	0.697
Uruguay	0.857
Viet Nam	0.612

* See note under Table 16.6.



Table 16.16 shows the item wording, international item parameters and item fit for BELONG.

Table 16.16 Item parameters for Sense of Belonging to School (BELONG)

Item	Thinking about your school: to what extent do you agree with the following statements?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST034Q01TA	I feel like an outsider (or left out of things) at school.	-0.00458	0.56688	0.37422	-0.94110	1.21518
ST034Q02TA	I make friends easily at school.	0.00475	1.02240	0.57396	-1.59636	0.77746
ST034Q03TA	I feel like I belong at school.	0.15553	1.14692	0.59957	-1.74650	0.61414
ST034Q04TA	I feel awkward and out of place in my school.	-0.00104	0.74923	0.34099	-1.09022	1.12698
ST034Q05TA	Other students seem to like me.	0.04790	1.35674	0.85709	-2.21383	0.66787
ST034Q06TA	I feel lonely at school.	-0.07787	0.53076	0.30405	-0.83481	1.59837

Students' dispositions for collaborative problem solving

PISA 2015 included a question on students' collaboration and teamwork dispositions relating to the test domain of collaborative problem solving (ST082). It asks students about their agreement to specific cooperative aspects on a four-point Likert scale with the answering categories "strongly agree", "agree", "disagree", and "strongly disagree". The question was used to build two scales, one on the enjoyment of co-operation (COOPERATE) including answers to items ST082Q02NA, ST082Q03NA, ST082Q08NA, and ST082Q12NA, and one on the value of co-operation (CPSVALUE) including answers to items ST082Q01NA, ST082Q09NA, ST082Q13NA and ST082Q14NA.

Tables 16.17 and 16.18 contain the two scales' reliabilities (Cronbach's Alpha) across all participating OECD and partner countries and economies, respectively.

Table 16.17 Scale reliabilities for COOPERATE and CPSVALUE in OECD countries

	COOPERATE	CPSVALUE
Australia	0.709	0.819
Austria	0.643	0.784
Belgium	0.652	0.783
Canada	0.746	0.830
Chile	0.690	0.754
Czech Republic	0.684	0.783
Denmark	0.654	0.792
Estonia	0.680	0.759
Finland	0.686	0.783
France	0.680	0.819
Germany	0.655	0.743
Greece	0.672	0.790
Hungary	0.675	0.821
Iceland	0.709	0.811
Ireland	0.671	0.833
Israel	0.726	0.754
Italy	0.607	0.791
Japan	0.683	0.794
Korea	0.700	0.822
Latvia	0.668	0.805
Luxembourg	0.695	0.821
Mexico	0.717	0.756
Netherlands	0.629	0.760
New Zealand	0.722	0.817
Norway	0.728	0.826
Poland	0.626	0.811
Portugal	0.706	0.790
Slovak Republic	0.696	0.798
Slovenia	0.661	0.767
Spain	0.685	0.753
Sweden	0.731	0.784
Switzerland	0.674	0.756
Turkey	0.698	0.565
United Kingdom	0.723	0.821
United States	0.728	0.835

Table 16.18 Scale reliabilities for COOPERATE and CPSVALUE in partner countries and economies

	COOPERATE	CPSVALUE
Albania	N/A	N/A
Algeria	N/A	N/A
Argentina	N/A	N/A
B-S-J-G (China)	0.677	0.821
Brazil	0.667	0.692
Bulgaria	0.715	0.818
Colombia	0.618	0.659
Costa Rica	0.675	0.729
Croatia	0.702	0.784
Cyprus*	0.727	0.796
Dominican Republic	0.780	0.753
FYROM	N/A	N/A
Georgia	N/A	N/A
Hong Kong (China)	0.736	0.871
Indonesia	N/A	N/A
Jordan	N/A	N/A
Kazakhstan	N/A	N/A
Kosovo	N/A	N/A
Lebanon	N/A	N/A
Lithuania	0.705	0.824
Macao (China)	0.605	0.724
Malaysia	0.578	0.767
Malta	N/A	N/A
Moldova	N/A	N/A
Montenegro	0.699	0.753
Peru	0.656	0.699
Qatar	0.730	0.738
Romania	N/A	N/A
Russia	0.692	0.795
Singapore	0.688	0.822
Chinese Taipei	0.714	0.863
Thailand	0.648	0.716
Trinidad and Tobago	N/A	N/A
Tunisia	0.593	0.787
United Arab Emirates	0.714	0.747
Uruguay	0.657	0.756
Viet Nam	N/A	N/A

* See note under Table 16.6.

Tables 16.19 and 16.20 show the actual item content, the international item parameters and item fit for each of the two scales, respectively.

Table 16.19 Item parameters for Enjoy co-operation (COOPERATE)

Item	To what extent do you disagree or agree with the following statements about yourself?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST082Q02NA	I am a good listener.	-0.15973	1.28074	0.69911	-1.97985	0.78526
ST082Q03NA	I enjoy seeing my classmates be successful.	0.00652	0.91051	0.68885	-1.59936	1.10539
ST082Q08NA	I take into account what others are interested in.	0.17180	1.12003	0.53218	-1.65221	1.27455
ST082Q12NA	I enjoy considering different perspectives.	-0.12068	1.20917	0.69511	-1.90428	0.83480

Table 16.20 Item parameters for Value co-operation (CPSVALUE)

Item	To what extent do you disagree or agree with the following statements about yourself?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST082Q01NA	I prefer working as part of a team to working alone.	0.26040	1.38266	0.42034	-1.80300	0.68975
ST082Q09NA	I find that teams make better decisions than individuals.	-0.04081	1.41758	0.28260	-1.70018	0.87040
ST082Q13NA	I find that teamwork raises my own efficiency.	0.15187	1.32041	0.21231	-1.53272	1.36366
ST082Q14NA	I enjoy cooperating with peers.	-0.32633	1.06557	0.60140	-1.66697	1.07619



Environmental awareness and optimism

PISA 2015 took up two trend questions from PISA 2006 (ID in 2006: ST22, ST24) on students' awareness of environmental matters (ENVAWARE, ST092) and their perception of environmental issues as a concern (ENVOPT, ST093). To harmonise items across the two questions, new items were added focusing on the topics of air pollution, extinction of plants and animals and water shortage for ST092, and the increase of greenhouse gases in the atmosphere and the use of genetically modified organisms for ST093. In ST092, students rated their knowledge on a four-point scale in the following categories: "I have never heard of this", "I have heard about this but I would not be able to explain what it is really about", "I know something about this and could explain the general issue", "I am familiar with this and I would be able to explain this well". For ST093, students answered on a three-point scale with the following categories: "improve", "stay about the same", and "get worse". Therefore, the ST093-items were reverse-coded so that higher WLEs and higher difficulty correspond to higher levels of environmental optimism. The derived variables ENVAWARE and ENVOPT were scaled using the IRT scaling model described above, allowing for a trend comparison between PISA 2006 and PISA 2015.

Tables 16.21 and 16.22 contain the two scales' reliabilities (Cronbach's Alpha) across all participating OECD and partner countries and economies, respectively.

Table 16.21 Scale reliabilities for ENVAWARE and ENVOPT in OECD countries

	ENVAWARE	ENVOPT
Australia	0.876	0.859
Austria	0.873	0.814
Belgium	0.862	0.861
Canada	0.877	0.874
Chile	0.862	0.899
Czech Republic	0.856	0.845
Denmark	0.854	0.767
Estonia	0.846	0.835
Finland	0.852	0.807
France	0.883	0.837
Germany	0.860	0.774
Greece	0.821	0.855
Hungary	0.854	0.872
Iceland	0.890	0.859
Ireland	0.849	0.810
Israel	0.882	0.873
Italy	0.848	0.830
Japan	0.887	0.808
Korea	0.890	0.864
Latvia	0.821	0.823
Luxembourg	0.876	0.846
Mexico	0.880	0.919
Netherlands	0.847	0.808
New Zealand	0.877	0.870
Norway	0.880	0.867
Poland	0.868	0.826
Portugal	0.894	0.904
Slovak Republic	0.875	0.894
Slovenia	0.875	0.849
Spain	0.858	0.840
Sweden	0.877	0.853
Switzerland	0.843	0.808
Turkey	0.902	0.933
United Kingdom	0.879	0.849
United States	0.871	0.865

Table 16.22 Scale reliabilities for ENVAWARE and ENVOPT in partner countries and economies

	ENVAWARE	ENVOPT
Albania	0.821	N/A
Algeria	0.780	N/A
Argentina	0.836	N/A
B-S-J-G (China)	0.860	0.880
Brazil	0.898	0.939
Bulgaria	0.904	0.914
Colombia	0.821	0.899
Costa Rica	0.877	0.911
Croatia	0.874	0.882
Cyprus*	0.856	0.905
Dominican Republic	0.878	0.927
FYROM	0.861	N/A
Georgia	0.844	N/A
Hong Kong (China)	0.868	0.876
Indonesia	0.830	N/A
Jordan	0.857	N/A
Kazakhstan	0.863	N/A
Kosovo	0.805	N/A
Lebanon	0.759	N/A
Lithuania	0.882	0.863
Macao (China)	0.846	0.838
Malaysia	0.873	0.877
Malta	0.860	N/A
Moldova	0.821	N/A
Montenegro	0.902	0.920
Peru	0.854	0.913
Qatar	0.889	0.895
Romania	0.768	N/A
Russia	0.879	0.892
Singapore	0.858	0.846
Chinese Taipei	0.903	0.863
Thailand	0.878	0.899
Trinidad and Tobago	0.826	N/A
Tunisia	0.810	0.858
United Arab Emirates	0.875	0.883
Uruguay	0.874	0.901
Viet Nam	0.749	N/A

* See note under Table 16.6..

Note: N/A indicates that the question has not been administered in the country.

Tables 16.23 and 16.24 show the actual item content, the international item parameters and item fit for each of the two scales, respectively.

Table 16.23 Item parameters for Environmental Awareness (ENVAWARE)

Item	How informed are you about the following environmental issues?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST092Q01TA	The increase of greenhouse gases in the atmosphere	0.28250	1.21751	0.03283	-1.25034	0.75505
ST092Q02TA	The use of genetically modified organisms (<GMO>)	0.92331	1.57194	-0.11008	-1.46185	0.50088
ST092Q04TA	Nuclear waste	0.41005	1.56468	-0.08269	-1.48198	0.74670
ST092Q05TA	The consequences of clearing forests for other land use	-0.15483	0.96316	0.09813	-1.06129	0.94178
ST092Q06NA	Air pollution	-0.34475	0.91931	0.14903	-1.06834	1.57386
ST092Q08NA	Extinction of plants and animals	-0.25612	1.05537	0.08030	-1.13567	1.47363
ST092Q09NA	Water shortage	-0.14049	1.05455	0.10982	-1.16437	0.93072

Table 16.24 Item parameters for Environmental optimism (ENVOPT)

Item	Do you think problems associated with the environmental issues below will improve or get worse over the next 20 years?	Parameter estimates			
		beta	d_1	d_2	alpha
ST093Q01TA	Air pollution	0.08759	0.05125	-0.05125	1.07684
ST093Q03TA	Extinction of plants and animals	0.06571	0.34506	-0.34506	1.16385
ST093Q04TA	Clearing of forests for other land use	0.13378	0.26068	-0.26068	1.17143
ST093Q05TA	Water shortages	-0.11964	0.40556	-0.40556	1.05629
ST093Q06TA	Nuclear waste	0.04693	0.46062	-0.46062	0.84528
ST093Q07NA	The increase of greenhouse gases in the atmosphere	0.10669	0.33837	-0.33837	1.21447
ST093Q08NA	The use of genetically modified organisms (<GMO>)	-0.25762	0.64808	-0.64808	0.66175

Interest in science

Interest in science was assessed with two scales, students' enjoyment of science (ST094) and their interest in broad science topics (ST095). Tables 16.25 and 16.26 contain the two scales' reliabilities (Cronbach's Alpha) across all participating OECD and partner countries and economies, respectively.



Table 16.25 Scale reliabilities for JOYSCIE and INTBRSCI in OECD countries

	JOYSCIE	INTBRSCI
Australia	0.956	0.826
Austria	0.945	0.766
Belgium	0.935	0.813
Canada	0.948	0.791
Chile	0.935	0.832
Czech Republic	0.914	0.796
Denmark	0.960	0.814
Estonia	0.930	0.756
Finland	0.945	0.831
France	0.924	0.802
Germany	0.945	0.765
Greece	0.934	0.799
Hungary	0.935	0.782
Iceland	0.970	0.894
Ireland	0.948	0.802
Israel	0.950	0.844
Italy	0.926	0.771
Japan	0.947	0.807
Korea	0.959	0.826
Latvia	0.919	0.719
Luxembourg	0.941	0.815
Mexico	0.899	0.826
Netherlands	0.953	0.820
New Zealand	0.945	0.808
Norway	0.963	0.855
Poland	0.919	0.763
Portugal	0.928	0.830
Slovak Republic	0.919	0.825
Slovenia	0.933	0.771
Spain	0.935	0.775
Sweden	0.968	0.852
Switzerland	0.934	0.766
Turkey	0.945	0.852
United Kingdom	0.949	0.821
United States	0.946	0.808

Table 16.26 Scale reliabilities for JOYSCIE and INTBRSCI in partner countries and economies

	JOYSCIE	INTBRSCI
Albania	0.883	N/A
Algeria	0.795	N/A
Argentina	0.881	N/A
B-S-J-G (China)	0.940	0.787
Brazil	0.911	0.850
Bulgaria	0.924	0.836
Colombia	0.903	0.826
Costa Rica	0.921	0.807
Croatia	0.940	0.806
Cyprus*	0.936	0.846
Dominican Republic	0.923	0.873
FYROM	0.898	N/A
Georgia	0.904	N/A
Hong Kong (China)	0.953	0.816
Indonesia	0.857	N/A
Jordan	0.884	N/A
Kazakhstan	0.912	N/A
Kosovo	0.919	N/A
Lebanon	0.823	N/A
Lithuania	0.933	0.769
Macao (China)	0.933	0.754
Malaysia	0.930	0.809
Malta	0.936	N/A
Moldova	0.818	N/A
Montenegro	0.938	0.840
Peru	0.914	0.822
Qatar	0.936	0.810
Romania	0.787	N/A
Russia	0.922	0.817
Singapore	0.956	0.765
Chinese Taipei	0.953	0.797
Thailand	0.898	0.767
Trinidad and Tobago	0.916	N/A
Tunisia	0.853	0.780
United Arab Emirates	0.929	0.794
Uruguay	0.930	0.813
Viet Nam	0.869	N/A

* See note under Table 16.6.

Note: N/A indicates that the question has not been administered in the country.

Enjoyment of science (ST094) is a trend question from PISA 2006 (ID in 2006: ST16), asking students to respond on a four-point Likert scale with the categories “strongly agree”, “agree”, “disagree”, and “strongly disagree”. The derived variable JOYSCIE was scaled using the IRT scaling model described above enabling a trend comparison between PISA 2006 and PISA 2015 at the country level. Table 16.27 shows the actual item content, the international item parameters and item fit for JOYSCIE.

Table 16.27 Item parameters for Enjoyment of science (JOYSCIE)

Item	How much do you disagree or agree with the statements about yourself below?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST094Q01NA	I generally have fun when I am learning <broad science> topics.	-0.03733	1.99379	0.44600	-2.43980	0.89314
ST094Q02NA	I like reading about <broad science>.	0.24044	2.18913	0.19370	-2.38282	0.96880
ST094Q03NA	I am happy working on <broad science> topics.	0.40009	2.32626	0.14198	-2.46825	0.83468
ST094Q04NA	I enjoy acquiring new knowledge in <broad science>.	-0.29106	1.89703	0.38915	-2.28617	1.14639
ST094Q05NA	I am interested in learning about <broad science>.	-0.17276	1.90115	0.29334	-2.19449	1.15698

A new question to assess students’ interest in science topics was developed for PISA 2015 (ST095) including topics like the biosphere, motion and forces, energy and its transformation, the Universe and its history as well as how science can help prevent disease. Students declared their interest on a five-point Likert scale with the categories “not interested”, “hardly interested”, “interested”, “highly interested”, and “I don’t know what this is”. The last category was recoded as a missing. The derived variable INTBRSCI was scaled using the IRT scaling model described above. Table 16.28 shows the actual item content, the international item parameters and item fit for INTBRSCI.

Table 16.28 Item parameters for Interest in broad science topics (INTBRSCI)

Item	To what extent are you interested in the following <broad science> topics?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST095Q04NA	Biosphere (e.g. ecosystem services, sustainability)	0.34847	1.01950	0.33721	-1.35670	0.69433
ST095Q07NA	Motion and forces (e.g. velocity, friction, magnetic and gravitational forces)	0.14145	0.88014	0.10062	-0.98076	1.41783
ST095Q08NA	Energy and its transformation (e.g. conservation, chemical reactions)	0.08373	0.84341	0.09190	-0.93531	1.86518
ST095Q13NA	The Universe and its history	-0.58932	0.52303	0.38720	-0.91023	0.49305
ST095Q15NA	How science can help us prevent disease	-0.58180	0.66498	0.45903	-1.12401	0.52962

Science learning in school

PISA 2015 focused on science learning in school by including several questions about the learning environment in the science classroom. They asked how often specific activities happened in the school science course.

The questions included the disciplinary climate in science classes (DISCLISCI , ST097), enquiry-based science teaching and learning practices (IBTEACH, ST098), teacher support in a science classes (TEACHSUP, ST100), teacher-directed science instruction (TDTEACH , ST103), perceived feedback (PERFEED, ST104), adaption of instruction (ADINST, ST107) and instrumental motivation (INSTSCIE, ST113). All of these derived variables were scaled using the IRT scaling model described above.

Tables 16.29 and 16.30 contain the seven scales’ reliabilities (Cronbach’s Alpha) across all participating OECD and partner countries and economies, respectively.



Table 16.29 Scale reliabilities for all seven indices relating to Science learning in school in OECD countries

	DISCLISCI	IBTEACH	TEACHSUP	TDTEACH	PERFEED	ADINST	INSTSCIE
Australia	0.919	0.854	0.927	0.863	0.940	0.824	0.949
Austria	0.897	0.868	0.865	0.806	0.905	0.800	0.929
Belgium	0.899	0.842	0.888	0.773	0.881	0.725	0.917
Canada	0.902	0.872	0.922	0.866	0.928	0.840	0.937
Chile	0.891	0.874	0.905	0.791	0.917	0.796	0.928
Czech Republic	0.899	0.845	0.864	0.799	0.888	0.822	0.922
Denmark	0.883	0.828	0.881	0.810	0.911	0.781	0.925
Estonia	0.903	0.840	0.895	0.805	0.906	0.770	0.876
Finland	0.906	0.832	0.905	0.841	0.929	0.815	0.933
France	0.891	0.838	0.892	0.827	0.891	0.764	0.924
Germany	0.881	0.853	0.885	0.786	0.902	0.785	0.924
Greece	0.815	0.865	0.888	0.838	0.901	0.796	0.891
Hungary	0.911	0.845	0.893	0.818	0.889	0.804	0.908
Iceland	0.899	0.892	0.919	0.846	0.941	0.842	0.955
Ireland	0.906	0.836	0.903	0.816	0.918	0.793	0.926
Israel	0.918	0.890	0.907	0.845	0.929	0.799	0.921
Italy	0.869	0.847	0.887	0.712	0.871	0.762	0.893
Japan	0.876	0.862	0.891	0.719	0.888	0.728	0.924
Korea	0.892	0.899	0.914	0.834	0.943	0.841	0.950
Latvia	0.892	0.825	0.871	0.793	0.896	0.705	0.887
Luxembourg	0.907	0.868	0.882	0.840	0.923	0.781	0.925
Mexico	0.833	0.872	0.895	0.802	0.921	0.806	0.915
Netherlands	0.875	0.864	0.868	0.702	0.909	0.771	0.948
New Zealand	0.918	0.866	0.920	0.859	0.934	0.826	0.943
Norway	0.899	0.877	0.922	0.834	0.940	0.809	0.929
Poland	0.894	0.873	0.910	0.835	0.903	0.812	0.913
Portugal	0.911	0.885	0.930	0.887	0.941	0.876	0.958
Slovak Republic	0.898	0.872	0.885	0.817	0.893	0.784	0.899
Slovenia	0.905	0.881	0.875	0.850	0.923	0.825	0.911
Spain	0.892	0.848	0.906	0.729	0.910	0.808	0.937
Sweden	0.898	0.896	0.930	0.877	0.943	0.855	0.923
Switzerland	0.888	0.848	0.871	0.825	0.913	0.767	0.924
Turkey	0.892	0.893	0.915	0.800	0.911	0.814	0.902
United Kingdom	0.919	0.856	0.918	0.835	0.933	0.838	0.933
United States	0.904	0.890	0.918	0.872	0.944	0.833	0.925

Table 16.30 Scale reliabilities for all seven indices relating to Science learning in school in partner countries and economies

	DISCLISCI	IBTEACH	TEACHSUP	TDTEACH	PERFEED	ADINST	INSTSCIE
Albania	0.804	0.756	0.782	0.648	0.865	N/A	0.822
Algeria	0.746	0.763	0.788	0.790	0.753	N/A	0.795
Argentina	0.823	0.824	0.856	0.763	0.859	N/A	0.868
B-S-J-G (China)	0.890	0.898	0.880	0.858	0.913	0.781	0.901
Brazil	0.884	0.870	0.902	0.842	0.886	0.793	0.889
Bulgaria	0.890	0.892	0.884	0.873	0.912	0.824	0.895
Colombia	0.821	0.839	0.877	0.743	0.900	0.720	0.885
Costa Rica	0.842	0.853	0.890	0.759	0.921	0.791	0.923
Croatia	0.890	0.881	0.881	0.851	0.918	0.814	0.921
Cyprus*	0.853	0.879	0.901	0.880	0.914	0.810	0.897
Dominican Republic	0.834	0.839	0.875	0.827	0.890	0.758	0.920
FYROM	0.828	0.831	0.843	0.784	0.857	N/A	0.845
Georgia	0.819	0.813	0.802	0.746	0.863	N/A	0.851
Hong Kong (China)	0.925	0.906	0.928	0.847	0.941	0.844	0.951
Indonesia	0.775	0.769	0.684	0.690	0.791	N/A	0.876
Jordan	0.826	0.857	0.879	0.851	0.854	N/A	0.830
Kazakhstan	0.778	0.816	0.788	0.822	0.864	N/A	0.916
Kosovo	0.784	0.772	0.756	0.840	0.823	N/A	0.857
Lebanon	0.773	0.762	0.780	0.758	0.835	N/A	0.756
Lithuania	0.925	0.861	0.900	0.871	0.928	0.773	0.900
Macao (China)	0.856	0.842	0.897	0.825	0.904	0.740	0.900
Malaysia	0.849	0.837	0.877	0.854	0.905	0.782	0.903
Malta	0.886	0.819	0.910	0.791	0.904	N/A	0.923
Moldova	0.777	0.738	0.780	0.757	0.821	N/A	0.852
Montenegro	0.888	0.920	0.928	0.884	0.925	0.830	0.898
Peru	0.841	0.867	0.879	0.834	0.877	0.736	0.878
Qatar	0.897	0.903	0.908	0.882	0.915	0.810	0.895
Romania	0.776	0.764	0.785	0.563	0.743	N/A	0.826
Russia	0.906	0.882	0.884	0.839	0.905	0.769	0.895
Singapore	0.889	0.865	0.914	0.851	0.933	0.828	0.906
Chinese Taipei	0.912	0.902	0.914	0.874	0.931	0.837	0.944
Thailand	0.847	0.897	0.908	0.894	0.882	0.813	0.852
Trinidad and Tobago	0.839	0.807	0.895	0.815	0.903	N/A	0.905
Tunisia	0.800	0.860	0.877	0.841	0.846	0.723	0.840
United Arab Emirates	0.885	0.896	0.909	0.864	0.917	0.816	0.899
Uruguay	0.889	0.869	0.910	0.779	0.903	0.776	0.908
Viet Nam	0.683	0.778	0.730	0.719	0.756	N/A	0.796

* See note under Table 16.6.

Note: N/A indicates that the question has not been administered in the country.

For ST097, students responded on a four-point Likert scale with the categories “every lesson”, “most lessons”, “some lessons” and “never or hardly ever”. Table 16.31 shows the item wording, international item parameters and item fit for DISCLISCI.

Table 16.31 Item parameters for Disciplinary climate in science classes (DISCLISCI)

Item	To what extent are you interested in the following <broad science> topics?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST097Q01TA	Students don't listen to what the teacher says.	0.19029	1.25309	0.51737	-1.77046	0.94803
ST097Q02TA	There is noise and disorder.	0.19407	1.22680	0.34986	-1.57666	1.29726
ST097Q03TA	The teacher has to wait a long time for students to quiet down.	-0.00888	1.07093	0.31662	-1.38755	1.14809
ST097Q04TA	Students cannot work well.	-0.33810	1.08205	0.48490	-1.56696	0.79547
ST097Q05TA	Students don't start working for a long time after the lesson begins.	-0.18866	0.99587	0.37880	-1.37468	0.81114

For ST098, students responded on a four-point Likert scale with the categories “in all lessons”, “in most lessons”, “in some lessons”, “never or hardly ever”. Therefore, the ST098-items were reverse-coded so that higher WLEs and higher difficulty correspond to higher levels enquiry-based science teaching and learning practices. Table 16.32 shows the item wording, international item parameters and item fit for IBTEACH.

Table 16.32 Item parameters for Inquiry-based science teaching and learning practices (IBTEACH)

Item	When learning <school science> topics at school, how often do the following activities occur?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST098Q01TA	Students are given opportunities to explain their ideas.	-0.83337	0.97787	-0.23677	-0.74110	0.67430
ST098Q02TA	Students spend time in the laboratory doing practical experiments.	0.46050	1.06306	-0.49034	-0.57272	0.80028
ST098Q03NA	Students are required to argue about science questions.	0.08387	0.81230	-0.19579	-0.61652	1.17948
ST098Q05TA	Students are asked to draw conclusions from an experiment they have conducted.	-0.10179	0.89409	-0.17404	-0.72005	1.10195
ST098Q06TA	The teacher explains how a <school science> idea can be applied to a number of different phenomena (e.g. the movement of objects, substances with similar properties).	-0.50277	1.01857	-0.16747	-0.85110	0.86825
ST098Q07TA	Students are allowed to design their own experiments.	0.46842	0.46246	-0.15807	-0.30440	1.05809
ST098Q08NA	There is a class debate about investigations.	0.23539	0.67936	-0.16805	-0.51131	1.19736
ST098Q09TA	The teacher clearly explains the relevance of <broad science> concepts to our lives.	-0.36377	0.89348	-0.20540	-0.68808	0.87390

For ST100, students responded on a four-point Likert scale with the categories “every lesson”, “most lessons”, “some lessons” and “never or hardly ever”. As a result, the responses had to be reverse-coded so that higher WLEs and higher difficulty correspond to higher levels of teacher support in science classes. Table 16.33 shows the item wording, international item parameters and item fit for TEACHSUP.

Table 16.33 Item parameters for Teacher support in a science classes (TEACHSUP)

Item	How often do these things happen in your <school science> lessons?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST100Q01TA	The teacher shows an interest in every student's learning.	-0.00750	1.26155	-0.08523	-1.17632	0.77330
ST100Q02TA	The teacher gives extra help when students need it.	-0.03532	1.25157	-0.04839	-1.20318	1.09980
ST100Q03TA	The teacher helps students with their learning.	-0.01039	1.10086	-0.02113	-1.07973	1.32146
ST100Q04TA	The teacher continues teaching until the students understand.	0.04437	1.13059	-0.07816	-1.05242	1.01506
ST100Q05TA	The teacher gives students an opportunity to express opinions.	0.01687	1.22992	-0.10423	-1.12570	0.79038

For ST103, students responded on a four-point Likert scale with the categories “never or almost never”, “some lessons”, “many lessons”, and “every lesson or almost every lesson”. Table 16.34 shows the item wording, international item parameters and item fit for TDTEACH.

Table 16.34 Item parameters for Teacher-directed science instruction (TDTEACH)

Item	How often do these things happen in your lessons for this <school science> course?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST103Q01NA	The teacher explains scientific ideas.	-0.12171	1.31470	-0.29502	-1.01968	0.82588
ST103Q03NA	A whole class discussion takes place with the teacher.	0.27343	1.26280	-0.21721	-1.04559	0.79269
ST103Q08NA	The teacher discusses our questions.	-0.02685	1.09781	-0.07651	-1.02130	1.32030
ST103Q11NA	The teacher demonstrates an idea.	-0.07612	1.16753	-0.12307	-1.04446	1.06113



For ST104, students responded on a four-point Likert scale with the categories “never or almost never”, “some lessons”, “many lessons”, and “every lesson or almost every lesson”. Table 16.35 shows the item wording, international item parameters and item fit for PERFEED.

Table 16.35 Item parameters for Perceived Feedback (PERFEED)

Item	How often do these things happen in your lessons for this <school science> course?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST104Q01NA	The teacher tells me how I am performing in this course.	0.12621	2.18594	-0.46816	-1.71778	0.58887
ST104Q02NA	The teacher gives me feedback on my strengths in this <school science> subject.	0.29760	1.68041	-0.15019	-1.53023	0.89077
ST104Q03NA	The teacher tells me in which areas I can still improve.	0.02181	1.64021	-0.11011	-1.53010	1.23510
ST104Q04NA	The teacher tells me how I can improve my performance.	-0.16677	1.66298	-0.14453	-1.51845	1.28301
ST104Q05NA	The teacher advises me on how to reach my learning goals.	-0.15203	1.56291	-0.15248	-1.41044	1.00225

For ST107, students responded on a four-point Likert scale with the categories “never or almost never”, “some lessons”, “many lessons”, and “every lesson or almost every lesson”. Table 16.36 shows the item wording, international item parameters and item fit for ADINST.

Table 16.36 Item parameters for Adaption of instruction (ADINST)

Item	How often do these things happen in your lessons for this <school science> course?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST107Q01NA	The teacher adapts the lesson to my class’s needs and knowledge.	-0.00130	1.32590	-0.14690	-1.17900	0.99511
ST107Q02NA	The teacher provides individual help when a student has difficulties understanding a topic or task.	-0.15312	1.33032	-0.14904	-1.18128	1.05697
ST107Q03NA	The teacher changes the structure of the lesson on a topic that most students find difficult to understand.	0.17210	1.21377	-0.08922	-1.12455	0.94792

For ST113, students responded on a four-point Likert scale with the categories “strongly agree”, “agree”, “disagree”, and “strongly disagree”. Therefore, the responses had to be reverse-coded so that higher WLEs and higher difficulty correspond to higher levels of instrumental motivation. INSTSCIE was used in PISA 2006 (ID in 2006: ST35) and thus allows for a trend comparison between PISA 2006 and PISA 2015. Table 16.37 shows the item wording, international item parameters and item fit for INSTSCIE.

Table 16.37 Item parameters for Instrumental motivation (INSTSCIE)

Item	How much do you agree with the statements below?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST113Q01TA	Making an effort in my <school science> subject(s) is worth it because this will help me in the work I want to do later on.	-0.12727	1.84275	0.31828	-2.16103	0.94547
ST113Q02TA	What I learn in my <school science> subject(s) is important for me because I need this for what I want to do later on.	0.11242	1.91144	0.17816	-2.08960	1.28323
ST113Q03TA	Studying my <school science> subject(s) is worthwhile for me because what I learn will improve my career prospects.	0.01054	1.95128	0.23715	-2.18843	1.13179
ST113Q04TA	Many things I learn in my <school science> subject(s) will help me to get a job.	0.17985	2.01656	0.21798	-2.23454	0.86955

Students’ motivation

New questions were developed for PISA 2015 addressing test anxiety (ANXTEST, ST118) and achievement motivation (MOTIVAT, ST119). Students gave statements about themselves on a four-point Likert scale with the answering categories “strongly agree”, “agree”, “disagree”, and “strongly disagree”. Tables 16.38 and 16.39 contain the scales’ reliabilities (Cronbach’s Alpha) across all participating OECD and partner countries and economies, respectively.

Table 16.38 Scale reliabilities for ANXTEST and MOTIVAT in OECD countries

	ANXTEST	MOTIVAT
Australia	0.852	0.845
Austria	0.829	0.790
Belgium	0.835	0.786
Canada	0.856	0.846
Chile	0.796	0.807
Czech Republic	0.822	0.768
Denmark	0.829	0.841
Estonia	0.830	0.797
Finland	0.808	0.834
France	0.831	0.783
Germany	0.802	0.795
Greece	0.750	0.734
Hungary	0.820	0.788
Iceland	0.895	0.838
Ireland	0.820	0.816
Israel	0.802	0.828
Italy	0.813	0.758
Japan	0.803	0.836
Korea	0.856	0.852
Latvia	0.812	0.797
Luxembourg	0.835	0.820
Mexico	0.803	0.717
Netherlands	0.833	0.753
New Zealand	0.846	0.864
Norway	0.872	0.843
Poland	0.839	0.768
Portugal	0.817	0.779
Slovak Republic	0.822	0.798
Slovenia	0.816	0.795
Spain	0.730	0.773
Sweden	0.856	0.830
Switzerland	0.826	0.780
Turkey	0.825	0.840
United Kingdom	0.849	0.834
United States	0.837	0.855

Table 16.39 Scale reliabilities for ANXTEST and MOTIVAT in partner countries and economies

	ANXTEST	MOTIVAT
Albania	N/A	N/A
Algeria	N/A	N/A
Argentina	N/A	N/A
B-S-J-G (China)	0.824	0.780
Brazil	0.716	0.667
Bulgaria	0.841	0.825
Colombia	0.617	0.662
Costa Rica	0.711	0.698
Croatia	0.813	0.773
Cyprus*	0.799	0.798
Dominican Republic	0.705	0.717
FYROM	N/A	N/A
Georgia	N/A	N/A
Hong Kong (China)	0.872	0.831
Indonesia	N/A	N/A
Jordan	N/A	N/A
Kazakhstan	N/A	N/A
Kosovo	N/A	N/A
Lebanon	N/A	N/A
Lithuania	0.830	0.827
Macao (China)	0.845	0.770
Malaysia	0.730	0.845
Malta	N/A	N/A
Moldova	N/A	N/A
Montenegro	0.846	0.804
Peru	0.654	0.695
Qatar	0.780	0.872
Romania	N/A	N/A
Russia	0.814	0.814
Singapore	0.827	0.827
Chinese Taipei	0.839	0.812
Thailand	0.837	0.753
Trinidad and Tobago	N/A	N/A
Tunisia	0.713	0.782
United Arab Emirates	0.762	0.850
Uruguay	0.741	0.729
Viet Nam	N/A	N/A

* See note under Table 16.6.

Note: N/A indicates that the question has not been administered in the country.



Tables 16.40 and 16.41 show the item wording, international item parameters and item fit for ANXTEST and MOTIVAT, respectively.

Table 16.40 Item parameters for Test Anxiety (ANXTEST)

Item	To what extent do you disagree or agree with the following statements about yourself?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST118Q01NA	I often worry that it will be difficult for me taking a test.	-0.05038	1.16536	0.18421	-1.34957	1.16699
ST118Q02NA	I worry that I will get poor <grades> at school.	-0.30152	1.01826	0.22357	-1.24184	1.00140
ST118Q03NA	Even if I am well prepared for a test I feel very anxious.	-0.01720	1.00922	0.13716	-1.14639	1.15496
ST118Q04NA	I get very tense when I study for a test.	0.36492	1.19985	-0.05589	-1.14396	0.96393
ST118Q05NA	I get nervous when I don't know how to solve a task at school.	0.04046	1.16225	0.08846	-1.25071	0.71272

Table 16.41 Item parameters for Achievement motivation (MOTIVAT)

Item	To what extent do you disagree or agree with the following statements about yourself?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST119Q01NA	I want top <grades> in most or all of my courses.	-0.15045	1.04968	0.19424	-1.24392	1.25562
ST119Q02NA	I want to be able to select from among the best opportunities available when I graduate.	-0.59253	0.73268	0.61224	-1.34492	1.03250
ST119Q03NA	I want to be the best, whatever I do.	0.18966	1.25665	-0.03152	-1.22513	1.07198
ST119Q04NA	I see myself as an ambitious person.	0.14552	1.75488	0.37566	-2.13054	0.43402
ST119Q05NA	I want to be one of the best students in my class.	0.44301	1.18145	0.03728	-1.21872	1.20588

Parental support

Students were asked about their perceived emotional support from their parents using a newly developed question (ST123) that used a four-point Likert scale with the answering categories “strongly agree”, “agree”, “disagree”, and “strongly disagree”. It included items on whether parents are interested in school activities, support the students’ educational efforts and achievements, support students when they are facing difficulties at school and encourage them to be confident. The derived variable EMOSUPS was scaled using the IRT scaling model described above.

Tables 16.42 and 16.43 contain the scales’ reliabilities (Cronbach’s Alpha) across all participating OECD and partner countries and economies, respectively.

Table 16.42 Scale reliabilities for the Parental support index in OECD countries

	EMOSUPS
Australia	0.868
Austria	0.794
Belgium	0.831
Canada	0.872
Chile	0.912
Czech Republic	0.801
Denmark	0.877
Estonia	0.850
Finland	0.894
France	0.840
Germany	0.820
Greece	0.784
Hungary	0.813
Iceland	0.911
Ireland	0.880
Israel	N/A
Italy	0.789
Japan	0.855
Korea	0.889
Latvia	0.861
Luxembourg	0.850
Mexico	0.925
Netherlands	0.847
New Zealand	0.894
Norway	0.888
Poland	0.836
Portugal	0.856
Slovak Republic	0.853
Slovenia	0.761
Spain	0.847
Sweden	0.880
Switzerland	0.825
Turkey	0.856
United Kingdom	0.884
United States	0.871

Note: N/A indicates that the question has not been administered in the country.

Table 16.43 Scale reliabilities for the Parental support index in partner countries and economies

	EMOSUPS
Albania	N/A
Algeria	N/A
Argentina	N/A
B-S-J-G (China)	0.788
Brazil	0.818
Bulgaria	0.844
Colombia	0.863
Costa Rica	0.889
Croatia	0.797
Cyprus*	0.830
Dominican Republic	0.882
FYROM	N/A
Georgia	N/A
Hong Kong (China)	0.804
Indonesia	N/A
Jordan	N/A
Kazakhstan	N/A
Kosovo	N/A
Lebanon	N/A
Lithuania	0.850
Macao (China)	0.813
Malaysia	0.731
Malta	N/A
Moldova	N/A
Montenegro	0.762
Peru	0.822
Qatar	0.867
Romania	N/A
Russia	0.806
Singapore	0.851
Chinese Taipei	0.851
Thailand	0.771
Trinidad and Tobago	N/A
Tunisia	0.731
United Arab Emirates	0.816
Uruguay	0.867
Viet Nam	N/A

* See note under Table 16.6.

Note: N/A indicates that the question has not been administered in the country.

Table 16.44 shows the item wording, international item parameters and item fit for EMOSUPS.

Table 16.44 Item parameters for Parents emotional support (EMOSUPS)

Item	Thinking about the <this academic year>: to what extent do you agree or disagree with the following statements?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST123Q01NA	My parents are interested in my school activities.	-0.06068	0.94571	0.96986	-1.91557	0.74465
ST123Q02NA	My parents support my educational efforts and achievements.	-0.14486	0.96658	0.69472	-1.66130	1.15171
ST123Q03NA	My parents support me when I am facing difficulties at school.	0.13633	1.13270	0.53417	-1.66687	1.14779
ST123Q04NA	My parents encourage me to be confident.	0.05811	0.99182	0.60103	-1.59285	0.95585

Science-related dispositions

Three questions were included to measure science-related dispositions: Science self-efficacy (ST129), epistemological beliefs about science (ST131), and students' science activities (ST146). Tables 16.45 and 16.46 contain the scales' reliabilities (Cronbach's Alpha) across all participating OECD and partner countries and economies, respectively.



Table 16.45 Scale reliabilities for indices on Science related dispositions in OECD countries

	SCIEEFF	EPIST	SCIEACT
Australia	0.907	0.900	0.912
Austria	0.880	0.877	0.908
Belgium	0.880	0.863	0.912
Canada	0.898	0.907	0.924
Chile	0.884	0.900	0.915
Czech Republic	0.859	0.860	0.918
Denmark	0.879	0.912	0.891
Estonia	0.865	0.864	0.904
Finland	0.889	0.903	0.921
France	0.887	0.863	0.909
Germany	0.879	0.850	0.911
Greece	0.865	0.805	0.928
Hungary	0.879	0.834	0.937
Iceland	0.936	0.938	0.915
Ireland	0.873	0.817	0.886
Israel	0.889	0.891	0.946
Italy	0.859	0.840	0.911
Japan	0.913	0.902	0.906
Korea	0.933	0.932	0.931
Latvia	0.828	0.859	0.907
Luxembourg	0.891	0.867	0.923
Mexico	0.885	0.874	0.912
Netherlands	0.895	0.864	0.905
New Zealand	0.901	0.879	0.910
Norway	0.921	0.910	0.926
Poland	0.861	0.883	0.890
Portugal	0.909	0.899	0.925
Slovak Republic	0.892	0.882	0.937
Slovenia	0.863	0.869	0.914
Spain	0.886	0.880	0.911
Sweden	0.915	0.918	0.927
Switzerland	0.880	0.860	0.909
Turkey	0.892	0.919	0.941
United Kingdom	0.902	0.896	0.902
United States	0.900	0.919	0.927

Table 16.46 Scale reliabilities for indices on Science related dispositions in partner countries and economies

	SCIEEFF	EPIST	SCIEACT
Albania	0.822	0.695	N/A
Algeria	0.734	0.707	N/A
Argentina	0.838	0.854	N/A
B-S-J-G (China)	0.891	0.857	0.922
Brazil	0.904	0.873	0.938
Bulgaria	0.888	0.887	0.925
Chinese Taipei	0.917	0.934	0.915
Colombia	0.877	0.858	0.912
Costa Rica	0.888	0.895	0.920
Croatia	0.884	0.876	0.922
Cyprus*	0.904	0.875	0.941
Dominican Republic	0.895	0.913	0.936
FYROM	0.860	0.806	N/A
Georgia	0.835	0.823	N/A
Hong Kong (China)	0.915	0.921	0.937
Indonesia	0.835	0.683	N/A
Jordan	0.840	0.853	N/A
Kazakhstan	0.858	0.829	N/A
Kosovo	0.840	0.790	N/A
Lebanon	0.755	0.731	N/A
Lithuania	0.875	0.906	0.922
Macao (China)	0.887	0.850	0.902
Malaysia	0.888	0.833	0.918
Malta	0.873	0.828	N/A
Moldova	0.815	0.751	N/A
Montenegro	0.906	0.897	0.931
Peru	0.854	0.884	0.909
Qatar	0.898	0.897	0.934
Romania	0.789	0.713	N/A
Russia	0.899	0.882	0.928
Singapore	0.883	0.883	0.917
Thailand	0.885	0.866	0.913
Trinidad and Tobago	0.841	0.832	N/A
Tunisia	0.846	0.798	0.879
United Arab Emirates	0.886	0.874	0.925
Uruguay	0.889	0.911	0.926
Viet Nam	0.782	0.685	N/A

* See note under Table 16.6.

Note: N/A indicates that the question has not been administered in the country.

Science self-efficacy (ST129) is a trend question that was taken from PISA 2006 (ID in 2006: ST17). Students were asked to rate how they would perform in different science tasks, using a four-point answering scale with the categories “I could do this easily”, “I could do this with a bit of effort”, “I would struggle to do this on my own”, and “I couldn’t do this”. As a result, the responses had to be reverse-coded so that higher WLEs and higher difficulty correspond to higher levels of science self-efficacy. The derived variable SCIEEFF was scaled using the IRT scaling model described above, thus allowing for a trend comparison between PISA 2006 and PISA 2015. Table 16.47 shows the item wording, international item parameters and item fit for SCIEEFF.

Table 16.47 Item parameters for Science self-efficacy (SCIEEFF)

Item	How easy do you think it would be for you to perform the following tasks on your own?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST129Q01TA	Recognise the science question that underlies a newspaper report on a health issue.	-0.16940	0.98685	0.30908	-1.29594	0.93845
ST129Q02TA	Explain why earthquakes occur more frequently in some areas than in others.	-0.27092	0.83348	0.16974	-1.00323	0.92431
ST129Q03TA	Describe the role of antibiotics in the treatment of disease.	0.06516	0.88992	0.10362	-0.99354	1.00384
ST129Q04TA	Identify the science question associated with the disposal of garbage.	0.00601	0.93480	0.13846	-1.07326	1.04883
ST129Q05TA	Predict how changes to an environment will affect the survival of certain species.	-0.03415	0.82526	0.13232	-0.95758	1.13443
ST129Q06TA	Interpret the scientific information provided on the labelling of food items.	-0.04337	0.91786	0.12501	-1.04287	0.98109
ST129Q07TA	Discuss how new evidence can lead you to change your understanding about the possibility of life on Mars.	0.28023	0.80702	0.13201	-0.93903	0.97553
ST129Q08TA	Identify the better of two explanations for the formation of acid rain.	0.14654	0.78166	0.13256	-0.91422	0.99352

Epistemological beliefs about science were measured with a new question about students’ views on scientific approaches (ST131). Students answered on a four-point Likert scale with the answering categories “strongly agree”, “agree”, “disagree”, and “strongly disagree”. The derived variable EPIST was scaled using the IRT scaling model described above. Table 16.48 shows the item wording, international item parameters and item fit for EPIST.

Table 16.48 Item parameters for Epistemological beliefs (EPIST)

Item	How much do you disagree or agree with the statements below?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST131Q01NA	A good way to know if something is true is to do an experiment.	0.00900	0.69269	1.00678	-1.69947	0.83989
ST131Q03NA	Ideas in <broad science> sometimes change.	0.12064	1.37107	0.58817	-1.95924	1.11811
ST131Q04NA	Good answers are based on evidence from many different experiments.	-0.11558	1.01482	0.58431	-1.59913	1.16975
ST131Q06NA	It is good to try experiments more than once to make sure of your findings.	-0.19914	0.95392	0.54680	-1.50072	1.06412
ST131Q08NA	Sometimes <broad science> scientists change their minds about what is true in science.	0.11261	1.37343	0.58717	-1.96059	0.96138
ST131Q11NA	The ideas in <broad science> science books sometimes change.	0.11386	1.39472	0.60798	-2.00270	0.84676

Another trend question from PISA 2006 (ID in 2006: ST19) addressed students’ science activities (ST146). Students were asked how often they engaged in science-related activities on a four-point scale with the answering categories “very often”, “regularly”, “sometimes”, and “never or hardly ever”. Therefore, the responses had to be reverse-coded so that higher WLEs and higher difficulty correspond to higher levels of students’ science activities. The derived variable SCIEACT was scaled using the IRT scaling model described above, thus allowing for a trend comparison between PISA 2006 and PISA 2015. Table 16.49 shows the item wording, international item parameters and item fit for SCIEACT.

Table 16.49 Item parameters for Science activities (SCIEACT)

Item	How often do you do these things?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
ST146Q01TA	Watch TV programmes about <broad science>	-0.75036	1.87968	-0.83248	-1.04720	0.64488
ST146Q02TA	Borrow or buy books on <broad science> topics	-0.01962	1.10537	-0.35079	-0.75459	1.10371
ST146Q03TA	Visit web sites about <broad science> topics	-0.17128	1.23499	-0.44357	-0.79142	0.72994
ST146Q04TA	Read <broad science> magazines or science articles in newspapers	-0.37920	1.26074	-0.38471	-0.87602	0.85784
ST146Q05TA	Attend a <science club>	0.45931	0.42171	-0.06008	-0.36164	0.83529
ST146Q06NA	Simulate natural phenomena in computer programs/virtual labs	0.16648	0.82516	-0.11161	-0.71355	1.50118
ST146Q07NA	Simulate technical processes in computer programs/virtual labs	0.15594	0.78812	-0.12517	-0.66295	1.43343
ST146Q08NA	Visit web sites of ecology organisations	0.07336	0.98205	-0.22220	-0.75984	1.14309
ST146Q09NA	Follow news of science, environmental, or ecology organizations via blogs and microblogging	-0.05048	0.96640	-0.24713	-0.71927	0.86875



SCHOOL QUESTIONNAIRE DERIVED VARIABLES

The PISA 2015 School Questionnaire consisted mainly of trend questions used in previous cycles. As the major domain of the 2015 cycles was once again science, some scales focused on science-specific aspects of learning context on a school level. However, no trend scales were reported in both 2006 and 2015 cycles. All derived variables are shown in Table 16.50 and described below. Simple questionnaire indices are preceded by those that are based on IRT scaling.

Table 16.50 Derived variables in the PISA 2015 School Questionnaire

DV Name	Description	Question no.	Trend to PISA 2006	IRT scaling
SCHSIZE	School Size	SC002		
CLSIZE	Class Size	SC003		
RATCMP1	Index of computer availability	SC004		
RATCMP2	Index of computers connected to the Internet	SC004		
LEAD	Educational leadership	SC009		YES
LEADCOM	Curricular development	SC009		YES
LEADINST	Instructional leadership	SC009		YES
LEADPD	Professional development	SC009		YES
LEADTCH	Teachers participation	SC009		YES
RESPCUR	Responsibility for curriculum	SC010		
RESPRES	Responsibility for resources	SC010		
SCHAUT	School autonomy	SC010		
TEACHPART	Teacher participation	SC010		
SCHLTYPE	School Ownership	SC013, SC016		
EDUSHORT	Shortage of educational material	SC017		YES
STAFFSHORT	Shortage of educational staff	SC017		YES
PROAT5AB	Proportion of all teachers ISCED LEVEL 5A Bachelor	SC018		
PROAT5AM	Proportion of all teachers ISCED LEVEL 5A Master	SC018		
PROAT6	Proportion of all teachers ISCED LEVEL 6	SC018		
PROATCE	Proportion of all teachers fully certified	SC018		
TOTAT	Total number of all teachers at school	SC018		
STRATIO	Student teacher ratio	SC018, SC002		
PROSTAT	Proportion of science teachers by all teachers	SC018, SC019		
PROSTCE	Proportion of science teachers fully certified	SC019		
PROSTMAS	Proportion of science teachers with ISCED level 5A and a major in science	SC019		
TOTST	Total number of science teachers at school	SC019		
CREACTIV	Creative extra-curricular activities	SC053		
SCIERES	Science specific resources	SC059		
STUBEHA	Student-related factors affecting school climate	SC061		YES
TEACHBEHA	Teacher-related factors affecting school climate	SC061		YES

Simple questionnaire indices

School size

The index of school size (SCHSIZE) contains the total enrolment at school. It is based on the enrolment data provided by the school principal, summing the number of girls and boys at a school (SC002). This index was calculated in 2015 and in all previous cycles.

Class size

The average class size (CLSIZE) is derived from one of nine possible categories in question SC003, ranging from “15 students or fewer” to “More than 50 students”.

Availability of computers

School principals were asked to report the number of computers available at school (SC004). The index of availability of computers (RATCMP1) is the ratio of computers available to 15-year olds for educational purposes to the total number of students in the modal grade for 15-year olds. The index RATCMP2 was calculated as the ratio of number of computers available to 15-year olds for educational purposes to the number of these computers that were connected to the internet.

A new index was built in 2015 to reflect the schools’ science-specific resources (SCIERES). It was constructed by summing up the principals’ answers to SC059 (yes/no question).



School responsibility

As in previous cycles, school responsibility for curriculum and resources as well as school autonomy and teacher participation was addressed in question SC010. An index of the relative level of responsibility of school staff in allocating resources (RESPRES) was derived from six items of the school principals' report regarding who had considerable responsibility for tasks related to resource allocation ("selecting teachers for hire", "firing teachers", "establishing teachers' starting salaries", "determining teachers' salary increases", "formulating the school budget", "deciding on budget allocations within the school"). The index was calculated on the basis of the ratio of "yes" responses for school governing board, principal or teachers to "yes" responses for regional/local education authority or national educational authority. Higher values on the scale indicated relatively higher levels of school responsibility in this area. The index was standardised to having an OECD mean of '0' and a standard deviation of '1' for the pooled data set with equally weighted country samples. This index was also created in the 2006, 2009 and 2012 PISA cycles.

An index of the relative level of responsibility of school staff in issues relating to curriculum and assessment (RESPCUR) was computed from the school principal's report regarding who had responsibility for four aspects of curriculum and assessment, namely "establishing student assessment policies", "choosing which textbooks are used", "determining course content", and "deciding which courses are offered". The index was calculated on the basis of the ratio of "yes" responses for school governing board, principal or teachers on the one hand to "yes" responses for regional/local education authority or national educational authority on the other hand. Higher values indicated relatively higher levels of school responsibility in this area. The index was standardised to having an OECD mean of '0' and a standard deviation of '1' for the pooled data with equally weighted country samples). This index was also created in all previous PISA cycles, although in PISA 2009 the variable name was RESPCURR.

School type

Schools are classified as either public or private according to whether a private entity or a public agency has the ultimate power for decision making concerning its affairs. As in previous PISA surveys, the index on school type (SCHLTYPE) has three categories, based on two questions: SC013 asks if the school is a public or a private school, SC016 asks about the source of resources. This index was calculated in 2015 and in all previous cycles. In 2009 the variable name was SCHTYPE.

Quantity of teaching staff at school

Principals were asked to report the total number of teachers at their school (TOTAT) and provide additional information on how many of the staff was full-time and part-time employed teachers qualified at different ISCED levels (SC018).

The proportion of fully certified teachers (PROATCE) was computed by dividing the number of fully certified teachers by the total number of teachers.

The proportion of teachers with an ISCED 5A bachelor qualification (PROAT5AB) was calculated by dividing the number of these teachers by the total number of teachers.

The proportion of teachers with an ISCED 5A master qualification (PROAT5AM) was calculated by dividing the number of these teachers by the total number of teachers.

The proportion of teachers with an ISCED level 6 qualification (PROAT6) was calculated by dividing the number of these teachers by the total number of teachers.

The student-teacher ratio (STRATIO) was obtained by dividing the number of enrolled students (SC002) by the total number of teachers (TOTAT).

An additional question (SC019) asked about the number of science teachers at the school, including information about full-time or part-time employment and the respective ISCED level qualification of these science teachers.

The proportion of science teachers (PROSTAT) was computed by dividing the number of science teachers by the total number of teachers.

The proportion of fully certified science teachers (PROSTCE) was computed by dividing the number of fully certified science teachers by the total number of teachers.



The proportion of science teachers with an ISCED 5A qualification and a major in science (PROSTMAS) was calculated by dividing the number of these teachers by the total number of science teachers.

Extra-curricular activities at school

School principals were asked to report what extra-curricular activities their schools offered to 15-year old students (SC053). The index of creative extra-curricular activities at school (CREACTIV) was computed as the total number of the following activities that occurred at school: i) band, orchestra or choir; ii) school play or school musical; and iii) art club or art activities.

Derived variables based on IRT Scaling

The School Questionnaire provided data for nine scaled indices which will be presented along with the item content and parameters in the following. Tables 16.51 and 16.52 contain the scale reliabilities (Cronbach's Alpha coefficients) for all participating OECD and partner countries and economies, respectively.

Table 16.51 Scale reliabilities for School Questionnaire indices in OECD countries

	LEAD	LEADCOM	LEADINST	LEADPD	LEADTCH	EDUSHORT	STAFFSHORT	STUBEHA	TEACHBEHA
Australia	0.914	0.790	0.795	0.811	0.814	0.869	0.799	0.850	0.805
Austria	0.902	0.761	0.760	0.826	0.794	0.838	0.646	0.804	0.749
Belgium	0.902	0.726	0.761	0.834	0.789	0.829	0.670	0.801	0.782
Canada	0.899	0.766	0.792	0.767	0.760	0.841	0.765	0.836	0.810
Chile	0.912	0.804	0.782	0.815	0.691	0.842	0.815	0.865	0.802
Czech Republic	0.893	0.701	0.754	0.848	0.765	0.782	0.642	0.799	0.696
Denmark	0.869	0.728	0.701	0.822	0.782	0.876	0.755	0.793	0.813
Estonia	0.856	0.697	0.695	0.814	0.650	0.781	0.767	0.692	0.769
Finland	0.900	0.725	0.756	0.834	0.695	0.857	0.680	0.761	0.781
France	0.902	0.749	0.724	0.868	0.769	0.834	0.713	0.766	0.784
Germany	0.888	0.687	0.747	0.789	0.735	0.846	0.701	0.771	0.631
Greece	0.903	0.703	0.790	0.881	0.833	0.878	0.653	0.818	0.768
Hungary	0.888	0.733	0.734	0.837	0.669	0.825	0.534	0.821	0.722
Iceland	0.894	0.754	0.735	0.829	0.720	0.824	0.717	0.763	0.782
Ireland	0.897	0.721	0.757	0.754	0.754	0.870	0.719	0.760	0.842
Israel	0.899	0.762	0.693	0.813	0.796	0.834	0.811	0.670	0.821
Italy	0.886	0.736	0.682	0.810	0.779	0.864	0.689	0.767	0.807
Japan	0.840	0.755	0.656	0.732	0.687	0.903	0.732	0.767	0.674
Korea	0.923	0.714	0.773	0.834	0.869	0.880	0.701	0.832	0.806
Latvia	0.860	0.652	0.709	0.804	0.764	0.815	0.751	0.752	0.758
Luxembourg	0.887	0.749	0.760	0.641	0.863	0.831	0.745	0.773	0.765
Mexico	0.906	0.821	0.746	0.759	0.785	0.906	0.721	0.791	0.845
Netherlands	0.888	0.716	0.705	0.857	0.818	0.789	0.716	0.794	0.706
New Zealand	0.894	0.669	0.709	0.798	0.776	0.816	0.741	0.822	0.814
Norway	0.903	0.797	0.760	0.799	0.758	0.837	0.695	0.768	0.761
Poland	0.860	0.665	0.678	0.811	0.721	0.835	0.687	0.753	0.812
Portugal	0.905	0.740	0.826	0.805	0.795	0.868	0.710	0.803	0.819
Slovak Republic	0.893	0.644	0.699	0.848	0.775	0.808	0.608	0.777	0.722
Slovenia	0.912	0.761	0.843	0.819	0.717	0.806	0.765	0.748	0.718
Spain	0.863	0.657	0.726	0.789	0.737	0.901	0.726	0.787	0.832
Sweden	0.900	0.741	0.747	0.823	0.662	0.807	0.824	0.736	0.791
Switzerland	0.861	0.698	0.694	0.823	0.763	0.810	0.647	0.797	0.739
Turkey	0.909	0.679	0.818	0.755	0.867	0.905	0.804	0.802	0.751
United Kingdom	0.897	0.780	0.751	0.829	0.792	0.833	0.714	0.801	0.806
United States	0.916	0.737	0.730	0.780	0.795	0.854	0.840	0.797	0.869

Table 16.52 Scale reliabilities for School Questionnaire in partner countries and economies

	LEAD	LEADCOM	LEADINST	LEADPD	LEADTCH	EDUSHORT	STAFFSHORT	STUBEHA	TEACHBEHA
Albania	0.844	0.702	0.612	0.734	0.733	0.859	0.736	0.779	0.739
Algeria	0.918	0.673	0.831	0.856	0.823	0.819	0.682	0.787	0.664
Argentina	0.893	0.777	0.722	0.796	0.704	0.842	0.746	0.758	0.809
B-S-J-G (China)	0.888	0.680	0.731	0.755	0.807	0.939	0.885	0.959	0.906
Brazil	0.909	0.780	0.757	0.806	0.789	0.848	0.760	0.833	0.847
Bulgaria	0.902	0.722	0.786	0.788	0.823	0.762	0.693	0.875	0.879
Colombia	0.929	0.835	0.795	0.856	0.765	0.892	0.824	0.860	0.839
Costa Rica	0.916	0.749	0.735	0.866	0.808	0.869	0.813	0.858	0.826
Croatia	0.918	0.716	0.812	0.871	0.763	0.813	0.642	0.825	0.820
Cyprus*	0.882	0.674	0.707	0.854	0.806	0.894	0.868	0.768	0.680
Dominican Republic	0.867	0.745	0.727	0.662	0.655	0.807	0.753	0.763	0.761
FYROM	0.901	0.763	0.812	0.754	0.804	0.854	0.756	0.794	0.769
Georgia	0.861	0.627	0.621	0.727	0.769	0.860	0.741	0.865	0.848
Hong Kong (China)	0.914	0.780	0.759	0.834	0.832	0.885	0.821	0.720	0.820
Indonesia	0.908	0.774	0.747	0.772	0.820	0.885	0.792	0.667	0.578
Jordan	0.869	0.618	0.702	0.741	0.782	0.905	0.854	0.833	0.819
Kazakhstan	0.845	0.627	0.577	0.720	0.750	0.874	0.823	0.913	0.939
Kosovo	0.886	0.715	0.679	0.783	0.783	0.789	0.756	0.844	0.793
Lebanon	0.855	0.745	0.719	0.692	0.721	0.890	0.739	0.811	0.828
Lithuania	0.892	0.684	0.687	0.843	0.782	0.803	0.613	0.776	0.788
Macao (China)	0.868	0.716	0.611	0.818	0.773	0.911	0.901	0.945	0.924
Malaysia	0.944	0.815	0.844	0.851	0.873	0.876	0.827	0.860	0.820
Malta	0.784	0.614	0.598	0.699	0.653	0.815	0.739	0.794	0.770
Moldova	0.820	0.540	0.642	0.675	0.782	0.767	0.735	0.821	0.837
Montenegro	0.902	0.743	0.759	0.786	0.793	0.889	0.654	0.757	0.806
Peru	0.930	0.816	0.797	0.796	0.818	0.882	0.769	0.829	0.873
Qatar	0.880	0.713	0.663	0.764	0.813	0.877	0.856	0.762	0.798
Romania	0.854	0.626	0.736	0.579	0.681	0.796	0.703	0.807	0.794
Russia	0.889	0.762	0.714	0.809	0.781	0.874	0.799	0.851	0.889
Singapore	0.917	0.802	0.766	0.844	0.799	0.813	0.854	0.778	0.761
Chinese Taipei	0.928	0.811	0.782	0.823	0.881	0.866	0.713	0.929	0.858
Thailand	0.932	0.807	0.817	0.841	0.879	0.884	0.767	0.803	0.798
Trinidad and Tobago	0.876	0.656	0.739	0.772	0.726	0.842	0.820	0.829	0.839
Tunisia	0.842	0.526	0.628	0.735	0.797	0.827	0.733	0.840	0.821
United Arab Emirates	0.889	0.745	0.681	0.773	0.777	0.930	0.894	0.849	0.856
Uruguay	0.884	0.697	0.681	0.795	0.775	0.865	0.814	0.825	0.819
Viet Nam	0.897	0.642	0.755	0.823	0.738	0.846	0.711	0.699	0.737

* See note under Table 16.6.

School leadership

A question on school leadership was developed for PISA 2012 and partially taken up again for PISA 2015. Question SC009 with 13 items asks about school leadership. The results provided data for five scaled indices. Principals were asked to indicate the frequency of the listed activities and behaviours in their school during the last academic year. The six response categories were “did not occur”, “1-2 times during the year”, “3-4 times during the year”, “once a month”, “once a week”, to “more than once a week”. The overall scale for leadership (LEAD) consists of all 13 items. Table 16.53 shows the item wording, international item parameters and item fit for LEAD.



Table 16.53 Item parameters for Educational leadership (LEAD)

Item	Below are statements about your management of this school. Please indicate the frequency of the following activities and behaviours in your school during <the last academic year>.	Parameter estimates						
		beta	d_1	d_2	d_3	d_4	d_5	alpha
SC009Q01TA	I use student performance results to develop the school's educational goals.	0.46464	2.35073	0.32178	-0.69840	-1.35309	-0.62102	0.75818
SC009Q02TA	I make sure that the professional development activities of teachers are in accordance with the teaching goals of the school.	0.29463	2.09230	0.18305	-0.38615	-1.08206	-0.80714	0.83482
SC009Q03TA	I ensure that teachers work according to the school's educational goals.	-0.11346	1.86425	0.25513	-0.34342	-0.95865	-0.81732	1.00750
SC009Q04TA	I promote teaching practices based on recent educational research.	0.32348	1.44205	0.16228	-0.19596	-0.93725	-0.47112	0.87299
SC009Q05TA	I praise teachers whose students are actively participating in learning.	-0.01904	1.38715	0.29741	-0.14263	-0.85219	-0.68974	0.98060
SC009Q06TA	When a teacher has problems in his/her classroom, I take the initiative to discuss matters.	-0.13401	1.13879	0.37206	-0.07387	-0.67910	-0.75787	1.00091
SC009Q07TA	I draw teachers' attention to the importance of pupils' development of critical and social capacities.	0.05311	1.17565	0.36168	-0.10448	-0.67021	-0.76264	1.47738
SC009Q08TA	I pay attention to disruptive behaviour in classrooms.	-0.38714	0.76147	0.40453	-0.06023	-0.48927	-0.61649	0.92058
SC009Q09TA	I provide staff with opportunities to participate in school decision-making.	-0.18983	1.44581	0.53346	-0.12085	-0.93344	-0.92498	0.91883
SC009Q10TA	I engage teachers to help build a school culture of continuous improvement.	-0.17508	1.24219	0.43019	-0.12964	-0.73994	-0.80281	1.37113
SC009Q11TA	I ask teachers to participate in reviewing management practices.	0.39472	1.47123	0.09030	-0.04154	-0.84679	-0.67320	0.79238
SC009Q12TA	When a teacher brings up a classroom problem, we solve the problem together.	-0.32621	1.18322	0.38598	-0.11159	-0.66445	-0.79317	1.07053
SC009Q13TA	I discuss the school's academic goals with teachers at faculty meetings.	0.11599	1.75821	0.62338	-0.11506	-1.15915	-1.10738	0.99417

The index LEADCOM reflects how school's goals and curricular development are framed and communicated. The IRT scaling model uses items SC009Q01TA, SC009Q02TA, SC009Q03TA, and SC009Q13TA. Table 16.54 shows the item wording, international item parameters and item fit for LEADCOM.

Table 16.54 Item parameters for Curricular development (LEADCOM)

Item	Below are statements about your management of this school. Please indicate the frequency of the following activities and behaviours in your school during <the last academic year>.	Parameter estimates						
		beta	d_1	d_2	d_3	d_4	d_5	alpha
SC009Q01TA	I use student performance results to develop the school's educational goals.	0.32244	2.38253	0.38339	-0.65558	-1.32651	-0.78382	0.88402
SC009Q02TA	I make sure that the professional development activities of teachers are in accordance with the teaching goals of the school.	0.17496	1.88930	0.30071	-0.31267	-0.93355	-0.94378	1.35180
SC009Q03TA	I ensure that teachers work according to the school's educational goals.	-0.31443	2.00895	0.34210	-0.35579	-1.00368	-0.99158	1.19417
SC009Q13TA	I discuss the school's academic goals with teachers at faculty meetings.	-0.25626	2.71719	0.87071	-0.24749	-1.85411	-1.48629	0.57000

The index reflecting instructional leadership (LEADINST) at a school is built by scaling items SC009Q04TA, SC009Q05TA, and SC009Q07TA. Table 16.55 shows the item wording, international item parameters and item fit for LEADINST.

Table 16.55 Item parameters for Instructional leadership (LEADINST)

Item	Below are statements about your management of this school. Please indicate the frequency of the following activities and behaviours in your school during <the last academic year>.	Parameter estimates						
		beta	d_1	d_2	d_3	d_4	d_5	alpha
SC009Q04TA	I promote teaching practices based on recent educational research.	0.26577	1.59619	0.21769	-0.21557	-1.00781	-0.59051	0.88207
SC009Q05TA	I praise teachers whose students are actively participating in learning.	-0.09737	1.49024	0.36747	-0.14803	-0.87302	-0.83666	1.12929
SC009Q07TA	I draw teachers' attention to the importance of pupils' development of critical and social capacities.	-0.12589	1.57384	0.43930	-0.17246	-0.92012	-0.92056	0.98864

The index on how instructional improvements and professional development are promoted by the principal (LEADPD) is scaled by using items SC009Q06TA, SC009Q08TA, and SC009Q12TA. Table 16.56 shows the item wording, international item parameters and item fit for LEADPD.

Table 16.56 Item parameters for Professional development (LEADPD)

Item	Below are statements about your management of this school. Please indicate the frequency of the following activities and behaviours in your school during <the last academic year>.	Parameter estimates						
		beta	d_1	d_2	d_3	d_4	d_5	alpha
SC009Q06TA	When a teacher has problems in his/her classroom, I take the initiative to discuss matters.	0.20078	1.63228	0.62162	-0.04782	-0.91567	-1.29040	0.92126
SC009Q08TA	I pay attention to disruptive behaviour in classrooms.	-0.17788	1.15397	0.62822	-0.02301	-0.66721	-1.09198	0.86532
SC009Q12TA	When a teacher brings up a classroom problem, we solve the problem together.	-0.02559	1.57517	0.61935	-0.06903	-0.82037	-1.30512	1.21342

The index of teacher participation in leadership (LEADTCH) is reported using items SC009Q09TA, SC009Q10TA, and SC009Q11TA. Table 16.57 shows the item wording, international item parameters and item fit for LEADTCH.

Table 16.57 Item parameters for Teachers participation (LEADTCH)

Item	Below are statements about your management of this school. Please indicate the frequency of the following activities and behaviours in your school during <the last academic year>.	Parameter estimates						
		beta	d_1	d_2	d_3	d_4	d_5	alpha
SC009Q09TA	I provide staff with opportunities to participate in school decision-making.	-0.11497	1.90159	0.73619	-0.13752	-1.10972	-1.39054	1.04028
SC009Q10TA	I engage teachers to help build a school culture of continuous improvement.	-0.17367	1.78244	0.64523	-0.17203	-0.98132	-1.27432	1.39244
SC009Q11TA	I ask teachers to participate in reviewing management practices.	0.63711	2.20995	0.18705	-0.06463	-1.25134	-1.08103	0.56728

School resources

PISA 2015 included a question with eight items about school resources, measuring the school principals' perceptions of potential factors hindering the provision of instruction at school. The four response categories were "not at all", "very little", "to some extent", to "a lot". A similar question was used in previous cycles, but items were reduced and reworded for 2015 focusing on two derived variables. The index on staff shortage (STAFFSHORT) was derived from four items SC017Q01NA, SC017Q02NA, SC017Q03NA, and SC017Q04NA. The index on shortage of educational material (EDUSHORT) was scaled using four items SC017Q05NA, SC017Q06NA, SC017Q07NA, and SC017Q08NA. The items were not reversed for scaling. Tables 16.58 and 16.59 show the item wording, international item parameters and item fit for STAFFSHORT and EDUSHORT, respectively.

Table 16.58 Item parameters for Shortage of educational material (EDUSHORT)

Item	Is your school's capacity to provide instruction hindered by any of the following issues?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
SC017Q05NA	A lack of educational material (e.g. textbooks, IT equipment, library or laboratory material).	0.21882	1.59613	0.43175	-2.02788	0.39524
SC017Q06NA	Inadequate or poor quality educational material (e.g. textbooks, IT equipment, library or laboratory material).	0.43446	1.84628	0.30677	-2.15305	0.40730
SC017Q07NA	A lack of physical infrastructure (e.g. building, grounds, heating/cooling, lighting and acoustic systems).	-0.11732	1.23750	0.14076	-1.37826	1.53249
SC017Q08NA	Inadequate or poor quality physical infrastructure (e.g. building, grounds, heating/cooling, lighting and acoustic systems).	-0.05024	1.32658	0.10092	-1.42751	1.66497

Table 16.59 Item parameters for Shortage of educational staff (STAFFSHORT)

Item	Is your school's capacity to provide instruction hindered by any of the following issues?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
SC017Q01NA	A lack of teaching staff.	0.06314	0.75909	0.34257	-1.10165	0.73336
SC017Q02NA	Inadequate or poorly qualified teaching staff.	0.13603	1.05954	0.03870	-1.09824	0.92824
SC017Q03NA	A lack of assisting staff.	-0.26505	0.60896	0.21200	-0.82096	0.95589
SC017Q04NA	Inadequate or poorly qualified assisting staff.	0.05843	0.72331	0.05539	-0.77870	1.38251

School climate

The School Questionnaire included a trend question on school climate (SC061) that had been used in previous cycles with a larger set of items. It measured the school principals' perceptions of the school climate, in particular his or her perceptions of teacher and student behaviour that might influence the provision of instruction at school. The four response categories were "not at all", "very little", "to some extent" and "a lot". For PISA 2015, the items were rearranged to reflect student-related factors (STUBEHA) and teacher-related factors (TEACHBEHA) affecting school climate. The scaling model



used items SC061Q01TA, SC061Q02TA, SC061Q03TA, SC061Q04TA, and SC061Q05TA to reflect STUBEHA, and SC061Q06TA, SC061Q07TA, SC061Q08TA, SC061Q09TA, and SC061Q10TA to reflect TEACHBEHA. Tables 16.60 and 16.61 show the item wording, international item parameters and item fit for STUBEHA and TEACHBEHA, respectively.

Table 16.60 Item parameters for Student-related factors affecting school climate (STUBEHA)

Item	In your school, to what extent is the learning of students hindered by the following phenomena?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
SC061Q01TA	Student truancy	-0.46872	1.48863	-0.12469	-1.36395	1.25759
SC061Q02TA	Students skipping classes	-0.28674	1.50293	-0.09281	-1.41012	1.46127
SC061Q03TA	Students lacking respect for teachers	0.08023	1.88225	-0.35878	-1.52347	0.81146
SC061Q04TA	Student use of alcohol or illegal drugs	0.73855	1.14267	-0.51484	-0.62783	0.78086
SC061Q05TA	Students intimidating or bullying other students	0.53229	2.05337	-0.64487	-1.40851	0.68882

Table 16.61 Item parameters for Teacher-related factors affecting school climate (TEACHBEHA)

Item	In your school, to what extent is the learning of students hindered by the following phenomena?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
SC061Q06TA	Teachers not meeting individual students' needs	-0.05338	1.63983	-0.03794	-1.60189	1.06092
SC061Q07TA	Teacher absenteeism	0.00094	1.44904	-0.26889	-1.18014	0.88448
SC061Q08TA	Staff resisting change	-0.22931	1.37983	0.04536	-1.42519	1.09578
SC061Q09TA	Teachers being too strict with students	0.43368	2.16129	-0.20726	-1.95403	0.71598
SC061Q10TA	Teachers not being well prepared for classes	-0.00276	1.44495	-0.31509	-1.12986	1.24283

EDUCATIONAL CAREER QUESTIONNAIRE

The Educational Career Questionnaire (ECQ) is an international option that countries can choose to implement. It is administered to the PISA students after they have completed the Student Questionnaire. As the content of the ECQ changes in every cycle, no trend scales were built for PISA 2015. The derived variables of the ECQ are simple questionnaire indices only. An overview of all derived variables is shown in Table 16.62, and each index is described in the following sections.

Table 16.62 Derived variables in the optional PISA 2015 Educational Career Questionnaire

DV Name	Description	Question no.	Trend to PISA 2006	IRT scaling
HADDINST	Total hours of additional instruction	EC001		
SADDINST	Number of learning domains with additional instruction	EC001		
ADDSCIIN	Number of science disciplines and subjects with additional instruction	EC003		
COMSCSUP	Comparison science school lessons and additional instruction support	EC009		
COMSCSTRCO	Comparison science school lessons and additional instruction structuredness content	EC010		
COMSCSTRLE	Comparison science school lessons and additional instruction structuredness lessons	EC010		
COMSCTSREL	Comparison science school lessons and additional instruction teacher-student relation	EC011		
COMMASUP	Comparison mathematics school lessons and additional instruction support	EC019		
COMMASTRCO	Comparison mathematics school lessons and additional instruction structuredness content	EC020		
COMMASTRLE	Comparison mathematics school lessons and additional instruction structuredness lessons	EC020		
COMMATSREL	Comparison mathematics school lessons and additional instruction teacher-student relation	EC021		
SCCHANGE	Number of school changes	EC031, EC032		
CHANGE	Number of changes in educational biography	EC031-EC033		

Simple questionnaire indices

Learning time

Question EC001 asks about the hours per week that the student attended any additional instruction, and the subjects that were covered in this additional instruction. The derived variable HADDINST reflects the sum of all hours of additional instruction. The derived variable SADDINST states the number of individual subjects in which a student attends additional lessons.

To focus on science-specific additional instruction (SC003), the derived variable ADDSCIIN reflects the sum of all science disciplines and subjects in which the student attends additional lessons.



Instructional quality

To assess the instructional quality of additional instruction, PISA 2015 included newly developed questions that asked students to compare the quality in regular school lessons to that in their additional instruction. The questions focused on science (EC009/EC010/EC011) and mathematics (EC019/EC020/EC021). For each aspect, the student was asked whether it was more likely to occur in the regular school lessons, the additional instruction, or if there was no difference between the two.

Aspects included a comparison of teacher support in science lessons (COMSCSUP, EC009) and mathematics lessons (COMMASUP, EC019), derived variables are built based on the mean of all answers.

Questions EC010 (for science) and EC020 (for mathematics) asked about the structuredness of the lessons. The respective indicators report the structuredness of content (e.g. pacing, curriculum coherence, COMSCSTRCO) and the structuredness of the lessons (e.g. classroom management, COMSCSTRLE) for science, as well as for mathematics (COMMASTRCO/COMMASTRLE).

In addition, students were asked to compare teacher-student relationships. The respective indicators are COMSCTSREL for science (EC011) and COMMATSREL for mathematics (EC021).

Educational pathways

The Educational Career Questionnaire also included questions about the students' educational pathways within the school system, asking for information on whether students had ever changed schools when attending ISCED 1 (EC031) or ISCED 2 (EC031), as well as whether they had ever changed a study programme (EC033).

The respective indicators summed up the number of school changes in EC031 and EC032 (SCCHANGE) and all three questions reported on the number of overall changes in the educational biography (CHANGE).

ICT FAMILIARITY QUESTIONNAIRE

The ICT Familiarity Questionnaire (ICQ) is an international option that countries can choose to implement. It is administered to the PISA students after they have completed the Student Questionnaire. For PISA 2015, nine derived variables were built, eight of which were scaled using the IRT model described above. Most of the scales were already reported in PISA 2012 but some now include updated items and further theoretical constructs.

An overview of all derived variables is shown in Table 16.63, and each is described in the following sections. Simple questionnaire indices are preceded by those that are based on IRT scaling.

Table 16.63 Derived variables in the optional PISA 2015 ICT Familiarity Questionnaire

DV Name	Description	Question no.	Trend to PISA 2006	IRT scaling
ICTHOME	ICT available at Home Index	IC001		
ENTUSE	ICT use outside of school leisure	IC008		YES
ICTSCH	ICT available at School Index	IC009		
HOMESCH	ICT use outside of school for schoolwork	IC010		YES
USESCH	Use of ICT at school in general	IC011		YES
INTICT	Students' ICT Interest	IC013		YES
COMPICT	Students' Perceived ICT Competence	IC014		YES
AUTICT	Students' Perceived Autonomy related to ICT Use	IC015		YES
SOIAICT	Students' ICT as a topic in Social Interaction	IC016		YES

Simple questionnaire indices

Availability and usage of ICT

The ICQ asked about the availability of ICT at home and if students used it for various purposes. ICTHOME is an index based on the sum of the availability of all items included in IC001.

IC009 asked about the availability of ICT at school, the respective derived variable ICTSCH is calculated as the sum of all items.



Derived variables based on IRT Scaling

The ICT Familiarity Questionnaire provided data for seven scaled indices which will be presented along with the item content and parameters in the following sections. Tables 16.64 and 16.65 contain the scale reliabilities (Cronbach's Alpha coefficients) for all participating OECD and partner countries and economies, respectively.

Table 16.64 Scale reliabilities for ICT Familiarity Questionnaire indices in OECD countries

	ENTUSE	HOMESCH	USESCH	INTICT	COMPICT	AUTICT	SOIAICT
Australia	0.804	0.906	0.836	0.785	0.848	0.871	0.850
Austria	0.784	0.885	0.857	0.765	0.840	0.840	0.864
Belgium	0.797	0.919	0.910	0.794	0.846	0.811	0.855
Chile	0.831	0.911	0.867	0.797	0.839	0.850	0.859
Czech Republic	0.810	0.901	0.887	0.775	0.858	0.821	0.880
Denmark	0.792	0.860	0.769	0.737	0.851	0.839	0.843
Estonia	0.779	0.885	0.899	0.782	0.846	0.867	0.868
Finland	0.801	0.916	0.851	0.792	0.852	0.836	0.851
France	0.820	0.917	0.889	0.818	0.862	0.805	0.859
Germany	0.834	0.854	0.843	0.755	0.841	0.845	0.802
Greece	0.850	0.933	0.930	0.771	0.831	0.819	0.851
Hungary	0.823	0.929	0.912	0.778	0.872	0.844	0.878
Iceland	0.786	0.919	0.867	0.809	0.832	0.889	0.843
Ireland	0.788	0.887	0.851	0.737	0.820	0.845	0.849
Israel	0.872	0.938	0.938	0.849	0.885	0.876	0.904
Italy	0.812	0.914	0.886	0.753	0.827	0.833	0.814
Japan	0.779	0.840	0.785	0.856	0.875	0.887	0.888
Korea	0.777	0.906	0.927	0.824	0.854	0.853	0.883
Latvia	0.807	0.902	0.887	0.776	0.821	0.845	0.795
Luxembourg	0.815	0.922	0.909	0.800	0.857	0.851	0.883
Mexico	0.889	0.916	0.901	0.827	0.880	0.876	0.840
Netherlands	0.736	0.849	0.827	0.749	0.822	0.827	0.839
New Zealand	0.806	0.920	0.873	0.789	0.839	0.861	0.842
Poland	0.812	0.890	0.903	0.744	0.866	0.849	0.837
Portugal	0.850	0.943	0.911	0.806	0.866	0.859	0.859
Slovak Republic	0.840	0.923	0.903	0.801	0.867	0.861	0.843
Slovenia	0.808	0.896	0.907	0.772	0.868	0.837	0.843
Sweden	0.805	0.928	0.878	0.811	0.876	0.909	0.902
Switzerland	0.799	0.903	0.879	0.755	0.846	0.817	0.859
United Kingdom ¹	0.787	0.901	0.839	0.762	0.840	0.853	0.846

1. The ICT Questionnaire was only administered to a subset of students (United Kingdom excluding Scotland).

Table 16.65 Scale reliabilities for ICT Familiarity Questionnaire in partner countries and economies

	ENTUSE	HOMESCH	USESCH	INTICT	COMPICT	AUTICT	SOIAICT
B-S-J-G (China)	0.890	0.918	0.868	0.791	0.804	0.887	0.840
Brazil	0.903	0.944	0.928	0.867	0.853	0.881	0.852
Bulgaria	0.874	0.946	0.932	0.852	0.871	0.877	0.870
Colombia	0.894	0.917	0.905	0.857	0.850	0.858	0.844
Costa Rica	0.872	0.911	0.878	0.799	0.844	0.852	0.867
Croatia	0.840	0.915	0.909	0.809	0.880	0.853	0.903
Dominican Republic	0.920	0.933	0.918	0.864	0.854	0.895	0.885
Hong Kong (China)	0.842	0.931	0.930	0.800	0.843	0.913	0.895
Lithuania	0.834	0.930	0.935	0.764	0.843	0.852	0.858
Macao (China)	0.817	0.888	0.866	0.756	0.773	0.842	0.823
Peru	0.892	0.883	0.847	0.790	0.815	0.857	0.769
Russia	0.852	0.926	0.946	0.807	0.857	0.858	0.852
Singapore	0.777	0.914	0.885	0.777	0.808	0.870	0.839
Chinese Taipei	0.822	0.909	0.855	0.778	0.842	0.890	0.860
Thailand	0.888	0.929	0.924	0.848	0.850	0.869	0.821
Uruguay	0.846	0.921	0.916	0.817	0.873	0.863	0.874

Availability and usage of ICT

Three questions in the ICT Familiarity Questionnaire asked about how often digital devices are used outside of school for leisure activities (IC008), outside of school for school work (IC010), as well as for activities in school (IC011). The answering scale for all three questions ranged from “never or hardly ever”, “once or twice a month”, “once or twice a week”, “almost every day” to “every day”. The respective indices ENTUSE (leisure activities), HOMESCH (for school work outside of

school) and USESCH (use of ICT at school) are scaled using the IRT scaling model described above. Tables 16.66, 16.67 and 16.68 shows the item wording, international item parameters and item fit for each of the three scales, respectively.

Table 16.66 Item parameters for ICT use outside of school for leisure (ENTUSE)

Item	How often do you use digital devices for the following activities outside of school?	Parameter estimates					
		beta	d_1	d_2	d_3	d_4	alpha
IC008Q01TA	Playing one-player games.	0.36391	-0.42410	0.57430	0.02973	-0.17992	0.62185
IC008Q02TA	Playing collaborative online games.	0.34197	-0.71734	0.48043	0.12492	0.11199	0.67610
IC008Q03TA	Using email.	0.19326	0.31538	0.26763	-0.30965	-0.27337	0.73903
IC008Q04TA	<Chatting online> (e.g. <MSN@>).	-0.22935	-0.85711	0.28840	0.30105	0.26766	0.62893
IC008Q05TA	Participating in social networks (e.g. <Facebook>, <MySpace>).	-0.41520	-0.53824	0.24012	0.18246	0.11566	0.82910
IC008Q07NA	Playing online games via social networks (e.g. <Farmville@>, <The Sims Social>).	0.50370	-0.84069	0.39629	0.13189	0.31251	0.68935
IC008Q08TA	Browsing the Internet for fun (such as watching videos, e.g. <YouTube™>).	-0.39931	0.08828	0.29156	-0.07780	-0.30204	1.44481
IC008Q09TA	Reading news on the Internet (e.g. current affairs).	-0.05522	0.09735	0.31773	-0.10172	-0.31336	1.00796
IC008Q10TA	Obtaining practical information from the Internet (e.g. locations, dates of events).	-0.02996	0.29259	0.30988	-0.17476	-0.42771	1.28358
IC008Q11TA	Downloading music, films, games or software from the internet.	-0.11231	0.33351	0.17029	-0.14709	-0.35672	1.58840
IC008Q12TA	Uploading your own created contents for sharing (e.g. music, poetry, videos, computer programs).	0.36991	-0.22438	0.22686	0.01040	-0.01287	0.92774
IC008Q13NA	Downloading new apps on a mobile device.	0.03020	0.55471	0.03540	-0.24813	-0.34198	1.56315

Table 16.67 Item parameters for ICT use outside of school for schoolwork (HOMESCH)

Item	How often do you use digital devices for the following activities outside of school?	Parameter estimates					
		beta	d_1	d_2	d_3	d_4	alpha
IC010Q01TA	Browsing the Internet for schoolwork (e.g. for preparing an essay or presentation).	-0.41339	1.13119	0.39950	-0.56070	-0.96999	0.79565
IC010Q02NA	Browsing the Internet to follow up lessons, e.g. for finding explanations.	-0.20642	0.78816	0.39942	-0.38277	-0.80481	0.98209
IC010Q03TA	Using email for communication with other students about schoolwork.	0.05830	0.30292	0.40577	-0.18827	-0.52043	0.94595
IC010Q04TA	Using email for communication with teachers and submission of homework or other schoolwork.	0.13185	0.58899	0.18496	-0.22650	-0.54746	1.25479
IC010Q05NA	Using social networks for communication with other students about schoolwork (e.g. <Facebook>, <MySpace>).	-0.53830	0.01470	0.63540	-0.21312	-0.43699	0.47914
IC010Q06NA	Using social networks for Communication with teachers (e.g. <Facebook>, <MySpace>).	0.17351	-0.33093	0.41087	0.01487	-0.09481	0.79062
IC010Q07TA	Downloading, uploading or browsing material from my school's website (e.g. timetable or course materials).	0.00293	0.42131	0.27136	-0.19846	-0.49422	1.06545
IC010Q08TA	Checking the school's website for announcements, e.g. absence of teachers.	0.04214	0.12897	0.34903	-0.09830	-0.37969	0.77715
IC010Q09NA	Doing homework on a computer.	-0.21896	0.70257	0.29219	-0.31999	-0.67477	0.95482
IC010Q10NA	Doing homework on a mobile device.	0.06459	0.27387	0.36208	-0.14757	-0.48838	1.02083
IC010Q11NA	Downloading learning apps on a mobile device.	0.14689	0.37227	0.20218	-0.13282	-0.44164	1.44971
IC010Q12NA	Downloading science learning apps on a mobile device.	0.21977	0.21062	0.25286	-0.07046	-0.39301	1.48379

Table 16.68 Item parameters for Use of ICT at school in general (USESCH)

Item	How often do you use digital devices for the following activities at school?	Parameter estimates					
		beta	d_1	d_2	d_3	d_4	alpha
IC011Q01TA	<Chatting online> at school.	-0.08101	-1.92165	1.06281	0.71262	0.14622	0.32115
IC011Q02TA	Using email at school.	0.02675	0.22049	0.42081	-0.25424	-0.38706	0.82288
IC011Q03TA	Browsing the Internet for schoolwork.	-0.40192	0.70655	0.41315	-0.39752	-0.72218	0.94650
IC011Q04TA	Downloading, uploading or browsing material from the school's website (e.g. <intranet>).	-0.05588	0.35786	0.32971	-0.18652	-0.50105	1.35374
IC011Q05TA	Posting my work on the school's website.	0.16357	0.18035	0.37225	-0.17175	-0.38085	1.36812
IC011Q06TA	Playing simulations at school.	0.23974	0.05051	0.38127	-0.08727	-0.34451	1.03355
IC011Q07TA	Practicing and drilling, such as for foreign language learning or mathematics.	0.01084	0.33078	0.42926	-0.23567	-0.52437	0.85901
IC011Q08TA	Doing homework on a school computer.	0.01316	0.39722	0.31216	-0.22927	-0.48011	1.16646
IC011Q09TA	Using school computers for group work and communication with other students.	-0.03205	0.56723	0.20722	-0.29528	-0.47917	1.12858

Interest in ICT and perceived competence

PISA 2015 included four newly developed questions in the ICT Familiarity Questionnaire addressing students' ICT interest (IC013, INTICT), their perceived competence in ICT usage (IC014, COMP ICT), their perceived autonomy related to ICT usage (IC015, AUTICT) and the degree to which ICT is a part of their daily social life (IC016, SOIAICT). All



questions used a four-point Likert answering scale ranging from “strongly disagree” to “strongly agree”. Tables 16.69, 16.70, 16.71 and 16.72 shows the item wording, international item parameters and item fit for each of the four scales, respectively.

Table 16.69 Item parameters for Students' ICT Interest (INTICT)

Item	Thinking about your experience with digital media and digital devices: to what extent do you disagree or agree with the following statements?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
IC013Q01NA	I forget about time when I'm using digital devices.	0.43669	1.37049	0.36889	-1.73938	0.51239
IC013Q04NA	The Internet is a great resource for obtaining information I am interested in (e.g. news, sports, dictionary).	-0.24377	0.56601	0.70236	-1.26837	1.03630
IC013Q05NA	It is very useful to have social networks on the Internet.	-0.08135	0.81946	0.45866	-1.27812	1.30416
IC013Q11NA	I am really excited discovering new digital devices or applications.	0.22493	1.10714	0.21950	-1.32664	1.04545
IC013Q12NA	I really feel bad if no internet connection is possible.	0.38223	1.35827	-0.01344	-1.34483	0.56837
IC013Q13NA	I like using digital devices.	-0.20702	0.74116	0.52997	-1.27113	1.53333

Table 16.70 Item parameters for Students' Perceived ICT Competence (COMPICT)

Item	Thinking about your experience with digital media and digital devices: to what extent do you disagree or agree with the following statements?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
IC014Q03NA	I feel comfortable using digital devices that I am less familiar with.	0.21920	1.97262	0.55698	-2.52959	0.51025
IC014Q04NA	If my friends and relatives want to buy new digital devices or applications, I can give them advice.	0.11190	1.57835	0.40265	-1.98100	1.01112
IC014Q06NA	I feel comfortable using my digital devices at home.	-0.69950	1.01256	1.14309	-2.15565	0.67422
IC014Q08NA	When I come across problems with digital devices, I think I can solve them.	0.03847	1.55917	0.33360	-1.89277	1.38527
IC014Q09NA	If my friends and relatives have a problem with digital devices, I can help them.	0.13623	1.48395	0.33846	-1.82241	1.41915

Table 16.71 Item parameters for Students' Perceived Autonomy related to ICT Use (AUTICT)

Item	Thinking about your experience with digital media and digital devices: to what extent do you disagree or agree with the following statements?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
IC015Q02NA	If I need new software, I install it by myself.	0.31464	1.18861	0.26837	-1.45697	1.00771
IC015Q03NA	I read information about digital devices to be independent.	0.45793	1.60058	0.33888	-1.93946	0.72918
IC015Q05NA	I use digital devices as I want to use them.	-0.33563	1.26079	0.69274	-1.95353	0.92111
IC015Q07NA	If I have a problem with digital devices I start to solve it on my own.	-0.02182	1.33828	0.36100	-1.69929	1.26416
IC015Q09NA	If I need a new application, I choose it by myself.	-0.29154	1.17731	0.57501	-1.75232	1.07784

Table 16.72 Item parameters for Students' ICT as a topic in Social Interaction (SOIAICT)

Item	Thinking about your experience with digital media and digital devices: to what extent do you disagree or agree with the following statements?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
IC016Q01NA	To learn something new about digital devices, I like to talk about them with my friends.	-0.15657	1.50358	0.49371	-1.99730	0.97548
IC016Q02NA	I like to exchange solutions to problems with digital devices with others on the internet.	0.16938	1.58669	0.22627	-1.81296	1.05025
IC016Q04NA	I like to meet friends and play computer and video games with them.	0.05221	1.18775	0.45862	-1.64637	0.52396
IC016Q05NA	I like to share information about digital devices with my friends.	-0.01459	1.41803	0.28206	-1.70009	1.38479
IC016Q07NA	I learn a lot about digital media by discussing with my friends and relatives.	-0.03033	1.45972	0.37279	-1.83251	1.06553

PARENT QUESTIONNAIRE

The Parent Questionnaire is an international option that countries can choose to implement. It addresses the parents of students participating in the PISA assessment. In PISA 2015, the Parent Questionnaire provided eight derived variables. All of them were scaled using the IRT scaling model described above. Four of these scales were mapped to the respective scales used in PISA 2006 so that trend comparison is possible. All derived variables from the Parent Questionnaire were scaled using IRT modelling.

An overview of all derived variables is shown in Table 16.73, and each will be described in the following sections.

Table 16.73 Derived variables in the optional PISA 2015 Parent Questionnaire

DV Name	Description	Question no.	Trend to PISA 2006	IRT scaling
PRESUPP	Child's past science activities	PA002		YES
CURSUPP	Parental current support for learning at home	PA003		YES
EMOSUPP	Parental emotional support	PA004		YES
PASCHPOL	School policies for parental involvement	PA007		YES
PQSCHOOL	Parents perceived school quality	PA007	YES	YES
PQGENSCI	Parents' view on science	PA033	YES	YES
PQENPERC	Parents concerns regarding environmental topics	PA035	YES	YES
PQENVOPT	Parents' view on future environmental topics	PA036	YES	YES

Derived variables based on IRT Scaling

The PISA 2015 Parent Questionnaire provided data for eight scaled indices which will be presented along with the item content and parameters in the following sections. Tables 16.74 and 16.75 contain the scale reliabilities (Cronbach's Alpha coefficients) for all participating OECD and partner countries and economies, respectively.

Table 16.74 Scale reliabilities for the Parent Questionnaire indices in OECD countries

	PRESUPP	CURSUPP	EMOSUPP	PQSCHOOL	PASCHPOL	PQGENSCI	PQENPERC	PQENVOPT
Belgium ¹	0.729	0.742	0.848	0.836	0.807	0.862	0.804	0.810
Chile	0.803	0.800	0.850	0.887	0.847	0.878	0.841	0.874
France	0.731	0.752	0.817	0.849	0.802	0.846	0.802	0.821
Germany	0.742	0.749	0.777	0.823	0.819	0.838	0.805	0.749
Ireland	0.806	0.744	0.917	0.898	0.851	0.874	0.875	0.856
Italy	0.776	0.723	0.809	0.845	0.818	0.851	0.799	0.864
Korea	0.845	0.834	0.848	0.868	0.838	0.847	0.887	0.913
Luxembourg	0.759	0.768	0.818	0.845	0.830	0.856	0.863	0.867
Mexico	0.801	0.800	0.872	0.884	0.840	0.861	0.846	0.923
Portugal	0.775	0.770	0.779	0.859	0.844	0.818	0.826	0.907
Spain	0.781	0.731	0.853	0.897	0.866	0.863	0.870	0.889
United Kingdom ²	0.808	0.744	0.932	0.912	0.857	0.884	0.863	0.830

1 For PRESUPP, items PA002Q07TA and PA002Q08TA were deleted by the country.

2 The Parent Questionnaire was only administered to a subset of students (Scotland).

Table 16.75 Scale reliabilities for the Parent Questionnaire in partner countries and economies

	PRESUPP	CURSUPP	EMOSUPP	PQSCHOOL	PASCHPOL	PQGENSCI	PQENPERC	PQENVOPT
Croatia	0.782	0.771	0.819	0.819	0.853	0.876	0.842	0.908
Dominican Republic	0.808	0.812	0.854	0.917	0.852	0.928	0.836	0.936
Georgia	0.720	0.754	0.779	0.881	0.835	0.790	0.831	0.906
Hong Kong (China)	0.829	0.831	0.781	0.826	0.820	0.898	0.876	0.885
Macao (China)	0.815	0.843	0.795	0.850	0.833	0.889	0.874	0.918
Malta	0.803	0.777	0.769	0.893	0.871	0.849	0.827	0.870

Parental support

PISA 2015 measured parental support with three questions. PA002 retrospectively asked how frequently their child engaged in science-related learning activities at home when he or she was 10 years old and thus inquired about parents' support for science learning in the middle childhood years; examples are reading books about scientific topics or construction play. The answering categories were "very often", "regularly", "sometimes", "never" and had to be reverse-coded so that higher WLEs and higher difficulty correspond to higher levels of parental support. The corresponding scale PRESUPP consists of all ten items of this question, some of which had been used in previous PISA cycles. Table 16.76 shows the item wording, international item parameters and item fit for PRESUPP.

**Table 16.76 Item parameters for Child's past science activities (PRESUPP)**

Item	Thinking back to when your child was about 10 years old, how often would your child have done these things?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
PA002Q01TA	Watched TV programmes about science	-0.33940	1.07762	-0.53619	-0.54143	1.30842
PA002Q02TA	Read books on scientific discoveries	-0.02541	0.84575	-0.44699	-0.39876	1.23082
PA002Q03TA	Watched, read or listened to science fiction	-0.29498	1.04045	-0.51632	-0.52412	0.83692
PA002Q04TA	Visited web sites about science topics	0.06720	0.66895	-0.32492	-0.34403	1.49265
PA002Q05TA	Attended a science club	0.80339	0.05692	-0.14065	0.08372	0.87210
PA002Q06NA	Construction play, e.g.<lego bricks>	-0.76810	0.98068	-0.79201	-0.18867	0.43817
PA002Q07NA	Took apart technical devices	0.05260	0.29790	-0.44784	0.14993	0.86777
PA002Q08NA	Fixed broken objects or items, e.g. broken electronic toys	0.11708	0.37036	-0.53145	0.16109	0.82646
PA002Q09NA	Experimented with a science kit, electronics kit, or chemistry set, used a microscope or telescope	0.18758	0.64835	-0.41434	-0.23401	0.99861
PA002Q10NA	Played computer games with a science content	-0.06372	0.66390	-0.41505	-0.24885	1.12808

PA003 asked about current parental support for learning at home, including both science-specific and general aspects of parental support. The corresponding scale (CURSUPP) consists of all items in that question, some of which had been used in previous PISA cycles. Answering categories ranged from “never or hardly ever”, “once or twice a year”, “once or twice a month”, “once or twice a week”, to “every day or almost every day”. Table 16.77 shows the item wording, international item parameters and item fit for CURSUPP.

Table 16.77 Item parameters for Parental current support for learning at home (CURSUPP)

Item	How often do you or someone else in your home do the following things with your child?	Parameter estimates					
		beta	d_1	d_2	d_3	d_4	alpha
PA003Q01TA	Discuss how well my child is doing at school.	-0.99995	0.21467	0.56229	-0.14574	-0.63123	0.65088
PA003Q02TA	Eat <the main meal> with my child around a table.	-1.98683	-2.31373	-0.00007	1.31367	1.00013	0.34292
PA003Q03TA	Spend time just talking to my child.	-1.24493	-0.67030	0.67091	0.34271	-0.34332	0.63097
PA003Q04NA	Help my child with his/her science homework.	0.41497	-0.13300	0.60189	0.11597	-0.58486	0.90084
PA003Q05NA	Ask how my child is performing in science class.	0.02912	0.18737	0.48529	-0.06953	-0.60313	1.35385
PA003Q06NA	Obtain science-related materials (e.g., applications, software, study guides etc.) for my child.	0.54701	0.33774	0.20059	-0.14773	-0.39059	1.23451
PA003Q07NA	Discuss with my child how science is used in everyday life.	0.31372	0.39363	0.34023	-0.18121	-0.55264	1.69328
PA003Q08NA	Discuss <science related career> options with my child.	0.41746	0.38888	0.29604	-0.25126	-0.43366	1.19274

A new focus in PISA 2015 addressed the emotional support given by parents. Question PA004 included four items asking parents about their interest and support for students' school-related difficulties and achievements. Answering categories on a four-point Likert scale ranged from “strongly agree” to “strongly disagree”. Table 16.78 shows the item wording, international item parameters and item fit for EMOSUPP.

Table 16.78 Item parameters for Parental emotional support (EMOSUPP)

Item	Thinking about <the last academic year>, to what extent do you agree with the following statements?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
PA004Q01NA	I am interested in my child's school activities.	0,12430	0,84668	1,27001	-2,11669	0,75303
PA004Q02NA	I am supportive of my child's efforts at school and his/her achievements.	0,01177	0,93360	0,89965	-1,83325	1,14243
PA004Q03NA	I support my child when he/she is facing difficulties at school.	0,07517	0,79412	0,93781	-1,73192	1,11850
PA004Q04NA	I encourage my child to be confident.	-0,19384	0,43333	1,16728	-1,60061	0,98605

Parental involvement in school

The question addressing both parents' view on school quality and school policies for parental involvement (PA007) has been modified for each PISA cycle so far. Parents were asked how much they agreed with the statements about school policies. The response categories included “strongly agree”, “agree”, “disagree” and “strongly disagree”. The responses had to be reverse-coded so that higher WLEs and higher difficulty correspond to higher levels of parental involvement in school.

In PISA 2015, two derived variables were built. The scale addressing parental involvement (PASCHPOL) uses six newly developed items to measure different aspects of parental participation (PA007Q09NA, PA007Q11NA, PA007Q12NA, PA007Q13NA, PA007Q14NA, and PA007Q15NA). Table 16.79 shows the item wording, international item parameters and item fit for PASCHPOL.

Table 16.79 Item parameters for School policies for parental involvement (PASCHPOL)

Item	How much do you agree or disagree with the following statements?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
PA007Q09NA	My child's school provides an inviting atmosphere for parents to get involved.	-0.29549	1.45689	0.36785	-1.82473	1.23011
PA007Q11NA	My child's school provides effective communication between the school and families.	-0.35675	1.39322	0.40011	-1.79334	1.17906
PA007Q12NA	My child's school involves parents in the school's decision-making process.	0.00006	1.59285	0.25193	-1.84478	1.03779
PA007Q13NA	My child's school offers parent education (e.g. <courses on family literacy>) or family support programmes (e.g. <to assist with health, nutrition>).	0.75008	1.66258	0.28344	-1.94603	0.57040
PA007Q14NA	My child's school informs families about how to help students with homework and other school-related activities.	0.23771	1.38616	0.28893	-1.67509	1.09151
PA007Q15NA	My child's school cooperates with <community services>to strengthen school programmes and student development.	0.10857	1.51714	0.41933	-1.93647	0.89113

The trend indicator PQSCHOOL uses seven trend items to summarize parents' perceptions of the quality of school learning (PA007Q01TA, PATA007Q02TA, PA007Q03TA, PA007Q04TA, PA007Q05TA, PA007Q06TA, and PA007Q07TA). The same scale was used in PISA 2006, 2009, and 2012. It was scaled in such a way that a trend comparison is possible between PISA 2006 and 2015. Table 16.80 shows the item wording, international item parameters and item fit for PQSCHOOL.

Table 16.80 Item parameters for Parents perceived school quality (PQSCHOOL)

Item	How much do you agree or disagree with the following statements?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
PA007Q01TA	Most of my child's school teachers seem competent and dedicated.	-0.24354	1.59279	0.78792	-2.38072	0.89632
PA007Q02TA	Standards of achievement are high in my child's school.	-0.08680	2.34506	0.37890	-2.72396	0.61911
PA007Q03TA	I am happy with the content taught and the instructional methods used in my child's school.	0.07616	1.73442	0.50465	-2.23907	1.18881
PA007Q04TA	I am satisfied with the disciplinary atmosphere in my child's school.	-0.03327	1.50732	0.68950	-2.19682	0.76172
PA007Q05TA	My child's progress is carefully monitored by the school.	0.14735	1.68369	0.37150	-2.05519	1.16190
PA007Q06TA	My child's school provides regular and useful information on my child's progress.	0.17990	1.60999	0.37147	-1.98146	0.85679
PA007Q07TA	My child's school does a good job in educating students.	-0.07821	1.53553	0.46970	-2.00523	1.51535

Parents' views on science and environmental topics

As in PISA 2006, the 2015 Parent Questionnaire took up the topic of parents' views on science and aspects of the environment.

Question PA033 included only trend items from 2006 and focused on parents' opinions on the importance of scientific approaches for their daily lives and society. The response categories included "strongly agree", "agree", "disagree" and "strongly disagree". The responses had to be reverse-coded so that higher WLEs and higher difficulty correspond to higher levels of parents' view on science. The respective scale (PQGENSCI) was scaled in such a way that a trend comparison is possible between PISA 2006 and 2015. Table 16.81 shows the item wording, international item parameters and item fit for PQGENSCI.

Table 16.81 Item parameters for Parents' view on science (PQGENSCI)

Item	How much do you agree with the following statements?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
PA033Q02TA	<Broad science> is important to help us to understand the natural world.	-0.37395	1.27597	0.98893	-2.26490	1.01006
PA033Q06TA	<Broad science> is valuable to society.	-0.21465	1.45867	0.78733	-2.24599	1.12141
PA033Q07TA	<Broad science> is very relevant to me.	0.64417	2.04909	0.30847	-2.35756	1.00697
PA033Q08TA	I find that <broad science> helps me to understand the things around me.	0.37096	1.82657	0.50188	-2.32844	1.34284
PA033Q09TA	Advances in <broad science> usually bring social benefits.	-0.05992	1.79102	0.67006	-2.46108	0.71425

Question PA035 asked parents about their concerns related to current environmental topics (PQENPERC), while question PA036 asked about their optimism regarding the future trend of environmental topics (PQENVOPT). Both questions, PA035 and PA036, included trend items and some newly developed aspects regarding current environmental topics. Still, the scales were analysed to enable a trend comparison to PISA 2006.

For PA035, parents were asked to answer on a four-point Likert scale with the response options "this is a serious concern for me personally as well as others", "this is a serious concern for other people in my country but not for me personally", "this is a serious concern only for people in other countries", and "this is not a serious concern for anyone". The responses had to be reverse-coded so that higher WLEs and higher difficulty correspond to higher levels of parents' concerns regarding environmental topics. Table 16.82 shows the item wording, international item parameters and item fit for PQENPERC.

**Table 16.82 Item parameters for Parents concerns regarding environmental topics (PQENPERC)**

Item	Do you see the environmental issues below as a serious concern for yourself and/or others?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
PA035Q01TA	Air pollution	-0.39748	0.31475	-0.03886	-0.27589	1.00967
PA035Q03TA	Extinction of plants and animals	0.12756	0.59566	-0.05785	-0.53781	1.09251
PA035Q04TA	Clearing of forests for other land use	0.13784	0.79664	-0.23400	-0.56264	1.12582
PA035Q05TA	Water shortages	-0.03219	0.93264	-0.67558	-0.25706	1.07186
PA035Q06TA	Nuclear waste	0.10260	0.92366	-0.51496	-0.40870	0.97315
PA035Q07NA	Extreme weather conditions	0.12049	0.87692	-0.48587	-0.39105	1.01581
PA035Q08NA	Human contact with animal diseases	0.00784	0.68053	-0.40535	-0.27518	0.75381

For PA036, parents were asked to answer on a three-point Likert scale with the response options “improve”, “stay about the same”, and “get worse”. The responses had to be reverse-coded so that higher WLEs and higher difficulty correspond to higher levels of parents’ environmental optimism. Table 16.83 shows the item wording, international item parameters and item fit for PQENVOPT.

Table 16.83 Item parameters for Parents’ view on future environmental topics (PQENVOPT)

Item	Do you think problems associated with the environmental issues below will improve or get worse over the next 20 years?	Parameter estimates			
		beta	d_1	d_2	alpha
PA036Q01TA	Air pollution	-0.01047	0.07795	-0.07795	0.85812
PA036Q03TA	Extinction of plants and animals	0.00748	0.43749	-0.43749	1.20731
PA036Q04TA	Clearing of forests for other land use	0.04940	0.31905	-0.31905	1.04442
PA036Q05TA	Water shortages	-0.00735	0.42547	-0.42547	1.20626
PA036Q06TA	Nuclear waste	-0.02245	0.41584	-0.41584	0.89242
PA036Q07NA	Extreme weather conditions	0.35808	0.51074	-0.51074	1.18526
PA036Q08NA	Human contact with animal diseases	-0.36865	0.59186	-0.59186	0.81450

TEACHER QUESTIONNAIRES

The Teacher Questionnaire was implemented in PISA 2015 for the first time as an international option and all content was newly developed. Some questions were taken from the Teaching and Learning International Survey (TALIS) to enable comparisons and possible linkages. From the data, 20 derived variables can be analysed, nine of which were scaled using the IRT model described above. Due to the partial overlap in the two teacher questionnaires, some indices can be reported for all teachers (all indicators that are based on questions TC004 to TC026, e.g. teacher satisfaction), others only for science teachers or only for non-science teachers.

An overview of all derived variables is shown in Table 16.84, and each will be described in the following sections. Simple questionnaire indices are followed by those that are based on IRT scaling.

Table 16.84 Derived variables in the optional PISA 2015 Teacher Questionnaire

DV Name	Description	Question no.	Trend to PISA 2006	IRT scaling
EMPLSTAT	Employment Status Contract	TC004		
EMPLTIM1	Teacher Employment Time - 4 steps	TC005		
EMPLSTATd	Employment Status Contract - dichotomous	TC004		
EMPLTIM2	Teacher Employment Time - dichotomous.	TC005		
NSCHEMPL	Number of schools employed by – dichotomous	TC005		
OTT1	Originally trained teachers (wide definition).	TC013, TC014, TC015		
OTT2	Originally trained teachers (strict definition).	TC013, TC014, TC015		
NTEACH1-NTEACH11	Number of teacher educated for a specific subject (Subject was part of the Teacher education or training programme)	TC018		
STTMG1-STTMG11	Subject specific overlap between initial education and teaching the modal grade	TC018		
PROPDT20	Proportion of professional development (Teacher reported).	TC020		
SATJOB	Satisfaction with the current job environment	TC026		YES
SATTEACH	Satisfaction with teaching profession	TC026		YES
TCEDUSHORT	Educational material shortage teachers view	TC028		YES
TCSTAFFSHORT	Staff shortage teachers view	TC028		YES
COLSCIT	Science teacher collaboration	TC031		YES
SETEACH	Self-efficacy related to teaching science content	TC033		YES
SECONT	Self-efficacy related to science content	TC034		YES
TC045Q01-TC045Q15	Content overlap between initial education and professional development	TC045		
EXCHT	Exchange and co-ordination for teaching	TC046		YES
TCLEAD	Transformational leadership teachers view	TC060		YES



Simple questionnaire indices

Employment status

Two questions in the Teacher Questionnaire were used to build five derived variables indicating various aspects of teachers' employment.

TC004 asked about employment status in terms of the contract duration (permanent/fixed-term contract for a year or less/fixed-term contract for more than 1 year), while TC005 addressed whether the teacher was in full-time or part-time employment (full-time/part-time more than 70%/part-time more than 50%/part-time 50% or less) at one or more schools.

The corresponding derived variables reflected the duration of employment, measured via TC004, a) on the original three-point scale (EMPLSTAT) and b) dichotomous, distinguishing a permanent position from fixed-term contracts (EMPLSTATd).

The data from TC005 was recoded to provide three indicators. EMPLTIM1 reflects the original four-point scale, EMPLTIM2 was recoded to reflect a dichotomous variable (full-time versus part-time), and NSCHEMPL indicates whether the teacher is employed by one or by more than one school simultaneously.

Teacher education

The Teacher Questionnaire addressed a range of questions about teachers' initial education and professional development. This included a question on whether a career in the teaching profession was intended after completing ISCED 3 education (TCQ013, yes/no) and if a teacher education or training programme was completed (TC014, yes/no). TC015 asked about how the teacher qualification was received. Answering options included "standard teacher education or training programme", "in-service teacher education or training programme", "work-based teacher education or training programme", "training in another pedagogical profession" or "other".

These three questions were used to build the derived variables OTT1 (Originally trained teachers, broad definition) and OTT2 (Originally trained teachers, strict definition). The strict definition implies that a teacher had intended to be trained as a teacher from the very beginning of his or her career and has finished a "standard teacher education or training programme at a <educational institute which is eligible to educate or train teachers>". In the less strict definition, the teacher also had intended to be trained as a teacher all along and has finished any of the following three programs: either a "standard teacher education or training programme at a <educational institute which is eligible to educate or train teachers>" (option 1 in TC015), an "in-service teacher education or training programme" (option 2) or a "work-based teacher education or training programme" (option 3 in TC015).

TC018 enquired about the specific subjects that were included in the teacher's education or training programme or other professional qualification and asked if the respondents taught these subjects to the national modal grade for 15-year olds in the current school year. The derived variables NTEACH1 to NTEACH 11 reflect whether the teacher was trained to teach a certain subject. The same question is used to build the derived variables STTMG1 to STTMG11, indicating the subject-specific overlap between initial education and teaching the modal grade, i.e. whether a teacher currently teaches a certain subject combined with whether it was included in the teacher's initial training.

Participation in different professional development activities in the last 12 months was reported in TC020. This included participation in a "qualification programme", a "network of teachers focusing on professional development", "individual or collaborative research on a topic of interest", "mentoring and/or peer observation and coaching", "reading professional literature" and "engaging in informal dialogue with colleagues". The derived variable PROPDT20 indicates whether a teacher took part in any of these activities in the past 12 months. It is important to note that this question is also included in TALIS 2008, but there it refers to a time frame of the past 18 months.

TC045 asked about 15 content topics that might have been included in the teachers' initial education and training and/or in professional development activities during the last 12 months. Teachers could select both if applicable. Amongst others, these included pedagogical competencies, student assessment practices and ICT skills for teaching. The derived variables TC045Q01 to TC045Q15 reflect the content overlap between initial education and professional development.



Derived variables based on IRT Scaling

The PISA 2015 Teacher Questionnaire provided data for nine scaled indices which will be presented along with the item content and parameters in the following sections. Tables 16.85 and 16.86 contain the scale reliabilities (Cronbach's Alpha coefficients) for all participating OECD and partner countries and economies, respectively.

Table 16.85 Scale reliabilities for Teacher Questionnaire indices in OECD countries

	SATJOB	SATTEACH	TCEDUSHORT	TCSTAFFSHORT	COLSCIT	SETEACH	SECONT	EXCHT	TCLEAD
Australia	0.828	0.843	0.861	0.771	0.881	0.775	0.841	0.707	0.902
Chile	0.804	0.798	0.868	0.758	0.928	0.777	0.798	0.762	0.903
Czech Republic	0.836	0.792	0.814	0.681	0.868	0.681	0.704	0.724	0.889
Germany	0.781	0.813	0.857	0.673	0.863	0.690	0.776	0.701	0.856
Italy	0.775	0.797	0.877	0.684	0.870	N/A	N/A	0.738	0.877
Korea	0.831	0.773	0.883	0.745	0.885	0.861	0.769	0.804	0.921
Portugal	0.795	0.849	0.859	0.667	0.898	0.688	0.715	0.748	0.875
Spain	0.833	0.806	0.873	0.710	0.907	0.785	0.809	0.681	0.908
United States	0.841	0.852	0.835	0.802	0.894	0.733	0.834	0.743	0.919

Note: N/A indicates that the question has not been administered in the country.

Table 16.86 Scale reliabilities for Teacher Questionnaire indices in partner countries and economies

	SATJOB	SATTEACH	TCLEAD	TCEDUSHORT	TCSTAFFSHORT	COLSCIT	EXCHT	SETEACH	SECONT
B-S-J-G (China)	0.856	0.653	0.922	0.929	0.910	0.921	0.851	0.816	0.807
Brazil	0.804	0.780	0.910	0.898	0.817	0.907	0.806	0.782	0.759
Colombia	0.838	0.761	0.928	0.885	0.752	0.912	0.782	0.702	0.727
Dominican Republic	0.847	0.666	0.901	0.821	0.759	0.884	0.736	0.539	0.722
Hong Kong (China)	0.805	0.697	0.903	0.866	0.783	0.862	0.781	0.732	0.786
Macao (China)	0.804	0.801	0.884	0.863	0.839	0.886	0.756	0.785	0.834
Malaysia	0.812	0.764	0.926	0.908	0.827	0.889	0.819	0.747	0.823
Peru	0.808	0.733	0.905	0.875	0.783	0.897	0.776	0.759	0.799
Chinese Taipei	0.858	0.761	0.921	0.896	0.768	0.886	0.824	0.795	0.785
United Arab Emirates	0.823	0.788	0.919	0.919	0.863	0.916	0.750	0.783	0.764

Job satisfaction and school leadership

The teacher questionnaires used one question (TC026) to ask about teachers' job satisfaction. The four-point Likert scale ranged from "strongly agree", "agree", "disagree" to "strongly disagree". The derived variable "satisfaction with the current job environment" (SATJOB) was scaled using items TC026Q05NA, TC026Q07NA, TC026Q09NA, TC026Q10NA. The derived variable "satisfaction with teaching profession" (SATTEACH) was scaled using items TC026Q01NA, TC026Q02NA, TC026Q04NA (recoded), and TC026Q06N (recoded). Tables 16.87 and 16.88 show the item wording, international item parameters and item fit for SATJOB and SATTEACH, respectively.

Table 16.87 Item parameters for Satisfaction with the current job environment (SATJOB)

Item	We would like to know how you generally feel about your job. How strongly do you agree or disagree with the following statements?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
TC026Q05NA	I enjoy working at this school.	0.08511	1.62541	0.54615	-2.17156	1.25762
TC026Q07NA	I would recommend my school as a good place to work.	0.36952	1.70996	0.43825	-2.14821	1.13821
TC026Q09NA	I am satisfied with my performance in this school.	-0.33945	1.85826	0.92920	-2.78746	0.74091
TC026Q10NA	All in all, I am satisfied with my job.	-0.31986	1.81916	0.78320	-2.60236	0.86326

Table 16.88 Item parameters for Satisfaction with teaching profession (SATTEACH)

Item	We would like to know how you generally feel about your job. How strongly do you agree or disagree with the following statements?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
TC026Q01NA	The advantages of being a teacher clearly outweigh the disadvantages.	0.00964	1.50124	0.58113	-2.08236	0.57877
TC026Q02NA	If I could decide again, I would still choose to work as a teacher.	0.08215	1.14089	0.25229	-1.39318	1.33432
TC026Q04NA	I regret that I decided to become a teacher.	-0.33769	0.93611	0.39061	-1.32672	1.25278
TC026Q06NA	I wonder whether it would have been better to choose another profession.	0.36908	1.63123	-0.20855	-1.42269	0.83412

TC060 asked about teachers' views on school leadership (TCLEAD). The items can be related to those used in SC009. The four-point Likert scale ranged from "strongly agree", "agree", "disagree" to "strongly disagree". Table 16.89 shows the item wording, international item parameters and item fit for TCLEAD.

Table 16.89 Item parameters for Transformational leadership teachers view (TCLEAD)

Item	To what extent do you disagree or agree with the following statements regarding your school?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
TC060Q02NA	The principal tries to achieve consensus with all staff when defining priorities and goals in school.	-0.10263	1.86481	0.49417	-2.35898	1.04441
TC060Q04NA	The principal is aware of my needs.	0.13401	2.15078	0.39237	-2.54316	1.05004
TC060Q06NA	The principal inspires new ideas for my professional learning.	0.25823	2.21824	0.34937	-2.56761	0.75192
TC060Q07NA	The principal treats teaching staff as professionals.	-0.62260	1.59634	0.73520	-2.33154	0.92705
TC060Q09NA	The principal ensures our involvement in decision making.	0.28493	1.95661	0.30381	-2.26042	1.22657

Educational resources

In parallel to the questions addressing shortage of educational resources in the School Questionnaire (SC017), teachers were asked whether their school's capacity to provide instruction is hindered (TC028) due to lack of educational resources (TCEDUSHORT) or staff shortage (TCSTAFFSHORT). The four-point Likert scales ranged from "not at all", "very little", to "to some extent", and "a lot". The respective IRT scaled derived variables used items TC028Q05NA, TC028Q06NA, TC028Q07NA, TC028Q08NA (TCEDUSHORT) and TC028Q01NA, TC028Q02NA, TC028Q03NA, TC028Q04NA (TCSTAFFSHORT). Tables 16.90 and 16.91 show the item wording, international item parameters and item fit for TCEDUSHORT and TCSTAFFSHORT, respectively.

Table 16.90 Item parameters for Educational material shortage teachers view (TCEDUSHORT)

Item	Is your school's capacity to provide instruction hindered by any of the following issues?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
TC028Q05NA	A lack of educational material (e.g. textbooks, IT equipment, library or laboratory material).	-0.00584	1.79252	0.20125	-1.99377	0.38660
TC028Q06NA	Inadequate or poor quality educational material (e.g. textbooks, IT equipment, library or laboratory material).	0.17238	1.96513	0.13631	-2.10144	0.41894
TC028Q07NA	A lack of physical infrastructure (e.g. building, grounds, heating/cooling, lighting and acoustic systems).	-0.02702	1.46428	0.05783	-1.52211	1.60609
TC028Q08NA	Inadequate or poor quality physical infrastructure (e.g. building, grounds, heating/cooling, lighting and acoustic systems).	-0.01673	1.54394	0.03828	-1.58222	1.58837

Table 16.91 Item parameters for Staff shortage teachers view (TCSTAFFSHORT)

Item	Is your school's capacity to provide instruction hindered by any of the following issues?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
TC028Q01NA	A lack of teaching staff.	0.05865	0.82239	0.28125	-1.10364	0.70148
TC028Q02NA	Inadequate or poorly qualified teaching staff.	0.27045	1.09231	-0.02139	-1.07092	0.94076
TC028Q03NA	A lack of assisting staff.	-0.36633	0.77807	0.15947	-0.93754	0.97423
TC028Q04NA	Inadequate or poorly qualified assisting staff.	0.04432	0.90031	0.00200	-0.90231	1.38352

Teaching and teacher collaboration

Science teacher collaboration (COLSCIT) was assessed asking about teachers' agreement on a four-point Likert scale ranging from "strongly disagree" to "strongly agree" regarding different aspects of cooperation (SC031). Table 16.92 shows the item wording, international item parameters and item fit for COLSCIT.

Table 16.92 Item parameters for Science teacher collaboration (COLSCIT)

Item	To what extent do you disagree or agree with the following statements about regular cooperation among your fellow <school science> teachers and yourself?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
TC031Q04NA	We discuss the achievement requirements for <school science> when setting tests.	-0.16011	1.28360	0.56727	-1.85087	1.05515
TC031Q07NA	It is natural for us to cooperate on what homework to give to our students.	0.40101	1.59176	0.30721	-1.89897	0.87181
TC031Q11NA	We discuss the criteria we use to grade written tests.	-0.26537	1.30104	0.47756	-1.77860	0.97670
TC031Q13NA	We exchange tasks for lessons and homework that cover a range of different levels of difficulty.	0.12939	1.54771	0.32741	-1.87513	0.96791
TC031Q14NA	I prepare a selection of teaching units with my fellow <school science> teachers.	0.22109	1.48868	0.28867	-1.77735	0.98267
TC031Q15NA	We discuss ways to teach learning strategies and techniques to our students.	-0.14758	1.39740	0.46003	-1.85743	1.22837
TC031Q18NA	My fellow <school science> teachers benefit from my specific skills and interests.	0.02407	1.63974	0.56793	-2.20767	0.89188
TC031Q20NA	We discuss ways to better identify students' individual strengths and weaknesses.	-0.10157	1.54729	0.39715	-1.94445	1.02551



TC046 addressed teaching-related co-operation using items like “teaching jointly” or “exchanging teaching materials”. Teachers were asked to rate these activities with the following answering categories “never”, “once a year or less”, “2-4 times a year”, “5-10 times a year”, “1-3 times a month”, and “once a week or more”. The derived variable indicates exchange and co-ordination for teaching (EXCHT, items TC046Q04NA, TC046Q05NA, TC046Q06NA, TC046Q07NA). Table 16.93 shows the item wording, international item parameters and item fit for EXCHT.

Table 16.93 Item parameters for Exchange and co-ordination for teaching (EXCHT)

Item	On average, how often do you do the following in this school?	Parameter estimates						
		beta	d_1	d_2	d_3	d_4	d_5	alpha
TC046Q04NA	Exchange teaching materials with colleagues	0.01092	0.72353	0.55623	-0.32800	-0.27921	-0.67255	0.79876
TC046Q05NA	Engage in discussions about the learning development of specific students	-0.07710	0.71516	0.42550	-0.26368	-0.24930	-0.62768	1.34674
TC046Q06NA	Work with other teachers in my school to ensure common standards in evaluations for assessing student progress	0.14917	0.69949	0.50130	-0.25550	-0.21187	-0.73343	1.27682
TC046Q07NA	Attend team conferences	-0.16507	0.65883	0.83414	-0.08830	-0.46112	-0.94355	0.57768

The Teacher Questionnaire also addressed teachers’ self-efficacy related to teaching science content (SETEACH) such as using experiments in everyday teaching (TC033) and self-efficacy related to science content (SECONT) such as explaining a complex scientific concept to a fellow teacher (TC034). Teachers were asked to rate their agreement with different statements on a four-point Likert scale with the answering options “not at all”, “very little”, “to some extent”, “to a large extent”. Tables 16.94 and 16.95 show the item wording, international item parameters and item fit for SETEACH and SECONT, respectively.

Table 16.94 Item parameters for Self-efficacy related to teaching science content (SETEACH)

Item	To what extent can (or could) you do the following?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
TC033Q04NA	Design experiments and hands-on activities for <inquiry-based learning>	0.12659	1.83102	0.16742	-1.99844	0.78105
TC033Q05NA	Assign tailored tasks to the weakest as well as to the best students	0.22470	1.70739	0.20821	-1.91560	0.99481
TC033Q06NA	Use a variety of assessment strategies	-0.10617	1.62195	0.21158	-1.83353	1.15511
TC033Q08NA	Facilitate a discussion among students on how to interpret experimental findings	-0.18687	1.56568	0.29511	-1.86079	1.06903

Table 16.95 Item parameters for Self-efficacy related to science content (SECONT)

Item	To what extent can (or could) you do the following?	Parameter estimates				
		beta	d_1	d_2	d_3	alpha
TC034Q01NA	Explain a complex scientific concept to a fellow teacher	-0.07070	1.84108	0.14818	-1.98925	1.02075
TC034Q02NA	State and defend an informed position on ethical problems relating to <broad science>	0.11600	1.73719	0.15930	-1.89649	1.21705
TC034Q04NA	Read state-of-the-art papers in my scientific discipline	0.08670	1.65776	0.06347	-1.72124	0.86318
TC034Q06NA	Explain the links between biology, physics and chemistry	-0.16001	1.67677	0.24832	-1.92509	0.89902

THE PISA INDEX OF ECONOMIC, SOCIAL AND CULTURAL STATUS (ESCS)

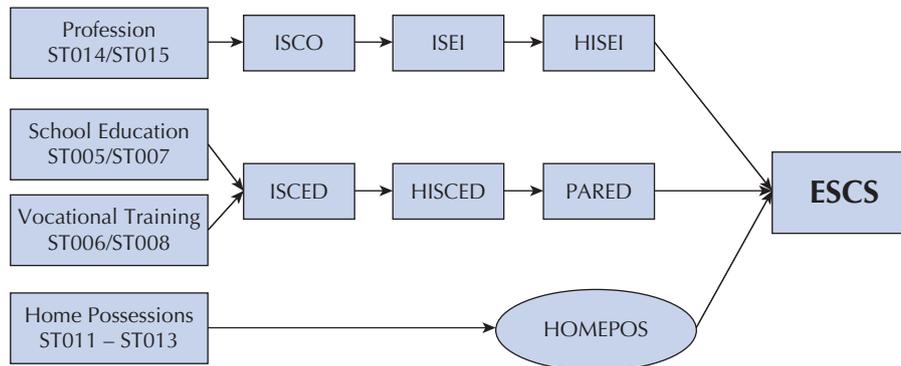
Computation of ESCS

The ESCS is a composite score built by the indicators parental education (PARED), highest parental occupation (HISEI), and home possessions (HOMEPOS) including books in the home via principal component analysis (PCA). (See description of these three variables above). The rationale for using these three components was that socio-economic status has usually been seen as based on education, occupational status and income. As no direct income measure has been available from the PISA data, the existence of household items has been used as a proxy for family wealth.

For students with missing data on one out of the three components, the missing variable was imputed. Regression on the other two variables was used to predict the third (missing) variable, and a random component was added to the predicted value. If there were missing data on more than one component, ESCS was not computed and a missing value was assigned for ESCS. After imputation, all three components were standardised for OECD countries⁷ and partner countries/economies with an OECD mean of zero and a standard deviation of one.

Standardised variables, including imputed values, were used in the PCA to obtain ESCS values. As in previous cycles, ESCS was defined as the component score for the first principal component. The PCA was run across equally weighted countries, including OECD as well as partner countries/economies.

■ Figure 16.5 ■

Computation of ESCS in PISA 2015

Note: ISCO: International Standard Classification of Occupations; ISEI: occupational status of mother and father; HISEI: highest parental occupational status; ISCED: International Standard Classification of Education; HISCED: Highest education of parents (ISCED); PARED: Index for highest parental education in years of schooling; HOMEPOS: Index of home possessions (WLE); ESCS: Index of economic, social and cultural status.

Please note that in previous cycles, the PCA was based on OECD countries only. For partner countries/economies, ESCS scores were simple indices using standardised imputed variables, fixed factor scores from PCA across OECD countries, and the eigenvalue of the first principal component (please see PISA 2012 Technical Report⁸). In PISA 2015, the PCA is estimated across all OECD and partner countries/economies concurrently⁹. Thus, all countries and economies contribute equally to the estimation of ESCS scores. However, for the purpose of reporting the ESCS scale has been transformed with zero being the score of an average OECD student and one being the standard deviation across equally weighted OECD countries¹⁰.

Consistency across countries

Using principal component analysis (PCA) to derive factor loadings for each participating country provided insight into the extent to which relationships of the index were similar between the three variables. Table 16.96 shows the PCA results for the OECD countries and Table 16.97 shows those for partner countries/ economies. The tables also include the scale reliabilities (Cronbach's alpha) for the z-standardised variables.

Table 16.96 Factor loadings and reliability (Cronbach's Alpha) of ESCS 2015 in OECD countries

	HISEI	PARED	HOMEPOS	Reliability
Australia	0.80	0.79	0.67	0.60
Austria	0.81	0.79	0.72	0.66
Belgium	0.84	0.79	0.71	0.68
Canada	0.80	0.79	0.64	0.58
Chile	0.85	0.84	0.77	0.76
Czech Republic	0.82	0.76	0.72	0.65
Denmark	0.83	0.79	0.68	0.65
Estonia	0.83	0.78	0.68	0.63
Finland	0.80	0.76	0.68	0.59
France	0.83	0.78	0.72	0.66
Germany	0.83	0.81	0.74	0.70
Greece	0.83	0.82	0.71	0.70
Hungary	0.85	0.83	0.75	0.74
Iceland	0.75	0.76	0.65	0.53
Ireland	0.81	0.80	0.70	0.65
Israel	0.80	0.79	0.68	0.60
Italy	0.83	0.79	0.72	0.68
Japan	0.74	0.76	0.68	0.54
Korea	0.78	0.79	0.73	0.62
Latvia	0.83	0.82	0.72	0.69
Luxembourg	0.86	0.79	0.75	0.72
Mexico	0.85	0.85	0.80	0.77
Netherlands	0.81	0.78	0.75	0.67
New Zealand	0.81	0.75	0.68	0.58
Norway	0.80	0.78	0.68	0.60
Poland	0.81	0.80	0.71	0.65
Portugal	0.86	0.84	0.76	0.75
Slovak Republic	0.84	0.82	0.74	0.72
Slovenia	0.84	0.82	0.69	0.68
Spain	0.85	0.83	0.74	0.73
Sweden	0.82	0.77	0.66	0.61
Switzerland	0.82	0.81	0.69	0.68
Turkey	0.82	0.79	0.77	0.68
United Kingdom	0.80	0.76	0.73	0.63
United States	0.84	0.81	0.74	0.71



Table 16.97 Factor loadings and reliability (Cronbach's Alpha) of ESCS 2015 in partner countries and economies

	HISEI	PARED	HOMEPOS	Reliability
Albania	0.82	0.82	0.74	0.69
Algeria	0.79	0.76	0.72	0.62
Argentina	0.84	0.82	0.75	0.72
B-S-J-G (China)	0.84	0.80	0.80	0.74
Brazil	0.82	0.80	0.78	0.71
Bulgaria	0.82	0.81	0.69	0.67
Colombia	0.81	0.78	0.80	0.70
Costa Rica	0.82	0.79	0.82	0.73
Croatia	0.82	0.80	0.70	0.67
Cyprus*	0.85	0.82	0.70	0.70
Dominican Republic	0.79	0.77	0.75	0.66
FYROM	0.77	0.76	0.72	0.61
Georgia	0.78	0.76	0.76	0.62
Hong Kong (China)	0.84	0.81	0.76	0.73
Indonesia	0.83	0.81	0.80	0.74
Jordan	0.81	0.83	0.73	0.67
Kazakhstan	0.72	0.77	0.69	0.44
Kosovo	0.76	0.76	0.70	0.58
Lebanon	0.60	0.79	0.77	0.54
Lithuania	0.83	0.81	0.71	0.68
Macao (China)	0.79	0.80	0.70	0.64
Malaysia	0.85	0.76	0.80	0.73
Malta	0.84	0.82	0.65	0.67
Moldova	0.80	0.76	0.76	0.65
Montenegro	0.79	0.76	0.70	0.61
Peru	0.86	0.82	0.81	0.76
Qatar	0.74	0.78	0.50	0.38
Romania	0.81	0.78	0.74	0.67
Russia	0.80	0.80	0.70	0.63
Singapore	0.83	0.82	0.77	0.73
Chinese Taipei	0.79	0.80	0.75	0.67
Thailand	0.82	0.81	0.79	0.72
Trinidad and Tobago	0.76	0.75	0.70	0.57
Tunisia	0.83	0.79	0.80	0.73
United Arab Emirates	0.74	0.79	0.48	0.36
Uruguay	0.83	0.82	0.77	0.73
Viet Nam	0.82	0.83	0.80	0.74

* See note under Table 16.6.

Trends in ESCS

ESCS model

The index of ESCS was used first in the PISA 2000 analysis and at that time was derived from five indices: highest occupational status of parents (HISEI), highest educational level of parents (PARED), and three IRT scales based on student reports on home possessions: family wealth (WEALTH), cultural possessions (CULTPOSS) and home educational resources (HEDRES).

Since PISA 2003 the ESCS is derived from three indices: highest parental occupation (HISEI), highest parental education (PARED), and one IRT scale based on student reports on home possessions including books in the home (HOMEPOS). However, until PISA 2012 the PCA was based on OECD countries only. In PISA 2015, the PCA is estimated across all countries concurrently. Thus, all countries and economies contribute equally to the estimation of ESCS scores.

ESCS components

The mapping of ISCED levels to years of schooling (PARED) was updated in 2009 and 2015 for some countries, taking into account changes in countries' educational systems.

Indicators of HOMEPOS have been dropped or added in all PISA cycles (except in PISA 2012) taking into account social, technical and economic changes in participating societies. Moreover, the method for HOMEPOS estimation has changed in PISA 2009, PISA 2012 and PISA 2015.

Since PISA 2012 parental occupation is coded into HISEI using the current international standard classification of occupations, ISCO-08. Previous cycles used ISCO-88. For the effects of ISCO-08 compared to ISCO-88 on ESCS and performance please see PISA 2012 Technical Report, pp. 372 (OECD, 2014).



In conclusion, ESCS components and the ESCS model has changed over cycles and with that, ESCS scores are not comparable across cycles directly. In order to enable a trends study, in PISA 2015 the ESCS was computed for the current cycle and also recomputed for the earlier cycles using a similar methodology.

ESCS trend scores

Before trend scores could be estimated, slight adjustments of the three trend components had to be made. As in PISA 2012 the occupational coding scheme involved in the process of forming HISEI changed from ISCO-88 to ISCO-08, the occupational codes for previous cycles were mapped from the former to the current scheme (see also PISA 2012 Technical Report, Chapter 3 (OECD, 2014)).

In order to make the PARED component comparable across cycles, similar ISCED to PARED mapping schemes were employed for all the cycles. These mappings to years of education can be found in Annex E. To make the HOMEPOS component more comparable across cycles, the variable *books in the home* (ST013Q01TA) was recoded into a four-level categorical variable (fewer than or equal to 25 books, 26-100 books, 101-500 books, more than 500 books).

The HOMEPOS scale was constructed in three steps. In the first step, international item parameters for all items (except country-specific items, i.e. ST011Q17NA, ST011Q18NA and ST011Q19NA) administered in PISA 2015 were obtained from a concurrent calibration of the 2015 data. Except for the recoding of variable ST013Q01TA, this step is identical with the regular scaling of HOMEPOS in PISA 2015 (see above). In the second step, items from all previous cycles (i.e., 2000-2012) were scaled whereas parameters were fixed for all items administered in 2015 and for which no unique (i.e., country-specific) item parameters became necessary (see Table 16.9 for the respective subset of items and their parameters). Item parameters for all other items (except national items) were freely estimated but constrained to be equal across countries within cycles. Only national items (i.e., ST011Q17NA, ST011Q18NA and ST011Q19NA) received unique parameters throughout. Additional analyses on the invariance of item parameters across countries, languages and cycles were conducted and unique parameters were assigned if necessary. Once this process was finished, WLEs for all students from previous cycles (2000-2012) were estimated in the third and final step. By restricting the largest subset of items (17 out of 27) to be equal across cycles, the HOMEPOS scores can be regarded to be on a joint scale, allowing for comparisons of countries across cycles and thus allowing to be used in the calculation of trend ESCS.

The PCA for obtaining ESCS scores was then calculated as described in the section “ESCS computation” above. However, the calculation was done across all cycles using these three comparable components (HISEI, PARED, and HOMEPOS).



Notes

1. For ease of understanding, the scaling constant, D , has been omitted from formulas 16.1 to 16.3 (refer chapter 9 for details).
2. For standardisation, data were grouped by national centre rather than by country; as a result, data for the United Kingdom (GBR) comprised two sets QUK (United Kingdom excluding Scotland) and QSC (Scotland) and data for Belgium comprised two sets, BFL (Flemish Community) and BFR (French- and German-speaking Community), thus contributing as OECD countries with double weight each.
3. Based on pseudo counts from the E-step (during the EM algorithm).
4. It should be noted that research on the validity of this procedure is still ongoing. Further empirical evidence is needed to support setting the cut-off value of .3 and its implications, meanwhile this approach can be compared with other psychometric methods to evaluate cross-cultural comparability (e.g. He and Kubacka, 2015).
5. See Annex D.
6. <https://stats.oecd.org/glossary/detail.asp?ID=1436>
7. In line with the standardisation of the IRT-based Derived Variables, the United Kingdom (GBR) and Belgium contributed two samples each, with each sample's weight equal to that of other countries.
8. <https://www.oecd.org/pisa/pisaproducts/pisa2012technicalreport.htm>
9. For Spain, the QES sample was included in the Principal Component Analysis whereas for ESCS standardization, ESP was used to compute the OECD transformation constants.
10. In October 2016, it turned out that the PARED variable was coded incorrectly for Spain, Lebanon and Latvia. As a consequence, the ESCS calculation was based on incorrect variables in some of the countries. To avoid changing the values of ESCS for all countries, at a time where most reports were already completed, ESCS was recalculated only for the samples with mistakes in the original PARED values, using the results from the international ESCS calculation (i.e., constants for standardizing input variables, factor loadings, eigenvalue, and constants for standardising the ESCS). As a consequence of this partial recalculation, the ESCS mean across OECD countries is no longer exactly zero and the standard deviation is no longer exactly one. Instead, the respective descriptives are -0.0259 and 1.00001.

References

- Bempechat, J., N. V. Jimenez and B. A. Boulay** (2002), "Cultural-cognitive issues in academic achievement: New directions for cross-national research", in A. C. Porter and A. Gamoran (eds.), *Methodological Advances in Cross-National Surveys of Educational Achievement*, National Academic Press, Washington, D.C.
- Buckley, J.** (2009), "Cross-national response styles in international educational assessments: Evidence from PISA 2006", https://edsurveys.rti.org/PISA/documents/Buckley_PISAresponsestyle.pdf (accessed on November 2 2016).
- Ganzeboom, H.B.G. and D.J. Treiman** (2003), "Three internationally standardised measures for comparative research on occupational status", in J.H.P. Hoffmeyer-Zlotnik and C. Wolf (eds.), *Advances in Cross-National Comparison, A European Working Book for Demographic and Socio-Economic Variables*, pp. 159-193, Kluwer Academic Press, New York.
- Glas, C. A. W. and K. Jehangir** (2014), "Modeling country-specific differential item functioning", in L. Rutkowski, M. von Davier and D. Rutkowski (eds.), *Handbook of International Large-Scale Assessment: Background, Technical Issues and Methods of Data Analysis*, pp. 97-115, Springer, New York.
- He, J. and K. Kubacka** (2015), "Data comparability in the teaching and learning international survey (TALIS) 2008 and 2013", *OECD Education Working Papers*, No. 124, OECD Publishing, Paris.
- International Labour Office** (2012), International standard classification of occupations, ISCO-08, www.ilo.org/public/english/bureau/stat/isco/ (accessed on November 2016).
- Masters, G. N. and B. D. Wright** (1997), "The partial credit model", in W. J. van der Linden and R. K. Hambleton (eds.), *Handbook of Modern Item Response Theory*, Springer, New York.
- Muraki, E.** (1992), "A generalized partial credit model: Application of an EM algorithm", *ETS Research Report Series*, Vol. 1992/1, pp. i-30.
- OECD** (2017), *PISA 2015 Assessment and Analytical Framework: Science, Reading, Mathematic, Financial Literacy and Collaborative Problem Solving*, PISA, OECD Publishing, Paris, <http://dx.doi.org/10.1787/9789264281820-en>.



Penfield, R. D., N. D. Myers and E. W. Wolfe: OECD (2014), *PISA 2012 Technical Report*, PISA, OECD publishing, Paris.

OECD (1999), *Classifying Educational Programmes: Manual for ISCED-97 Implementation in OECD Countries*, OECD Publishing, Paris, <http://www.oecd.org/education/skills-beyond-school/1962350.pdf>.

Penfield, R. D., N. D. Myers and E. W. Wolfe (2008), "Methods for Assessing Item, Step, and Threshold Invariance in Polytomous Items Following the Partial Credit Model", *Educational and Psychological Measurement*, Vol. 68, pp. 717-733.

Rasch, G. (1960), *Probabilistic Models for Some Intelligence and Attainment Tests*, Nielsen and Lydiche, Copenhagen, Denmark.

von Davier, M. (2008), "A general diagnostic model applied to language testing data", *British Journal of Mathematical and Statistical Psychology*, Vol. 61, pp. 287-307.

Warm, T. A. (1989), Weighted likelihood estimation of ability in item response theory, *Psychometrika*, Vol. 54, pp. 427-450.