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Scaling Procedures and Construct Validation of Context Questionnaire Data

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OVERVIEW

The PISA 2012 context questionnaires included numerous items on student characteristics, student family background, student perceptions, school characteristics and perceptions of school principals. While student and school context questionnaires were mandatory in all countries, 11 countries also administered the optional questionnaire to parents of the tested students. In addition, students were administered the Information and Communication Technology Questionnaire (ICT) in 42 countries and the Educational Career Questionnaire in 23 countries.

Some of the items were designed to be used in analyses as single items (for example, gender). However, most questionnaire items were designed to be combined in some way in order to measure latent constructs that cannot be observed directly. To these items, transformations or scaling procedures were applied to construct meaningful indices.

This chapter describes, for all five questionnaires, how indices based on one or more items were constructed and validated. As in previous PISA surveys, two different kinds of indices can be distinguished:

- simple indices: these indices were constructed through the arithmetical transformation or recoding of one or more items; and
- scale indices: these indices were constructed through the scaling of items. Typically, scale scores for these indices were estimates of latent traits derived through Item Response Theory (IRT) scaling of dichotomous or Likert-type items.

This chapter (i) outlines how simple indices were constructed, (ii) describes the methodology used for construct validation and scaling, (iii) details the construction and validation of scaled indices and (iv) illustrates the computation of the *PISA index of economic, social and cultural status (ESCS)*. Some indices have been used in previous PISA surveys and were constructed based on a similar scaling methodology (see Schulz, 2003; OECD, 2005). Other indices were based on the elaboration of the PISA 2012 questionnaire framework (see OECD, 2013, Chapter 6) and related to mathematics as the major domain of the fifth PISA cycle (see Chapter 1).

SIMPLE QUESTIONNAIRE INDICES

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 and the student tracking forms. If the month of testing was not known for a particular student, the median month of testing for that country was used in the calculation. The formula for computing *AGE* was

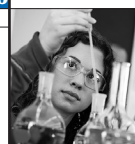
16.1

$$AGE = (100 + T_y - S_y) + \frac{(T_m - S_m)}{12}$$

where T_y and S_y are the year of the test and the year of the students' birth of the tested student, 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.

Study programme indices

PISA 2012 collected data on study programmes available to 15-year-old students in each country. This information was obtained through the student tracking form and the Student Questionnaire. In the final database, all national programmes are included in a separate 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) (OECD, 1999). The following indices were derived from the data on study programmes: programme level (*ISCEDL*) indicating whether students were at the lower or upper secondary level (ISCED 2 or ISCED 3); programme designation (*ISCEDD*) indicating 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*) indicating whether the programme's curricular content was general, pre-vocational or vocational.



Highest occupational status of parents

Occupational data for both the student's father and student's mother were obtained by asking open-ended questions. The responses were coded to four-digit ISCO codes (ILO, 2007) and then mapped to the international socio-economic index of occupational status (*ISEI*) (Ganzeboom, 2010). In PISA 2012, the new ISCO and *ISEI* in their 2008 version were used rather than the 1988 versions that had been applied in the previous four cycles. For details regarding the update and results of analyses of the possible impact of this update, please see Chapter 17 of this report.

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.

Educational level of parents

Parental education is a second family background variable that is often used in the analysis of educational outcomes. Theoretically, it has been argued that parental education is more relevant for students' academic outcomes than parental occupation. Like occupation, the collection of internationally comparable data on parental education poses significant challenges, and less work has been done on internationally comparable measures of parental education than has been done on occupational status. The main difficulties with parental education relate to international comparability (education systems differ widely between countries and within countries over time), response validity (students are often unable to accurately report their parents level of education) and – especially with increasing migration – difficulties in the national mapping of parental qualifications gained elsewhere.

Students' responses regarding parental education were classified using ISCED (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, 6 (theoretically oriented tertiary and post-graduate). Indices with these categories were provided for the students' mother (*MISCED*) and the students' 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*). A mapping of ISCED levels of years of schooling is provided in Annex D.

Immigration background

Information on the country of birth of the students and their parents was also collected. Included in the database were three country-specific variables relating to the country of birth of the student, their mother and father (*COBN_S*, *COBN_M*, and *COBN_F*). The items ST20Q01, ST20Q02 and ST20Q03 were also recoded for the database into the following categories: (1) country of birth is same as country of assessment and (2) otherwise.

The *index of immigrant background* (*IMMIG*) was calculated from these variables with the following categories: (1) 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 also indicated what language they usually spoke at home (*ST25*) and the database includes a variable (*LANGN*) containing a country-specific code for each language. In addition, an internationally comparable variable *ST25Q01* 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.

Family structure

Information collected from students regarding their family structure formed the basis for the index *FAMSTRUC* with the following categories: "1" if "single parent family" (students living with only one of the following: mother, father, male guardian, female guardian), "2" if "two parent family" (students living with a father or step/foster father and a mother or step/foster mother) and "3" for students who do not live with their parents.



Relative grade

The relative grade index (*GRADE*) was computed to capture between country variation. It indicates whether students are at a modal grade in a country (value of 0) or whether they are below or above the modal grade (+x grades, -x grades).

Grade repetition

The grade repetition variable (*REPEAT*) was computed by recoding variables *ST07Q01*, *ST07Q02*, *ST07Q03*. It took the value of “1” if the student had repeated a grade in at least one level and the value of “0” if “No, never” was chosen at least one time, 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 of three levels.

Out-of-school study time

Students were asked in open-ended format how much time they spent studying outside school, for example, with a tutor or parent (*ST57Q01*- *ST57Q06*). The index *OUTHOURS* was computed by summing the time spent studying for school subjects.

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 (*ST69* and *ST70*). Comparable indices were computed for mathematics (*MMINS*) and science (*SMINS*).

School Questionnaire indices

School size

The *index of school size* (*SCHSIZE*) contains the total enrolment at school based on the enrolment data provided by the school principal, summing the number of girls and boys at a school. This index was calculated in 2012 and in all previous cycles.

Proportion of girls enrolled at school

The *index on the proportion of girls at school* (*PCGIRLS*) is based on the enrolment data provided by the school principal (*SC07*), dividing the number of girls by the total number of girls and boys at a school. Prior to 2012, this index was also calculated in 2000 and 2006.

School type

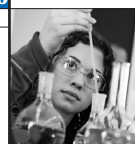
Schools are classified as either public or private according to whether a private entity or a public agency has the ultimate power to make decisions concerning its affairs. As in previous PISA surveys, the index on school type (*SCHLTYPE*) has three categories, based on two questions: (1) government-independent private schools controlled by a non-government organisation or with a governing board not selected by a government agency which receive less than 50% of their core funding from government agencies, (2) government-dependent private schools controlled by a non-government organisation or with a governing board not selected by a government agency which receive more than 50% of their core funding from government agencies, (3) public schools controlled and managed by a public education authority or agency. This index was calculated in 2012 and in all previous cycles. In 2009 the variable name was *SCHTYPE*.

Availability of computers

School principals were asked to report the number of computers available at school. The *index of availability of computers* (*RATCMP15*) was 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. This was a new index in 2012.

As in previous cycles, in PISA 2012, the index *COMPWEB* 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 web.

To obtain information on the educational use of technology, a question in the school questionnaire (*SC13*) asked about the proportion of time that the school expected students to use Internet/World Wide Web for homework, during lessons and for assignments or projects. No index was created, however.



Quantity of teaching staff at school

Principals were asked to report the number of full-time and part-time teachers at their school. Teachers in general and mathematics teachers were reported separately. However, since PISA 2006, the number of items about teachers in general has been reduced to capture only teachers in total, certified teachers, and teachers with an ISCED 5A qualification, rather than providing further break-downs by subject or specialist areas. For all of the following indices the number of part-time teachers contributed 0.5 and the number of full-time teachers 1.0 to the estimated numbers of teachers at school.

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

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

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

The student-mathematics teacher ratio (*SMRATIO*) was obtained by dividing the number of enrolled students (index *SCHSIZE*) by the total number of mathematics teachers.

The proportion of mathematics teachers (*PROPMATH*) was computed by dividing the number of mathematics teachers by the total number of teachers.

The proportion of mathematics teachers with an ISCED 5A qualification (*PROPMA5A*) was calculated by dividing the number of these teachers by the total number of mathematics teachers.

Use of assessments

School principals were asked to indicate whether or not assessments of 15-year-old students were used for the following purposes at school: *i*) informing parents about progress; *ii*) for decisions about students' retention or promotion; *iii*) grouping students for instructional purposes; *iv*) comparison with district or national performance; *v*) monitoring the school's yearly progress; *vi*) judgements about teachers' effectiveness; *vii*) identification of areas for improvement; and *viii*) comparison with other schools. The index *use of assessments* (*ASSESS*) was calculated as the sum of "yes" responses to these eight items. Although the variable name of this index is the same as in some of the previous cycles, this index is not comparable with those cycles.

Class size

The average class size (*CLSIZE*) was derived from one of nine possible categories, ranging from "15 students or fewer" to "More than 50 students" for the average class size of the test language in the sampled schools. The midpoint of each response category was used for *CLSIZE*, resulting in a value of 13 for the lowest category, and a value of 53 for the highest.

Extra-curricular activities at school

School principals were asked to report what extra-curricular activities their schools offered to 15-year-old students (*SC16*).

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.

Mathematics activities at school

The index of mathematics-related extra-curricular activities at school (*MACTIV*) was computed as follows. First, the question *SCQ21* was assigned the value of '1' if the purpose of additional mathematics lessons was "enrichment mathematics only", "remedial mathematics only", or "without differentiation depending on the prior achievement level of the students" whereas it was assigned the value of '2' if "both enrichment mathematics and remedial mathematics" was the reported purpose. Second, each of three items about a mathematics club (*SC16Q05*), mathematics competitions (*SC16Q06*), or club with a focus on computers/ ICT (*SC16Q08*) was assigned the value of '1' if a school reported to offer these activities to 15-year-old students. Where a school did not offer one of these three activities, the corresponding



variable received the value of '0'. Third, these recoded variables were summed up to result in a range of "0" to "5" for *MACTIV*. For example, if the purpose of additional lessons was "both enrichment mathematics and remedial mathematics" and the school offered a mathematics club, but not an ICT club or mathematics competitions, the value of *MACTIV* was coded as "3".

The index of mathematics extension courses offered at school (*MATHEXC*) was created by assigning schools to one of three different categories based on the mathematics extension course types offered at school. Schools that offered additional mathematics courses without differentiation based on prior achievement were assigned a '1', schools that offered either enrichment mathematics only or remedial mathematics classes only were assigned a '2' and schools that offered both enrichment and remedial mathematics classes were assigned a '3'.

School selectivity

As in previous cycles, school principals were asked about admittance policies at their school, including placement tests and recommendation by feeder schools. The response scale was modified in 2012 from indicating whether or not a policy was a prerequisite to a frequency scale of "never", "sometimes", and "always".

In 2012, an index of academic school selectivity (*SCHSEL*) was computed by assigning schools to one of three categories based on how often two factors, namely student academic performance and recommendation of feeder schools were considered when admitting students to the school as follows: (1) the two factors were never considered, (2) at least one factor was considered sometimes but neither always and (3) at least one factor was considered always.

Ability grouping for mathematics classes

School principals were asked to report the extent to which their mathematics instruction catered for students with different abilities (*SC15*). The first two items asked about the occurrence of ability grouping into different classes either with similar content but different difficulty levels or with different content, one about ability grouping within classes and one about the application of different pedagogies within a class rather than ability grouping. Response categories were "For all classes", "For some classes" and "Not for any classes".

An index of ability grouping between mathematics classes (*ABGMATH*) was derived from the first two items by assigning schools to three categories: (1) schools with no ability grouping for any classes, (2) schools with one of these forms of ability grouping between some classes and (3) schools with one of these forms of ability grouping for all classes.

School responsibility for resource allocation

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' salaries 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 2006 and 2009 PISA cycles.

School responsibility for curriculum and assessment

An index of the relative level of responsibility of school staff in issues relating to curriculum and assessment (*RESPCURR*) 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*.



Parent Questionnaire indices

Educational level of parents

Administration of the parent questionnaire in PISA 2012 provided the opportunity to collect data on parental education directly from the parents in addition to the data provided from their children in the student questionnaire. Similar to the student questionnaire data, parental educational levels were classified using ISCED (OECD, 1999). The question format differed from the one used in the student questionnaire as only four items were included with the dichotomous response categories of “yes” or “no”.

Indices were constructed by taking the highest level for father and mother and having the following categories: (0) None, (1) ISCED 3A (general upper secondary) and/or ISCED 4 (non-tertiary post-secondary), (2) ISCED 5B (vocational tertiary), (3) ISCED 5A, 6 (theoretically oriented tertiary and post-graduate). Indices with these categories were computed for mother (*PQMISCED*) and father (*PQFISCED*). Highest educational level of parents (*PQHISCED*) corresponds to the higher ISCED level of either parent.

Occupational status of parents reported by parents

Occupational data for both the student’s father and student’s mother were obtained by asking open-ended questions of the parents themselves. The responses were coded into four-digit ISCO-08 codes and then mapped to the international socio-economic index of occupational status (*ISEI*) (Ganzeboom et al., 2010). Three indices were obtained from these data: father’s occupational status (*PQBFMI*); mother’s occupational status (*PQBMMI*); and the highest occupational status of parents (*PQHISEI*) which corresponds to the higher *ISEI* of either parent or to the only available parent’s *ISEI* score. For all three indices, higher *ISEI* indicates higher levels of occupational status.

Occupational aspirations of parents for their child

In addition, parents were asked about the occupational aspirations for their child. The response was coded into a four-digit ISCO-08 code and then mapped to the international socio-economic index of occupational status (Ganzeboom et al., 2010). This resulted in the *PQOCCASP* index.

Immigration status of parents

Two indices reflecting the immigrant status of parents were calculated based on responses to the countries of birth of the students’ parents as well as the students’ grandparents: father’s immigration status (*PQIMMIGF*) and mother’s immigration status (*PQIMMIGM*). The indices were coded to have the following categories: (1) native parent (those parents who had at least one parent (students’ grandparent) born in the country of the assessment); (2) second generation parent (those born in the country of assessment but whose parent(s) were born in another country); (3) first-generation parent (those parent born outside the country of assessment and whose parents were also born outside the country of assessment). Parents with missing responses for either the parent or for both grandparents were assigned missing values for these indices.

Citizenship of parents

Two indices regarding the citizenship of parents were calculated: father’s citizenship (*PQCITIZF*) and mother’s citizenship (*PQCITIZM*). The indices were coded to have the following categories: (1) parent has citizenship of the country of the assessment only; (2) parent has citizenship of the country of the assessment and another country (or countries); (3) parent has citizenship of a country (or countries) other than the country of the assessment.

Language spoken by parents at home

Two indices reflecting the language spoken by parents at home were calculated. *PQLANGNM* is a country-specific three digit code for the language the mother spoke at home most of the time. Responses to this question were transformed into an internationally comparable variable, *PA25Q01*, with the following categories: (1) mother’s language at home was same as the language in which the student took the test; (2) mother’s language at home was another language.

PQLANGNF is a country-specific three digit code for the language the father spoke at home most of the time. Responses to this question were transformed into an internationally comparable variable, *PA25Q02*, with the following categories: (1) father’s language at home was same as the language in which the student took the test; (2) father’s language at home was another language.



SCALING METHODOLOGY AND CONSTRUCT VALIDATION

Scaling procedures

Most questionnaire items were scaled using IRT scaling methodology. With the One-Parameter (Rasch) model (Rasch, 1960) for dichotomous items, the probability of selecting category 1 instead of 0 is modelled as

16.2

$$P_i(\theta_n) = \frac{\exp(\theta_n - \delta_i)}{1 + \exp(\theta_n - \delta_i)}$$

where $P_i(\theta_n)$ is the probability of person n to score 1 on item i . θ_n is the estimated latent trait of person n and δ_i the estimated location of item i on this dimension. For each item, item responses are modelled as a function of the latent trait θ_n .

In the case of items with more than two (k) categories (as for example with Likert-type items) this model can be generalised to the Partial credit model (Masters and Wright, 1997), which takes the form of

16.3

$$P_{xi}(\theta_n) = \frac{\exp \sum_{k=0}^x (\theta_n - \delta_i + \tau_{ij})}{\sum_{h=0}^{m_i} \exp \sum_{k=0}^h (\theta_n - \delta_i + \tau_{ik})} \quad x_i = 0, 1, \dots, m_i$$

where $P_{xi}(\theta_n)$ denotes the probability of person n to score x on item i out of the m_i possible scores on the item. θ_n denotes the person's latent trait, the item parameter δ_i gives the location of the item on the latent continuum and τ_{ij} denotes an additional step parameter.¹

International item parameters were obtained using the *ConQuest* software (Adams, Wu, and Wilson, 2012a). The calibration samples consisted of randomly selected sub-samples:

- For the calibration of student item parameters except items involved in household possessions and home background indices, sub-samples of 750 students were randomly selected within each country sample available at the time of calibration. As final student weights had not been available at the time the calibration sample was drawn, the random selection was based on preliminary student weights obtained from the ratio between sampled and enrolled students within explicit sampling strata. The final calibration sample included data from 48 000 students.
- For the calibration of parent item parameters, all available data from the parent questionnaires were merged with the student calibration sample described above.
- For the calibration of student item parameters for the items involved in household possessions and home background indices the calibration sample was drawn from all cycles for trend purposes. For the first four cycles, 500 cases were drawn from each participating country. For the fifth cycle, PISA 2012, 750 cases were drawn from each country to emphasise the PISA 2012 data as the basis for trend. The final calibration sample included data from 154 541 students.
- For the calibration of school item parameters, all available data were used and countries were weighted equally.

Once the international item parameters had been estimated from the calibration sample, Weighted Likelihood Estimate (WLE; Warm, 1989) was used to obtain individual participant scores. The WLEs were derived using the *ConQuest* software (Wu, Adams and Wilson, 2012a) with pre-calibrated item parameters.

WLEs were transformed to an international metric with an OECD average of zero and an OECD standard deviation of one. The transformation was achieved by applying the formula

16.4

$$\theta'_n = \frac{\theta_n - \bar{\theta}_{OECD}}{\sigma_{\theta(OECD)}}$$

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

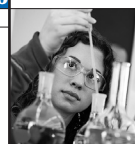


Table 16.1 OECD means and standard deviations of Weighted Likelihood Estimates (WLEs)

Student-level indices	N	Mean	S.D.
ANXMAT	22008	-0.27	1.87
ATSchL	21939	1.01	1.45
ATTLNACT	21908	2.71	1.97
BELONG	21980	1.36	1.57
CLSMAN	21900	0.97	1.45
COGACT	21989	0.35	1.26
CULTDIST	1161	1.13	1.90
CULTPOS	33062	0.17	1.41
DISCLIMA	21989	0.97	2.01
ENTUSE	27412	-0.02	0.77
EXAPPLM	21940	0.00	1.21
EXPUREM	21900	2.39	2.23
FAILMAT	21994	0.03	0.96
FAMCON	21284	0.15	0.69
FAMCONC	21201	0.86	0.84
HEDRES	33400	2.06	1.39
HERITCUL	1194	2.00	2.31
HOMEPOS	33495	1.45	0.93
HOMSCH	27234	-0.92	1.18
HOSTCUL	1204	2.53	2.50
ICTATTNEG	26902	-0.57	1.74
ICTATTPOS	26978	2.16	2.09
ICTHOME	27630	0.59	0.76
ICTRES	33439	1.34	1.38
ICTSCH	27614	-0.21	1.15
INFOCAR	14374	-0.35	1.34
INFOJOB1	7019	-1.23	1.15
INFOJOB2	7019	-0.88	1.26
INSTMOT	22101	1.32	2.78
INTMAT	22119	-0.82	2.93
LMINS	20053	214.69	93.93
MATBEH	21993	-1.55	1.12
MATHEFF	22080	1.15	1.50
MATINTFC	20960	0.06	1.68
MATWKETH	22003	0.75	1.77
MTSUP	21954	1.33	1.84
OPENPS	21962	0.85	1.50
PERSEV	21984	0.28	0.91
SCMAT	22008	-0.13	2.36
STUDREL	22004	1.32	2.01
SUBNORM	22104	0.35	1.17
TCHBEHFA	22000	-0.28	1.35
TCHBEHSD	22019	-0.98	1.06
TCHBEHTD	22041	0.54	1.14
TEACHSUP	22070	1.03	1.73
USEMATH	26921	-1.57	1.57
USESCH	27152	-1.60	1.22
WEALTH	33477	1.25	1.10
ANCATSchL	21527	0.07	1.55
ANCATTLNACT	21522	1.39	3.08
ANCBELONG	21570	0.21	1.63
ANCCLSMAN	21607	0.00	1.58
ANCCOGACT	21593	-0.36	1.47
ANCINSTMOT	10852	-0.18	2.41
ANCINTMAT	10852	-1.91	3.52
ANCMATWKETH	10800	-0.30	2.18
ANCMTSUP	21619	0.17	1.90
ANCSCMAT	21546	-0.84	2.33
ANCSTUDREL	21590	-0.01	1.99
ANCSUBNORM	10859	-0.39	1.52
Parent-level indices	N	Mean	S.D.
PARINVOL	7832	-2.04	1.56
PARSUPP	7902	0.59	1.02
PQMCAR	7873	-0.44	1.68
PQMIMP	7880	2.99	2.77
PQSCHOOL	7882	1.83	2.09
School-level indices	N	Mean	S.D.
SCMATBUI	31458	1.06	1.61
SCMATEDU	32427	1.06	1.45
STUDCLIM	32338	1.34	1.60
TCFOCST	32139	1.46	1.70
TCHPARTI	32649	-1.99	1.75
TCMORALE	32413	3.61	2.43
TCSHORT	32346	-2.32	1.85
TEACCLIM	31676	1.49	1.30
SCHAUTON	32649	1.44	1.88
LEADINST	32082	0.42	1.23
LEADTCH	31779	0.60	1.33
LEADPD	31871	1.22	1.46
LEADCOM	32131	0.27	1.13



Construct validation

The development of comparable measures of student background, 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. There are different methodological approaches for validating questionnaire constructs, each with their advantages and limitations.

Cronbach's alpha was used to check internal consistency of each scaled index within the countries and to compare it between the countries. For some indices, some countries opted to delete one or two questions. Strictly speaking, this constituted a different index and, therefore, a footnote was added in the tables to note which item had been deleted.

Cross-country validity of the constructs not only requires a thorough and closely monitored process of translation into different languages. It also makes assumptions about having measured similar characteristics, attitudes and perceptions in different national and cultural contexts. Psychometric techniques can be used to analyse the extent to which constructs have consistent construct validity across participating countries. This is done by first checking the reliability of the scales across individual countries and then correlations are also estimated for certain scales which are thought to be related. These correlations should be consistent across countries.

Patterns of consistent relationships between certain indices across countries can be seen, for example, in Table 16.20 with similar correlations across the OECD countries between the indices, *teacher behaviour - student orientation (TCHBEHSO)* and *teacher behaviour - formative assessment (TCHBEHFA)*. Table 16.21 shows that the correlations between these two indices are also similar for the partner countries and economies. Similar results are found in Table 16.20 for OECD countries and in Table 16.21 for partner countries and economies for the correlations between the indices, *classroom management (CLSMAN)* and *disciplinary climate (DISCLIMA)*. Likewise, Table 16.39 for OECD countries and Table 16.40 for partner countries and economies show the expected positive relationship between the indices, *attitude towards school - learning activities (ATTLNACT)* and *attitude towards school - learning outcomes (ATSCHL)* across countries.

Describing questionnaire scale indices

As in previous PISA surveys, in PISA 2012 categorical items from the context questionnaires were scaled using IRT modelling. WLEs (logits) for the latent dimensions were transformed to scales with an OECD average of 0 and a standard deviation of 1 (with equally weighted samples). It is possible to interpret these scores by comparing individual scores or group average 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 variable. However, the scaling model used to derive individual scores allows descriptions of these scales by mapping scale scores to (expected) item responses.²

Item characteristics can be described using the parameters of the partial credit model by summing for each category its probability of being chosen with the probabilities of all higher categories. This is equivalent to computing the odds of scoring higher than a particular category.

The results of plotting these cumulative probabilities against scale scores for a fictitious item are displayed in Figure 16.1. The three vertical lines denote those points on the latent continuum where it becomes more likely to score >0 , >1 or >2 . These locations, Γ_k , are Thurstonian thresholds that can be obtained through an iterative procedure that calculates summed probabilities for each category at each (decimal) point on the latent variable.

Summed probabilities are not identical with expected item scores and have to be understood in terms of the probability to score *at least* a particular category. Other ways of describing the item characteristics based on the partial credit model are item characteristic curves (by plotting the individual category probabilities) and expected item score curves (for a more detailed description see Masters and Wright, 1997).

Thurstonian thresholds can be used to indicate those points on a scale for each item category, at which respondents have a 0.5 probability to score this category or higher. For example, in the case of Likert-type items with categories "Strongly disagree" (SD), "Disagree" (D), "Agree" (A) and "Strongly agree" (SA) it is possible to determine at what point of a scale a respondent has a 50% chance to agree with the item.



Figure 16.1

Summed category probabilities for fictitious items

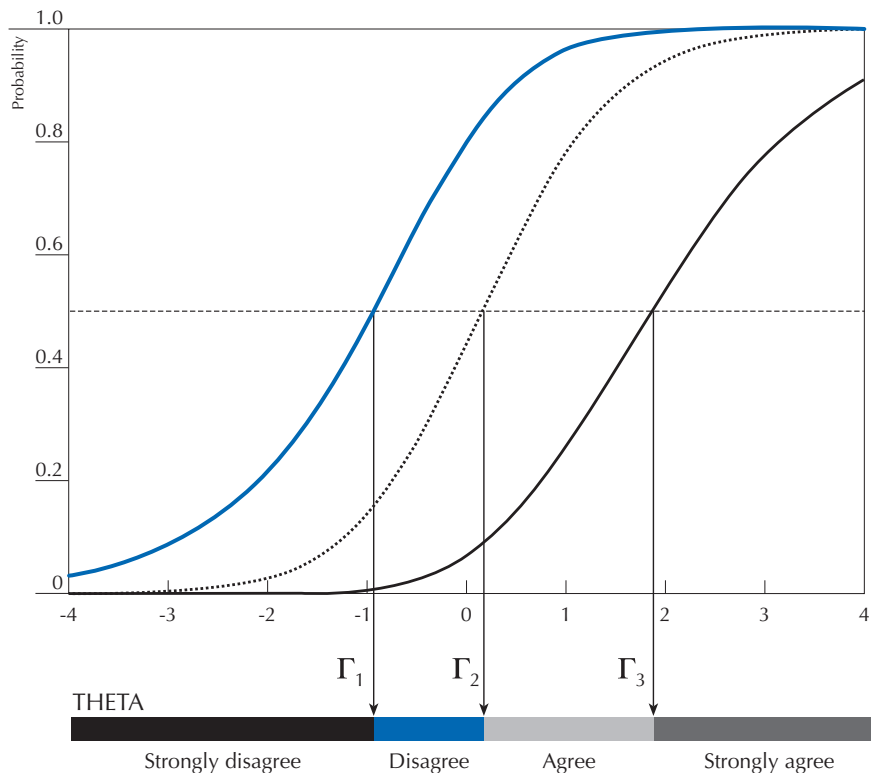
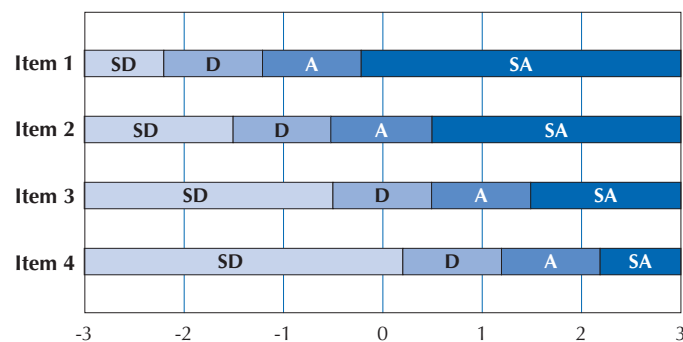


Figure 16.2 shows the fictitious example of an item map for a fictitious scale that consists of four Likert-type items, each with four response options, namely “Strongly disagree” (SD), “Disagree” (D), “Agree” (A) and “Strongly agree” (SA). Interpretation of this item map is as follows:

- Students with a score of -2 (that is, 2 standard deviations below the OECD average) have a 0.5 probability to disagree, agree or strongly agree (or not to disagree strongly with item 1), but they have more than a 50% chance to strongly disagree with the other three items.
- Students with a score of -1 (one standard deviation below the OECD average), have already a probability greater than 0.5 to agree with the first item, but they would still be expected to disagree with item 2 or even to strongly disagree with item 3 and 4.

Figure 16.2

Fictitious example of item map



- Likewise, students with a score of 1 (one standard deviation above the OECD average) would have a probability greater than 0.5 to strongly agree with the first two items, but still have a probability lower than 0.5 to agree with item 4.

Item maps can help to illustrate the relationship between scores and item responses. For example, even scores of one standard deviation below the OECD average on an attitudinal scale could still indicate affirmative responses. This would not be revealed by the international metric, which have to be interpreted relative to the OECD average, but can be concluded from the corresponding item map.

QUESTIONNAIRE SCALE INDICES

Student scale indices

Household possessions

Collecting information about household possessions as indicators of family wealth has received much attention in international studies in the field of education (Spiezia, 2010; Traynor and Raykov, 2013). Household assets are believed to capture wealth better than income because they reflect a more stable source of wealth.

In PISA 2012, students reported the availability of 14 household items at home (ST26). In addition, countries added three specific household items that were seen as appropriate measures of family wealth within the country's context.

Four indices were derived from these items: *i) family wealth possessions (WEALTH)*, *ii) cultural possessions (CULTPOS)*, *iii) home educational resources (HEDRES)*, and *iv) home possessions (HOMEPOS)*. The last index was a summary index of all household items from the units ST26 and ST27 and also included the variable indicating the number of books at home (ST28) which was recoded from the original six categories into three: (0) 0-25 books, (1) 26-100 books, (2) more than 100. Questions ST27Q01 and ST27Q02 were recoded from the original four categories into three: (0) "None or one", (1) "Two" (2) "Three or more". Questions ST27Q03, ST27Q04 and ST27Q05 retained four categories. *HOMEPOS* was 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). Table 16.2 shows the wording of items and their allocation to the four indices.

Table 16.2 Household possessions and home background indices

Item		Item is used to measure index			
		WEALTH	CULTPOS	HEDRES	HOMEPOS
ST26	In your home, do you have:				
ST26Q01	A desk to study at			X	X
ST26Q02	A room of your own	X			X
ST26Q03	A quiet place to study			X	X
ST26Q04	A computer you can use for school work			X	X
ST26Q05	Educational software			X	X
ST26Q06	A link to the Internet	X			X
ST26Q07	Classical literature		X		X
ST26Q08	Books of poetry		X		X
ST26Q09	Works of art		X		X
ST26Q10	Books to help with your school work			X	X
ST26Q11	Technical reference books			X	X
ST26Q12	A dictionary			X	X
ST26Q13	A dishwasher				X
ST26Q14	A <DVD> player	X			X
ST26Q15	<Country-specific wealth item 1>	X			X
ST26Q16	<Country-specific wealth item 2>	X			X
ST26Q17	<Country-specific wealth item 3>	X			X
ST27	How many of these are there at your home?				
ST27Q01	Cellular phones	X			X
ST27Q02	Televisions	X			X
ST27Q03	Computers	X			X
ST27Q04	Cars	X			X
ST27Q05	Rooms with a bath or shower	X			X
ST28	How many books are there in your home?				X

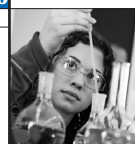


Table 16.3 provides information on the reliabilities in OECD countries for all four scales while Table 16.4 shows the corresponding reliabilities in partner countries and economies. Scale reliabilities were generally higher in partner countries and economies than in OECD countries. This may have been due to the higher degree of accessibility of household items for larger proportions of the population in economically more developed countries which saw these differentiate less between more and less affluent households in these countries. Table 16.5a provides international item parameters for home possession indices. Please note that items *ST26Q13- ST26Q17* were scaled nationally because these items had different meaning for different countries. National item parameters for these items are provided in Table 16.5b and were not included in the reliability scales to keep comparability of Cronbach's alpha across countries for each scale.

Table 16.3 Scale reliabilities for home possession indices in OECD countries

	HOMEPOS	CULTPOS	HEDRES	WEALTH
Australia	0.74	0.74	0.65	0.64
Austria	0.68	0.68	0.50	0.61
Belgium	0.70	0.70	0.53	0.62
Canada	0.71	0.71	0.61	0.63
Chile	0.84	0.84	0.57	0.80
Czech Republic	0.72	0.72	0.46	0.68
Denmark	0.71	0.71	0.52	0.59
Estonia	0.72	0.72	0.46	0.68
Finland	0.68	0.68	0.51	0.57
France	0.68	0.68	0.43	0.62
Germany	0.67	0.67	0.52	0.58
Greece	0.75	0.75	0.52	0.68
Hungary	0.76	0.76	0.49	0.69
Iceland	0.67	0.67	0.57	0.59
Ireland	0.70	0.70	0.56	0.59
Israel	0.76	0.76	0.56	0.75
Italy	0.70	0.70	0.44	0.61
Japan	0.67	0.67	0.48	0.55
Korea	0.77	0.77	0.55	0.64
Luxembourg	0.74	0.74	0.56	0.66
Mexico	0.87	0.87	0.60	0.85
Netherlands	0.64	0.64	0.52	0.53
New Zealand	0.74	0.74	0.66	0.62
Norway	0.71	0.71	0.59	0.62
Poland	0.75	0.75	0.48	0.71
Portugal	0.76	0.76	0.50	0.65
Slovak Republic	0.77	0.77	0.68	0.69
Slovenia	0.70	0.70	0.45	0.61
Spain	0.69	0.69	0.47	0.59
Sweden	0.71	0.71	0.55	0.61
Switzerland	0.64	0.64	0.49	0.55
Turkey	0.86	0.86	0.66	0.81
United Kingdom	0.72	0.72	0.62	0.61
United States	0.80	0.80	0.66	0.69
OECD median	0.72	0.72	0.53	0.62

Table 16.4 Scale reliabilities for home possession indices in partner countries and economies

	HOMEPOS	CULTPOS	HEDRES	WEALTH
Albania	0.81	0.81	0.59	0.76
Argentina	0.77	0.77	0.52	0.71
Brazil	0.80	0.80	0.54	0.75
Bulgaria	0.79	0.79	0.60	0.73
Colombia	0.82	0.82	0.58	0.76
Costa Rica	0.84	0.84	0.59	0.80
Croatia	0.71	0.71	0.44	0.63
Cyprus ^{1, 2}	0.73	0.73	0.56	0.63
Hong Kong-China	0.76	0.76	0.53	0.66
Indonesia	0.84	0.84	0.59	0.81
Jordan	0.84	0.84	0.70	0.79
Kazakhstan	0.82	0.82	0.64	0.77
Latvia	0.74	0.74	0.44	0.68
Liechtenstein	0.71	0.71	0.51	0.59
Lithuania	0.76	0.76	0.51	0.69
Macao-China	0.74	0.74	0.56	0.68
Malaysia	0.77	0.77	0.54	0.71
Montenegro	0.80	0.80	0.59	0.74
Peru	0.85	0.85	0.63	0.82
Qatar	0.78	0.78	0.70	0.77
Romania	0.82	0.82	0.61	0.75
Russian Federation	0.75	0.75	0.54	0.68
Serbia	0.77	0.77	0.47	0.71
Shanghai-China	0.81	0.81	0.52	0.75
Singapore	0.75	0.75	0.57	0.63
Chinese Taipei	0.75	0.75	0.60	0.63
Thailand	0.85	0.85	0.67	0.81
Tunisia	0.86	0.86	0.69	0.82
United Arab Emirates	0.78	0.78	0.65	0.77
Uruguay	0.79	0.79	0.57	0.72
Viet Nam	0.82	0.82	0.54	0.81
Median	0.79	0.79	0.57	0.74

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”.

2. 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.

Table 16.5a International item parameters for home possession indices

Item		Parameter estimates							
		WEALTH			CULTPOS	HEDRES	HOMEPOS		
		Delta	tau_1	tau_2	Delta	Delta	Delta	tau_1	tau_2
ST26	In your home, do you have:								
ST26Q01	A desk to study at					-0.92754	-1.54387		
ST26Q02	A room of your own	-1.27697					-0.79605		
ST26Q03	A quiet place to study					-0.48891	-1.15166		
ST26Q04	A computer you can use for school work					-0.20727	-0.81434		
ST26Q05	Educational software					2.09794	1.06883		
ST26Q06	A link to the Internet	-0.45176					-0.01091		
ST26Q07	Classical literature				0.08751		1.00802		
ST26Q08	Books of poetry				0.16730		1.07070		
ST26Q09	Works of art				0.25481		0.73601		
ST26Q10	Books to help with your school work					-0.29046	0.97589		
ST26Q11	Technical reference books					1.65251	0.80082		
ST26Q12	A dictionary					-1.83627	2.37387		
ST27	How many of these are there at your home?								
ST27Q01	Cellular phones	-0.44841	0.58740				0.08010	0.69876	
ST27Q02	Televisions	0.16215	0.50786				0.61400	0.39179	
ST27Q03	Computers	0.54215	-1.43777	0.57453			0.95064	1.24456	0.56661
ST27Q04	Cars	0.82013	-1.57244	0.02151			1.20761	-1.36576	0.01463
ST27Q05	Rooms with a bath or shower	0.65271	-2.85942	0.69222			1.03345	-2.59720	0.67423
ST28	How many books are there in your home?						0.92900	-0.08203	

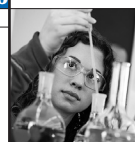


Table 16.5b National item parameters for items ST26Q13-ST26Q17

		HOMEPOS					WEALTH				
		ST26Q13	ST26Q14	ST26Q15	ST26Q16	ST26Q17	ST26Q13	ST26Q14	ST26Q15	ST26Q16	ST26Q17
OECD	Australia	0.92001	-2.99451	1.52384	1.64010	1.72177	0.81937	-3.09018	1.49028	1.60871	1.69333
	Austria	-0.82504	-2.14069	0.44607	0.39620	0.72274	-1.20657	-2.44629	0.15728	0.10561	0.44421
	Belgium	-0.03350	-2.90529	0.90322	2.02001	1.94527	-0.30989	-3.18368	0.70531	1.83671	1.75994
	Canada	0.07628	-3.15817	-0.96986	1.12842	0.71438	-0.10286	-3.36528	-1.14859	1.03136	0.59748
	Chile	0.31967	-1.61146	-0.37854	0.09626	0.25152	-0.19587	-2.11183	-0.85569	-0.37000	-0.21043
	Czech Republic	1.68771	-1.90989	0.69060	1.01578	0.19373	0.97915	-2.60326	-0.00026	0.33711	-0.45745
	Denmark	-0.56525	-3.37462	1.34240	-1.40201	1.20628	-0.56408	-3.43123	1.28240	-1.45876	1.14635
	Estonia	2.07437	-0.49580	1.41945	-0.61023	0.14241	1.44800	-1.19011	0.77418	-1.30682	-0.53814
	Finland	-0.91111	-2.33719	-0.18326	0.72674	1.38458	-1.20925	-2.62107	-0.45258	0.46984	1.13760
	France	-0.06990	-2.97166	0.69948	0.82488	0.86548	-0.47749	-3.34517	0.41808	0.54822	0.59096
	Germany	-0.53598	-2.30400	0.30271	0.82117	1.30732	-0.93518	-2.67240	-0.01881	0.49996	0.99776
	Greece	0.32384	-2.19891	1.76390	0.59751	1.73481	-0.12290	-2.63569	1.44201	0.25407	1.41192
	Hungary	0.97335	-2.48418	-0.11226	0.77080	0.65854	0.21316	-3.16436	-0.82977	0.06388	-0.04951
	Iceland	-0.40061	-2.58105	2.86889	2.78256	1.45703	-0.90331	-3.04338	2.43042	2.34328	1.00722
	Ireland	-0.01310	-3.75455	-0.30069	0.89664	0.57593	-0.14915	-3.87541	-0.32222	0.89358	0.50171
	Israel	0.80221	-0.97503	2.60077	1.87352	1.87048	0.32855	-1.47998	2.27761	1.50927	1.51400
	Italy	0.99334	-2.30967	1.35900	1.70954	1.22048	0.58811	-2.70862	0.99389	1.34562	0.85501
	Japan	1.52598	-2.07939	-0.84910	-0.04520	0.59179	1.35315	-2.26600	-1.03420	-0.22853	0.41053
	Korea	2.06627	0.68528	0.82654	-0.01571	0.83472	1.32317	-0.01721	0.12305	-0.70282	0.12900
	Luxembourg	-1.11390	-2.46776	0.62207	0.92144	0.24069	-1.35117	-2.68419	0.47026	0.77427	0.08314
	Mexico	2.28317	-1.83565	0.30166	-0.53624	-0.46241	1.90490	-2.57429	-0.21010	-1.13442	-1.05248
	Netherlands	-0.22987	-3.00590	1.01001	2.74732	0.27238	-0.34611	-3.13882	0.90282	2.65832	0.15596
	New Zealand	0.48069	-2.57486	0.40991	0.59301	1.19121	0.33606	-2.71838	0.33609	0.52125	1.10131
	Norway	-1.24781	-2.66837	2.29501	2.51362	1.95438	-1.50608	-2.90709	2.08483	2.30569	1.71219
	Poland	2.20325	-1.28919	0.21525	0.16732	1.16861	1.41126	-2.10977	-0.62819	-0.67797	0.44005
	Portugal	0.55289	-1.37820	-0.28270	1.27435	2.44553	0.25755	-1.64679	-0.52775	1.07539	2.28063
	Slovak Republic	2.26815	-1.69047	1.29991	0.19004	0.30678	1.53405	-2.41324	0.60359	-0.52448	-0.40585
	Slovenia	0.06242	-1.32179	0.06507	0.93390	2.19644	-0.29738	-1.69151	-0.29459	0.58351	1.86380
	Spain	0.66871	-2.44119	-0.38198	0.89927	1.62306	0.23296	-2.86859	-0.78215	0.52507	1.26599
	Sweden	-0.25694	-3.19230	2.44263	1.32602	1.86250	-0.34381	-3.29017	2.36191	1.24096	1.77952
	Switzerland	-0.58744	-2.20113	0.41359	1.00812	0.56765	-0.88262	-2.49863	0.19503	0.76004	0.30900
	Turkey	0.03688	-0.45954	1.09665	0.55897	0.94418	-0.65294	-1.19760	0.40232	-0.13371	0.25030
	United Kingdom	0.82683	-3.20227	-0.18204	0.01550	1.72790	0.67016	-3.35310	-0.30782	-0.10822	1.62409
	United States	0.11783	-2.87797	1.80754	0.00510	0.74034	0.17057	-2.85219	1.90622	0.06490	0.81581
Partners	Albania	1.21681	-1.20501	-0.28034	-0.31013	-0.10923	0.57085	-1.86225	-0.90941	-0.94073	-0.73330
	Argentina	1.23191	-1.30960	0.34978	0.01160	-2.24498	0.64023	-1.92822	-0.21679	-0.56633	-2.88646
	Brazil	1.23447	-1.82940	-0.20238	0.25991	1.46311	0.75787	-2.42878	-0.71385	-0.22469	1.04050
	Bulgaria	1.82280	-0.84258	1.05605	-0.18339	1.34047	1.16793	-1.42923	0.49416	-0.76491	0.78444
	Colombia	-2.13670	-1.24874	-0.34186	-1.31106	-1.28262	-2.97053	-2.05642	-1.11871	-2.12079	-2.09167
	Costa Rica	1.10039	-1.73227	-0.12289	0.31990	0.91284	0.64121	-2.30074	-0.63377	-0.17240	0.44568
	Croatia	0.44244	-2.13399	0.81493	1.66983	0.97007	0.07634	-2.51804	0.45316	1.31809	0.61007
	Cyprus ^{1, 2}	0.21793	-1.33632	2.22184	-0.99834	2.86380	0.22663	-1.35277	2.28447	-1.01027	2.94143
	Hong Kong-China	3.18175	-2.00308	0.76515	0.97588	0.84677	2.56917	-2.56486	0.18740	0.39278	0.24136
	Indonesia	0.72581	-1.86522	0.62727	-1.62599	1.37452	-0.21394	-2.99129	-0.30063	-2.73399	0.50191
	Jordan	1.82083	-0.42988	1.13782	-0.34879	0.71787	1.43282	-0.88118	0.72637	-0.79844	0.29311
	Kazakhstan	2.52300	-2.05933	0.50627	1.12367	0.19343	1.60888	-3.07687	-0.45765	0.17641	-0.77869
	Latvia	2.78833	-0.74066	0.24415	0.87602	0.41383	1.83584	-1.67520	-0.65336	0.00646	-0.47617
	Liechtenstein	-1.26426	-2.48280	0.35808	0.83648	0.00816	-1.43671	-2.65339	0.25895	0.70073	-0.14055
	Lithuania	2.42182	-0.34677	0.47916	1.15563	0.90951	1.87083	-0.90557	-0.07859	0.59915	0.35261
	Macao-China	2.91259	-1.55873	0.28086	0.07277	-0.18504	2.59497	-1.95789	-0.08373	-0.29531	-0.55989
	Malaysia	2.42760	-1.03209	-4.07799	-3.02713	0.89650	2.04273	-1.64914	-4.79127	-3.72328	0.40900
	Montenegro	0.46432	-1.97117	-0.21968	1.35462	0.15915	-0.07288	-2.51741	-0.76032	0.82539	-0.37972
	Peru	3.25512	-1.70496	-0.76344	-0.40852	1.01574	2.54814	-2.86656	-1.83066	-1.43796	0.13374
	Qatar	1.46986	-0.62698	0.11477	-0.09098	1.12366	1.73788	-0.60044	0.21134	-0.10645	1.34451
	Romania	1.98883	-0.08632	0.86913	1.60458	1.83613	1.12649	-0.95401	0.03311	0.79409	1.03342
	Russian Federation	3.08632	-1.48144	0.20223	1.72097	1.63714	1.98126	-2.61474	-0.86323	0.71981	0.63337
	Serbia	1.53910	-0.99978	1.01031	2.16185	0.71458	0.97066	-1.59069	0.43540	1.60118	0.13637
	Shanghai-China	2.93689	-1.44542	0.65878	-0.18624	0.12192	2.25693	-2.18398	-0.05694	-0.91341	-0.60152
	Singapore	1.51213	-1.84961	-0.46405	-0.56857	2.35257	1.18476	-2.17985	-0.79381	-0.89849	0.20619
	Chinese Taipei	1.52702	-1.38425	1.34433	1.61435	0.62799	1.10773	-1.77959	0.92604	1.19479	0.21518
	Thailand	1.01137	-2.31523	1.34014	-1.09118	0.98234	0.31123	-3.19055	0.69982	-1.89802	0.31797
	Tunisia	1.47195	-0.77529	-0.35494	-0.70572	-1.40743	0.95317	-1.43989	-0.88738	-1.23852	-1.94124
	United Arab Emirates	1.46428	-1.09524	0.39164	0.32730	1.75656	1.63847	-1.26864	0.39432	0.31829	1.98312
	Uruguay	1.26025	-1.31281	-0.74818	-0.54775	0.19524	0.68181	-1.89856	-1.34948	-1.14790	-0.39735
	Viet Nam	0.48032	-1.21234	1.69718	-3.15495	2.60703	-0.34963	-2.18230	0.96541	-4.24295	1.93235

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".

2. 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.

Attitudes towards mathematics

With mathematics being the major domain in 2012, attitudes towards this subject received considerable attention in the PISA 2012 Student Questionnaire. In total, ten indices were constructed using 67 items. Table 16.6 summarises all indices related to attitudes towards mathematics and their relationship to the similar indices in the PISA 2003 survey, the previous cycle in which mathematics was a major domain.

Table 16.6 Attitudes towards mathematics indices

Index	Index label	Relationship to other PISA surveys
INTMAT	Mathematics Interest	Used in 2003
INSTMOT	Instrumental Motivation for Mathematics	Used in 2003
SUBNORM	Subjective Norms in Mathematics	New
MATHEFF	Mathematics Self-Efficacy	Used in 2003
ANXMAT	Mathematics Anxiety	Used in 2003
SCMAT	Mathematics Self-Concept	Used in 2003
FAILMAT	Attributions to Failure in Mathematics	New
MATWKETH	Mathematics Work Ethic	New
MATINTFC	Mathematics Intentions	New
MATBEH	Mathematics Behaviour	New

Table 16.7 shows a high degree of internal consistency across OECD countries for all indices except Subjective Norms in Mathematics (*SUBNORM*) and Attributions to Failure in Mathematics (*FAILMAT*) which exhibit moderate to high reliability.

Table 16.7 Scale reliabilities for attitudes towards mathematics indices in OECD countries

	INTMAT	INSTMOT	SUBNORM	MATHEFF	ANXMAT	SCMAT	FAILMAT	MATWKETH	MATINTFC	MATBEH
Australia	0.91	0.90	0.69	0.88	0.85	0.89	0.71	0.91	0.76	0.77
Austria	0.88	0.86	0.70	0.82	0.86	0.90	0.62	0.87	0.76	0.70
Belgium	0.88	0.89	0.64	0.84	0.83	0.88	0.60	0.87	0.76	0.71
Canada	0.90	0.90	0.68	0.86	0.87	0.91	0.70	0.88	0.74	0.75
Chile	0.89	0.89	0.66	0.83	0.70	0.90	0.65	0.88	0.79	0.72
Czech Republic	0.87	0.88	0.63	0.81	0.85	0.91	0.56	0.84	0.77	0.64
Denmark	0.90	0.86	0.60	0.84	0.86	0.91	0.64	0.90	0.69	0.71
Estonia	0.89	0.87	0.66	0.82	0.86	0.89	0.61	0.83	0.70	0.67
Finland	0.90	0.89	0.71	0.85	0.82	0.92	0.68	0.88	0.83	0.72
France	0.87	0.88	0.65	0.82	0.77	0.90	0.57	0.89	0.71	0.71
Germany	0.89	0.84	0.63	0.81	0.87	0.91	0.64	0.87	0.77	0.70
Greece	0.89	0.90	0.67	0.83	0.81	0.87	0.56	0.89	0.73	0.76
Hungary	0.89	0.87	0.71	0.86	0.83	0.82	0.64	0.86	0.85	0.71
Iceland	0.91	0.91	0.70	0.88	0.88	0.91	0.73	0.91	0.69	0.78
Ireland	0.91	0.87	0.66	0.84	0.84	0.89	0.60	0.89	0.73	0.67
Israel	0.90	0.87	0.61	0.84	0.85	0.85	0.69	0.88	0.65*	0.78
Italy	0.87	0.89	0.63	0.81	0.78	0.88	0.59	0.87	0.65*	0.69
Japan	0.90	0.92	0.72	0.86	0.83	0.88	0.75	0.87	0.72	0.66
Korea	0.91	0.91	0.68	0.89	0.76	0.88	0.65	0.91	0.76	0.72
Luxembourg	0.89	0.91	0.70	0.86	0.84	0.90	0.70	0.89	0.73	0.81
Mexico	0.85	0.84	0.70	0.83	0.75	0.84	0.70	0.87	0.74	0.80
Netherlands	0.86	0.88	0.62	0.85	0.86	0.89	0.63	0.86	0.66	0.81
New Zealand	0.90	0.90	0.72	0.88	0.83	0.87	0.70	0.90	0.73	0.80
Norway	0.91	0.90	0.65	0.87	0.86	0.91	0.69	0.90	0.78	0.77
Poland	0.88	0.90	0.67	0.85	0.87	0.91	0.65	0.86	0.82	0.72
Portugal	0.87	0.91	0.68	0.88	0.78	0.89	0.62	0.91	0.74	0.74
Slovak Republic	0.88	0.87	0.70	0.83	0.84	0.83	0.63	0.88	0.79	0.75
Slovenia	0.89	0.88	0.68	0.85	0.83	0.86	0.70	0.87	0.80	0.79
Spain	0.86	0.90	0.62	0.82	0.79	0.89	0.58	0.88	0.76	0.71
Sweden	0.92	0.89	0.67	0.86	0.84	0.89	0.65	0.89	0.71	0.76
Switzerland	0.87	0.87	0.65	0.83	0.84	0.90	0.62	0.87	0.77	0.70
Turkey	0.89	0.87	0.71	0.82	0.82	0.85	0.66	0.91	0.77	0.80
United Kingdom	0.90	0.86	0.66	0.86	0.84	0.88	0.64	0.90	0.70	0.72
United States	0.91	0.91	0.71	0.85	0.88	0.90	0.73	0.88	0.76	0.80
OECD median	0.89	0.89	0.67	0.85	0.84	0.89	0.64	0.88	0.75	0.72

* Item ST48Q04 was deleted by the country.

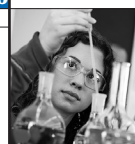


Table 16.8 also shows high degree of internal consistency across partner countries for all indices except Attributions to Failure in Mathematics (*FAILMAT*) which exhibits moderate to high reliability.

Table 16.8 Scale reliabilities for attitudes towards mathematics indices in partner countries and economies

	INTMAT	INSTMOT	SUBNORM	MATHEFF	ANXMAT	SCMAT	FAILMAT	MATWKETH	MATINTFC	MATBEH
Albania	0.85	0.84	0.72	0.81	0.79	0.81	0.60	0.90	0.78	0.80
Argentina	0.88	0.85	0.67	0.81	0.75	0.83	0.64	0.89	0.77	0.81
Brazil	0.84	0.84	0.69	0.82	0.71	0.82	0.63	0.87	0.77	0.82
Bulgaria	0.89	0.88	0.76	0.84	0.83	0.83	0.66	0.90	0.79	0.86
Colombia	0.84	0.86	0.68	0.82	0.72	0.83	0.66	0.88	0.80	0.78
Costa Rica	0.88	0.87	0.69	0.79	0.77	0.85	0.65	0.86	0.77	0.74
Croatia	0.90	0.88	0.68	0.83	0.84	0.88	0.63	0.88	0.75	0.72
Cyprus ^{1, 2}	0.91	0.90	0.70	0.86	0.82	0.86	0.72	0.91	0.72	0.82
Hong Kong-China	0.91	0.90	0.73	0.89	0.85	0.89	0.71	0.90	0.76	0.77
Indonesia	0.83	0.79	0.76	0.82	0.74	0.73	0.64	0.88	0.78	0.84
Jordan	0.84	0.87	0.73	0.83	0.51	0.80	0.74	0.90	0.61	0.84
Kazakhstan	0.89	0.87	0.81	0.84	0.82	0.82	0.77	0.90	0.80	0.83
Latvia	0.85	0.86	0.66	0.79	0.80	0.88	0.62	0.83	0.73	0.71
Liechtenstein	0.90	0.87	0.60	0.82	0.82	0.90	0.52	0.86	0.80	0.71
Lithuania	0.88	0.90	0.68	0.82	0.81	0.87	0.68	0.87	0.73*	0.74
Macao-China	0.90	0.90	0.72	0.86	0.86	0.90	0.70	0.86	0.72	0.75
Malaysia	0.87	0.85	0.74	0.80	0.74	0.81	0.70	0.88	0.72	0.80
Montenegro	0.91	0.91	0.78	0.85	0.79	0.86	0.66	0.91	0.85	0.83
Peru	0.87	0.85	0.68	0.80	0.69	0.81	0.65	0.90	0.75	0.79
Qatar	0.88	0.89	0.80	0.88	0.83	0.74	0.80	0.91	0.69	0.87
Romania	0.77	0.84	0.66	0.79	0.72	0.70	0.64	0.84	0.80	0.89
Russian Federation	0.86	0.90	0.73	0.83	0.80	0.83	0.63	0.89	0.84	0.74
Serbia	0.89	0.88	0.70	0.84	0.81	0.87	0.66	0.88	0.83	0.73
Shanghai-China	0.91	0.88	0.72	0.91	0.86	0.87	0.71	0.91	0.80	0.76
Singapore	0.90	0.87	0.67	0.86	0.83	0.88	0.71	0.88	0.73	0.73
Chinese Taipei	0.91	0.91	0.74	0.91	0.82	0.91	0.76	0.92	0.78	0.76
Thailand	0.86	0.84	0.75	0.82	0.63	0.80	0.76	0.86	0.71	0.79
Tunisia	0.87	0.86	0.68	0.79	0.68	0.85	0.62	0.88	0.79	0.80
United Arab Emirates	0.87	0.87	0.71	0.82	0.79	0.82	0.71	0.89	0.65	0.83
Uruguay	0.88	0.89	0.71	0.82	0.79	0.89	0.66	0.89	0.81	0.77
Viet Nam	0.82	0.81	0.67	0.78	0.71	0.77	0.45	0.85	0.85	0.70
Median	0.88	0.87	0.71	0.82	0.79	0.83	0.66	0.88	0.77	0.79

* Item ST48Q04 was deleted by the country.

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".

2. 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.

Four items measuring mathematics interest (*INTMAT*) were used in the Main Survey of PISA 2012 as well as for PISA 2003. Table 16.9 shows the item wording and the international item parameters for this scale. The response categories were "Strongly agree", "Agree", "Disagree" and "Strongly disagree". All items were reversed so that the higher difficulty corresponds to a higher level of interest. For this index, item difficulties vary from a comparatively easy one "I am interested in the things I learn in mathematics" ($\delta = -0.87$) to a more difficult "I enjoy reading about mathematics" ($\delta = 0.52$). This indicates that even those students who are interested in the things they learn in mathematics do not necessarily read about mathematics.

Table 16.9 Item parameters for mathematics interest (*INTMAT*)

Item	Thinking about your views on mathematics: to what extent do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
ST29Q01	a) I enjoy reading about mathematics	0.51591	-3.61604	0.04022
ST29Q03	c) I look forward to my mathematics lessons	0.28224	-3.63880	0.05071
ST29Q04	d) I do mathematics because I enjoy it	0.07060	-3.48903	0.14803
ST29Q06	f) I am interested in the things I learn in mathematics	-0.86875	-3.66945	-0.16382

Four items measuring instrumental motivation for mathematics (*INSTMOT*) were used in the Main Survey of PISA 2012 as well as for PISA 2003. Table 16.10 shows the item wording and the international item parameters for this scale. The response categories vary from “Strongly Agree”, “Agree”, “Disagree”, to “Strongly disagree”. All items were reversed, so the higher difficulty corresponds to the higher level of motivation. For this index, item difficulties do not vary considerably.

Table 16.10 Item parameters for instrumental motivation for mathematics (*INSTMOT*)

Item	Thinking about your views on mathematics: to what extent do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
ST29Q02	b) Making an effort in mathematics is worth it because it will help me in the work that I want to do later on	-0.21392	-2.92583	-0.54753
ST29Q05	e) Learning mathematics is worthwhile for me because it will improve my career <prospects, chances>	-0.26314	-2.80478	-0.65997
ST29Q07	g) Mathematics is an important subject for me because I need it for what I want to study later on	0.29837	-2.76227	-0.34159
ST29Q08	h) I will learn many things in mathematics that will help me get a job	0.17869	-2.95336	-0.51783

A new scale was created in PISA 2012 consisting of six items measuring subjective norms in mathematics (*SUBNORM*) in the Main Survey. Table 16.11 shows the item wording and the international item parameters for this scale. The response categories range from “Strongly agree”, “Agree”, “Disagree” to “Strongly disagree”. All items were reversed, so the higher difficulty corresponds to the higher level of agreement. Values for delta indicated that students found it harder to agree with the statement “My friends enjoy taking mathematics tests” ($\delta = 1.36$) whereas it was relatively easy to agree with the statement “My parents believe it’s important for me to study mathematics” ($\delta = -1.08$).

Table 16.11 Item parameters for subjective norms in mathematics (*SUBNORM*)

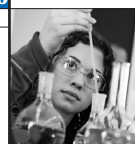
Item	Thinking about how people important to you view mathematics: how strongly do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
ST35Q01	a) Most of my friends do well in mathematics	0.08571	-2.48453	-0.14556
ST35Q02	b) Most of my friends work hard at mathematics	0.27374	-2.47999	0.06737
ST35Q03	c) My friends enjoy taking mathematics tests	1.36375	-2.00831	0.53358
ST35Q04	d) My parents believe it’s important for me to study mathematics	-1.08125	-1.20914	-0.77788
ST35Q05	e) My parents believe that mathematics is important for my career	-0.77458	-1.58049	-0.24409
ST35Q06	f) My parents like mathematics	0.13263	-1.97702	-0.13822

Eight items measuring mathematics self-efficacy (*MATHEFF*) were used in the Main Survey of PISA 2012 as well as for PISA 2003. Table 16.12 shows the item wording and the international item parameters for this scale. The response categories were “Very confident”, “Confident”, “Not very confident” and “Not at all confident”. All items were reversed, so the higher difficulty corresponds to the higher level of confidence. For this index, item difficulties ranged from a comparatively easy one “Solving an equation like $3x+5=17$ ” ($\delta = -0.62$) to more difficult ones, such as “Finding the actual distance between two places on a map with a 1:10 000 scale” ($\delta = 0.56$) and “Calculating the petrol consumption rate of a car” ($\delta = 0.65$). This indicates that students felt more confident in solving linear equations than they felt applying rates and proportions to real life situations.

Table 16.12 Item parameters for mathematics self-efficacy (*MATHEFF*)

Item	How confident do you feel about having to do the following mathematics tasks?	Parameter estimates		
		Delta	tau_1	tau_2
ST37Q01	a) Using a <train timetable> to work out how long it would take to get from one place to another	-0.16537	-1.85539	-0.10055
ST37Q02	b) Calculating how much cheaper a TV would be after a 30% discount	-0.31699	-1.69833	-0.05907
ST37Q03	c) Calculating how many square metres of tiles you need to cover a floor	0.13366	-1.83729	0.14817
ST37Q04	d) Understanding graphs presented in newspapers	-0.15505	-1.78957	-0.12065
ST37Q05	e) Solving an equation like $3x+5=17$	-0.62211	-1.09181	-0.05693
ST37Q06	f) Finding the actual distance between two places on a map with a 1:10 000 scale	0.55600	-1.89647	0.29021
ST37Q07	g) Solving an equation like $2(x+3) = (x+3)(x-3)$	-0.07740	-1.38321	0.06433
ST37Q08	h) Calculating the petrol consumption rate of a car	0.64726	-1.96788	0.13774

The five items measuring mathematics anxiety (*ANXMAT*) that were used in the Main Survey of PISA 2012 had also been used in PISA 2003. Table 16.13 shows the item wording and the international item parameters for this scale. The response categories were “strongly agree”, “agree”, “disagree” and “strongly disagree”. All items were reversed, so the higher difficulty corresponds to the higher level of anxiety.

**Table 16.13 Item parameters for mathematics anxiety (ANXMAT)**

Item	Thinking about studying mathematics: to what extent do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
ST42Q01	a) I often worry that it will be difficult for me in mathematics classes	-0.66180	-2.01172	-0.09668
ST42Q03	c) I get very tense when I have to do mathematics homework	0.38199	-2.13733	0.37662
ST42Q05	e) I get very nervous doing mathematics problems	0.41758	-2.30251	0.35980
ST42Q08	h) I feel helpless when doing a mathematics problem	0.55522	-2.20650	0.41807
ST42Q10	j) I worry that I will get poor <grades> in mathematics	-0.69299	-1.42498	-0.23096

Five items measuring mathematics self-concept (*SCMAT*) were used in the Main Survey of PISA 2012 as well as in PISA 2003. Table 16.14 shows the item wording and the international item parameters for this scale. The response categories range from “Strongly agree” to “Strongly disagree”. All items except ST42Q02 were reversed, so the higher difficulty corresponds to the higher self-concept.

Table 16.14 Item parameters for mathematics self-concept (SCMAT)

Item	Thinking about studying mathematics: to what extent do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
ST42Q02	b) I am just not good at mathematics	-0.14882	-2.13451	-0.24910
ST42Q04	d) I get good <grades> in mathematics	-0.48764	-2.75557	-0.08299
ST42Q06	f) I learn mathematics quickly	-0.22529	-2.75319	0.01990
ST42Q07	g) I have always believed that mathematics is one of my best subjects	0.32326	-2.02405	0.24282
ST42Q09	i) In my mathematics class, I understand even the most difficult work	0.53849	-2.69926	0.12835

A new scale indicating attributions to failure in mathematics (*FAILMAT*) was developed in PISA 2012 based on six items. Table 16.15 shows the item wording and the international item parameters for this scale. The response categories were “Very likely”, “Likely”, “Slightly likely”, “Not at all likely”. All items were reversed, so the higher difficulty corresponds to the higher level of external attribution of failure such as bad luck, bad guesses or the teacher.

Table 16.15 Item parameters for attributions to failure in mathematics (FAILMAT)

Item	Suppose that you are a student in the following situation: <i>Each week, your mathematics teacher gives a short quiz. Recently you have done badly on these quizzes. Today you are trying to figure out why. How likely are you to have these thoughts or feelings in this situation?</i>	Parameter estimates		
		Delta	tau_1	tau_2
ST44Q01	a) I'm not very good at solving mathematics problems	-0.13633	-1.24959	-0.27963
ST44Q03	b) My teacher did not explain the concepts well this week	0.24787	-1.14744	-0.10283
ST44Q04	c) This week I made bad guesses on the quiz	0.28440	-0.99882	-0.29146
ST44Q05	d) Sometimes the course material is too hard	-0.55077	-1.04547	-0.29291
ST44Q07	e) The teacher did not get students interested in the material	0.04449	-0.96201	0.00242
ST44Q08	f) Sometimes I am just unlucky	0.11034	-0.76450	-0.22261

Nine items were used in the Main Survey of PISA 2012 to create a new scale labeled “Mathematics work ethic” (*MATWKETH*). Table 16.16 shows the item wording and the international item parameters for this scale. The response categories ranged from “Strongly agree” to “Strongly disagree”. All items were reversed, so the higher difficulty corresponds to the higher level of work ethic.

Table 16.16 Item parameters for mathematics work ethic (MATWKETH)

Item	Thinking about the mathematics you do for school: to what extent do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
ST46Q01	a) I finish my homework in time for mathematics class	-0.05155	-2.11022	-0.25487
ST46Q02	b) I work hard on my mathematics homework	0.23278	-2.46941	-0.07761
ST46Q03	c) I am prepared for my mathematics exams	0.06373	-2.39979	-0.16623
ST46Q04	d) I study hard for mathematics quizzes	0.44044	-2.57064	0.07100
ST46Q05	e) I keep studying until I understand mathematics material	0.13279	-2.53385	-0.02092
ST46Q06	f) I pay attention in mathematics class	-0.44658	-2.29932	-0.48632
ST46Q07	g) I listen in mathematics class	-0.69306	-2.12994	-0.72488
ST46Q08	h) I avoid distractions when I am studying mathematics	0.11249	-2.59695	-0.03840
ST46Q09	i) I keep my mathematics work well organised	0.20896	-2.50181	-0.04529

The five items measuring mathematics intentions (*MATINTFC*) are all of the so-called “Forced Choice” format which was one of the new item types employed in PISA 2012 (see also Chapters 3 and 17). This item type forces students to choose between mathematics and some other subject like language or science with respect to additional courses at school and

beyond. All items were reversed. Table 16.17 shows the item wording and the international item parameters for this scale. The item deltas show that the items forcing students to choose between mathematics and the test language are easier than the items that force students to choose between mathematics and science.

Table 16.17 Item parameters for mathematics intentions (MATINTFC)

Item	For each pair of statements, please choose the item that best describes you	Parameter estimates
		Delta
ST48Q01	a) 1. I intend to take additional mathematics courses after school finishes 2. I intend to take additional <test language> courses after school finishes	-0.50884
ST48Q02	b) 1. I plan on majoring in a subject in <college> that requires mathematics skills 2. I plan on majoring in a subject in <college> that requires science skills	0.53523
ST48Q03	c) 1. I am willing to study harder in my mathematics classes than is required 2. I am willing to study harder in my <test language> classes than is required	-0.53939
ST48Q04	d) 1. I plan on <taking> as many mathematics classes as I can during my education 2. I plan on <taking> as many science classes as I can during my education	0.05019
ST48Q05	e) 1. I am planning on pursuing a career that involves a lot of mathematics 2. I am planning on pursuing a career that involves a lot of science	0.46281

Another new scale was created in PISA 2012 to indicate students mathematics behaviour regarding mathematics both at and outside school (MATBEH) based on eight items. Table 16.18 shows the item wording and the international item parameters for this scale. The response categories were “Always or almost always”, “Often”, “Sometimes” and “Never or rarely”. All items were reversed, so the higher difficulty corresponds to the higher frequency. For this index, most of the items were easy, indicating, for example, that students frequently talk to their friends about mathematics ($\delta = -0.44$) and help their friends with mathematics ($\delta = -0.61$). However, participation in mathematics clubs or mathematics competitions is comparatively rare, probably because it depends on whether such activities are offered by the school.

Table 16.18 Item parameters for mathematics behaviour (MATBEH)

Item	How often do you do the following things at school and outside of school?	Parameter estimates		
		Delta	tau_1	tau_2
ST49Q01	a) I talk about mathematics problems with my friends	-0.43912	-1.36979	0.28510
ST49Q02	b) I help my friends with mathematics	-0.61070	-1.62219	0.24023
ST49Q03	c) I do mathematics as an <extracurricular> activity	-0.06138	-0.86084	0.08992
ST49Q04	d) I take part in mathematics competitions	0.32585	-0.23329	-0.06082
ST49Q05	e) I do mathematics more than 2 hours a day outside of school	0.13873	-0.79764	0.25319
ST49Q06	f) I play chess	-0.00254	-0.53372	0.04487
ST49Q07	g) I program computers	-0.07083	-0.36567	-0.06427
ST49Q09	h) I participate in a mathematics club	0.71999	0.41950	-0.42667

Opportunity to learn (OTL)

In PISA 2012 opportunity to learn scales included indices relating to student-perceived experiences and familiarity with mathematical tasks (OTL content: *EXAPPLM*, *EXPUREM*, *FAMCON*, *FAMCONC*) as well as indices relating to student-perceived teaching practices (*TCHBEHTD*, *TCHBEHFA*, *TCHBEHSO*) and student-perceived teaching quality (*TEACHSUP*, *COGACT*, *MTSUP*, *CLSMAN*, *DISCLIMA*). Table 16.19 summarises all scaled indices related to opportunity to learn.

Table 16.19 Opportunity to learn indices

Index	Index label	Relationship to other PISA surveys
OTL - Content		
EXAPPLM	Experience with Applied Mathematics Tasks at School	New
EXPUREM	Experience with Pure Mathematics Tasks at School	New
FAMCON	Familiarity with Mathematical Concepts	New
FAMCONC	Familiarity with Mathematical Concepts (Signal Detection Adjusted)	New composite scale based on FAMCONC (see description above Table 16.24)
OTL - Teaching Practices		
TCHBEHTD	Teacher Behaviour: Teacher-directed Instruction	New
TCHBEHFA	Teacher Behaviour: Formative Assessment	New
TCHBEHSO	Teacher Behaviour: Student Orientation	New
OTL - Teaching Quality		
TEACHSUP	Math Teaching	Used in 2003
COGACT	Cognitive Activation	New
DISCLIMA	Disciplinary Climate	Similar index was used in 2000 and 2009, modified in 2012
MTSUP	Teacher Support	New
CLSMAN	Classroom Management	New

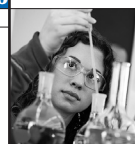


Table 16.20 shows a high degree of internal consistency across OECD countries for all indices except teacher behavior - student orientation index (*TCHBEHSO*) which exhibit moderate to high reliability.

[Part 1/2]

Table 16.20 Scale reliabilities and correlations for opportunity to learn indices in OECD countries

	Cronbach's Alpha							Correlation between
	EXAPPLM	EXPUREM	FAMCON	TCHBEHTD	TCHBEHFA	TCHBEHSO	TEACHSUP	TCHBEHSO and TCHBEHFA
Australia	0.78	0.92	0.90	0.76	0.79	0.69	0.90	0.49
Austria	0.69	0.94	0.84	0.69	0.73	0.68	0.84	0.43
Belgium	0.74	0.94	0.86	0.67	0.72	0.67	0.84	0.44
Canada	0.77	0.94	0.84	0.76	0.78	0.69	0.88	0.50
Chile	0.77	0.93	0.87	0.74	0.77	0.67	0.87	0.53
Czech Republic	0.73	0.89	0.84	0.67	0.67	0.51	0.83	0.44
Denmark	0.81	0.88	0.84	0.70	0.77	0.60	0.84	0.46
Estonia	0.71	0.91	0.82	0.68	0.73	0.63	0.83	0.49
Finland	0.76	0.90	0.85	0.74	0.78	0.64	0.87	0.49
France	0.71	0.92	0.82	0.71	0.71	0.63	0.84	0.38
Germany	0.72	0.90	0.84	0.68	0.73	0.67	0.84	0.47
Greece	0.78	0.92	0.87	0.73	0.75	0.79	0.82	0.51
Hungary	0.75	0.88	0.86	0.73	0.75	0.72	0.85	0.50
Iceland	0.82	0.95	0.86	0.70	0.78	0.67	0.88	0.55
Ireland	0.73	0.93	0.85	0.73	0.75	0.63	0.87	0.35
Israel	0.77	0.88	0.83	0.71	0.76	0.64	0.85	0.56
Italy	0.71	0.88	0.84	0.71	0.72	0.63	0.84	0.47
Japan	0.79	0.93	0.83	0.68	0.68	0.57	0.87	0.48
Korea	0.81	0.95	0.89	0.74	0.79	0.76	0.84	0.61
Luxembourg	0.75	0.93	0.86	0.74	0.72	0.76	0.87	0.54
Mexico	0.79	0.92	0.90	0.73	0.76	0.71	0.87	0.58
Netherlands	0.77	0.93	0.85	0.74	0.74	0.75	0.82	0.56
New Zealand	0.82	0.93	0.90	0.76	0.80	0.69	0.89	0.54
Norway	0.78	0.91	*	0.75	0.81	0.63	0.87	0.54
Poland	0.72	0.84	0.85	0.71	0.76	0.72	0.86	0.54
Portugal	0.82	0.95	0.85	0.78	0.81	0.79	0.90	0.59
Slovak Republic	0.75	0.84**	0.83	0.69	0.70	0.69	0.83	0.53
Slovenia	0.76	0.90	0.84	0.75	0.75	0.80	0.82	0.51
Spain	0.74	0.90	0.86	0.70	0.78	0.72	0.88	0.49
Sweden	0.81	0.90	0.91	0.75	0.79	0.67	0.89	0.61
Switzerland	0.71	0.92	0.81	0.68	0.73	0.67	0.82	0.52
Turkey	0.80	0.92	0.87	0.79	0.75	0.75	0.85	0.58
United Kingdom	0.77	0.93	0.88	0.71	0.79	0.62	0.87	0.47
United States	0.79	0.90	0.89	0.76	0.79	0.68	0.87	0.52
OECD median α	0.77	0.92	0.85	0.73	0.76	0.68	0.85	
OECD average correlation								0.51
Correlation S.D.								0.06

* Unit ST62 was deleted by the country.

** Item ST61Q09 was deleted during adjudication because of the printing error.

[Part 2/2]

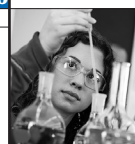
Table 16.20 Scale reliabilities and correlations for opportunity to learn indices in OECD countries

	Cronbach's Alpha				Correlation between
	COGACT	MTSUP	CLSMAN	DISCLIMA	DISCLIMA and CLSMAN
Australia	0.88	0.85	0.76	0.91	0.64
Austria	0.81	0.67	0.71	0.89	0.66
Belgium	0.83	0.71	0.75	0.89	0.58
Canada	0.86	0.82	0.75	0.89	0.57
Chile	0.82	0.76	0.73	0.87	0.56
Czech Republic	0.81	0.77	0.75	0.90	0.60
Denmark	0.81	0.75	0.72	0.88	0.60
Estonia	0.81	0.75	0.75	0.90	0.59
Finland	0.85	0.74	0.72	0.90	0.62
France	0.80	0.74	0.79	0.89	0.66
Germany	0.79	0.68	0.71	0.89	0.63
Greece	0.80	0.77	0.71	0.82	0.48
Hungary	0.79	0.77	0.72	0.91	0.60
Iceland	0.89	0.83	0.75	0.89	0.55
Ireland	0.84	0.81	0.79	0.91	0.68
Israel	0.81	0.77	0.71	0.90	0.60
Italy	0.79	0.77	0.72	0.87	0.57
Japan	0.83	0.77	0.31	0.85	0.32
Korea	0.85	0.81	0.62	0.87	0.50
Luxembourg	0.85	0.77	0.72	0.88	0.60
Mexico	0.82	0.73	0.66	0.83	0.42
Netherlands	0.86	0.69	0.75	0.89	0.62
New Zealand	0.89	0.83	0.74	0.90	0.57
Norway	0.88	0.79	0.70	0.88	0.53
Poland	0.83	0.82	0.75	0.90	0.61
Portugal	0.90	0.81	0.74	0.90	0.62
Slovak Republic	0.80	0.71	0.65	0.86	0.48
Slovenia	0.82	0.76	0.65	0.90	0.50
Spain	0.83	0.79	0.70	0.89	0.52
Sweden	0.89	0.80	0.70	0.88	0.55
Switzerland	0.79	0.72	0.72	0.88	0.62
Turkey	0.83	0.81	0.57	0.85	0.38
United Kingdom	0.86	0.83	0.77	0.91	0.64
United States	0.87	0.84	0.75	0.89	0.47
OECD median α	0.83	0.77	0.72	0.89	
OECD average correlation					0.56
Correlation S.D.					0.08

* Unit ST62 was deleted by the country.

** Item ST61Q09 was deleted during adjudication because of the printing error.

The table also displays correlations between scales that were assumed to be related. Thus, teacher behaviour that was perceived to be more student oriented (*TCHBEHSO*) was expected to be positively related to teachers using formative assessments (*TCHBEHFA*) to guide further instruction. Similarly, good classroom management (*CLSMAN*) was assumed to be related to a better disciplinary climate (*DISCLIMA*). As can be seen, correlations between the indices *TCHBEHSO* and *TCHBEHFA* were positive (0.51) and quite consistent across countries as indicated by the small standard deviation (0.06). In addition, the average correlation (0.56) between *DISCLIMA* and *CLSMAN* was also reasonably consistent across countries as indicated by the standard deviation of 0.08. Given the coding of the variables underlying the *DISCLIMA* and



CLSMAN indices, the positive correlation indicated that where students reported fewer problems with the disciplinary climate, students were more likely to agree that there was good classroom management whereby teachers started lessons on time, kept the class orderly and got students to listen to them.

Table 16.21 shows that internal consistency for the opportunity to learn across partner countries and economies was slightly lower than for OECD countries with the classroom management index (*CLSMAN*) exhibiting the lowest but still acceptable median reliability (0.66). The correlations between *TCHBEHSO* and *TCHBEHFA* for partner countries and economies are similar to those in the OECD countries while a slightly lower median correlation (0.43) and larger standard deviation (0.11) is recorded for the correlation between *DISCLIMA* and *CLSMAN*, probably as a consequence of the lower reliability of *CLSMAN* in partner countries and economies.

[Part 1/2]

Table 16.21 Scale reliabilities and correlations for opportunity to learn indices in partner countries and economies

	Cronbach's Alpha							Correlation between
	EXAPPLM	EXPUREM	FAMCON	TCHBEHTD	TCHBEHFA	TCHBEHSO	TEACHSUP	TCHBEHSO and TCHBEHFA
Albania	0.73	0.87	0.91	0.63	0.70	0.68	0.70	0.56
Argentina	0.78	0.90	0.86	0.69	0.72	0.70	0.85	0.58
Brazil	0.76	0.87	0.90	0.71	0.76	0.67	0.82	0.54
Bulgaria	0.80	0.88	0.89	0.73	0.76	0.76	0.82	0.59
Colombia	0.76	0.91	0.88	0.70	0.74	0.59	0.82	0.54
Costa Rica	0.75	0.92	0.86	0.72	0.75	0.62	0.86	0.54
Croatia	0.73	0.88	0.83	0.74	0.70	0.70	0.81	0.49
Cyprus ^{1, 2}	0.83	0.93	0.86	0.77	0.78	0.76	0.87	0.56
Hong Kong-China	0.77	0.92	0.86	0.76	0.76	0.78	0.85	0.50
Indonesia	0.79	0.90	0.89	0.69	0.65	0.63	0.65	0.56
Jordan	0.80	0.84	0.95	0.81	0.78	0.80	0.88	0.70
Kazakhstan	0.75	0.85	0.89	0.69	0.65	0.67	0.76	0.51
Latvia	0.74	0.86	0.82	0.69	0.73	0.67	0.79	0.54
Liechtenstein	0.71	0.94	0.88	0.69	0.73	0.55	0.81	0.41
Lithuania	0.75	0.86	0.81	0.69	0.77	0.69	0.81	0.51
Macao-China	0.75	0.89	0.84	0.74	0.77	0.62	0.83	0.49
Malaysia	0.77	0.92	0.86	0.67	0.72	0.67	0.79	0.54
Montenegro	0.79	0.87	0.87	0.75	0.71	0.75	0.86	0.59
Peru	0.76	0.89	0.91	0.72	0.71	0.65	0.81	0.55
Qatar	0.84	0.89	0.91	0.79	0.79	0.79	0.86	0.70
Romania	0.76	0.84	0.91	0.68	0.69	0.77	0.77	0.56
Russian Federation	0.77	0.87	0.83	0.71	0.69	0.69	0.79	0.56
Serbia	0.78	0.89	0.86	0.75	0.75	0.74	0.86	0.60
Shanghai-China	0.81	0.92	0.81	0.70	0.69	0.75	0.81	0.56
Singapore	0.74	0.91	0.89	0.73	0.79	0.74	0.87	0.52
Chinese Taipei	0.81	0.97	0.88	0.78	0.74	0.69	0.86	0.49
Thailand	0.78	0.91	0.89	0.72	0.75	0.80	0.82	0.70
Tunisia	0.70	0.83	0.82	0.74	0.71	0.69	0.81	0.56
United Arab Emirates	0.78	0.89	0.89	0.75	0.77	0.73	0.85	0.62
Uruguay	0.79	0.91	0.87	0.68	0.72	0.68	0.86	0.53
Viet Nam	0.73	0.84	0.85	0.59	0.64	0.64	0.73	0.50
Median α	0.77	0.89	0.87	0.72	0.73	0.69	0.82	
Average correlation								0.56
Correlation S.D.								0.06

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".

2. 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.

[Part 2/2]

Table 16.21 Scale reliabilities and correlations for opportunity to learn indices in partner countries and economies

	Cronbach's Alpha				Correlation between
	COGACT	MTSUP	CLSMAN	DISCLIMA	DISCLIMA and CLSMAN
Albania	0.74	0.75	0.54	0.85	0.35
Argentina	0.81	0.74	0.59	0.82	0.37
Brazil	0.82	0.78	0.64	0.84	0.42
Bulgaria	0.84	0.80	0.69	0.84	0.42
Colombia	0.80	0.73	0.68	0.81	0.41
Costa Rica	0.79	0.77	0.70	0.80	0.39
Croatia	0.81	0.82	0.74	0.90	0.55
Cyprus ^{1, 2}	0.84	0.83	0.68	0.85	0.44
Hong Kong-China	0.86	0.86	0.75	0.90	0.57
Indonesia	0.80	0.71	0.49	0.80	0.19
Jordan	0.86	0.82	0.54	0.84	0.31
Kazakhstan	0.80	0.79	0.62	0.85	0.42
Latvia	0.77	0.79	0.68	0.88	0.55
Liechtenstein	0.74	0.63	0.72	0.88	0.66
Lithuania	0.82	0.78	0.66	0.91	0.58
Macao-China	0.83	0.82	0.72	0.84	0.51
Malaysia	0.78	0.77	0.57	0.82	0.26
Montenegro	0.83	0.79	0.66	0.87	0.45
Peru	0.81	0.74	0.61	0.78	0.37
Qatar	0.88	0.82	0.48	0.89	0.35
Romania	0.77	0.70	0.60	0.84	0.44
Russian Federation	0.80	0.81	0.57	0.90	0.43
Serbia	0.82	0.77	0.72	0.89	0.49
Shanghai-China	0.84	0.82	0.71	0.88	0.54
Singapore	0.87	0.82	0.69	0.90	0.54
Chinese Taipei	0.85	0.88	0.73	0.91	0.56
Thailand	0.81	0.81	0.51	0.83	0.30
Tunisia	0.80	0.76	0.61	0.77	0.30
United Arab Emirates	0.83	0.82	0.64	0.86	0.38
Uruguay	0.80	0.76	0.66	0.88	0.42
Viet Nam	0.73	0.64	0.60	0.76	0.38
Median α	0.81	0.79	0.66	0.85	
Average correlation					0.43
Correlation S.D.					0.11

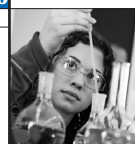
1. Note by Turkey: The information in this document with reference to "Cyprus" relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and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

2. 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.

Six items measuring students' exposure to applied mathematics tasks at school (*EXAPPLM*) were used in PISA 2012. Table 16.22 shows the item wording and the international item parameters for this scale. Response categories were "Frequently", "Sometimes", "Rarely" and "Never". All items were reversed so the higher difficulty corresponds to the higher frequency of exposure to applied mathematics tasks.

Table 16.22 Item parameters for experience with applied mathematics tasks at school (*EXAPPLM*)

Item	How often have you encountered the following types of mathematics tasks during your time at school?	Parameter estimates		
		Delta	tau_1	tau_2
ST61Q01	a) Working out from a <train timetable> how long it would take to get from one place to another	-0.07187	-1.07751	-0.37378
ST61Q02	b) Calculating how much more expensive a computer would be after adding tax	0.02359	-0.97187	-0.37078
ST61Q03	c) Calculating how many square metres of tiles you need to cover a floor	-0.21670	-0.84392	-0.35893
ST61Q04	d) Understanding scientific tables presented in an article	0.10966	-1.10943	-0.22095
ST61Q06	f) Finding the actual distance between two places on a map with a 1:10 000 scale	-0.11147	-1.34065	-0.01261
ST61Q08	h) Calculating the power consumption of an electronic appliance per week	0.26679	-1.22494	-0.11481



Three items measuring experience with applied mathematics tasks at school (*EXPUREM*) were used in the Main Survey of PISA 2012. Table 16.23 shows the item wording and the international item parameters for this scale. Response categories were: “Frequently”, “Sometimes”, “Rarely”, “Never”. All items were reversed so the higher difficulty corresponds to the higher frequency of exposure to pure mathematics tasks at school. However all three items have similar difficulty around 0 indicating that all of them on average are similarly frequently experienced at school.

Table 16.23 Item parameters for experience with pure mathematics tasks at school (*EXPUREM*)

Item	How often have you encountered the following types of mathematics tasks during your time at school?	Parameter estimates		
		Delta	tau_1	tau_2
ST61Q05	e) Solving an equation like $6x^2 + 5 = 29$	-0.03727	-1.83076	-0.42382
ST61Q07	g) Solving an equation like $2(x+3) = (x+3)(x-3)$	0.06218	-1.81880	-0.42771
ST61Q09	i) Solving an equation like $3x+5=17$	-0.02491	-1.87078	-0.35859

Thirteen items measuring students’ perceived familiarity with mathematics concepts (*FAMCON*) were used in the Main Survey of PISA 2012 (ST62). Table 16.24 shows the item wording and the international item parameters for this scale as well as the item wording and the item difficulties for three foils that were used to adjust *FAMCON* for overclaiming (or signal detection, see also Chapter 17 on new item formats in PISA 2012). Foils represented non-existing pseudo-concepts and formed the auxiliary scale *FOIL*. Response categories for students indicating their familiarity with real concepts and with foils were “Never heard of it”, “Heard of it once or twice”, “Heard of it a few times”, “Heard of it often” and “Know it well, understand the concept”. If students indicated that they had heard of these pseudo-concepts or even know them well, this would indicate overclaiming. In other words, higher values on *FOIL* were indicative of greater signal detection in terms of students making unsubstantiated claims. An additional index was constructed as $FAMCONC = FAMCON - FOIL$ to adjust the scale indicating familiarity with mathematical concepts for signal detection - or overclaiming.

Table 16.24 Item parameters for familiarity with mathematics concepts (*FAMCON*) and foils used for signal detection adjustment

Item	Thinking about mathematical concepts: how familiar are you with the following terms?	Parameter estimates			
		Delta	tau_1	tau_2	tau_3
ST62Q01	a) Exponential Function	0.70602	0.17846	-0.30139	0.03381
ST62Q02	b) Divisor	-0.39879	0.03620	0.09771	-0.02375
ST62Q03	c) Quadratic Function	-0.09809	0.09546	-0.14735	-0.03443
ST62Q06	e) Linear Equation	-0.18839	0.26520	-0.07690	-0.14734
ST62Q07	f) Vectors	0.24874	0.38656	-0.17589	-0.09203
ST62Q08	g) Complex Number	0.42614	-0.09410	-0.27074	0.09469
ST62Q09	h) Rational Number	-0.28493	0.08260	-0.12672	-0.11466
ST62Q10	i) Radicals	-0.26031	0.18900	0.05347	-0.05948
ST62Q12	k) Polygon	-0.25186	0.37874	-0.09779	-0.09941
ST62Q15	m) Congruent Figure	0.14285	0.45932	-0.19293	0.00194
ST62Q16	n) Cosine	0.12545	0.85226	-0.11527	-0.25220
ST62Q17	o) Arithmetic Mean	0.11169	0.51964	-0.13652	-0.02297
ST62Q19	p) Probability	-0.27852	0.23043	-0.11633	-0.05049
<i>Foils used for signal detection adjustment</i>					
ST62Q04	d) <Proper Number>	-0.59662	-0.16511	-0.33622	0.16107
ST62Q11	j) <Subjunctive Scaling>	0.35197	0.01429	-0.50321	0.09209
ST62Q13	l) <Declarative Fraction>	0.24465	0.04043	-0.41630	0.06777

Five items measuring teacher behaviour when giving directed instruction (*TCHBEHTD*) were used in the Main Survey of PISA 2012. Table 16.25 shows the item wording and the international item parameters for this scale. Response categories were “Every lesson”, “Most lessons”, “Some lessons” and “Never or hardly ever”. All items were reversed. Item difficulties vary considerably within this index indicating that teachers summarising the previous lesson at the beginning of the next one is reported to occur less frequently than teachers telling students what they have to learn.

Table 16.25 Item parameters for teacher behaviour - teacher directed instruction (*TCHBEHTD*)

Item	How often do these things happen in your mathematics lessons?	Parameter estimates		
		Delta	tau_1	tau_2
ST79Q01	a) The teacher sets clear goals for our learning	-0.19996	-1.24116	-0.00712
ST79Q02	b) The teacher asks me or my classmates to present our thinking or reasoning at some length	0.44775	-1.22218	0.07681
ST79Q06	f) The teacher asks questions to check whether we have understood what was taught	-0.28343	-1.17827	0.08576
ST79Q08	h) At the beginning of a lesson, the teacher presents a short summary of the previous lesson	0.61041	-1.01121	0.28672
ST79Q15	i) The teacher tells us what we have to learn	-0.57477	-1.19271	-0.00089

Four items measuring teacher behaviour when performing student orientation (*TCHBEHSO*) were used in the Main Survey of PISA 2012. Table 16.26 shows the item wording and the international item parameters for this scale. Response categories were “Every lesson”, “Most lessons”, “Some lessons” and “Never or hardly ever”. All items were reversed.

Table 16.26 Item parameters for teacher behaviour - student orientation (*TCHBEHSO*)

Item	How often do these things happen in your mathematics lessons?	Parameter estimates		
		Delta	tau_1	tau_2
ST79Q03	c) The teacher gives different work to classmates who have difficulties learning and/or to those who can advance faster	-0.22534	-0.36141	-0.11517
ST79Q04	d) The teacher assigns projects that require at least one week to complete	0.18333	-0.63919	0.24772
ST79Q07	g) The teacher has us work in small groups to come up with joint solutions to a problem or task	-0.14024	-0.73802	0.22400
ST79Q10	i) The teacher asks us to help plan classroom activities or topics	0.18225	-0.57358	0.10084

Four items measuring teacher behaviour when conducting formative assessment (*TCHBEHFA*) were used in the Main Survey of PISA 2012. Table 16.27 shows the item wording and the international item parameters for this scale. Response categories ranged from “Every lesson” to “Never or hardly ever”. All items were reversed.

Table 16.27 Item parameters for teacher behaviour - formative assessment (*TCHBEHFA*)

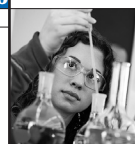
Item	How often do these things happen in your mathematics lessons?	Parameter estimates		
		Delta	tau_1	tau_2
ST79Q05	e) The teacher tells me about how well I am doing in my mathematics class	0.37671	-1.33131	0.31409
ST79Q11	j) The teacher gives me feedback on my strengths and weaknesses in mathematics	0.57510	-1.14889	0.18644
ST79Q12	k) The teacher tells us what is expected of us when we get a test, quiz or assignment	-0.62686	-1.33841	0.01580
ST79Q17	m) The teacher tells me what I need to do to become better in mathematics	-0.32495	-1.07529	0.11227

Five items measuring teacher support (*TEACHSUP*) in mathematics classes were used in the Main Survey of PISA 2012. Table 16.28 shows the item wording and the international item parameters for this scale. Response categories were “Every lesson”, “Most lessons”, “Some lessons”, “Never or hardly ever”. All items were reversed. For this index, item difficulties do not vary considerably which means that some of the listed events were reported to occur only slightly more frequently than others.

Table 16.28 Item parameters for teacher support in mathematics classes (*TEACHSUP*)

Item	How often do these things happen in your mathematics lessons?	Parameter estimates		
		Delta	tau_1	tau_2
ST77Q01	a) The teacher shows an interest in every student's learning	0.21139	-1.84713	0.23901
ST77Q02	b) The teacher gives extra help when students need it	-0.15553	-1.70507	0.20380
ST77Q04	c) The teacher helps students with their learning	-0.23982	-1.51771	0.18839
ST77Q05	d) The teacher continues teaching until the students understand	0.06497	-1.43938	0.21261
ST77Q06	e) The teacher gives students an opportunity to express opinions	0.11899	-1.44889	0.17471

Nine items measuring cognitive activation in mathematics lessons (*COGACT*) were used in the Main Survey of PISA 2012. Table 16.29 shows the item wording and the international item parameters for this scale. Response categories were “Always or almost always”, “Often”, “Sometimes” and “Never or rarely”. All items were reversed, so the higher difficulty corresponds to the lower frequency of the event in the classroom. From the students' points of view, teachers asking students to decide on their own procedures for solving complex problems and teachers presenting problems for which there was no immediately obvious method of solution occurred far less frequently in the classroom than other activities.

**Table 16.29 Item parameters for cognitive activation in mathematics lessons (COGACT)**

Item	Thinking about the mathematics teacher that taught your last mathematics class: How often does each of the following happen?	Parameter estimates		
		Delta	tau_1	tau_2
ST80Q01	a) The teacher asks questions that make us reflect on the problem	-0.11581	-1.64361	0.12254
ST80Q04	b) The teacher gives problems that require us to think for an extended time	0.11324	-1.99125	0.26411
ST80Q05	c) The teacher asks us to decide on our own procedures for solving complex problems	0.61110	-1.34058	0.15393
ST80Q06	d) The teacher presents problems for which there is no immediately obvious method of solution	0.54115	-1.45498	0.12179
ST80Q07	e) The teacher presents problems in different contexts so that students know whether they have understood the concepts	-0.06531	-1.55612	0.09338
ST80Q08	f) The teacher helps us to learn from mistakes we have made	-0.18099	-1.20016	0.03615
ST80Q09	g) The teacher asks us to explain how we have solved a problem	-0.43909	-1.28211	0.08367
ST80Q10	h) The teacher presents problems that require students to apply what they have learned to new contexts	-0.17076	-1.48658	0.10387
ST80Q11	i) The teacher gives problems that can be solved in several different ways	-0.29353	-1.75602	0.17498

This scale provides information on mathematics teacher support (*MTSUP*). There are four items in this scale. The four response categories vary from “Strongly agree” to “Strongly disagree”. All items were reversed. From Table 16.30 which shows the item wording and the international item parameters for this scale it can be seen that students find it harder to agree with the statement that teachers give them the opportunity to express opinions.

Table 16.30 Item parameters mathematics teacher support (MTSUP)

Item	Thinking about the mathematics teacher who taught your last mathematics class: to what extent do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
ST83Q01	a) My teacher lets us know we need to work hard	-0.27208	-1.97628	-0.79466
ST83Q02	b) My teacher provides extra help when needed	0.02497	-1.70752	-0.75517
ST83Q03	c) My teacher helps students with their learning	-0.08478	-1.72847	-0.80214
ST83Q04	d) My teacher gives students the opportunity to express opinions	0.33189	-1.64770	-0.70635

This scale provides information on classroom management (*CLSMAN*) and consists of four items. The four response categories vary from “Strongly agree” to “Strongly disagree”. Table 16.31 shows the item wording and the international item parameters for this scale. All items except the last one (ST85Q04) were reversed.

Table 16.31 Item parameters classroom management (CLSMAN)

Item	Thinking about the mathematics teacher who taught your last mathematics class: to what extent do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
ST85Q01	a) My teacher gets students to listen to him or her	-0.27661	-1.46872	-0.60820
ST85Q02	b) My teacher keeps the class orderly	-0.14614	-1.66419	-0.44530
ST85Q03	c) My teacher starts lessons on time	-0.25532	-1.57764	-0.34718
ST85Q04	d) The teacher has to wait a long time for students to <quiet down>	0.67807	-1.49277	-0.21922

This scale provides information on disciplinary climate in the classroom (*DISCLIMA*) based on five items. The four response categories were “Every lesson”, “Most lessons”, “Some lessons”, to “Never or hardly ever”. Table 16.32 shows the item wording and the international item parameters for this scale.

Table 16.32 Item parameters for disciplinary climate (DISCLIMA)

Item	How often do these things happen in your mathematics lessons?	Parameter estimates		
		Delta	tau_1	tau_2
ST81Q01	a) Students don't listen to what the teacher says	0.35916	-2.06346	-0.61398
ST81Q02	b) There is noise and disorder	0.19734	-1.73779	-0.50655
ST81Q03	c) The teacher has to wait a long time for students to <quiet down>	-0.09943	-1.54240	-0.41861
ST81Q04	d) Students cannot work well	-0.30906	-1.71494	-0.55403
ST81Q05	e) Students don't start working for a long time after the lesson begins	-0.14801	-1.44841	-0.40606

School climate

In PISA 2012, school climate was covered by two scaled indices based on responses to the Student Questionnaire as listed in Table 16.33.

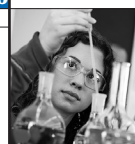
Table 16.33 School climate indices

Index	Index label	Relationship to other PISA surveys
STUDREL	Teacher-Student Relation	Used in 2000, 2003 and 2009; STUREL in 2003; not used in 2006.
BELONG	Sense of Belonging to School	Similar index was used in 2000 and 2003, but the scale included only 6 items with the wording similar to the first 6 items of 2012. The stem and items 2, 3, 4 and 6 have been modified from the 2003 Student Questionnaire and three more items were added. Not used in 2006 and 2009.

Table 16.34 shows high degree of internal consistency across OECD countries for teacher-student relations (*STUDREL*) and moderate to low reliability for sense of belonging to school (*BELONG*).

Table 16.34 Scale reliabilities for school climate indices in OECD countries

	STUDREL	BELONG
Australia	0.85	0.32
Austria	0.82	0.39
Belgium	0.80	0.38
Canada	0.85	0.35
Chile	0.83	0.44
Czech Republic	0.83	0.39
Denmark	0.82	0.36
Estonia	0.81	0.40
Finland	0.83	0.31
France	0.78	0.32
Germany	0.81	0.38
Greece	0.80	0.47
Hungary	0.83	0.44
Iceland	0.88	0.45
Ireland	0.83	0.27
Israel	0.85	0.43
Italy	0.81	0.41
Japan	0.86	0.35
Korea	0.83	0.43
Luxembourg	0.83	0.48
Mexico	0.81	0.53
Netherlands	0.78	0.44
New Zealand	0.84	0.35
Norway	0.86	0.38
Poland	0.84	0.45
Portugal	0.84	0.49
Slovak Republic	0.80	0.43
Slovenia	0.79	0.49
Spain	0.82	0.46
Sweden	0.86	0.52
Switzerland	0.82	0.39
Turkey	0.76	0.47
United Kingdom	0.85	0.31
United States	0.83	0.32
OECD median	0.83	0.40



Similar to OECD countries Table 16.35 shows a high degree of internal consistency across partner countries and economies for teacher-student relations (*STUDREL*) and moderate to low reliability for sense of belonging to school (*BELONG*).

Table 16.35 Scale reliabilities for school climate indices in partner countries and economies

	STUDREL	BELONG
Albania	0.76	0.47
Argentina	0.80	0.60
Brazil	0.81	0.59
Bulgaria	0.82	0.65
Colombia	0.82	0.57
Costa Rica	0.79	0.49
Croatia	0.84	0.39
Cyprus ^{1, 2}	0.83	0.57
Hong Kong-China	0.84	0.41
Indonesia	0.71	0.55
Jordan	0.78	0.65
Kazakhstan	0.83	0.53
Latvia	0.79	0.32
Liechtenstein	0.83	0.43
Lithuania	0.82	0.43
Macao-China	0.83	0.35
Malaysia	0.73	0.53
Montenegro	0.85	0.62
Peru	0.80	0.60
Qatar	0.79	0.67
Romania	0.76	0.55
Russian Federation	0.81	0.55
Serbia	0.83	0.53
Shanghai-China	0.87	0.35
Singapore	0.83	0.32
Chinese Taipei	0.86	0.36
Thailand	0.83	0.58
Tunisia	0.76	0.51
United Arab Emirates	0.81	0.51
Uruguay	0.79	0.57
Viet Nam	0.75	0.45
Median	0.81	0.53

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".

2. 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.

Five items on teacher-student relations were included in the Student Questionnaire. This scale provides information on students' perceived teacher's interest in student performance. There are four response categories varying from "Strongly agree", "Agree", "Disagree" to "Strongly disagree". All items were reversed. Table 16.36 shows the item wording and the international item parameters for this scale. The statement that students found the most difficult to agree with was that most of their teachers really listened to what students had to say.

Table 16.36 Item parameters for teacher-student relations (*STUDREL*)

Item	Thinking about the teachers at your school: to what extent do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
ST86Q01	a) Students get along well with most teachers	-0.25440	-2.61793	-0.67095
ST86Q02	b) Most teachers are interested in students' well-being	0.02701	-2.58166	-0.58553
ST86Q03	c) Most of my teachers really listen to what I have to say	0.26661	-2.63891	-0.47193
ST86Q04	d) If I need extra help, I will receive it from my teachers	-0.11302	-2.23629	-0.77270
ST86Q05	e) Most of my teachers treat me fairly	0.07380	-2.02169	-0.91774

Nine items on sense of belonging to school were included in the Student Questionnaire. There were four response categories varying from "Strongly agree", "Agree", "Disagree" to "Strongly disagree". All items except *ST87Q01*, *ST87Q04* and *ST87Q06* were reversed. Table 16.37 shows the item wording and the international item parameters for this scale. As could be expected among 15-year-olds, the statement that students found the most difficult to endorse was the statement that things were ideal in their school.

Table 16.37 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		
		Delta	tau_1	tau_2
ST87Q01	a) I feel like an outsider (or left out of things) at school	-0.19030	-0.74122	-0.88944
ST87Q02	b) I make friends easily at school	-0.33145	-1.54867	-0.81858
ST87Q03	c) I feel like I belong at school	0.04298	-1.40019	-0.73306
ST87Q04	d) I feel awkward and out of place in my school	-0.16960	-0.98328	-0.68662
ST87Q05	e) Other students seem to like me	-0.01611	-1.63572	-1.07022
ST87Q06	f) I feel lonely at school	-0.38428	-0.74253	-0.79140
ST87Q07	g) I feel happy at school	0.09349	-1.40815	-0.79582
ST87Q08	h) Things are ideal in my school	0.73038	-1.83857	-0.26238
ST87Q09	i) I am satisfied with my school	0.22489	-1.24562	-0.79514

Attitudes towards School

In PISA 2012, the attitudes towards school was covered by two scaled indices based on eight items in the Student Questionnaire (ST88, ST89) as listed in Table 16.38.

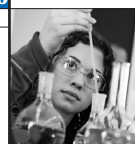
Table 16.38 Attitude towards school indices

Index	Index label	Relationship to other PISA surveys
ATSchL	Attitude towards School: Learning Outcomes	New
ATTLNACT	Attitude towards School: Learning Activities	New

Table 16.39 shows a high degree of internal consistency across OECD countries for attitude towards school in terms of learning activities (*ATTLNACT*) and moderate to high reliability for attitude towards school regarding learning outcomes (*ATSchL*).

Table 16.39 Scale reliabilities and correlations for attitude towards school indices in OECD countries

	ATSchL	ATTLNACT	Correlation
Australia	0.73	0.87	0.52
Austria	0.73	0.68	0.43
Belgium	0.65	0.77	0.40
Canada	0.74	0.85	0.50
Chile	0.65	0.79	0.38
Czech Republic	0.65	0.76	0.43
Denmark	0.68	0.81	0.40
Estonia	0.71	0.80	0.46
Finland	0.74	0.82	0.55
France	0.70	0.78	0.46
Germany	0.67	0.67	0.38
Greece	0.67	0.69	0.48
Hungary	0.65	0.78	0.50
Iceland	0.68	0.87	0.48
Ireland	0.76	0.85	0.48
Israel	0.73	0.80	0.44
Italy	0.69	0.74	0.48
Japan	0.70	0.78	0.45
Korea	0.74	0.81	0.44
Luxembourg	0.62	0.78	0.44
Mexico	0.55	0.78	0.43
Netherlands	0.55	0.81	0.42
New Zealand	0.72	0.86	0.48
Norway	0.72	0.83	0.44
Poland	0.71	0.79	0.50
Portugal	0.71	0.85	0.50
Slovak Republic	0.64	0.75	0.47
Slovenia	0.61	0.78	0.46
Spain	0.69	0.80	0.47
Sweden	0.68	0.85	0.46
Switzerland	0.67	0.72	0.40
Turkey	0.59	0.80	0.45
United Kingdom	0.73	0.86	0.45
United States	0.75	0.87	0.50
OECD median α	0.69	0.80	
OECD average correlation			0.46
Correlation S.D.			0.04



The internal consistency of the scale indicating attitudes towards school in terms of learning activities (*ATTLNACT*) was also high in partner countries and economies (see Table 16.40) and moderate to high for the scale indicating attitudes towards school regarding learning outcomes (*ATSCHL*). Correlations for these two scales were positive and consistent across both OECD and partner countries and economies as indicated by the low standard deviation of the correlation (0.04). This supports the construct validity of these scales across all participating countries.

Table 16.40 Scale reliabilities and correlations for attitude towards school indices in partner countries and economies

	ATSCHL	ATTLNACT	Correlation
Albania	0.54	0.75	0.44
Argentina	0.56	0.79	0.43
Brazil	0.58	0.81	0.44
Bulgaria	0.52	0.82	0.48
Colombia	0.62	0.77	0.44
Costa Rica	0.59	0.81	0.43
Croatia	0.68	0.80	0.47
Cyprus ^{1, 2}	0.63	0.82	0.53
Hong Kong-China	0.68	0.82	0.43
Indonesia	0.60	0.82	0.44
Jordan	0.29	0.77	0.43
Kazakhstan	0.60	0.84	0.48
Liechtenstein	0.60	0.74	0.45
Lithuania	0.67	0.72	0.52
Latvia	0.66	0.78	0.45
Macao-China	0.62	0.79	0.41
Malaysia	0.51	0.83	0.51
Montenegro	0.59	0.79	0.44
Peru	0.52	0.77	0.42
Qatar	0.45	0.83	0.44
Romania	0.57	0.75	0.48
Russian Federation	0.70	0.82	0.48
Serbia	0.41	0.75	0.41
Shanghai-China	0.75	0.78	0.43
Singapore	0.62	0.81	0.38
Chinese Taipei	0.70	0.84	0.48
Thailand	0.43	0.79	0.40
Tunisia	0.63	0.78	0.51
United Arab Emirates	0.59	0.80	0.45
Uruguay	0.55	0.80	0.37
Viet Nam	0.65	0.61	0.36
Median	0.60	0.79	
Average correlation			0.45
Correlation SD			0.04

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".

2. 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.

Four items were included in the attitude towards school regarding learning outcomes (*ATSCHL*) scale. All four items had four response categories from "Strongly agree", "agree", "Disagree" to "Strongly disagree" and items *ST88Q03* and *ST88Q04* were reversed. Table 16.41 shows the item wording and the international item parameters for this scale. Results show that students found it hardest to strongly disagree with the statement that school had done little to prepare them for adult life after leaving school.

Table 16.41 Item parameters for attitude towards school: Learning outcomes (ATSCHL)

Item	Thinking about what you have learned at school: to what extent do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
ST88Q01	a) School has done little to prepare me for adult life when I leave school	0.69821	-1.45109	-0.55021
ST88Q02	b) School has been a waste of time	-0.25285	-0.68621	-1.08584
ST88Q03	c) School has helped give me confidence to make decisions	-0.01432	-1.59410	-0.66939
ST88Q04	d) School has taught me things which could be useful in a job	-0.43104	-0.99365	-0.89887

Four items regarding attitude towards school in terms of learning activities (*ATTLNACT*) were included in the Student Questionnaire with four response categories from "Strongly agree" to "Strongly disagree". All items were reversed. Table 16.42 shows the item wording and the international item parameters for this scale, the latter indicating that difficulty levels were similar for these four attitudinal items.

Table 16.42 Item parameters for attitude towards school: Learning activities (ATLNACT)

Item	Thinking about your school: to what extent do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
ST89Q02	a) Trying hard at school will help me get a good job	0.20147	-2.11171	-0.89032
ST89Q03	b) Trying hard at school will help me get into a good <college>	-0.04516	-1.75930	-1.05927
ST89Q04	c) I enjoy receiving good <grades>	-0.28492	-1.70583	-1.08044
ST89Q05	d) Trying hard at school is important	0.12861	-1.88420	-1.10550

Problem Solving

In PISA 2012, the two new scaled indices (see Table 16.43), namely perseverance and openness to problem solving were developed in recognition of the increasing importance of problems solving in the cognitive part of the assessment.

Table 16.43 Problem solving indices

Index	Index label	Relationship to other PISA surveys
PERSEV	Perseverance	New
OPENPS	Openness for Problem Solving	New

Tables 16.44 and 16.45 show a high degree of internal consistency for both OECD and partner countries and economies for the two problem solving indices.

Table 16.44 Scale reliabilities for problem solving indices in OECD countries

	PERSEV	OPENPS
Australia	0.87	0.84
Austria	0.68	0.80
Belgium	0.77	0.81
Canada	0.85	0.85
Chile	0.79	0.80
Czech Republic	0.76	0.80
Denmark	0.81	0.83
Estonia	0.80	0.84
Finland	0.82	0.85
France	0.78	0.83
Germany	0.67	0.81
Greece	0.69	0.77
Hungary	0.78	0.81
Iceland	0.87	0.89
Ireland	0.85	0.81
Israel	0.80	0.80
Italy	0.74	0.78
Japan	0.78	0.83
Korea	0.81	0.81
Luxembourg	0.78	0.83
Mexico	0.78	0.84
Netherlands	0.81	0.83
New Zealand	0.86	0.84
Norway	0.83	0.88
Poland	0.79	0.86
Portugal	0.85	0.84
Slovak Republic	0.75	0.80
Slovenia	0.78	0.80
Spain	0.80	0.80
Sweden	0.85	0.86
Switzerland	0.72	0.82
Turkey	0.80	0.78
United Kingdom	0.86	0.82
United States	0.87	0.85
OECD median	0.80	0.82

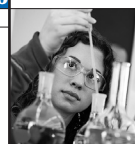


Table 16.45 Scale reliabilities for problem solving indices in partner countries and economies

	PERSEV	OPENPS
Albania	0.75	0.76
Argentina	0.79	0.80
Brazil	0.81	0.81
Bulgaria	0.82	0.81
Colombia	0.77	0.79
Costa Rica	0.81	0.81
Croatia	0.80	0.74
Cyprus ^{1, 2}	0.82	0.81
Hong Kong-China	0.82	0.86
Indonesia	0.82	0.81
Jordan	0.77	0.80
Kazakhstan	0.84	0.83
Latvia	0.78	0.80
Liechtenstein	0.74	0.82
Lithuania	0.72	0.80
Macao-China	0.79	0.82
Malaysia	0.83	0.81
Montenegro	0.79	0.74
Peru	0.77	0.78
Qatar	0.83	0.81
Romania	0.75	0.77
Russian Federation	0.82	0.81
Serbia	0.75	0.80
Shanghai-China	0.78	0.84
Singapore	0.81	0.81
Chinese Taipei	0.84	0.86
Thailand	0.79	0.82
Tunisia	0.78	0.75
United Arab Emirates	0.80	0.78
Uruguay	0.80	0.80
Viet Nam	0.61	0.80
Median	0.79	0.81

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".

2. 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.

Five items measuring perseverance (*PERSEV*) were included in the Student Questionnaire which had five response categories, namely "Very much like me", "Mostly like me", "Somewhat like me", "Not much like me" and "Not at all like me". The last three items were reversed. Table 16.46 shows the item wording and the international item parameters for this scale.

Table 16.46 Item parameters for perseverance (*PERSEV*)

Item	How well does each of the following statements below describe you?	Parameter estimates			
		Delta	tau_1	tau_2	tau_3
ST93Q01	a) When confronted with a problem, I give up easily	-0.05108	-0.58760	-0.69646	0.08203
ST93Q03	b) I put off difficult problems	0.28741	-0.91697	-0.62301	0.40159
ST93Q04	c) I remain interested in the tasks that I start	-0.20042	-1.19575	-0.51577	0.38405
ST93Q06	d) I continue working on tasks until everything is perfect	-0.11046	-1.23633	-0.33077	0.49403
ST93Q07	e) When confronted with a problem, I do more than what is expected of me	0.07455	-1.22383	-0.37935	0.57732

Five items on openness for problem solving (*OPENPS*) were included in the Student Questionnaire with five response categories, namely "Very much like me", "Mostly like me", "Somewhat like me", "Not much like me" and "Not at all like me". All items were reversed. Table 16.47 shows the item wording and the international item parameters for this scale.

Table 16.47 Item parameters for openness for problem solving (*OPENPS*)

Item	How well does each of the following statements below describe you?	Parameter estimates			
		Delta	tau_1	tau_2	tau_3
ST94Q05	a) I can handle a lot of information	-0.08964	-2.30286	-0.90555	0.83950
ST94Q06	b) I am quick to understand things	-0.20682	-2.21470	-0.89174	0.68774
ST94Q09	c) I seek explanations for things	-0.35650	-2.09394	-0.88564	0.75116
ST94Q10	d) I can easily link facts together	-0.17628	-2.27798	-0.77326	0.76166
ST94Q14	e) I like to solve complex problems	0.82924	-1.61131	-0.51812	0.61360

ICT familiarity

The ICT familiarity questionnaire was an optional instrument, which was administered in 42 of the participating countries in PISA 2012. Eight scaled indices (see Table 16.48) were computed based on the information obtained from this questionnaire.

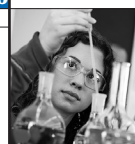
Table 16.48 ICT familiarity indices

Index	Index label	Relationship to other PISA surveys
ICTHOME	ICT Availability at Home	Modified from 2009, new items added
ICTSCH	ICT Availability at School	Modified from 2009, new items added
ENTUSE	ICT Entertainment Use	Modified from 2009, new items added
HOMSCH	ICT Use at Home for School-related Tasks	Modified from 2009
USESCH	Use of ICT at School	Modified from 2009
USEMATH	Use of ICT in Mathematics Lessons	New
ICTATTPOS	Attitudes Towards Computers: Computer as a Tool for School Learning	New
ICTATTNEG	Attitudes Towards Computers: Limitations of the Computer as a Tool for School Learning	New

Table 16.49 shows various degree of internal consistency across OECD countries for ICT familiarity indices. The OECD median for Cronbach's alpha varied from medium for ICT availability at home (*ICTHOME*, median $\alpha=0.53$) to very high for the use of ICT in mathematics lessons (*USEMATH*, median $\alpha=0.91$). These results were similar for partner countries and economies as can be seen in Table 16.50.

Table 16.49 Scale reliabilities for ICT familiarity indices in OECD countries

	ICTHOME	ICTSCH	ENTUSE	HOMSCH	USESCH	USEMATH	ICTATTPOS	ICTATTNEG
Australia	0.53	0.40	0.78	0.87	0.78	0.89	0.76	0.74
Austria	0.44	0.60	0.77	0.82	0.81	0.87	0.74	0.72
Belgium	0.50	0.70	0.77	0.85	0.88	0.89	0.76	0.66
Chile	0.68	0.65	0.83	0.83	0.84	0.91	0.76	0.65
Czech Republic	0.45	0.55	0.75	0.81	0.85	0.90	0.68	0.65
Denmark	0.49	0.45	0.74	0.80	0.80	0.91	0.77	0.78
Estonia	0.45	0.63	0.70	0.75	0.84	0.88	0.74	0.71
Finland	0.41	0.53	0.73	0.81	0.81	0.89	0.78	0.67
Germany	0.42	0.66	0.75	0.75	0.82	0.88	0.75	0.73
Greece	0.64	0.68	0.86	0.88	0.91	0.92	0.67	0.65
Hungary	0.64	0.65	0.80	0.84	0.88	0.92	0.76	0.71
Iceland	0.40	0.56	0.74	0.85	0.87	0.92	0.80	0.73
Ireland	0.50	0.67	0.78	0.80	0.81	0.91	0.75	0.74
Israel	0.65	0.76	0.80	0.84	0.91	0.94	0.72	0.68
Italy	0.56	0.72	0.80	0.82	0.87	0.89	0.68	0.71
Japan	0.63	0.71	0.78	0.70	0.74	0.96	0.81	0.71
Korea	0.55	0.68	0.74	0.83	0.88	0.95	0.81	0.70
Mexico	0.81	0.68	0.88	0.86	0.87	0.93	0.77	0.69
Netherlands	0.51	0.49	0.70	0.75	0.83	0.91	0.75	0.65
New Zealand	0.60	0.52	0.80	0.88	0.83	0.91	0.80	0.81
Norway	0.50	0.38	0.75	0.83	0.84	0.84	0.79	0.79
Poland	0.59	0.68	0.79	0.80	0.89	0.92	0.73	0.73
Portugal	0.55	0.62	0.83	0.88	0.92	0.93	0.68	0.78
Slovak Republic	0.61	0.66	0.83	0.84	0.87	0.92	0.70	0.67
Slovenia	0.56	0.69	0.81	0.86	0.92	0.92	0.75	0.71
Spain	0.51	0.61	0.76	0.83	0.83	0.92	0.69	0.68
Sweden	0.53	0.47	0.77	0.87	0.88	0.94	0.82	0.79
Switzerland	0.47	0.66	0.77	0.83	0.85	0.89	0.75	0.72
Turkey	0.78	0.75	0.90	0.86	0.89	0.92	0.79	0.77
OECD median	0.53	0.65	0.78	0.83	0.85	0.91	0.75	0.71

**Table 16.50 Scale reliabilities for ICT familiarity indices in partner countries and economies**

	ICTHOME	ICTSCH	ENTUSE	HOMSCH	USESCH	USEMATH	ICTATTPOS	ICTATTNEG
Costa Rica	0.76	0.69	0.87	0.83	0.86	0.94	0.75	0.63
Croatia	0.52	0.67	0.81	0.81	0.87	0.92	0.73	0.69
Hong Kong-China	0.52	0.55	0.74	0.82	0.85	0.90	0.67	0.61
Jordan	0.85	0.79	0.93	0.90	0.93	0.93	0.72	0.74
Latvia	0.57	0.67	0.79	0.82	0.89	0.92	0.73	0.69
Liechtenstein	0.38	0.65	0.78	0.83	0.83	0.85	0.79	0.73
Macao-China	0.56	0.61	0.79	0.80	0.81	0.90	0.74	0.72
Russian Federation	0.60	0.69	0.84	0.85	0.91	0.92	0.73	0.70
Serbia	0.70	0.74	0.84	0.85	0.89	0.93	0.78	0.75
Shanghai-China	0.65	0.70	0.86	0.81	0.82	0.91	0.72	0.71
Singapore	0.53	0.63	0.79	0.89	0.87	0.91	0.73	0.72
Chinese Taipei	0.63	0.59	0.83	0.86	0.85	0.95	0.81	0.72
Uruguay	0.74	0.72	0.84	0.84	0.90	0.92	0.77	0.71
Median	0.60	0.67	0.83	0.83	0.87	0.92	0.73	0.71

Eleven items provided information on ICT availability at home (*ICTHOME*) in the ICT familiarity questionnaire in PISA 2012. The three response categories were “Yes, and I use it”, “Yes, but I don’t use it” and “No”. All items were reversed. Table 16.51 shows the devices for which availability and use at home were checked as well as the international IRT parameters for this scale. The distribution of item difficulties and step difficulties for this scale are reasonable and appropriate with tablets and ebook readers not as often used as desktop computers or cell phones.

Table 16.51 Item parameters for ICT availability at home (*ICTHOME*)

Item	Are any of these devices available for you to use at home?	Parameter estimates	
		Delta	tau_1
IC01Q01	a) Desktop computer	-0.37724	0.90409
IC01Q02	b) Portable laptop, or notebook	-0.07181	1.26122
IC01Q03	c) <Tablet computer> (e.g. <iPad®>, <BlackBerry® PlayBook™>)	1.21142	1.56453
IC01Q04	d) Internet connection	-1.00973	2.17172
IC01Q05	e) <Video games console>, e.g. <Sony® PlayStation® >	0.35765	0.88705
IC01Q06	f) <Cell phone> (without Internet access)	0.10868	0.56614
IC01Q07	g) <Cell phone> (with Internet access)	-0.30415	1.15461
IC01Q08	h) Portable music player (Mp3/Mp4 player, iPod® or similar)	-0.35090	0.99946
IC01Q09	i) Printer	-0.18337	1.02506
IC01Q10	j) USB (memory) stick	-1.00313	0.72701
IC01Q11	k) <eBook reader>, e.g. <Amazon® Kindle™>	1.62258	0.95641

Seven items provided information on ICT availability at school (*ICTSCH*) in PISA 2012. Again, the three response categories included “Yes, and I use it”, “Yes, but I don’t use it” and “No”. All items were reversed. Table 16.52 shows the devices for which availability and use at school were checked as well as the international IRT parameters for this scale. The distribution of item difficulties and step difficulties for this scale are reasonable and appropriate with tablets and e-book readers not as often used at school as desktop computers or internet connections.

Table 16.52 Item parameters for ICT availability at school (*ICTSCH*)

Item	Are any of these devices available for you to use at school?	Parameter estimates	
		Delta	tau_1
IC02Q01	a) Desktop computer	-1.48349	-0.18181
IC02Q02	b) Portable laptop or notebook	0.43582	0.45335
IC02Q03	c) <Tablet computer> (e.g. <iPad®>, <BlackBerry® PlayBook™>)	1.70674	0.92454
IC02Q04	d) Internet connection	-1.53021	-0.06362
IC02Q05	e) Printer	-0.99947	-0.24697
IC02Q06	f) USB (memory) stick	0.14648	0.28204
IC02Q07	g) <eBook reader>, e.g. <Amazon® Kindle™>	1.72413	0.45042

Ten items sought information on use of ICT for entertainment (*ENTUSE*). Five response categories included “Never or hardly ever”, “Once or twice a month”, “Once or twice a week”, “Almost every day” and “Every day”. Table 16.53 shows the item wording and international IRT parameters for this scale. The distribution of item and step difficulties for this scale were reasonable and appropriate and indicated that uploading student’s own created contents for sharing occurred less often than browsing the Internet for fun.

Table 16.53 Item parameters for ICT entertainment use (*ENTUSE*)

Item	How often do you use a computer for the following activities outside of school?	Parameter estimates			
		Delta	tau_1	tau_2	tau_3
IC08Q01	a) Playing one-player games	0.56025	-0.07895	-0.55524	0.20545
IC08Q02	b) Playing collaborative online games	0.53815	0.48298	-0.48203	-0.02671
IC08Q03	c) Using email	0.05040	-0.50015	-0.37791	0.33186
IC08Q04	d) <Chatting online> (e.g. <MSN®>)	-0.18749	0.52895	-0.47947	-0.14916
IC08Q05	e) Participating in social networks (e.g. <Facebook>, <MySpace>)	-0.61577	0.82483	-0.51794	-0.17790
IC08Q06	f) Browsing the Internet for fun (such as watching videos, e.g. <YouTube™>)	-0.72756	0.00021	-0.60131	0.18488
IC08Q07	g) Reading news on the Internet (e.g. current affairs)	0.00238	-0.16180	-0.53502	0.25195
IC08Q08	h) Obtaining practical information from the Internet (e.g. locations, dates of events)	0.01770	-0.63263	-0.61047	0.48391
IC08Q09	i) Downloading music, films, games or software from the Internet	-0.25440	-0.38493	-0.37840	0.30821
IC08Q11	j) Uploading your own created contents for sharing (e.g. music, poetry, videos, computer programs)	0.61634	0.23946	-0.25311	0.09636

Seven items sought information on the use of ICT outside school but for school related tasks (*HOMSCH*). The five response categories were “Never or hardly ever”, “Once or twice a month”, “Once or twice a week”, “Almost every day” and “Every day”. Table 16.54 shows the item wording and international IRT parameters for this scale.

Table 16.54 Item parameters for ICT use at home for school related tasks (*HOMSCH*)

Item	How often do you use a computer for the following activities outside of school?	Parameter estimates			
		Delta	tau_1	tau_2	tau_3
IC09Q01	a) Browsing the Internet for schoolwork (e.g. for preparing an essay or presentation)	-0.47218	-1.84411	-0.61722	0.98683
IC09Q02	b) Using email for communication with other students about schoolwork	-0.07103	-0.63527	-0.62102	0.39880
IC09Q03	c) Using email for communication with teachers and submission of homework or other schoolwork	0.53073	-0.77744	-0.35176	0.56909
IC09Q04	d) Downloading, upload or browse material from my school's website (e.g. time table or course materials)	0.12747	-0.67462	-0.36316	0.36557
IC09Q05	e) Checking the school's website for announcements, e.g. absence of teachers	0.13397	-0.29759	-0.35088	0.16093
IC09Q06	f) Doing homework on the computer	-0.30237	-1.09545	-0.59187	0.57559
IC09Q07	g) Sharing school related materials with other students	0.05341	-0.67695	-0.60679	0.38437

Nine items invited students to report on the use of computers for ICT related activities at school (*USESCH*). Five response categories vary from “Never or hardly ever”, “Once or twice a month”, “Once or twice a week”, “Almost every day” to “Every day”. Table 16.55 shows the item wording and international IRT parameters for this scale.

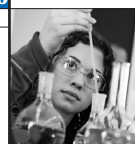
Table 16.55 Item parameters for use of ICT at school (*USESCH*)

Item	How often do you use a computer for the following activities at school?	Parameter estimates			
		Delta	tau_1	tau_2	tau_3
IC10Q01	a) <Chatting on line> at school	-0.04326	0.24104	-0.86815	0.45464
IC10Q02	b) Using email at school	-0.03091	-0.47426	-0.67827	0.65702
IC10Q03	c) Browsing the Internet for schoolwork	-0.66296	-1.16175	-0.75605	0.89120
IC10Q04	d) Downloading, uploading or browsing material from the school's website (e.g. <intranet>)	0.05209	-0.32018	-0.76602	0.47839
IC10Q05	e) Posting my work on the school's website	0.36697	0.01575	-0.83393	0.42845
IC10Q06	f) Playing simulations at school	0.39406	0.07572	-0.67624	0.32083
IC10Q07	g) Practicing and drilling, such as for foreign language learning or mathematics	0.11228	-0.70404	-0.59797	0.66411
IC10Q08	h) Doing homework on a school computer	-0.06137	-0.56136	-0.63843	0.54638
IC10Q09	i) Using school computers for group work and communication with other students	-0.12690	-0.94594	-0.50315	0.75345

A new scale was created in PISA 2012 based on seven items as an indicator of students' reported use of ICT in mathematics lessons (*USEMATH*). The three response categories included “Yes, students did this”, “Yes, but only the teacher demonstrated this” to “No”. All items were reversed. Table 16.56 shows the item wording and international IRT parameters for this scale.

Table 16.56 Item parameters for use of ICT in mathematics lessons (*USEMATH*)

Item	Within the last month, has a computer ever been used for the following purposes in your mathematics lessons?	Parameter estimates	
		Delta	tau_1
IC11Q01	a) Drawing the graph of a function (such as $y = 4x + 6$)	-0.18024	-0.22941
IC11Q02	b) Calculating with numbers (such as calculating $5 \times 233/8$)	0.02833	0.09262
IC11Q03	c) Constructing geometric figures (e.g. an equilateral triangle with given side lengths)	-0.03530	-0.25815
IC11Q04	d) Entering data in a spreadsheet (e.g. in <Excel™>)	-0.33025	0.04599
IC11Q05	e) Rewriting algebraic expressions and solving equations (such as $a^2 + 2ab + b^2$)	0.10770	-0.08542
IC11Q06	f) Drawing histograms (a graph that shows the distribution of frequencies of data)	0.21583	-0.21162
IC11Q07	g) Finding out how the graph of a function like $y = ax^2$ changes depending on a	0.19393	-0.31561



Three items in the ICT familiarity questionnaire formed a scale indicating attitudes towards the computer as a tool for school learning (*ICTATTPOS*). The items had for response categories, namely “Strongly agree”, “Agree”, “Disagree” and “Strongly disagree”. All items were reversed. Table 16.57 shows the item wording and the international item parameters for this scale. As can be seen, students found it harder to endorse the statement that “Doing my homework using a computer makes it more fun” than agreeing with the statement that the Internet being a great resource for students’ school work.

Table 16.57 Item parameters for attitudes towards computers: computer as a tool for school learning (*ICTATTPOS*)

Item	Thinking about your experience with computers: to what extent do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
IC22Q01	a) The computer is a very useful tool for my schoolwork	-0.24361	-1.95350	-0.81100
IC22Q02	b) Doing my homework using a computer makes it more fun	0.79826	-2.48214	-0.28989
IC22Q04	c) The Internet is a great resource for obtaining information I can use for my school work	-0.55465	-1.58778	-1.01963

Three items on attitudes towards computers limitations of the computer as a tool for school learning (*ICTATTNEG*) were included in the ICT familiarity questionnaire. There are four response categories varying from “Strongly agree”, “Agree”, “Disagree” to “Strongly disagree”. All items were reversed. Table 16.58 shows the item wording and the international item parameters for this scale.

Table 16.58 Item parameters for attitudes towards computers: limitations of the computer as a tool for school learning (*ICTATTNEG*)

Item	Thinking about your experience with computers: to what extent do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
IC22Q06	d) Using the computer for learning is troublesome	0.28503	-2.04715	0.59615
IC22Q07	e) Since anyone can upload information to the internet, it is in general not suitable to use it for schoolwork	-0.22365	-2.43535	0.47849
IC22Q08	f) Information obtained from the internet is generally too unreliable to be used for school assignments	-0.06138	-2.47303	0.62212

Educational career

The educational career questionnaire was an optional instrument, some parts of which were administered in 23 of the countries/economies participating in PISA 2012. Of these, 22 countries/economies collected sufficient information to compute some of the six scaled indices listed in Table 16.59.

It should be noted that not all 22 countries/economies administered all questions so that the information in the following tables is provided for only those countries/economies that had administered the questions forming a scale.

Table 16.59 Educational career indices

Index	Index label	Relationship to other PISA surveys
INFOCAR	Information about Careers	New
INFOJOB1	Information about the Labour Market provided by the School	New
INFOJOB2	Information about the Labour Market provided outside of School	New
HOSTCUL	Acculturation: Host Culture Oriented Strategies	New
HERITCUL	Acculturation: Heritage Culture Oriented Strategies	New
CULTDIST	Cultural Distance between Host and Heritage Culture	New

Table 16.60 shows an acceptable level of internal consistency across those OECD countries that administered questions for the educational career indices with only the scale indicating students’ reported activities to obtain career information having a slightly lower reliability.

Table 16.60 Scale reliabilities for educational career indices in OECD countries

	INFOCAR	INFOJOB1	INFOJOB2	HOSTCUL	HERITCUL	CULTDIST
Australia	0.67	0.79	0.76	*	*	*
Austria	0.59**	0.72	0.68	*	*	*
Belgium	0.60	0.62	0.64	0.85	0.83	0.80
Canada	0.64	0.79	0.75	*	*	*
Denmark	0.53	0.61	0.62	0.88	0.81	0.75
Finland	0.67**	0.79	0.77	0.86	0.84	0.79
Germany	*	*	*	*	*	*
Hungary	0.64	0.67	0.70	*	*	*
Ireland	0.70	0.79	0.73	*	*	*
Italy	0.59	0.63	0.58	0.82	0.81	0.79
Korea	0.67	0.78	0.79	0.92	0.94	0.95
Luxembourg	0.69	0.78	0.73	*	*	*
New Zealand	0.65**	0.76	0.75	*	*	*
Portugal	0.69	0.80	0.79	0.86	0.84	0.82
Slovak Republic	0.71	0.71	0.71	0.85	0.85	0.80
Slovenia	0.77	0.75	0.73	0.81	0.84	0.78

* All questions from the index deleted by the country.

** Item EC03Q10 deleted.

Table 16.61 shows an acceptable level of internal consistency across those partner countries and economies that administered questions for the educational career indices with only the scale indicating students' reported activities to obtain career information having a slightly lower reliability.

Table 16.61 Scale reliabilities for educational career indices in partner countries and economies

	INFOCAR	INFOJOB1	INFOJOB2	HOSTCUL	HERITCUL	CULTDIST
Croatia	0.63**	0.75	0.67	*	*	*
Hong Kong-China	0.62	0.67	0.67	0.72	0.81	0.81
Latvia	0.60	0.64	0.60	*	*	*
Macao-China	0.74	0.73	0.74	*	*	*
Serbia	0.74	0.79	0.75	0.88	0.88	0.50
Shanghai-China	0.60***	0.72	0.66	*	*	*
Singapore	0.66***	0.79	0.77	*	*	*

* All questions from the index deleted by the country/economy

** Items EC03Q01 and EC03Q10 deleted by the country.

*** Item EC03Q10 deleted by the country/economy.

Ten items provide data on information about careers (*INFOCAR*). Two response categories were provided “yes”, and “no, never”. All items were reversed. Table 16.62 shows the item wording and IRT parameters for those countries for which this scale could be created. As can be seen, students reported to use the internet to obtain career information to a much greater extent than they reported visiting a job fair or doing an internship.

Table 16.62 Item parameters for information about careers (*INFOCAR*)

Item	Have you done any of the following to find out about future study or types of work?	Parameter estimates
		Delta
EC03Q01	a) I did an internship	0.81357
EC03Q02	b) I attended <job shadowing or work-site visits>	0.35180
EC03Q03	c) I visited a <job fair>	0.83687
EC03Q04	d) I spoke to a <career advisor> at my school	0.00674
EC03Q05	e) I spoke to a <career advisor> outside of my school	1.23705
EC03Q06	f) I completed a questionnaire to find out about my interests and abilities	-1.10754
EC03Q07	g) I researched the internet for information about careers	-1.47633
EC03Q08	h) I went on an organised tour in an <ISCED 3-5> institution	0.45532
EC03Q09	i) I researched the internet for information about <ISCED 3-5> programmes	-0.72695
EC03Q10	j) <country specific item>	-0.39053

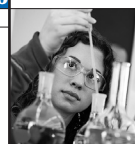
Six items formed the next two indices, which provided data about where students found information about the labour market, either at school (*INFOJOB1*) or outside of school (*INFOJOB2*). The three response categories were “Yes, at school”, “Yes, out of school”, and “No, never”. For the *INFOJOB1* index the initial variables were recoded into “at” variables coded as ‘1’ if the answer was “Yes, at school” and as ‘0’ if the answer was “No, never”. For the *INFOJOB2* index the initial variables were recoded into “out” variables coded as ‘1’ if the answer was “Yes, out of school” and as ‘0’ if the answer was “No, never”. Tables 16.63 and 16.64 show the item wording and IRT parameters for those countries that administered the items that provided the information for the *INFOJOB1* and *INFOJOB2* respectively.

Table 16.63 Item parameters for information about the labour market provided by the school (*INFOJOB1*)

Item	Which of the following skills have you acquired?	Parameter estimates
		Delta
EC04Q01at	a) How to find information on jobs I am interested in	-1.46392
EC04Q02at	b) How to search for a job	-0.01141
EC04Q03at	c) How to write a <résumé> or a summary of my qualifications	-0.28479
EC04Q04at	d) How to prepare for a job interview	0.92357
EC04Q05at	e) How to find information on <ISCED 3-5> programs I am interested in	-0.45867
EC04Q06at	f) How to find information on student financing (e.g. student loans or grants)	1.29522

Table 16.64 Item parameters for information about the labour market provided outside of school (*INFOJOB2*)

Item	Which of the following skills have you acquired?	Parameter estimates
		Delta
EC04Q01out	a) How to find information on jobs I am interested in	-1.61044
EC04Q02out	b) How to search for a job	-0.69714
EC04Q03out	c) How to write a <résumé> or a summary of my qualifications	0.49007
EC04Q04out	d) How to prepare for a job interview	1.13508
EC04Q05out	e) How to find information on <ISCED 3-5> programs I am interested in	-0.58496
EC04Q06out	f) How to find information on student financing (e.g. student loans or grants)	1.26739



Four items on acculturation in terms of host culture oriented strategies (*HOSTCUL*) were included in the educational career questionnaire. There are four response categories varying from “Strongly agree”, “Agree”, “Disagree” to “Strongly disagree”. All items were reversed. Table 16.65 shows the item wording and the item parameters for those countries that administered the items forming this scale. Results showed that students found it easier to agree with the statement about liking to have a friend from the host culture but harder to agree with the statement about participating in celebrations of the host culture.

Table 16.65 Item parameters for acculturation: Host culture oriented strategies (*HOSTCUL*)

Item	Below you will find statements about <host culture> and <heritage culture>. <Host culture> refers to the culture and country in which you now live. <Heritage culture> refers to the culture and country in which your mother was born. To what extent do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
ST23Q01	a) I like to have <host culture> friends	-0.82259	-1.6703	-1.56258
ST23Q03	c) I like to participate in <host culture> celebrations	0.34516	-2.58806	-0.6544
ST23Q05	e) I spend a lot of time with <host culture> friends	-0.14033	-2.50401	-0.5214
ST23Q07	g) I participate in <host culture> celebrations	0.61776	-2.50097	-0.63483

Four items on acculturation in terms of heritage culture oriented strategies (*HERITCUL*) were included in the educational career questionnaire with the four response categories varying from “Strongly agree”, “Agree”, “Disagree” to “Strongly disagree”. All items were reversed. Table 16.66 shows the item wording and the international item parameters for this scale. Again, results showed that it was easier to agree with liking to have friends from the heritage culture than it was to agree with the statement indicating participation in celebrations of the heritage culture.

Table 16.66 Item parameters for acculturation: Heritage culture oriented strategies (*HERITCUL*)

Item	Below you will find statements about <host culture> and <heritage culture>. <Host culture> refers to the culture and country in which you now live. <Heritage culture> refers to the culture and country in which your mother was born. To what extent do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
ST23Q02	b) I like to have <heritage culture> friends	-0.73995	-1.90060	-1.19650
ST23Q04	d) I like to participate in <heritage culture> celebrations	-0.09285	-2.15380	-0.69631
ST23Q06	f) I spend a lot of time with <heritage culture> friends	0.46761	-2.17534	-0.39655
ST23Q08	h) I participate in <heritage culture> celebrations	0.36519	-2.06592	-0.56792

Three items on cultural distance between host and heritage culture (*CULTDIST*) were included in the educational career questionnaire. There are four response categories varying from “Strongly agree”, “Agree”, “Disagree” to “Strongly disagree”. All items were reversed. Table 16.67 shows the item wording and the item parameters for those countries which had administered the questions forming this scale.

Table 16.67 Item parameters for cultural distance between host and heritage culture (*CULTDIST*)

Item	The statements below are about differences between <host culture> and <heritage culture>. To what extent do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
ST24Q01	a) The values of people in the <host culture> and in the <heritage culture> are the same	-0.37953	-2.20603	-0.04478
ST24Q02	b) Mothers in the <host culture> and in the <heritage culture> treat their children in the same way	0.19734	-2.07529	-0.03418
ST24Q03	c) Pupils from the <host culture> and the <heritage culture> deal with their teachers in the same way	0.18219	-1.87304	-0.13527

SCHOOL QUESTIONNAIRE SCALE INDICES

The School Questionnaire provided data for thirteen scaled indices including four new indices on school leadership (*LEADCOM*, *LEADINST*, *LEADPD*, *LEADTCH*). All indices are listed in Table 16.68.

Table 16.68 School Questionnaire indices

Index	Index label	Relationship to other PISA surveys
School leadership		
LEADCOM	Framing and Communicating the School's Goals and Curricular Development	New
LEADINST	Instructional Leadership	New
LEADPD	Promoting Instructional Improvements and Professional Development	New
LEADTCH	Teacher Participation in Leadership	New
School Autonomy		
SCHAUTON	School autonomy	Used in 2000, 2003 modified for 2012
TCHPARTI	Teacher Participation/Autonomy	Used in 2000, 2003, 2009, modified for 2012
School Resources		
TCSHORT	Shortage of Teaching Staff	Used in 2000, 2003, 2006, 2009
SCMATEDU	Quality of School Educational Resources	Used in 2000, 2003, modified for 2006, 2009
SCMATBUI	Quality of Physical Infrastructure	Used in 2000, 2003
School climate		
STUDCLIM	Student-related Factors Affecting School Climate	New scale; some of the questions were asked in previous cycles
TEACCLIM	Teacher-related Factors Affecting School Climate	New scale; some of the questions were asked in previous cycles
TCMORALE	Teacher Morale	Used in 2000, 2003
TCFOCST	Teacher Focus	New

Tables 16.69 and 16.70 show a high degree of internal consistency for School Questionnaire indices across participating OECD and partner countries and economies respectively.

Table 16.69 Scale reliabilities for School Questionnaire indices in OECD countries

	LEADCOM	LEADINST	LEADPD	LEADTCH	SCHAUTON	TCHPARTI	TCSHORT	SCMATEDU	SCMATBUI	STUDCLIM	TEACCLIM	TCMORALE	TCFOCST
Australia	0.77	0.74	0.81	0.78	0.78	0.72	0.87	0.84	0.82	0.89	0.87	0.81	0.61
Austria	0.69	0.80	0.89	0.73	0.82	0.77	0.78	0.83	0.80	0.85	0.82	0.76	0.48
Belgium	0.68	0.74	0.85	0.75	0.83	0.65	0.82	0.82	0.82	0.89	0.82	0.73	0.58
Canada	0.77	0.78	0.79	0.74	0.70	0.67	0.82	0.81	0.78	0.85	0.83	0.80	0.62
Chile	0.75	0.76	0.81	0.72	0.88	0.72	0.89	0.85	0.81	0.90	0.89	0.81	0.67
Czech Republic	0.76	0.82	0.84	0.78	0.96	0.74	0.74	0.78	0.75	0.86	0.81	0.73	0.64
Denmark	0.78	0.67	0.79	0.73	0.81	0.73	0.71	0.76	0.79	0.86	0.86	0.85	0.48
Estonia	0.74	0.68	0.76	0.64	0.76	0.71	0.56	0.71	0.80	0.82	0.82	0.79	0.68
Finland	0.77	0.74	0.81	0.73	0.76	0.69	0.75	0.79	0.86	0.83	0.82	0.73	0.63
France	0.73	0.64	0.78	0.79	0.77	0.53	0.81	0.82	0.82	0.86	0.79	0.74	0.70
Germany	0.68	0.72	0.77	0.63	0.69	0.70	0.77	0.81	0.81	0.81	0.76	0.79	0.33
Greece	0.78	0.79	0.78	0.79	0.52	0.42	0.89	0.76	0.87	0.88	0.87	0.78	0.52
Hungary	0.69	0.72	0.75	0.66	0.78	0.68	0.69	0.76	0.79	0.88	0.74	0.78	0.62
Iceland	0.70	0.72	0.82	0.70	0.73	0.69	0.67	0.77	0.76	0.86	0.82	0.77	0.55
Ireland	0.74	0.72	0.77	0.78	0.81	0.67	0.60	0.75	0.82	0.84	0.86	0.83	0.59
Israel	0.67	0.72	0.76	0.75	0.77	0.74	0.83	0.87	0.79	0.89	0.90	0.79	0.54
Italy	0.79	0.75	0.80	0.80	0.68	0.57	0.85	0.81	0.81	0.83	0.85	0.72	0.60
Japan	0.68	0.71	0.76	0.69	0.58	0.83	0.85	0.82	0.69	0.89	0.85	0.78	0.46
Korea	0.83	0.82	0.83	0.84	0.79	0.79	0.94	0.88	0.80	0.90	0.90	0.82	0.70
Luxembourg	0.39	0.70	0.82	0.74	0.73	0.64	0.81	0.73	0.81	0.86	0.83	0.67	0.68
Mexico	0.82	0.77	0.79	0.82	0.78	0.57	0.87	0.88	0.81	0.84	0.88	0.86	0.70
Netherlands	0.75	0.69	0.79	0.73	0.54	0.66	0.70	0.81	0.76	0.84	0.75	0.77	0.61
New Zealand	0.79	0.73	0.80	0.79	0.66	0.72	0.84	0.82	0.84	0.90	0.87	0.83	0.59
Norway	0.80	0.77	0.79	0.69	0.63	0.65	0.78	0.75	0.83	0.80	0.82	0.82	0.55
Poland	0.72	0.65	0.83	0.71	0.62	0.47	0.33	0.78	0.68	0.82	0.82	0.78	0.51
Portugal	0.70	0.79	0.75	0.80	0.80	0.60	0.84	0.78	0.79	0.87	0.85	0.76	0.50
Slovak Republic	0.70	0.68	0.73	0.76	0.61	0.69	0.61	0.75	0.85	0.81	0.72	0.72	0.29
Slovenia	0.76	0.85	0.81	0.79	0.77	0.65	0.74	0.81	0.84	0.86	0.79	0.77	0.66
Spain	0.69	0.74	0.79	0.77	0.84	0.61	0.78	0.78	0.81	0.85	0.86	0.72	0.69
Sweden	0.79	0.73	0.80	0.68	0.68	0.61	0.73	0.69	0.89	0.85	0.86	0.75	0.60
Switzerland	0.63	0.65	0.80	0.71	0.74	0.64	0.76	0.77	0.79	0.81	0.81	0.74	0.54
Turkey	0.77	0.81	0.84	0.88	0.74	0.74	0.88	0.83	0.75	0.87	0.89	0.78	0.77
United Kingdom	0.79	0.75	0.80	0.77	0.67	0.62	0.81	0.87	0.84	0.85	0.87	0.84	0.47
United States	0.80	0.80	0.83	0.80	0.76	0.71	0.85	0.86	0.74	0.87	0.90	0.83	0.68
OECD median	0.75	0.74	0.80	0.75	0.76	0.68	0.79	0.81	0.81	0.86	0.84	0.78	0.60

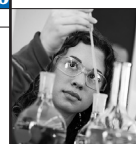


Table 16.70 Scale reliabilities for school questionnaire indices in partner countries and economies

	LEADCOM	LEADINST	LEADPD	LEADTCH	SCHAUTON	TCHPARTI	TCHSHORT	SCMATEDU	SCMATBUI	STUDCLIM	TEACCLIM	TCMORALE	TCFOCST
Albania	0.56	0.55	0.76	0.73	0.63	0.55	0.80	0.76	0.70	0.79	0.82	0.74	0.70
Argentina	0.76	0.81	0.78	0.74	0.72*	0.53*	0.87	0.81	0.84	0.85	0.86	0.74	0.61
Brazil	0.78	0.72	0.75	0.80	0.81	0.67	0.84	0.82	0.82	0.85	0.87	0.85	0.70
Bulgaria	0.62	0.65	0.61	0.75	0.64	0.67	0.20	0.77	0.71	0.88	0.89	0.69	0.49
Colombia	0.84	0.73	0.82	0.78	0.87	0.71	0.92	0.91	0.91	0.90	0.90	0.84	0.59
Costa Rica	0.84	0.78	0.83	0.84	0.78	0.53	0.79	0.87	0.85	0.87	0.85	0.83	0.68
Croatia	0.76	0.77	0.75	0.76	0.74	0.68	0.65	0.73	0.75	0.86	0.79	0.79	0.69
Cyprus ^{1, 2}	0.70	0.71	0.76	0.74	0.88	0.65	0.96	0.86	0.86	0.88	0.88	0.84	0.46
Hong Kong-China	0.76	0.77	0.77	0.85	0.71	0.73	0.87	0.86	0.80	0.87	0.88	0.79	0.52
Indonesia	0.81	0.73	0.73	0.79	0.81	0.81	0.85	0.88	0.64	0.74	0.80	0.84	0.68
Jordan	0.78	0.67	0.80	0.81	0.82	0.75	0.92	0.82	0.84	0.88	0.90	0.85	0.75
Kazakhstan	0.64	0.61	0.65	0.76	0.76	0.66	0.91	0.85	0.84	0.93	0.94	0.79	0.52
Latvia	0.73	0.67	0.81	0.73	0.74	0.69	0.76	0.72	0.73	0.85	0.83	0.73	0.58
Liechtenstein	0.88	0.85	0.89	0.73	0.84	0.81	0.74	0.32	0.81	0.62	0.79	0.76	0.25
Lithuania	0.59	0.72	0.84	0.73	0.77	0.77	0.57	0.73	0.75	0.81	0.78	0.76	0.68
Macao-China	0.64	0.68	0.70	0.56	0.93	0.82	0.92	0.89	0.84	0.94	0.94	0.84	0.41
Malaysia	0.85	0.79	0.80	0.79	0.77	0.81	0.70	0.84	0.83	0.88	0.82	0.88	0.64
Montenegro	0.84	0.81	0.84	0.80	0.70	0.50	0.54	0.73	0.66	0.83	0.79	0.80	0.65
Peru	0.82	0.79	0.72	0.76	0.87	0.67	0.87	0.89	0.82	0.76	0.89	0.83	0.71
Qatar	0.78	0.75	0.79	0.84	0.89	0.94	0.89	0.85	0.83	0.87	0.88	0.81	0.69
Romania	0.86	0.91	0.84	0.85	0.65	0.49	0.66	0.76	0.56	0.77	0.79	0.66	0.42
Russian Federation	0.66	0.72	0.79	0.71	0.81	0.68	0.84	0.83	0.78	0.91	0.90	0.74	0.51
Serbia	0.74	0.75	0.82	0.72	0.70	0.58	0.66	0.82	0.79	0.85	0.84	0.70	0.81
Shanghai-China	0.58	0.73	0.68	0.71	0.90	0.82	0.92	0.91	0.83	0.94	0.94	0.80	0.63
Singapore	0.83	0.78	0.84	0.80	0.79	0.77	0.76	0.86	0.79	0.88	0.87	0.86	0.57
Chinese Taipei	0.84	0.78	0.85	0.86	0.82	0.77	0.92	0.92	0.86	0.92	0.93	0.88	0.64
Thailand	0.83	0.83	0.84	0.85	0.86	0.86	0.86	0.90	0.87	0.84	0.82	0.85	0.73
Tunisia	0.63	0.73	0.71	0.81	0.79	0.62	0.84	0.80	0.77	0.83	0.79	0.83	0.67
United Arab Emirates	0.79	0.76	0.79	0.79	0.92	0.84	0.95	0.89	0.89	0.91	0.92	0.88	0.73
Uruguay	0.76	0.65	0.70	0.83	0.83	0.66	0.84	0.77	0.85	0.89	0.89	0.74	0.75
Viet Nam	0.65	0.79	0.73	0.74	0.69	0.67	0.92	0.86	0.78	0.80	0.77	0.81	0.62
Median	0.76	0.75	0.79	0.78	0.79	0.68	0.84	0.84	0.82	0.87	0.87	0.81	0.64

* SC33Q01 was deleted by the country.

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".

2. 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.

School leadership

In 2012, the PISA School Questionnaire contained 21 items about school leadership 13 of which provided data for four 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".

Table 16.71 shows the item wording and the international item parameters for framing and communicating the school's goals and curricular development (*LEADCOM*).

Table 16.71 Item parameters for framing and communicating the school's goals and 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				
		Delta	tau_1	tau_2	tau_3	tau_4
SC34Q02	b) I use student performance results to develop the school's educational goals	0.31712	-2.73434	-0.48319	0.82003	1.64976
SC34Q03	c) I make sure that the professional development activities of teachers are in accordance with the teaching goals of the school	0.11488	-2.76262	-0.43718	0.54590	1.62237
SC34Q04	d) I ensure that teachers work according to the school's educational goals	-0.51262	-2.75791	-0.45630	0.55446	1.57012
SC34Q14	n) I discuss the school's academic goals with teachers at faculty meetings	0.08100	-3.10596	-1.10527	0.23969	1.96756

Table 16.72 shows the item wording and the international item parameters for instructional leadership (*LEADINST*).

Table 16.72 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				
		Delta	tau_1	tau_2	tau_3	tau_4
SC34Q05	e) I promote teaching practices based on recent educational research	0.38344	-2.46672	-0.40380	0.40411	1.57547
SC34Q06	f) I praise teachers whose students are actively participating in learning	-0.27321	-2.21641	-0.76191	0.25683	1.38666
SC34Q08	h) I draw teachers' attention to the importance of pupil's development of critical and social capacities	-0.11000	-2.51090	-0.71637	0.31297	1.45357

Table 16.73 shows the item wording and the international item parameters for promoting instructional improvements and professional development (*LEADPD*).

Table 16.73 Item parameters for promoting instructional improvements and 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				
		Delta	tau_1	tau_2	tau_3	tau_4
SC34Q07	g) When a teacher has problems in his/her classroom, I take the initiative to discuss matters	0.27416	-2.71542	-0.96912	0.15629	1.52112
SC34Q09	i) I pay attention to disruptive behaviour in classrooms	-0.22389	-2.01263	-0.83660	-0.01204	1.19856
SC34Q13	m) When a teacher brings up a classroom problem, we solve the problem together	-0.05000	-2.63794	-1.08801	0.15253	1.50377

Table 16.74 shows the item wording and the international item parameters for teacher participation in leadership (*LEADTCH*). It can be seen that one item is notably more difficult than other items in the scale. This result indicates that principals reported asking the teachers in their schools to participate in reviewing management practices less frequently than in other activities.

Table 16.74 Item parameters for teacher participation in leadership (*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				
		Delta	tau_1	tau_2	tau_3	tau_4
SC34Q10	j) I provide staff with opportunities to participate in school decision-making	-0.38465	-2.80658	-1.23150	0.27523	1.79014
SC34Q11	k) I engage teachers to help build a school culture of continuous improvement	-0.53890	-2.76802	-0.97913	0.41103	1.63530
SC34Q12	l) I ask teachers to participate in reviewing management practices	0.92400	-2.63863	-0.35591	0.18107	1.50275

School autonomy

In 2012, the PISA School Questionnaire contained twelve items about school autonomy. Principals were asked to indicate who had a considerable responsibility for various tasks in their school. There were five response categories "Principal", "Teachers", "<School governing board>", "<Regional or local education authority>", "National education authority" and principals were asked to tick as many categories as appropriate. All twelve items provided data for two scaled indices, namely school autonomy (*SCHAUTON*) and teacher participation (*TCHPARTI*). However, these data were recoded differently for each index.

Table 16.75 shows the item wording and the international item parameters for school autonomy (*SCHAUTON*). The items were recoded as follows: If at least one of the categories "Principal", "Teachers" or "School governing board" was ticked, the scaled variable was coded as '1', otherwise it was coded as '0'. The easiest item was "Establishing student disciplinary policies" ($\delta = -2.06$), indicating that this was usually done within the school. The most difficult item was "Establishing teachers' starting salaries" ($\delta = 2.88$) indicating that this was usually done by local or national authorities.

Table 16.75 Item parameters for school autonomy (*SCHAUTON*)

Item	Regarding your school, who has a considerable responsibility for the following tasks?	Parameter estimates
		Delta
SC33Q01	a) Selecting teachers for hire	-0.08692
SC33Q02	b) Firing teachers	0.47358
SC33Q03	c) Establishing teachers' starting salaries	2.87671
SC33Q04	d) Determining teachers' salary increases	2.49770
SC33Q05	e) Formulating the school budget	0.15668
SC33Q06	f) Deciding on budget allocations within the school	-1.59541
SC33Q07	g) Establishing student disciplinary policies	-2.05562
SC33Q08	h) Establishing student assessment policies	-0.85521
SC33Q09	i) Approving students for admission to the school	-0.77633
SC33Q10	j) Choosing which textbooks are used	-0.91927
SC33Q11	k) Determining course content	0.28079
SC33Q12	l) Deciding which courses are offered	0.00300

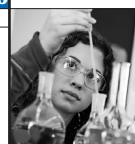


Table 16.76 shows the item wording and the international parameters used for teacher participation (*TCHPARTI*) in school decisions. The recoding was based on the “Teachers” column only. A “tick” in this column was coded as ‘1’ and no “tick” was coded as ‘0’. The distribution of item difficulties for this scale was reasonable and appropriate. The decisions relating to teachers themselves (e.g. firing teachers or hiring teachers and establishing their salaries) were difficult items, indicating that usually teachers do not participate in these decisions as could be expected. In contrast, the item regarding the choice of textbooks was a very easy item, indicating that usually teachers participated in this decision.

Table 16.76 Item parameters for teacher participation (*TCHPARTI*)

Item	Regarding your school, who has a considerable responsibility for the following tasks?	Parameter estimates
		Delta
SC33Q01	a) Selecting teachers for hire	1.24783
SC33Q02	b) Firing teachers	2.47040
SC33Q03	c) Establishing teachers’ starting salaries	3.40994
SC33Q04	d) Determining teachers’ salary increases	2.79464
SC33Q05	e) Formulating the school budget	1.45142
SC33Q06	f) Deciding on budget allocations within the school	0.67972
SC33Q07	g) Establishing student disciplinary policies	-2.29624
SC33Q08	h) Establishing student assessment policies	-2.75098
SC33Q09	i) Approving students for admission to the school	0.64240
SC33Q10	j) Choosing which textbooks are used	-3.62473
SC33Q11	k) Determining course content	-2.61041
SC33Q12	l) Deciding which courses are offered	-1.41400

School resources

The PISA 2012 school questionnaire contained thirteen items about school resources, measuring the school principal’s perceptions of potential factors hindering instruction at school. The four response categories were “Not at all”, “Very little”, “To some extent”, to “A lot”.

The index on teacher shortage (*TCSHORT*) was derived from four items. Similar items were used in PISA 2000, 2003, 2006 and 2009. The items were not reversed for scaling. Table 16.77 shows the item wording and the international parameters used for IRT scaling. As was the case in 2009, the deltas indicated that principals found it harder to recruit teachers who were appropriately qualified in the test language than in mathematics.

Table 16.77 Item parameters for teacher shortage (*TCSHORT*)

Item	Is your school’s capacity to provide instruction hindered by any of the following issues?	Parameter estimates		
		Delta	tau_1	tau_2
SC14Q01	a) A lack of qualified science teachers	0.02345	-1.51534	-0.51175
SC14Q02	b) A lack of qualified mathematics teachers	-0.00025	-1.39991	-0.33669
SC14Q03	c) A lack of qualified <test language> teachers	0.50620	-1.59703	-0.25525
SC14Q04	d) A lack of qualified teachers of other subjects	-0.52900	-2.59607	-0.28596

The index on the school’s educational resources (*SCMATEDU*) was computed on the basis of six items measuring the school principals’ perceptions of potential factors hindering instruction at school. Similar items were used in PISA 2000 and 2003 but question format and item wording were modified for PISA 2006 and PISA 2009. For 2012 the items were modified from 2009. All items were reversed for scaling. Table 16.78 shows the item wording and the international parameters used for IRT scaling.

Table 16.78 Item parameters for quality of educational resources (*SCMATEDU*)

Item	Is your school’s capacity to provide instruction hindered by any of the following issues?	Parameter estimates		
		Delta	tau_1	tau_2
SC14Q05	e) Shortage or inadequacy of science laboratory equipment	0.33310	-1.31836	0.17403
SC14Q06	f) Shortage or inadequacy of instructional materials (e.g. textbooks)	-0.49770	-1.70343	0.19337
SC14Q07	g) Shortage or inadequacy of computers for instruction	0.18530	-1.46462	0.25553
SC14Q08	h) Lack or inadequacy of Internet connectivity	-0.20079	-1.06959	0.15556
SC14Q09	i) Shortage or inadequacy of computer software for instruction	0.20494	-1.79123	0.18129
SC14Q10	j) Shortage or inadequacy of library materials	0.00015	-1.70562	0.07394

The index concerning the quality of physical infrastructure (*SCMATBUI*) was computed on the basis of three items measuring the principals' perceptions of potential factors hindering instruction at school. Similar items were used in PISA 2000 and 2003 but question format and item wording were modified for PISA 2006 and PISA 2009. For 2012 the items were modified from 2009. All items were reversed for scaling. Table 16.79 shows the item wording and the international parameters used for IRT scaling.

Table 16.79 Item parameters for quality of physical infrastructure (*SCMATBUI*)

Item	Is your school's capacity to provide instruction hindered by any of the following issues?	Parameter estimates		
		Delta	tau_1	tau_2
SC14Q11	k) Shortage or inadequacy of school buildings and grounds	0.29073	-1.53165	0.29387
SC14Q12	l) Shortage or inadequacy of heating/cooling and lighting systems	-0.25216	-1.33150	0.09259
SC14Q13	m) Shortage or inadequacy of instructional space (e.g. classrooms)	-0.03900	-1.58587	0.21897

School climate

In 2012, the PISA School Questionnaire contained three items batteries about school climate. The first item battery containing nineteen items measured the school principals' perceptions of potential phenomena hindering instruction at school. The four response categories were "Not at all", "Very little", "To some extent" and "A lot". This item battery contributed to two indices, namely student-related factors affecting school climate (*STUDCLIM*) and teacher related factors affecting school climate (*TEACCLIM*). Two other item batteries measured school principals' endorsement of statements regarding teacher morale (*TCMORALE*) and teacher focus on students (*TCFOCST*). The four response categories for endorsement ranged from "Strongly agree", "Agree", "Disagree" to "Strongly disagree".

Eight items regarding student related aspects of school climate, which had been employed in previous PISA cycles, were used for the index regarding the student-related aspects of school climate. Table 16.80 shows the item wording and the international parameters used for IRT scaling.

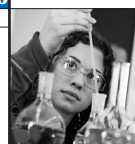
Table 16.80 Item parameters for student-related aspects of school climate (*STUDCLIM*)

Item	In your school, to what extent is the learning of students hindered by the following phenomena?	Parameter estimates		
		Delta	tau_1	tau_2
SC22Q01	a) Student truancy	-0.76575	-2.30414	0.25299
SC22Q02	b) Students skipping classes	-0.57107	-2.50950	0.29456
SC22Q03	c) Students arriving late for school	-0.59703	-3.15841	0.37340
SC22Q04	d) Students not attending compulsory school events (e.g. sports day) or excursions	0.66621	-2.87294	0.41253
SC22Q05	e) Students lacking respect for teachers	0.10665	-2.66405	0.44452
SC22Q06	f) Disruption of classes by students	-0.42016	-2.82902	0.27133
SC22Q07	g) Student use of alcohol or illegal drugs	1.02770	-1.61249	0.92065
SC22Q08	h) Students intimidating or bullying other students	0.55300	-2.71971	0.86493

Eleven questions regarding teacher-related factors affecting school climate has appeared in previous PISA cycles and were used for the index on the teacher-related factors affecting school climate in PISA 2012. Table 16.81 shows the item wording and the international parameters used for IRT scaling.

Table 16.81 Item parameters for teacher-related factors affecting school climate (*TEACCLIM*)

Item	In your school, to what extent is the learning of students hindered by the following phenomena?	Parameter estimates		
		Delta	tau_1	tau_2
SC22Q09	i) Students not being encouraged to achieve their full potential	-0.15258	-1.68163	-0.09457
SC22Q10	j) Poor student-teacher relations	0.38347	-2.13781	0.86510
SC22Q11	k) Teachers having to teach students of heterogeneous ability levels within the same class	-1.39607	-1.75757	-0.29288
SC22Q12	l) Teachers having to teach students of diverse ethnic backgrounds (i.e. language, culture) within the same class	0.11387	-1.09272	0.00761
SC22Q13	m) Teachers' low expectations of students	0.26123	-1.91961	-0.04530
SC22Q14	n) Teachers not meeting individual students' needs	-0.09722	-2.23969	0.05272
SC22Q15	o) Teacher absenteeism	0.00719	-1.73082	0.51369
SC22Q16	p) Staff resisting change	-0.15440	-1.95268	0.05339
SC22Q17	q) Teachers being too strict with students	0.50292	-2.55852	0.33750
SC22Q18	r) Teachers being late for classes	0.40059	-1.97713	0.76795
SC22Q19	s) Teachers not being well prepared for classes	0.13100	-1.91099	0.85873



Four items on teacher morale (*TCMORALE*) were included in the School Questionnaire. There are four response categories varying from “Strongly agree”, “Agree”, “Disagree” to “Strongly disagree”. All items were reversed. Table 16.82 shows the item wording and the international item parameters for this scale.

Table 16.82 Item parameters for teacher morale (*TCMORALE*)

Item	Think about the teachers in your school. How much do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
SC26Q01	a) The morale of teachers in this school is high	0.34116	-3.83956	-0.79275
SC26Q02	b) Teachers work with enthusiasm	0.40178	-4.13394	-1.00884
SC26Q03	c) Teachers take pride in this school	-0.15802	-3.86018	-0.82074
SC26Q04	d) Teachers value academic achievement	-0.58500	-3.57413	-0.97397

Three items measuring teacher focus (*TCFOCST*) on students were included in the School Questionnaire which were based on item batteries regarding teacher consensus in earlier cycles that had been shown to measure more the disagreement among teachers regarding certain pedagogical issues rather than consensus. The four response categories ranged from “Strongly agree” to “Strongly disagree”. All items were reversed. Table 16.83 shows the item wording and the international item parameters for this scale.

Table 16.83 Item parameters for teacher focus (*TCFOCST*)

Item	How much do you agree with these statements about teachers in your school?	Parameter estimates		
		Delta	tau_1	tau_2
SC27Q01	a) Mathematics teachers are interested in trying new methods and teaching practices	-0.32068	-3.16187	-0.26171
SC28Q02	d) There is consensus among mathematics teachers that it is best to adapt academic standards to the students' levels and needs	0.26357	-2.62849	-0.20707
SC29Q01	e) There is consensus among mathematics teachers that the social and emotional development of the students is as important as their acquisition of mathematical skills and knowledge in mathematics classes	0.05700	-3.03557	-0.09006

Parent Questionnaire scale indices

Parent Questionnaire indices were only available for those 11 countries that chose to administer the optional parent questionnaire. The data from the Parent Questionnaire contributed to the five indices that are listed in Table 16.84. All indices except parents' perception of school quality (*PQSCHOOL*) were modified from the previous PISA surveys, only *PQSCHOOL* is used the same way as in 2006 and 2009.

Table 16.84 Parent Questionnaire indices

Index	Index label	Relationship to other PISA surveys
PQSCHOOL	Parents' perception of school quality	Used in 2006 and 2009
PARINVOL	Parental involvement in their child's school	More items were added to 2009 scale
PARSUPP	Student support	Modified from 2009
PQMIMP	Parent attitudes toward mathematics	Modified from 2006 to be mathematics specific
PQMCAR	Mathematics career	Modified from 2006 to be mathematics specific

Tables 16.85 and 16.86 show very acceptable degree of internal consistency across participating OECD and partner countries and economies for the Parent Questionnaire indices.

Table 16.85 Scale reliabilities for Parent Questionnaire indices in OECD countries

	PQSCHOOL	PARINVOL	PARSUPP	PQMIMP	PQMCAR
Belgium	0.81	0.55	0.70	0.85	0.81
Chile	0.86	0.67	0.77	0.86	0.81
Germany	0.83	0.64	0.73	0.87	0.60
Hungary	0.85	0.68	0.73	0.85	0.79
Italy	0.83	0.63*	0.65	0.85	0.79
Korea	0.87	0.71	0.78	0.84	0.78
Mexico	0.86	0.75	0.79	0.86	0.74
Portugal	0.85	0.68	0.73	0.87	0.79

* PA10Q06 and PA10Q11 deleted by the country.

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

	PQSCHOOL	PARINVOL	PARSUPP	PQMIMP	PQMCAR
Croatia	0.81	0.58*	0.68	0.83	0.69
Hong Kong-China	0.83	0.73	0.80	0.86	0.72
Macao-China	0.85	0.75	0.81	0.86	0.76

* PA10Q06 and PA10Q11 deleted by the country.

Seven items measuring parents' perceptions of the quality of school learning were included in the PISA 2012 Parent Questionnaire as was the case in PISA 2006 and PISA 2009. Parents were asked how much they agreed with the seven statements. The response categories included "Strongly agree", "Agree", "Disagree" and "Strongly disagree". The items were reverse coded for scaling. The item wording and international parameters for IRT scaling are shown in Table 16.87. Results for the item deltas indicated that it was harder for parents to agree that the school their child attended had high standards of achievement and easier to agree that teachers seemed competent and dedicated.

Table 16.87 Item parameters for parent's perception of school quality (PQSCHOOL)

Item	How much do you agree or disagree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
PA09Q01	a) Most of my child's school teachers seem competent and dedicated	-0.46021	-3.12016	-1.15967
PA09Q02	b) Standards of achievement are high in my child's school	0.46438	-3.65406	-0.26069
PA09Q03	c) I am happy with the content taught and the instructional methods used in my child's school	-0.06860	-3.29511	-0.96367
PA09Q04	d) I am satisfied with the disciplinary atmosphere in my child's school	0.04788	-2.59975	-0.89333
PA09Q05	e) My child's progress is carefully monitored by the school	0.07441	-3.35336	-0.62689
PA09Q06	f) My child's school provides regular and useful information on my child's progress	0.32348	-2.84613	-0.63228
PA09Q07	g) My child's school does a good job in educating students	-0.38134	-2.98083	-1.00424

The scale regarding parental involvement was modified from PISA 2009 in that more items were added to align with a similar item battery in the school questionnaire. In 2012, eleven items measured parents' involvement in their child's school. The parents were asked whether they had participated in various school-related activities during the previous academic year. The response categories were "Yes" and "No". The items were reverse coded for scaling. The item wording and international parameters for IRT scaling are shown in Table 16.88. The distribution of item difficulties for this scale was reasonable and appropriate with easy items such as discussing the child's behaviour or progress and more difficult ones such as appearing as a guest speaker or volunteering in the school canteen.

Table 16.88 Item parameters for parental involvement (PARINVOL)

Item	During the last <academic year>, have you participated in any of the following school-related activities?	Parameter estimates
		Delta
PA10Q01	a) Discussed my child's behaviour with a teacher on my own initiative	-2.23093
PA10Q02	b) Discussed my child's behaviour on the initiative of one of his/her teachers	-1.88603
PA10Q03	c) Volunteered in physical activities, e.g. building maintenance, carpentry, gardening or yard work	1.00116
PA10Q04	d) Volunteered in extra-curricular activities, e.g. book club, school play, sports, field trip	0.29876
PA10Q05	e) Volunteered in the school library or media centre	1.63260
PA10Q06	f) Assisted a teacher in the school	0.86205
PA10Q07	g) Appeared as a guest speaker	1.96006
PA10Q08	h) Participated in local school <government>, e.g. parent council or school management committee	0.04862
PA10Q09	i) Discussed my child's progress with a teacher on my own initiative	-2.28397
PA10Q10	j) Discussed my child's progress on the initiative of one of their teachers	-1.88242
PA10Q11	k) Volunteered in the school <canteen>	2.48010

Seven items measuring support of students by their parents were included in the PISA 2012 Parent Questionnaire. Some items were modified from PISA 2009 to be mathematics specific. Parents were asked how often they or someone else in their home did various things with their child. The response categories included "Never or hardly ever", "Once or twice a year", "Once or twice a month", "Once or twice a week" and "Every day or almost every day". The item wording and international parameters for IRT scaling are shown in Table 16.89. Item deltas indicated that parents more frequently had the main meal with their child and less frequently helped their child with his or her mathematics homework.

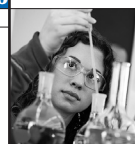


Table 16.89 Item parameters for student support (PARSUPP)

Item	How often do you or someone else in your home do the following things with your child?	Parameter estimates			
		Delta	tau_1	tau_2	tau_3
PA13Q01	a) Discuss how well my child is doing at school	-0.87051	-0.51519	-0.47941	0.15863
PA13Q02	b) Eat <the main meal> with my child around a table	-1.41782	0.70684	-0.13095	-0.88945
PA13Q03	c) Spend time just talking to my child	-1.13481	0.32403	-0.75715	-0.38028
PA13Q04	d) Help my child with his/her mathematics homework	1.25815	0.43140	-1.21920	-0.31943
PA13Q05	e) Discuss how my child is performing in mathematics class	0.16986	0.04751	-1.14690	-0.12075
PA13Q06	f) Obtain mathematics materials (e.g. applications, software, study guides etc.) for my child	1.24696	-0.36108	-0.39858	0.12684
PA13Q07	g) Discuss with my child how mathematics can be applied in everyday life	0.74817	-0.23617	-0.76437	0.25283

Four items measuring parent attitudes toward mathematics were included in the PISA 2012 Parent Questionnaire. The items were modified from PISA 2006 to be mathematics specific. Parents were asked how much they agreed with the four statements. The response categories ranged from “Strongly agree” to “Strongly disagree”. The items were reverse coded for scaling. The item wording and international parameters for IRT scaling are shown in Table 16.90.

Table 16.90 Item parameters for parent attitudes toward mathematics (PQMIMP)

Item	How much do you agree with the following statements?	Parameter estimates		
		Delta	tau_1	tau_2
PA14Q01	a) It is important to have good mathematics knowledge and skills in order to get any good job in today's world	-0.37976	-3.21500	-0.66593
PA14Q02	b) Employers generally appreciate strong mathematics knowledge and skills among their employees	0.60015	-4.00749	-0.27891
PA14Q03	c) Most jobs today require some mathematics knowledge and skills	0.10841	-3.98955	-0.58688
PA14Q04	d) It is an advantage in the job market to have good mathematics knowledge and skills	-0.32880	-3.26157	-0.78352

Five items measuring parental expectations regarding their child's and their own involvement in mathematics career were included in the PISA 2012 parent questionnaire. The items were modified from PISA 2006 to be mathematics specific. The response categories were “Yes” and “No” and all items were reverse coded for scaling. The item wording and international parameters for IRT scaling are shown in Table 16.91. It was of interest to note that the item deltas indicated that parents more easily affirmed that they expected their children to go into a mathematics related career yet they had not seen their child showing interest in studying mathematics after leaving secondary school.

Table 16.91 Item parameters for mathematics career (PQMCAR)

Item	Please answer the questions below	Parameter estimates
		Delta
PA15Q01	a) Does anybody in your family (including you) work in a <mathematics-related career>?	-0.02677
PA15Q02	b) Does your child show an interest in working in a <mathematics-related career>?	-0.09525
PA15Q03	c) Do you expect your child will go into a <mathematics-related career>?	-0.52103
PA15Q04	d) Has your child shown interest in studying mathematics after completing <secondary school>?	0.72876
PA15Q05	e) Do you expect your child will study mathematics after completing <secondary school>?	-0.08571

The PISA index of economic, social and cultural status (ESCS)

Computation of ESCS

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 (in years of education according to ISCED), family wealth, cultural possessions and home educational resources (all three WLEs based on student reports on home possessions).

The ESCS for PISA 2003 and 2006 was derived from three variables related to family background: highest parental education (in number of years of education according to ISCED classification), highest parental occupation (*HISEI* scores), and number of home possessions including books in the home. 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.

The ESCS was slightly modified in PISA 2009 because: (i) more indicators were available in that survey; and (ii) a consultation with countries regarding the mapping of ISCED levels to years of schooling led to minor changes in the indicator of parental education.

As in PISA 2003, PISA 2006, and PISA 2009, the variables comprising ESCS for PISA 2012 included: home possessions (*HOMEPOS*) – which comprised all items on the *WEALTH*, *CULTPOS* and *HEDRES* scales, as well as books in the home (*ST28Q01*) 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 highest parental occupation (*HISEI*); and the highest parental education expressed as years of schooling (*PARED*). However, the home possessions scale for PISA 2012 was computed differently than in the previous cycles for the purpose of enabling a trend study. For more details please refer to the section on trends in ESCS below.

Missing values for students with missing data for only one variable were imputed with predicted values plus a random component based on a regression on the other two variables. If there were missing data on more than one variable, ESCS was not computed for that case and a missing value was assigned for ESCS. Variables with imputed values were then used for a principal component analysis with an OECD senate weight.

The ESCS scores were obtained as component scores for the first principal component with zero being the score of an average OECD student and one being the standard deviation across equally weighted OECD countries. For partner countries and economies, ESCS scores were obtained as

16.5

$$ESCS = \frac{\beta_1 HISEI' + \beta_2 PARED' + \beta_3 HOMEPOS'}{\varepsilon_i}$$

where β_1 , β_2 and β_3 are the OECD factor loadings, *HISEI'*, *PARED'* and *HOMEPOS'* the “OECD-standardised” variables and ε_i is the eigenvalue of the first principal component.³

Consistency across countries

Using principal component analysis (PCA) to derive factor loading for each participating country provided insight into the extent to which relationships were similar between the three variables. Table 16.92 shows the PCA results for the OECD countries and Table 16.93 shows those for partner countries and economies. The tables also include the scale reliabilities (Cronbach’s alpha) for the z-standardised variables.

Comparing results from within-country PCA revealed generally similar patterns of factor loadings across countries. Only in a few countries somewhat distinct patterns emerged, however, all three variables contributed more or less equally to this index. The median scale reliability for the pooled OECD countries was 0.65.

Table 16.92 Factor loadings and internal consistency of ESCS 2012 in OECD countries

	Factor loadings			Reliability
	HISEI	PARED	HOMEPOS	
Australia	0.78	0.78	0.67	0.57
Austria	0.80	0.81	0.67	0.65
Belgium	0.84	0.81	0.70	0.69
Canada	0.79	0.79	0.66	0.60
Chile	0.89	0.88	0.84	0.79
Czech Republic	0.81	0.81	0.65	0.59
Denmark	0.83	0.80	0.72	0.67
Estonia	0.83	0.79	0.67	0.65
Finland	0.80	0.79	0.67	0.60
France	0.80	0.78	0.70	0.62
Germany	0.84	0.81	0.64	0.65
Greece	0.85	0.84	0.70	0.72
Hungary	0.84	0.85	0.74	0.75
Iceland	0.81	0.80	0.59	0.57
Ireland	0.81	0.81	0.68	0.65
Israel	0.82	0.82	0.67	0.65
Italy	0.84	0.81	0.68	0.68
Japan	0.76	0.77	0.66	0.55
Korea	0.78	0.79	0.73	0.64
Luxembourg	0.86	0.84	0.70	0.71
Mexico	0.86	0.86	0.81	0.79
Netherlands	0.80	0.78	0.72	0.64
New Zealand	0.82	0.77	0.69	0.62
Norway	0.80	0.79	0.63	0.56
Poland	0.89	0.88	0.71	0.75
Portugal	0.88	0.86	0.77	0.78
Slovak Republic	0.85	0.83	0.73	0.71
Slovenia	0.84	0.83	0.66	0.70
Spain	0.84	0.83	0.67	0.69
Sweden	0.81	0.77	0.65	0.60
Switzerland	0.81	0.79	0.67	0.65
Turkey	0.83	0.85	0.78	0.75
United Kingdom	0.78	0.75	0.72	0.59
United States	0.83	0.82	0.73	0.70
Median	0.82	0.81	0.69	0.65

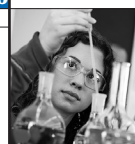


Table 16.93 Factor loadings and internal consistency of ESCS 2012 in partner countries and economies

	Factor loadings			Reliability
	HISEI	PARED	HOMEPOS	
Argentina	0.83	0.82	0.75	0.69
Brazil	0.83	0.83	0.78	0.73
Bulgaria	0.81	0.81	0.74	0.71
Colombia	0.80	0.82	0.77	0.71
Costa Rica	0.83	0.81	0.81	0.76
Croatia	0.84	0.81	0.68	0.68
Cyprus ^{1, 2}	0.84	0.81	0.68	0.67
Hong Kong-China	0.85	0.83	0.78	0.76
Indonesia	0.81	0.82	0.79	0.73
Jordan	0.83	0.83	0.70	0.68
Kazakhstan	0.76	0.79	0.70	0.51
Latvia	0.84	0.82	0.73	0.73
Liechtenstein	0.78	0.79	0.68	0.62
Lithuania	0.82	0.81	0.74	0.69
Macao-China	0.79	0.80	0.72	0.65
Malaysia	0.83	0.76	0.78	0.70
Montenegro	0.81	0.80	0.73	0.68
Peru	0.84	0.84	0.79	0.76
Qatar	0.79	0.82	0.45	0.44
Romania	0.82	0.77	0.77	0.69
Russian Federation	0.80	0.78	0.72	0.63
Serbia	0.83	0.83	0.69	0.69
Shanghai-China	0.83	0.84	0.80	0.76
Singapore	0.85	0.84	0.73	0.73
Chinese Taipei	0.83	0.82	0.72	0.69
Thailand	0.86	0.87	0.82	0.76
Tunisia	0.83	0.84	0.80	0.75
United Arab Emirates	0.80	0.82	0.50	0.47
Uruguay	0.86	0.84	0.78	0.76
Viet Nam	0.82	0.82	0.79	0.74
Median	0.83	0.82	0.74	0.69

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".

2. 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.

Trends in ESCS

As explained above, the ESCS in PISA 2012 consisted of three sub-components, the highest parental occupation (*HISEI*), the highest parental education expressed as years of schooling (*PARED*) and the index of home possessions (*HOMEPOS*) which comprised all items on the *WEALTH*, *CULTPOS* and *HEDRES* scales, as well as books in the home (ST28Q01) recoded into a four-level categorical variable (fewer than or equal to 25 books, 26-100 books, 101-500 books, and more than 500 books).

In order to enable a trends study, the ESCS was computed in such a way that the ESCS scores would be more comparable across cycles. The ESCS was computed for the current cycle and also recomputed for the earlier cycles using a similar methodology. 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 Chapter 3). In order to make the *PARED* sub-component of *ESCS* 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 D. To make the *HOMEPOS* sub-component more comparable across cycles, the scale was constructed in two steps. In the first step, a calibration sample over the five cycles was used to estimate international parameters for all items used over the five cycles. Items that were not administered in a certain cycle were treated as structurally missing data. This enabled comparisons across countries for these scales, the relative positions of the countries being estimated on a joint scale. When WLEs were estimated in the second step, the international parameters were anchored but the parameters corresponding to the items specific to each country, namely ST26Q15 to ST26Q17 were not fixed and were estimated during this run. The PCA for obtaining ESCS scores was then calculated across all cycles using these three comparable sub components (*HISEI*, *PARED* and *HOMEPOS*). The common weights for the PCA across cycles can be seen in Table 16.94.

Table 16.94 ESCS component weights use across cycles 2000, 2003, 2006, 2009 and 2012

ESCS sub-component weights		
HISEI	PARED	HOMEPOS
0.79	0.82	0.74

Computation of Scores based on Anchoring Vignettes in the PISA 2012 Student Questionnaire

As discussed in Chapter 3 of this report, anchoring vignettes were used as one of the new item formats in PISA 2012 to address issues of cross-cultural comparability of responses to context questionnaires. In this section, details are presented about how responses to anchoring vignettes were used as an alternative way of scoring responses to Likert-type questionnaire items.

Table 16.95 lists the twelve anchored indexes included in the international database for 2012, namely *ANCATSCHL*, *ANCATTLNACT*, *ANCBELONG*, *ANCLCLSMAN*, *ANCCOGACT*, *ANCINSTMOT*, *ANCINTMAT*, *ANCMATWKETH*, *ANCMTSUP*, *ANCSCMAT*, *ANCSTUDREL*, and *ANCSUBNORM*. It should be noted that these indices have the prefix “ANC” to indicate that they were anchored as these indices are also on the database in their unanchored form without that prefix. The reason that not all scaled indices from the Student Questionnaire were anchored is that due to the rotated administration, anchoring vignettes were in only two of the three questionnaire forms so that only the question on which indices were based in those forms could be anchored.

Table 16.95 Anchored indexes in the international database

Index	Index label
ANCATSCHL	Attitude towards School: Learning Outcomes (Anchored)
ANCATTLNACT	Attitude towards School: Learning Activities (Anchored)
ANCBELONG	Sense of Belonging to School (Anchored)
ANCLCLSMAN	Mathematics Teacher's Classroom Management (Anchored)
ANCCOGACT	Cognitive Activation in Mathematics Lessons (Anchored)
ANCINSTMOT	Instrumental Motivation for Mathematics (Anchored)
ANCINTMAT	Mathematics Interest (Anchored)
ANCMATWKETH	Mathematics Work Ethic (Anchored)
ANCMTSUP	Mathematics Teacher's Support (Anchored)
ANCSCMAT	Mathematics Self-Concept (Anchored)
ANCSTUDREL	Teacher-Student Relations (Anchored)
ANCSUBNORM	Subjective Norms in Mathematics (Anchored)

Question 84 in the Student Questionnaire forms B and C contained the set of three vignettes (ST84Q01 to ST84Q03) used in the anchoring procedure captured three levels of classroom management that could be described as low, medium, and high. Students read the vignettes and indicated their level of agreement with the statements that the described teacher was in control of his or her classroom using the same 4-point agreement scale that was used for most questionnaire items in the Student Questionnaire. Depending on their rating standards and their interpretation of the four levels of the response scale, students could place the three vignettes on different response categories. For instance, one student might have “Agreed” that a teacher described in the vignette was in control of his/her classroom while another student might have “Strongly agreed” or “Disagreed” with this statement. Since the actual levels for the people described in the vignettes were invariant across respondents, the only reason answers to the vignettes would have differed across respondents was interpersonal incomparability.

Differences in the evaluation of the vignettes between students indicated that students differed with regard to how they interpreted the response scale, and that any comparisons based on raw item responses might have resulted in validity problems. The alternative scoring based on the vignettes proposed by Bertling et al. (forthcoming) addressed this problem: regardless of where on the 4-point response scale a student placed the vignettes, a student's self-report answer could be scored relative to the rating the of low, medium, and high vignettes as three anchors that were invariant across respondents.

Responses on the original 4-point rating scale were re-scaled into a 7-point scale representing all possible relative rank comparisons between the responses to a 4-point self-report Likert-type item in the Student Questionnaire and the responses to the vignettes. On this scale, the value of “1” represented a rating of the self-report item lower than the rating of the low vignette, the value “2” represented a rating of the self-report item at the level of the rating of the low vignette, the value “3” represented a rating of the self-report item higher than the rating of the low vignette but lower than the rating of the medium vignette and so forth. The maximum value, “7”, was assigned where a student’s response to a questionnaire item was higher than his or her rating of the high vignette. In other words, low values were assigned where a self-report rating was relatively low compared to the rating of the vignettes, and high values were assigned where a self-report rating was relatively high compared to the rating of the vignettes. In this way, the three vignettes were used to anchor student ratings, providing context for the ratings on other self-report questionnaire items that shared the same response scale. Scoring was applied at the individual level using each student’s responses to the vignettes as an anchor for this student’s self-report answers. Table 16.96 illustrates the differences in possible values assigned to the original and the anchored item responses.

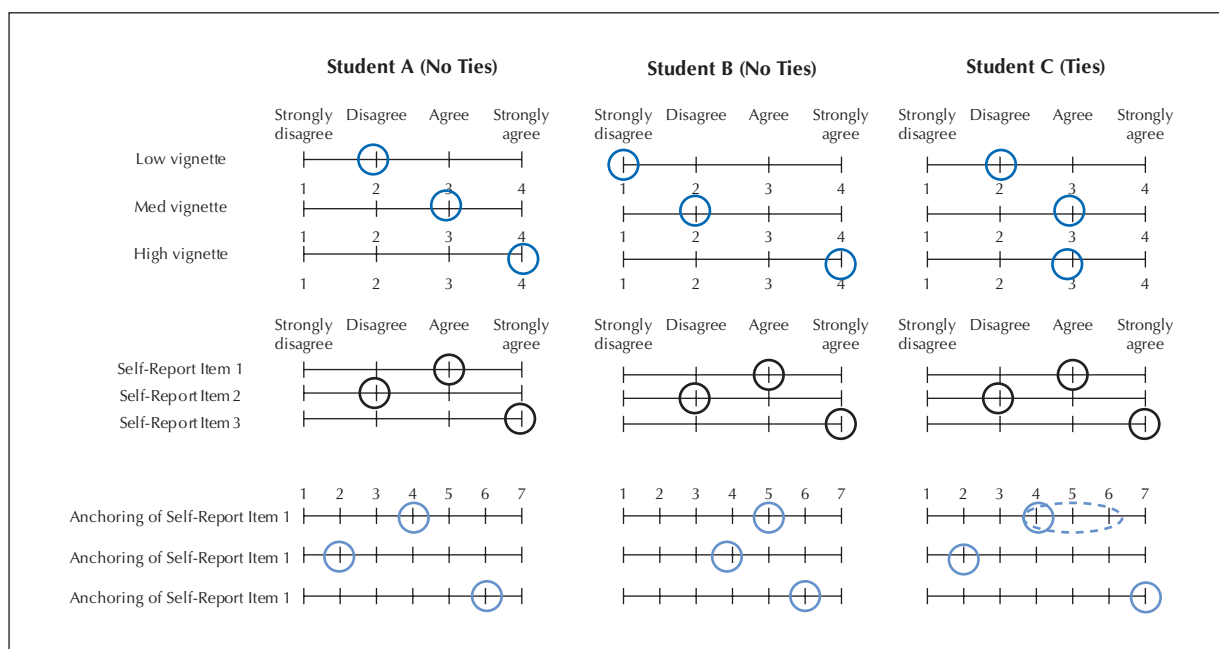
Table 16.96 Possible values for original and anchored item responses

Responses to a self-report item as presented in questionnaire	Strongly disagree	Disagree	Agree	Strongly Agree			
	1	2	3	4			
Anchored responses	Lower than low vignette	Same as low vignette	In between low and medium vignette	Same as medium vignette	In between medium and high vignette	Same as high vignette	Higher than high vignette
	1	2	3	4	5	6	7

A graphical illustration of the scoring procedure based on vignettes for three hypothetical examples of students’ responses is given in Figure 16.3. The three hypothetical students in this example provided exactly the same answer to three self-report items but differed in their responses to the vignettes. As a consequence, scores on the anchored items also differed between the three students.

■ Figure 16.3 ■

**Illustration of scoring based on vignettes for three hypothetical students
(figure from Bertling and Kyllonen, 2013, with permission of the authors)**





Two special cases during the calculation of anchored scores occurred when ties were encountered in the responses to the anchoring vignettes or when responses to the anchoring vignettes violated the expected order of vignettes. Ties occurred where a student chose the same response category for two or all three vignettes. Order violation occurred where a student chose a higher response category for a vignette representing a low value on the underlying construct than for a vignette representing a high value on the underlying construct. The scoring method used in PISA 2012 addressed these two special cases in the following ways.

Scoring if ties in the vignette ratings occurred: If students chose the same response category (e.g., “Agree”) for multiple vignettes, self-report answers were scored based on “lower bound scores”. This meant that the lowest possible score among the range of possible scores was assigned. This score reflected the value on a latent continuum that the respondent clearly pertained (i.e., the minimum) rather than a higher value that the respondent may or may not pertain. For example, if a student assigned the same ratings to the teachers with low and medium levels of classroom management, scores were adjusted based on the lower level (see Bertling et al. forthcoming for more details). The decision to use “lower bound” scores was also recommended by the PISA 2012 Technical Advisory Group who discussed preliminary findings for anchoring based on both Field Trial and Main Survey data at two meetings in 2012 and 2013.

Scoring if order violations in the vignette ratings occurred: To use the information provided with the responses of students who violated the expected order when rating the three vignettes, order violations were re-classified into ties. In other words, where a student rated the highest vignette lower than the medium vignette, responses for this student were rescaled in a way that the ratings for the medium and high vignette were tied. For instance, the rank order “low, high, med” would be rescaled into “low, {med, high}”, with the brackets indicating that the same rank was assigned to the medium and high vignettes. It should be noted that, in most cases order violations were rescaled into complete ties of all vignettes (i.e., “[low, medium, high]”). While ties could be created in several ways during this post-hoc process, in PISA 2012 it was decided to create ties at the highest response category chosen by the student. For instance, in the aforementioned example (“low, {med, high}”) the tie was created at the value which the respondent assigned to the high vignette. Ties were then scored as described above.

Four possible approaches to treating order violations were compared using initial Main Survey data from 52 countries to investigate whether or not the inclusion of anchored scores for these students in the international database would be feasible. To this end, the approaches were compared against the most conservative treatment of order violations, namely, the exclusion of students with such a response pattern. The first three approaches treated order violations by re-classifying “not-permitted” vignette ratings as ties. The first approach created ties at the lowest possible value, the second approach created ties at the medium value, and the third approach created ties at the highest possible value. In the fourth approach, order violations were transformed based on the ratings chosen by an individual irrespective of item content (cf. Fischer et al., 2009). The rationale for this alternative was that respondents might have mistakenly understood a preconceived “high” exemplar as a low one or a “low” exemplar as a high one. At the same time, the respondent might have been aware that exemplars varied in their standing on the dimension on which they were to be rated. Thus, through the pattern of ratings, respondents expressed their use of the rating scale (e.g., extreme, narrow, biased towards high, biased towards low), even when the respondent’s ordering of ratings did not conform to the preconceived ordering of ratings. Following this logic, a respondent’s self-rating could still be interpreted with respect to the vignette ratings, and mapped according to the nonmetric remapping rules, even though the respondent did not interpret the vignettes in accordance with their preconceived categories.

Results for the four approaches were compared, particularly in terms of potential differences in the correlations between indices and mathematics proficiency (see Chapter 17 for more details). Results indicated considerable variation in achievement correlations depending on the method used whereby, on average, the third approach showed the largest correlations, followed by the fourth approach. The details of the third approach whereby order violations were recoded into ties at the respondent’s highest rating are provided in Table 16. 97. Detailed results regarding the comparison of different re-scaling approaches are described in Bertling, Kyllonen, Roberts, and Blew (forthcoming).

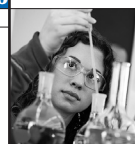


Table 16.97 Re-scaling rules for order violations on vignettes

Raw responses to vignettes			Recoding of actual values: order violations are recoded into ties of highest raw rating		
low	medium	high	low	medium	high
4	2	1	4	4	4
4	4	2	4	4	4
3	4	2	4	4	4
3	2	1	3	3	3
2	4	2	4	4	4
2	2	1	2	2	2
4	1	4	4	4	4
3	3	2	3	3	3
3	1	4	4	4	4
4	4	3	4	4	4
4	3	2	4	4	4
2	1	2	2	2	2
4	1	3	4	4	4
2	3	2	3	3	3
4	3	1	4	4	4
2	1	3	3	3	3
1	3	2	1	3	3
2	1	4	4	4	4
3	4	3	4	4	4
1	4	2	1	4	4
3	2	2	3	3	3
4	2	2	4	4	4
3	1	3	3	3	3
3	3	1	3	3	3
2	4	3	2	4	4
3	1	2	3	3	3
1	4	3	1	4	4
4	1	2	4	4	4
4	3	3	4	4	4
4	2	4	4	4	4
4	4	1	4	4	4
4	2	3	4	4	4
4	1	1	4	4	4
1	2	1	2	2	2
4	3	4	4	4	4
2	3	1	3	3	3
3	4	1	4	4	4
3	2	3	3	3	3
3	2	4	4	4	4
3	1	1	3	3	3
2	1	1	2	2	2
1	3	1	3	3	3
2	4	1	4	4	4
1	4	1	4	4	4

Assumptions and Cautions

The alternative scoring approach for Likert-type items based on anchoring vignettes makes the frame of reference for scoring of questionnaires items more transparent and can thereby help to interpret students' answers across different countries and educational systems. Several assumptions underlying the use of anchoring vignettes in the context of PISA have to be noted and careful consideration needs to be applied when interpreting anchored indices or using them in secondary data analyses.

First, the scoring approach is based on two main identifying assumptions, namely "vignette equivalence" and "response consistency" (see e.g., Kapteyn et al., 2011). The vignette equivalence assumption posits that different respondents interpret the vignette scenario in the same way. In other words, all differences in the ratings of the vignettes should be attributed to how different respondents interpret and use the response scale, not to any differences in their interpretation of the vignette scenarios themselves. The response consistency assumption posits that respondents use the same standards when evaluating themselves and when providing a rating of the vignette scenarios.

Secondly, the original anchoring vignette method was developed to anchor stand-alone questions only while in the context of the PISA 2012 student questionnaire the anchoring vignette method was extended so that the same vignette scenario was applied to a larger set of items. This extension was possible because of the third assumption that an



individual's rating standards were invariant across different contexts whenever the same rating scale was used. This meant that students were expected to use a four-point Likert scale with the categories "Strongly disagree" to "Strongly agree" in the same way for the different items in the student questionnaire, whether they were items such as "I learn mathematics quickly" or items such as "My teacher helps students with their learning".

Thirdly, the scoring process anchoring student responses using vignette scenarios depends on the particular vignette scenarios – that is where on the continuum of the underlying construct the vignettes are located – and the number of vignettes used. Analyses of the PISA 2012 data suggest reasonable consistency of results across the two sets of vignettes (see Chapter 17 for details on the second set of vignettes). Still, further research would be needed to understand fully the effects of different vignette contexts and the way in which the validity of results may depend on the number of vignettes and scale points used. For instance, gains in validity might be larger for questions that capture similar constructs as the constructs described in the vignettes. Also, future trend analyses of anchored indices would require the inclusion of the same vignettes in future questionnaires.

Fourth, the order of vignettes and self-reports in the questionnaire may have an influence on the results. As Hopkins and King (2010) showed, administering vignettes first might have a priming effect that reduces inter-individual differences in interpretation of the response scale. In the PISA 2012 Student Questionnaire, this might have been less of an issue as some self-report questions using the four-point Likert scale were presented before the vignettes and others were administered after the vignettes.

Finally, in order to use data from all students including those with tied ratings of anchoring vignettes or "order violations" additional assumptions were made as described above. Future research is intended to add to the understanding of students' response processes.

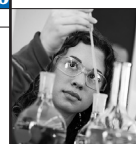
It is recommended that anchored indices should be interpreted in addition to original indices, not as a replacement. Values on both the original questionnaire indices and on anchored indices could be influenced by students' systematic or unsystematic response behaviours. Therefore, when undertaking analyses, both original and anchored indices should be used and results compared to arrive at an informed picture of the effects of using either type of index.

Notes

1. It should be noted that in the result for the international item parameters later in this chapter some item deltas are disordered. Adams, Wu and Wilson (2012b) have shown that rather than being indicative of a problem, such disordered deltas indicate specific patterns of relative numbers of respondents in each category.
2. A similar approach was used in the IEA Civic Education Study (see Schulz, 2004).
3. Only one principal component with an eigenvalue greater than 1 was identified in each of the participating countries.

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