ANNEX A6: DEVELOPMENT OF THE PISA ASSESSMENT INSTRUMENTS

The development of the PISA 2012 assessment instruments was an collaborative process between the PISA Consortium and its international teams experts working under the auspices of the OECD, the PISA Governing Board and national experts. In close consultation with participating countries and economies, a panel of international experts identified the range of skills and competencies in the respective assessment domains that were considered to be crucial for an individual's capacity to fully participate in and contribute to a successful modern society. A description of the assessment domains – the assessment framework – was then used by participating countries and economies, and other test-development professionals, as they contributed assessment materials. Building this assessment framework involved the following steps:

- Developing a working definition for the assessment area and description of the assumptions that underlay that definition;
- Determining how to organise the set of tasks constructed in order to report to policy makers and researchers on 15-year-old student performance in each assessment area;
- Identifying a set of key characteristics to be taken into account when assessment tasks were constructed for international use;
- Operationalising the set of key characteristics to be used in test construction, with definitions based on existing literature and the experience of other large-scale assessments;
- Validating the variables and assessing the contribution that each made to the understanding of task difficulty in participating countries; and
- Preparing an interpretative scheme for the results.

The frameworks were agreed at both scientific and policy levels and subsequently provided the basis for the development of the assessment instruments. The frameworks are described in *PISA 2012 Assessment and Analytical Framework – Mathematics, Reading, Science, Problem Solving and Financial Literacy* (OECD, 2013). They provided a common language and a vehicle for participating countries and economies to develop a consensus as to the measurement goals of PISA.

Assessment items were then developed to reflect the intentions of the frameworks and were piloted in a field trial in all participating countries and economies before a final set of items was selected for the PISA 2012 main survey. Tables A6.1, A6.2 and A6.3 show the distribution of PISA 2012 assessment items for mathematics, reading and science according to the various dimensions of the PISA frameworks.

In the case of mathematics, an education policy agency conducted an independent review of the item pool from which the main survey items were selected. That review confirmed that the item pool reflected the mathematics framework and the definition of mathematical literacy contained in that framework.

Due attention was paid to reflecting the national, cultural and linguistic variety among all participating countries and economies. As part of this effort, the PISA Consortium used professional test-item development teams in several countries: Australia, Belgium, Germany, Japan, Luxembourg, the Netherlands and Norway. In addition to the items that were developed by the international experts working with the PISA Consortium, assessment material was contributed by participating countries. The Consortium's multi-national team of test developers deemed a substantial amount of this submitted material as appropriate, given the requirements laid out by the PISA assessment frameworks. As a result, the item pool included assessment items contributed by Austria, Canada, the Czech Republic, Finland, France, Germany, Israel, Italy, Korea, Macao-China, the Netherlands, New Zealand, Serbia, Sweden and the United States.

Table A6.1a. Distribution of items by the dimensions of the PISA framework for the assessment of paper-based mathematics

	Number of items	Simple multiple choice	Complex multiple choice	Constructed response expert	Constructed response manual	Constructed response auto-coded
Distribution of paper-based mathematics items by content						
Quantity	28	10	3	3	12	0
Space and shape	27	6	4	9	6	2
Change and relationships	29	5	3	14	7	0
Uncertainty and data	25	11	3	5	5	1
Total	**109**	**32**	**13**	**31**	**30**	**3**
Distribution of paper-based mathematics items by process						
Employ	50	13	5	13	19	0
Formulate	32	7	3	12	7	3
Interpret	27	12	5	6	4	0
Total	**109**	**32**	**13**	**31**	**30**	**3**
Distribution of paper-based mathematics items by context						
Personal	21	7	3	2	9	0
Societal	36	16	3	6	10	1
Occupational	24	3	4	10	5	2
Scientific	28	6	3	13	6	0
Total	**109**	**32**	**13**	**31**	**30**	**3**

Table A6.1b. Distribution of items by the dimensions of the PISA framework for the assessment of computer-based mathematics

	Number of items	Simple multiple choice	Complex multiple choice	Constructed response auto-coded	Constructed response expert	Selected response variations
Distribution of computer-based mathematics items by content						
Quantity	9	2	0	6	1	0
Space and shape	12	4	2	6	0	0
Change and relationships	11	2	0	7	1	1
Uncertainty and data	9	0	2	3	2	2
Total	**41**	**8**	**4**	**22**	**4**	**3**
Distribution of computer-based mathematics items by process						
Employ	22	5	2	13	0	2
Formulate	9	0	0	7	1	1
Interpret	10	3	2	2	3	0
Total	**41**	**8**	**4**	**22**	**4**	**3**
Distribution of computer-based mathematics items by context						
Personal	13	3	2	7	1	0
Societal	11	0	2	6	2	1
Occupational	9	1	0	5	1	2
Scientific	8	4	0	4	0	0
Total	**41**	**8**	**4**	**22**	**4**	**3**

Table A6.1c Distribution of items by the dimensions of the PISA framework for the composite assessment of paper-based and computer-based mathematics

	Number of items	Simple multiple choice	Complex multiple choice	Constructed response expert	Constructed response manual	Constructed response auto-coded	Selected response variations
Distribution of mathematics items by content							
Quantity	37	12	3	4	12	6	0
Space and shape	39	10	6	9	6	8	0
Change and relationships	40	7	3	15	7	7	1
Uncertainty and data	34	11	5	7	5	4	2
Total	**150**	**40**	**17**	**35**	**30**	**25**	**3**
Distribution of mathematics items by process							
Employ	72	18	7	13	19	13	2
Formulate	41	7	3	13	7	10	1
Interpret	37	15	7	9	4	2	0
Total	**150**	**40**	**17**	**35**	**30**	**25**	**3**
Distribution of mathematics items by context							
Personal	34	10	5	3	9	7	0
Societal	47	16	5	8	10	7	1
Occupational	33	4	4	11	5	7	2
Scientific	36	10	3	13	6	4	0

Total	**150**	**40**	**17**	**35**	**30**	**25**	**3**

Table A6.2a Distribution of items by the dimensions of the PISA framework for the assessment of paper-based reading

	Number of items	Simple multiple choice	Complex multiple choice	Constructed response expert	Constructed response manual
Distribution of paper-based reading items by format					
Continuous	26	9	4	10	3
Non-continuous	13	3	2	5	3
Mixed	4	1	1	2	0
Multiple	1	0	0	1	0
Total	**44**	**13**	**7**	**18**	**6**
Distribution of paper-based reading items by aspect of reading task					
Access and retrieve	10	2	1	2	5
Integrate and interpret	24	9	6	8	1
Reflect and evaluate	10	2	0	8	0
Total	**44**	**13**	**7**	**18**	**6**
Distribution of paper-based reading items by situation					
Personal	16	4	2	8	2
Public	5	2	1	2	0
Occupational	9	1	2	4	2
Educational	14	6	2	4	2
Total	**44**	**13**	**7**	**18**	**6**

Table A6.2b Distribution of items by the dimensions of the PISA framework for the assessment of computer-based reading

	Number of items	Simple multiple choice	Constructed response expert	Constructed response auto-coded	Selected response variations
Distribution of computer-based reading items by format					
Continuous	1	1	0	0	0
Non-continuous	2	1	1	0	0
Mixed	1	1	0	0	0
Multiple	15	9	4	1	1
Total	**19**	**12**	**5**	**1**	**1**
Distribution of computer-based reading items by aspect of reading task					
Access and retrieve	5	5	0	0	0
Integrate and interpret	6	6	0	0	0
Reflect and evaluate	3	1	2	0	0
Complex	5	0	3	1	1
Total	**19**	**12**	**5**	**1**	**1**
Distribution of computer-based reading items by situation					
Personal	6	2	2	1	1

Public	10	8	2	0	0
Educational	3	2	1	0	0
Total	**19**	**12**	**5**	**1**	**1**

Table A6.2c Distribution of items by the dimensions of the PISA framework for the composite assessment of paper-based and computer-based reading

	Number of items	Simple multiple choice	Complex multiple choice	Constructed response expert	Constructed response manual	Constructed response auto-coded	Selected response variations
Distribution of reading items by format							
Continuous	27	10	4	10	3	0	0
Non-continuous	15	4	2	6	3	0	0
Mixed	5	2	1	2	0	0	0
Multiple	16	9	0	5	0	1	1
Total	**63**	**25**	**7**	**23**	**6**	**1**	**1**
Distribution of reading items by aspect of reading task							
Access and retrieve	15	7	1	2	5	0	0
Integrate and interpret	30	15	6	8	1	0	0
Reflect and evaluate	13	3	0	10	0	0	0
Complex	5	0	0	3	0	1	1
Total	**63**	**25**	**7**	**23**	**6**	**1**	**1**
Distribution of reading items by situation							
Personal	22	6	2	10	2	1	1
Public	15	10	1	4	0	0	0
Occupational	9	1	2	4	2	0	0
Educational	17	8	2	5	2	0	0
Total	**63**	**25**	**7**	**23**	**6**	**1**	**1**

Table A6.3 Distribution of items by the dimensions of the PISA framework for the assessment of paper-based science

	Number of items	Number of simple multiple choice	Number of complex multiple choice	Number of constructed response manual	Number of constructed response expert
Distribution of science items by content area					
Knowledge of science "Physical systems"	6	3	2	1	0
Knowledge of science "Living systems"	9	2	3	0	4
Knowledge of science "Earth and space systems"	7	3	2	0	2
Knowledge of science "Technology systems"	4	1	1	1	1
Knowledge of science "Scientific enquiry"	14	4	6	0	4
Knowledge of science "Scientific explanations"	13	5	2	0	6
Total	**53**	**18**	**16**	**2**	**17**
Distribution of science items by science competencies					
Identifying scientific issues	13	4	6	0	3
Explaining phenomena scientifically	22	8	7	1	6
Using scientific evidence	18	6	3	1	8
Total	**53**	**18**	**16**	**2**	**17**
Distribution of science items by situation or context					
Personal	12	5	4	1	2
Social	30	10	7	1	12
Global	11	3	5	0	3
Total	**53**	**18**	**16**	**2**	**17**

Reference

OECD (2013), *PISA 2012 Assessment and Analytical Framework: Mathematics, Reading, Science, Problem Solving and Financial Literacy*, OECD Publishing.