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Exhibit 1.1: TIMSS 2019 Science and Mathematics Item Review Committee (SMIRC)

Mathematics

Ray Philpot

Australian Council for Educational Research
(ACER)

Australia

Kiril Bankov

Faculty of Mathematics and Informatics,
University of Sofia

Bulgaria

Khattab Mohammad Ahmad Abulibdeh

National Center for Human Resources
Development

Jordan

Arne Hole

Department of Teacher Education and School
Research, University of Oslo

Exhibit 1.2: TIMSS 2019 Development Schedule for Achievement Items (continued)

Date(s)		Group and Activity
March	2018	NRCs received scoring training for constructed response field test items (4 th NRC meeting—Madrid, Spain)
May	2018	Countries submitted TIMSS 2019 Field Test achievement data for analysis and review
May	2018	NRCs provided feedback to the TIMSS & PIRLS International Study Center about the field-tested PSIs. Based on the NRC's evaluations, the TIMSS & PIRLS International Study Center selected the PSIs to move forward to eTIMSS 2019 Data Collection and began editing the tasks based on NRC feedback
June	2018	IEA Hamburg completed data processing and TIMSS & PIRLS International Study Center completed scoring of machine-scored items
June	2018	TIMSS & PIRLS International Study Center reviewed the field test item statistics and assembled sets of proposed items for data collection
July	2018	SMIRC reviewed the proposed items for data collection in conjunction with the field test results (3 rd SMIRC meeting—Tromsø, Norway)
August	2018	NRCs reviewed and approved the proposed item blocks for TIMSS 2019 Data Collection (5 th NRC meeting—Stockholm, Sweden)
September	2018	TIMSS & PIRLS International Study Center and IEA Hamburg finalized all TIMSS 2019 Data Collection instruments and released the international instruments to countries for translation
September–December	2018	Southern Hemisphere countries conducted TIMSS 2019 data collection
September	2018	Consultants and staff at the TIMSS & PIRLS International Study Center reviewed and updated scoring guides and scorer training materials (Boston, USA)
November	2018	NRCs from Southern Hemisphere countries received scoring training for constructed response items (Cape Town, South Africa)
November	2018	TIMSS & PIRLS International Study Center finalized scoring guides and training materials for constructed response items and distributed them to NRCs from Southern Hemisphere countries
March	2019	NRCs from Northern Hemisphere countries received scoring training for constructed response items (Limassol, Cyprus)
March–June	2019	Northern Hemisphere countries conducted TIMSS 2019 data collection

Updating the Assessment Frameworks for TIMSS 2019

[TIMSS 2019 Assessment Frameworks](#) & [PIRLS 2019 Assessment Frameworks](#)

Writing and Reviewing the TIMSS 2019 Field Test Items and Scoring Guides

The TIMSS 2019 Assessment Frameworks (see Appendix A) provide the conceptual and content domains that inform the development of the field test items and scoring guides. The frameworks are organized into three main sections: (1) the overall framework, (2) the content domain frameworks, and (3) the assessment domain frameworks. The overall framework provides a high-level overview of the assessment and its components. The content domain frameworks provide a detailed description of the content areas to be assessed, including the specific skills and knowledge that are expected to be demonstrated by students. The assessment domain frameworks provide a detailed description of the assessment tasks and the skills and knowledge that are expected to be demonstrated by students. The frameworks are organized into three main sections: (1) the overall framework, (2) the content domain frameworks, and (3) the assessment domain frameworks. The overall framework provides a high-level overview of the assessment and its components. The content domain frameworks provide a detailed description of the content areas to be assessed, including the specific skills and knowledge that are expected to be demonstrated by students. The assessment domain frameworks provide a detailed description of the assessment tasks and the skills and knowledge that are expected to be demonstrated by students.

[TIMSS 2019 Assessment Frameworks](#)

The TIMSS 2019 Field Test

International Association for Educational Assessment (IEA) & IEA Technical Centre for Mathematics and Science Assessment (IEA-TCSA)

Exhibit 1.4: Overview of the TIMSS 2019 Field Test

	Fourth Grade			Eighth Grade	
	eTIMSS	paperTIMSS	Less Difficult Mathematics	eTIMSS	paperTIMSS
Items in Field Test					
Mathematics	174	127	130	201	158
Science	164	134	134	212	167
Total	338	261	264	413	325
Responses per Item per Country (approx.)	200	200	200	200	200
Participants					
Countries	31	18	7	22	14
Benchmarking Entities	6	–	–	5	–
Students	50,158	19,656	8,128	37,512	16,225
Teachers	3,337	1,176	471	5,009	1,826
Schools	1,340	526	203	852	342

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Exhibit 1.6: TIMSS 2019 Number of Field Test Items by Cognitive Domain and Item Format – Fourth Grade

Cognitive Domain	Number of Selected Response Items	Number of Constructed Response Items	Total Number of Items	Percentage of Total Items
Mathematics – eTIMSS and paperTIMSS				
Knowing	29	14	43	33%
Applying	27	38	65	50%
Reasoning	8	15	23	18%
Total	64	67	131	
Mathematics – Less Difficult				
Knowing	36	11	47	36%
Applying	25	30	55	42%
Reasoning	8	20	28	22%
Total	69	61	130	
Science – eTIMSS and paperTIMSS				
Knowing	42	16	58	43%
Applying	28	17	45	34%
Reasoning	16	15	31	23%
Total	86	48	134	

Four mathematics items were only field tested in eTIMSS and four items were only field tested in paperTIMSS. Counts include all eight of these items.

Five item blocks (64 items) were common to both the regular and less difficult fourth grade mathematics assessments.

Because percentages are rounded to the nearest whole number, some totals may appear inconsistent.

Exhibit 1.7: TIMSS 2019 Number of Field Test Items by Content Domain and Item Format – Eighth Grade



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Developing the Materials for TIMSS 2019 Field Test Scoring Training

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Exhibit 1.9: Pilot Test Student Responses for Field Test Scoring Training Materials Development

	Number of Items	Approximate Number of Responses	
		eTIMSS	paperTIMSS
Fourth Grade			
Mathematics	5	93	96
Science	21	93	96
Countries		England	Australia and Ireland
Eighth Grade			
Mathematics	6	80	43
Science	19	80	43
Countries		England	Ireland

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Figure 1.1 shows the distribution of the TIMSS 2019 achievement items by content domain and cognitive domain. The chart shows that the majority of items are in the domain of Mathematics, with a smaller number in Science and Reading. Within Mathematics, the majority of items are in the domain of Algebra, with a smaller number in Geometry and Statistics. Within Science, the majority of items are in the domain of Earth and Space Science, with a smaller number in Life Science and Physical Science. Within Reading, the majority of items are in the domain of Reading Comprehension, with a smaller number in Reading Fluency and Reading Vocabulary.

Distribution of the TIMSS 2019 Achievement Items

Figure 1.1 shows the distribution of the TIMSS 2019 achievement items by content domain and cognitive domain. The chart shows that the majority of items are in the domain of Mathematics, with a smaller number in Science and Reading. Within Mathematics, the majority of items are in the domain of Algebra, with a smaller number in Geometry and Statistics. Within Science, the majority of items are in the domain of Earth and Space Science, with a smaller number in Life Science and Physical Science. Within Reading, the majority of items are in the domain of Reading Comprehension, with a smaller number in Reading Fluency and Reading Vocabulary.

Achievement Items by Content and Cognitive Domain

Figure 1.1 shows the distribution of the TIMSS 2019 achievement items by content domain and cognitive domain. The chart shows that the majority of items are in the domain of Mathematics, with a smaller number in Science and Reading. Within Mathematics, the majority of items are in the domain of Algebra, with a smaller number in Geometry and Statistics. Within Science, the majority of items are in the domain of Earth and Space Science, with a smaller number in Life Science and Physical Science. Within Reading, the majority of items are in the domain of Reading Comprehension, with a smaller number in Reading Fluency and Reading Vocabulary.

Exhibit 1.11: TIMSS 2019 Achievement Items by Cognitive Domain – Fourth Grade

Cognitive Domain	Trend		New		Total		Target Percentage of Score Points
	Number of Items	Percentage of Score Points	Number of Items	Percentage of Score Points	Number of Items	Percentage of Score Points	
Mathematics – eTIMSS and paperTIMSS							
Knowing	34 (34)	35%	29 (29)	31%	63 (63)	33%	40%
Applying	40 (42)	43%	34 (39)	42%	74 (81)	43%	40%
Reasoning	18 (21)	22%	20 (25)	27%	38 (46)	24%	20%
Total	92 (97)		83 (93)		175 (190)		
Mathematics – Less Difficult							
Knowing	56 (56)	48%	25 (26)	34%	81 (82)	43%	40%
Applying	39 (40)	34%	27 (32)	42%	66 (72)	38%	40%
Reasoning	16 (20)	17%	16 (18)	24%	32 (38)	20%	20%
Total	111 (116)		68 (76)		179 (192)		
Science – eTIMSS and paperTIMSS							
Knowing	42 (45)	44%	31 (32)	41%	73 (77)	43%	40%
Applying	35 (36)	35%	30 (30)	38%	65 (66)	36%	40%
Reasoning	21 (21)	21%	16 (17)	22%	37 (38)	21%	20%
Total	98 (102)		77 (79)		175 (181)		

Score points are shown in parentheses.

Exhibit 1.12: TIMSS 2019 Achievement Items by Content Domain – Eighth Grade

Content Domain	Trend		New		Total		Target Percentage of Score Points
	Number of Items	Percentage of Score Points	Number of Items	Percentage of Score Points	Number of Items	Percentage of Score Points	
Mathematics – eTIMSS and paperTIMSS							
Number	36 (37)	30%	28 (30)	30%	64 (67)	30%	30%
Algebra	31 (32)	26%	31 (32)	32%	62 (64)	29%	30%
Geometry	25 (28)	22%	18 (20)	20%	43 (48)	21%	20%
Data and Probability	25 (28)	22%	17 (17)	17%	42 (45)	20%	20%
Total	117 (125)		94 (99)		211 (224)		
Science – eTIMSS and paperTIMSS							
Biology	39 (48)	32%	38 (43)	39%	77 (91)	35%	35%
Chemistry	22 (23)	18%	22 (25)	22%	44 (48)	20%	20%
Physics	33 (33)	27%	22 (25)	22%	55 (58)	25%	25%
Earth Science	28 (29)	23%	16 (17)	16%	44 (46)	20%	20%
Total	122 (133)		98 (110)		220 (243)		

Score points are shown in parentheses.

Because percentages are rounded to the nearest whole number, some totals may appear inconsistent.

Exhibit 1.13: TIMSS 2019 Achievement Items by Cognitive Domain – Eighth Grade

Cognitive Domain	Trend		New		Total		Target Percentage of Score Points
	Number of Items	Percentage of Score Points	Number of Items	Percentage of Score Points	Number of Items	Percentage of Score Points	
Mathematics – eTIMSS and paperTIMSS							
Knowing	35 (35)	28%	30 (32)	32%	65 (67)	30%	35%
Applying	58 (61)	49%	39 (40)	40%	97 (101)	45%	40%
Reasoning	24 (29)	23%	25 (27)	27%	49 (56)	25%	25%
Total	117 (125)		94 (99)		211 (224)		
Science – eTIMSS and paperTIMSS							
Knowing	45 (50)	37%	35 (36)	36%	80 (86)	36%	35%
Applying	46 (50)	38%	36 (44)	37%	82 (94)	37%	35%
Reasoning	31 (33)	25%	27 (30)	28%	58 (63)	26%	30%
Total	122						

Achievement Items by Item Formats within Content and Cognitive Domains

The table is a large grid with multiple columns and rows. The columns represent different item formats, content domains, and cognitive domains. The rows list specific achievement items. The text is extremely faded and illegible.

Exhibit 1.14:

Exhibit 1.15: TIMSS 2019 Achievement Items by Cognitive Domain and Item Format – Fourth Grade

Cognitive Domain	Selected Response Items		Constructed Response Items		Total Items	Percentage of Score Points
	Single Selection	Multiple Selection	1 Point	2 Points		
Mathematics – eTIMSS and paperTIMSS						
Knowing	33 (33)	12 (12)	18 (18)	--	63 (63)	33%
Applying	25 (25)	2 (2)	40 (40)	7 (14)	74 (81)	43%
Reasoning	14 (14)	2 (2)	14 (14)	8 (16)	38 (46)	24%
Total	72 (72)	16 (16)	72 (72)	15 (30)	175 (190)	
Achieved Percentage of Score Points	46%		54%			
Mathematics – Less Difficult						
Knowing	46 (46)	2 (2)	32 (32)	1 (2)	81 (82)	43%
Applying	25 (25)	2 (3)	34 (34)	5 (10)	66 (72)	38%
Reasoning	11 (11)	1 (1)	14 (14)	6 (12)	32 (38)	20%
Total	82 (82)	5 (6)	80 (80)	12 (24)	179 (192)	
Achieved Percentage of Score Points	46%		54%			
Science – eTIMSS and paperTIMSS						
Knowing	42 (42)	10 (11)	18 (18)	3 (6)	73 (77)	43%
Applying	33 (33)	3 (3)	28 (28)	1 (2)	65 (66)	36%
Reasoning	19 (19)	2 (2)	15 (15)	1 (2)	37 (38)	21%
Total	94 (94)	15 (16)	61 (61)	5 (10)	175 (181)	
Achieved Percentage of Score Points	61%		39%			

Score points are shown in parentheses.

Two fourth grade mathematics items involving an on-screen ruler tool were only included in eTlrof131.6847 304.8646 T2 (e mv(s)-17.1-12.4/TT16.1 (s)-17

Exhibit 1.17: TIMSS 2019 Achievement Items by Cognitive Domain and Item Format – Eighth Grade



Exhibit 1.19: Comparison of Target and Achieved Percentages of Domain Coverage in the eTIMSS 2019 Mathematics and Science Assessments – Fourth Grade

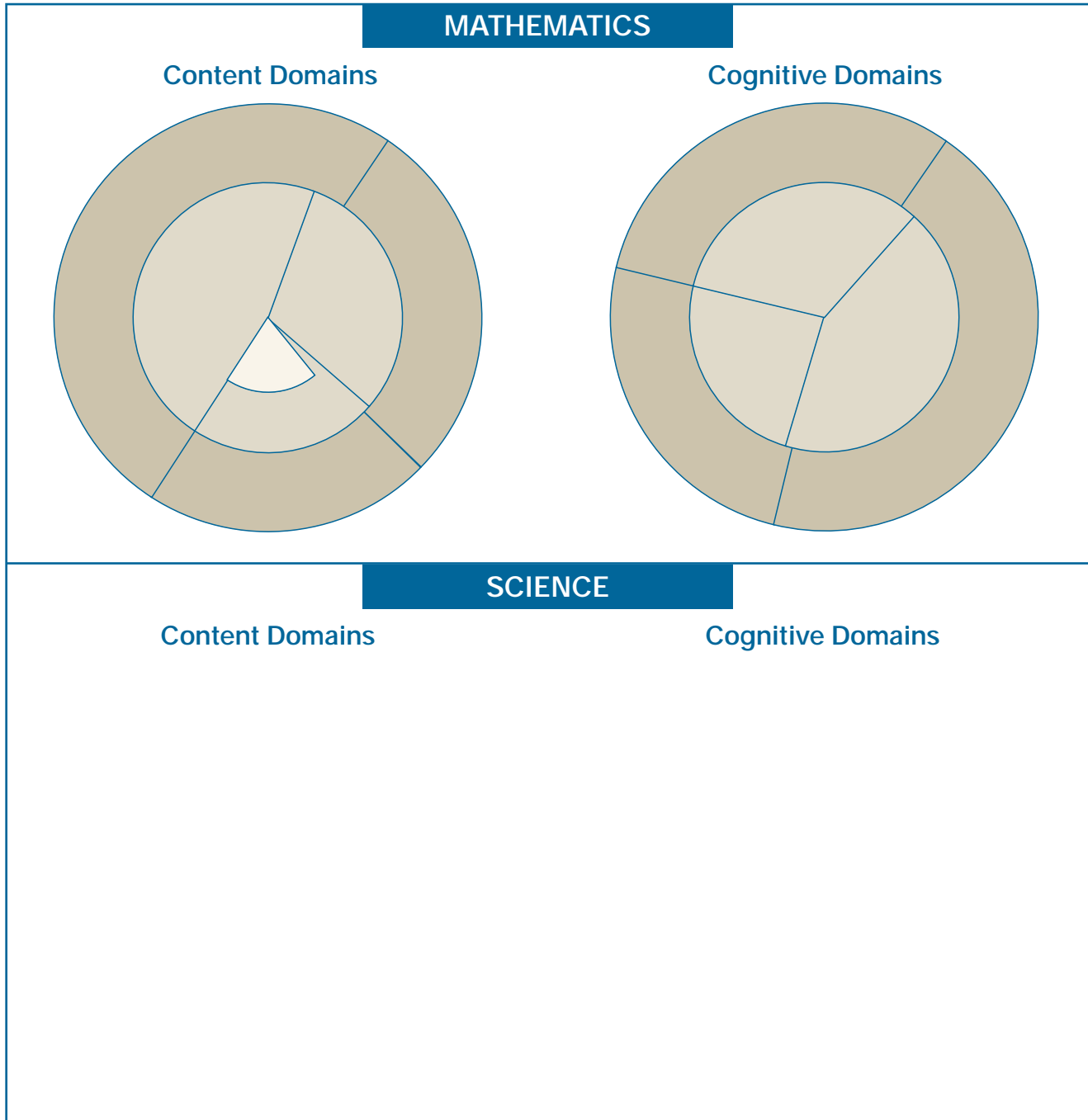


Exhibit 1.20: Comparison of Target and Achieved Percentages of Domain Coverage in the

TIMSS 2019 Constructed Response Scoring Training

1. The first step in scoring is to read the student response carefully and identify the key elements of the response. This includes identifying the student's understanding of the problem, the methods used to solve the problem, and the final answer.

2. The second step is to compare the student response to the scoring rubric. The rubric provides a clear description of the expected response for each score level, and the scorer should use it to determine the appropriate score for the student's response.

3. The third step is to provide feedback to the student. This feedback should be based on the scoring rubric and should focus on the student's strengths and areas for improvement. It should be provided in a clear, concise, and constructive manner.

4. The fourth step is to record the score and feedback in the scoring system. This information is used to generate reports and to provide feedback to the student and their teacher.

5. The fifth step is to review the scoring process and make any necessary adjustments. This includes reviewing the scoring rubric, the student responses, and the feedback provided to ensure that the scoring process is fair and consistent.

6. The sixth step is to provide training to scorers. This training should focus on the scoring rubric, the student responses, and the feedback provided to ensure that all scorers are using the same criteria and providing consistent feedback.

7. The seventh step is to monitor the scoring process and make any necessary adjustments. This includes monitoring the scoring process for consistency and fairness, and making any necessary adjustments to the scoring rubric or the training process.

8. The eighth step is to provide feedback to the student and their teacher. This feedback should be based on the scoring rubric and should focus on the student's strengths and areas for improvement. It should be provided in a clear, concise, and constructive manner.

9. The ninth step is to generate reports and provide feedback to the student and their teacher. This information is used to generate reports and to provide feedback to the student and their teacher.

10. The tenth step is to provide training to scorers. This training should focus on the scoring rubric, the student responses, and the feedback provided to ensure that all scorers are using the same criteria and providing consistent feedback.

11. The eleventh step is to monitor the scoring process and make any necessary adjustments. This includes monitoring the scoring process for consistency and fairness, and making any necessary adjustments to the scoring rubric or the training process.

12. The twelfth step is to provide feedback to the student and their teacher. This feedback should be based on the scoring rubric and should focus on the student's strengths and areas for improvement. It should be provided in a clear, concise, and constructive manner.

13. The thirteenth step is to generate reports and provide feedback to the student and their teacher. This information is used to generate reports and to provide feedback to the student and their teacher.

14. The fourteenth step is to provide training to scorers. This training should focus on the scoring rubric, the student responses, and the feedback provided to ensure that all scorers are using the same criteria and providing consistent feedback.

15. The fifteenth step is to monitor the scoring process and make any necessary adjustments. This includes monitoring the scoring process for consistency and fairness, and making any necessary adjustments to the scoring rubric or the training process.

16. The sixteenth step is to provide feedback to the student and their teacher. This feedback should be based on the scoring rubric and should focus on the student's strengths and areas for improvement. It should be provided in a clear, concise, and constructive manner.

17. The seventeenth step is to generate reports and provide feedback to the student and their teacher. This information is used to generate reports and to provide feedback to the student and their teacher.

18. The eighteenth step is to provide training to scorers. This training should focus on the scoring rubric, the student responses, and the feedback provided to ensure that all scorers are using the same criteria and providing consistent feedback.

19. The nineteenth step is to monitor the scoring process and make any necessary adjustments. This includes monitoring the scoring process for consistency and fairness, and making any necessary adjustments to the scoring rubric or the training process.

20. The twentieth step is to provide feedback to the student and their teacher. This feedback should be based on the scoring rubric and should focus on the student's strengths and areas for improvement. It should be provided in a clear, concise, and constructive manner.

The Process Following Instrument Development

The process following instrument development involves a series of steps to ensure the instrument is valid, reliable, and fair. This process includes the following steps:

1. **Validation:** The instrument is tested to ensure it measures what it is intended to measure. This is done through a series of validity studies, including content validity, construct validity, and criterion validity.
2. **Reliability:** The instrument is tested to ensure it produces consistent results over time and across different raters. This is done through a series of reliability studies, including test-retest reliability, internal consistency, and inter-rater reliability.
3. **Fairness:** The instrument is tested to ensure it is fair to all students, regardless of their background, gender, or ethnicity. This is done through a series of fairness studies, including differential item functioning (DIF) analysis and fairness index calculation.
4. **Scoring:** The instrument is scored using a standardized scoring procedure. This procedure is developed based on the instrument's characteristics and the intended use of the instrument.
5. **Reporting:** The results of the instrument are reported in a clear and concise manner. This is done through a series of reporting studies, including the development of a reporting manual and the use of standardized reporting formats.

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