Description of the Released Unit from the 2015 PISA Collaborative Problem-Solving Assessment, Collaborative Problem-Solving Skills, and Proficiency Levels
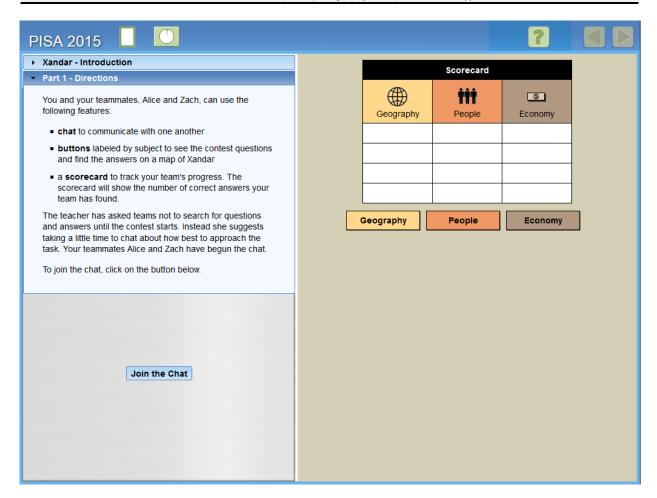
1.   This document illustrates the items that students faced in the 2015 PISA collaborative problem-solving assessment. It begins with a description of the released unit, *Xandar*. A screenshot of each item is presented, along with the correct action or response to the item and an explanation as to why the action or response is correct, the skills that are examined by the item and the difficulty of the item. The complete unit is presented.

2.   The assessment was framed around 12 collaborative problem-solving skills, which are the cross between four individual problem-solving processes and three collaborative competencies. These are described in the next part of the document. Finally, this document concludes with a description of the proficiency levels and a description of what students can accomplish at each proficiency level.

1. XANDAR

1.1. Part 1: Understanding the Contest
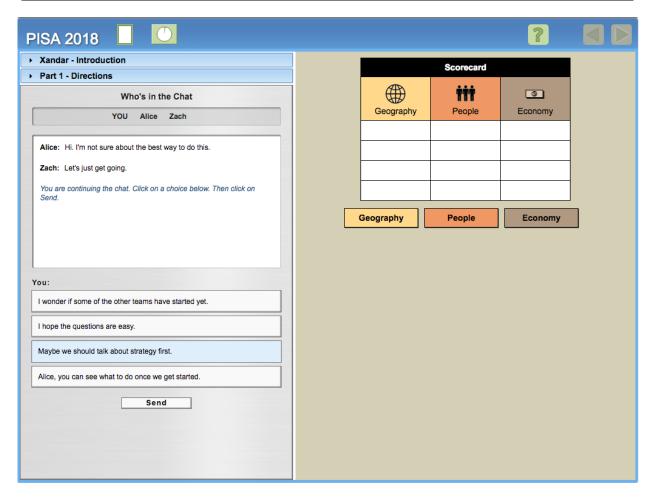
1.1.1. Part 1, Item 1: Following Directions

Item	CC100101
Collaborative competency	Establishing and maintaining team organisation
Problem-solving process	Planning and executing
Collaborative problem-solving skill	Following rules of engagement (e.g., prompting other team members to perform their tasks)
Difficulty	314 (Below Level 1)
Credited action	Student clicks on the "Join the Chat" button and does not click on any of the buttons in the task space (Geography, People or Economy)

3.   This item, which is the easiest in the unit, requires students to simply respond to the directions on the screen. While there are other active buttons in the problem space, these do not serve as strong distractors. No interaction with the other team members is required for this Below Level 1 item.
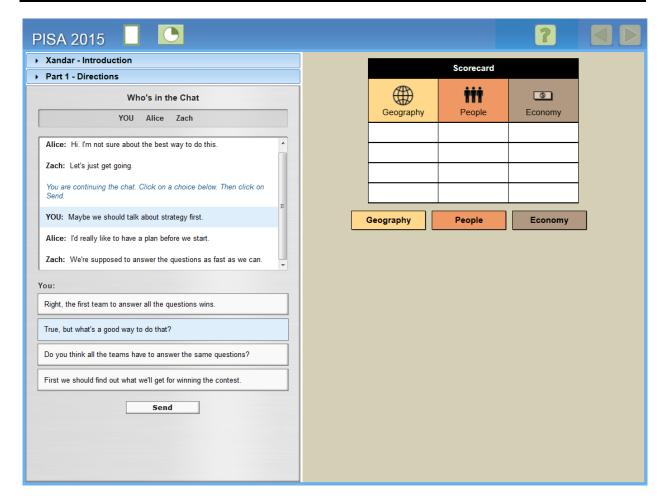
1.1.2. Part 1, Item 2: Understanding the Game

Item	CC100102
Collaborative competency	Establishing and maintaining shared understanding
Problem-solving process	Planning and executing
Collaborative problem-solving skill	Communicating with team members about the actions to be/being performed
Difficulty	502 (Level 2)
Credited response	"Maybe we should talk about strategy first."

4.   The credited response for this item helps focus the team on how to best approach the presented task. Students must take the initiative to suggest the first logical stop required to solve the problem, making this a higher Level 2 item.
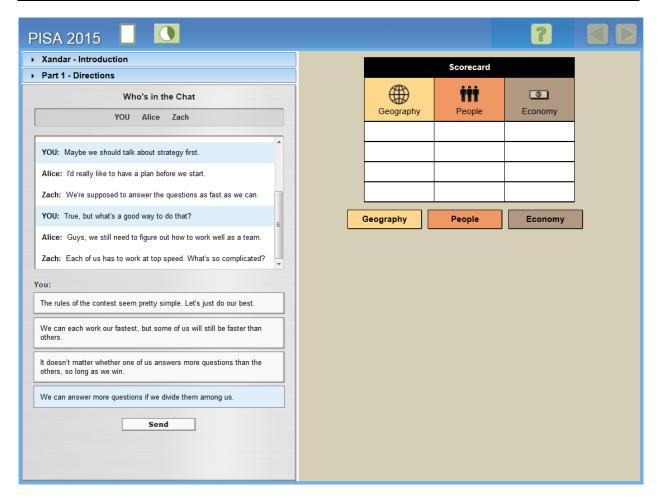
1.1.3. Part 1, Item 3: Agreeing on a Strategy

Item	CC100103
Collaborative competency	Establishing and maintaining shared understanding
Problem-solving process	Representing and formulating
Collaborative problem-solving skill	Building a shared representation and negotiating the meaning of the problem (common ground)
Difficulty	471 (Level 2)
Credited response	"True, but what's a good way to do that?"

5.   This is a mid-Level 2 item where actions are not required in the problem space. The credited response helps move the problem solving forward by focusing the discussion on how best to meet the goal of the contest. This response also solicits ideas from the team, facilitating collaboration. One distractor ("Right, the first team to answer all the questions wins.") sounds collaborative, but does not help the team work towards an approach to solve the problem.
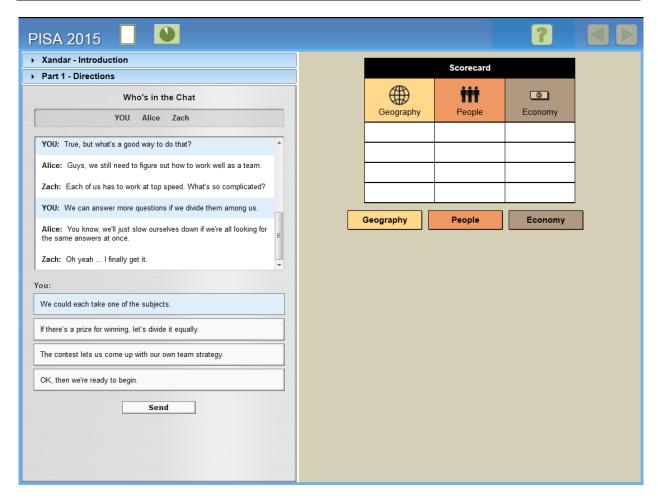
1.1.4. Part 1, Item 4: Agreeing on a Strategy

Item	CC100104
Collaborative competency	Establishing and maintaining shared understanding
Problem-solving process	Representing and formulating
Collaborative problem-solving skill	Building a shared representation and negotiating the meaning of the problem (common ground)
Difficulty	524 (Level 2)
Credited response	"We can answer more questions if we divide them among us."

6.   This item is a higher Level 2 task because the credited response requires students to take some initiative by proposing a strategy for sharing the work. Students must volunteer information not specifically requested by the other team members in order to help the team devise a strategy for playing the game.

1.1.5. Part 1, Item 5: Identifying the Optimal Approach

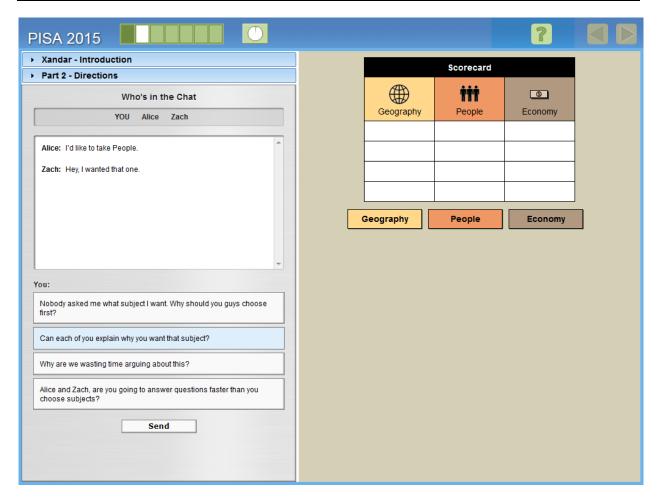| Item	CC100105
Collaborative competency	Establishing and maintaining team organisation
Problem-solving process	Representing and formulating
Collaborative problem-solving skill	Describe roles and team organisation (communication protocol/rules of engagement)
Difficulty	434 (Level 1)
Credited response	"We could each take one of the subjects."

7.   This Level 1 item requires students to simply confirm, and slightly extend, the approach that has been agreed upon – dividing the subjects among the team members. Given that there are 3 subjects and 3 team members, having each member take one subject is a logical approach. This item ends the first part of this unit, with everyone agreed on the approach to be taken.

1.2. Part 2: Reaching Consensus Regarding Preferences
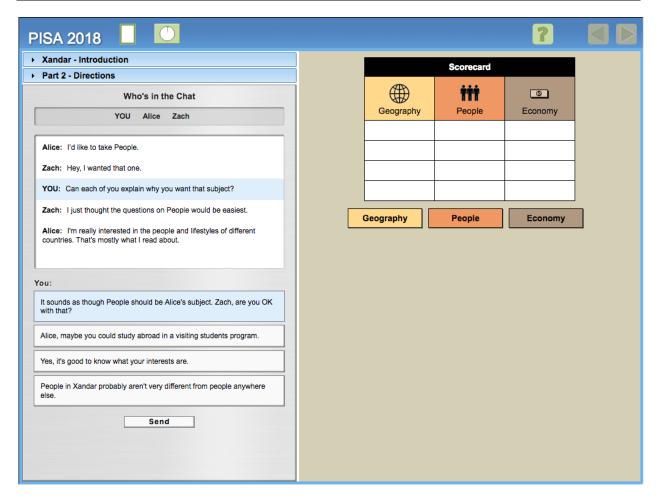
1.2.1. Part 2, Item 1: Choosing Subjects

Item	CC100201
Collaborative competency	Establishing and maintaining shared understanding
Problem-solving process	Exploring and understanding
Collaborative problem-solving skill	Discovering perspectives and abilities of team members
Difficulty	598 (Level 3)
Credited response	"Can each of you explain why you want that subject?"

8. Part 2 begins with a conflict between two team members. This item reflects the skills required at mid-Level 3, where students must help team members negotiate a solution when a conflict arises. The credited response solicits additional information about each team member's point of view, which both encourages collaboration and helps the team move forward.
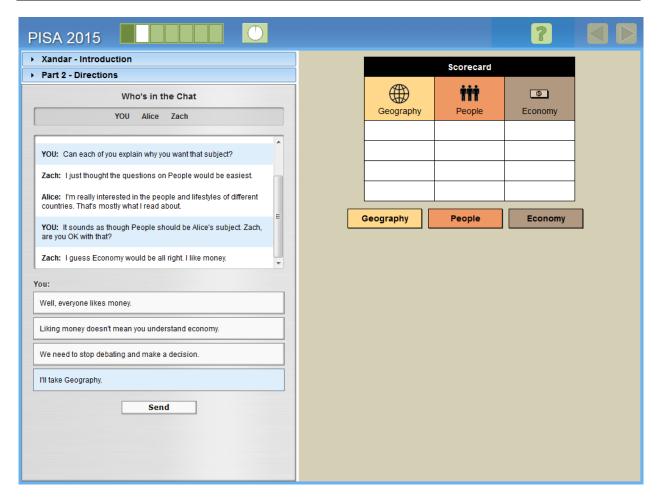
1.2.2. Part 2, Item 2: Choosing Subjects

Item	CC100202
Collaborative competency	Establishing and maintaining team organisation
Problem-solving process	Representing and formulating
Collaborative problem-solving skill	Describe roles and team organisation (communication protocol/rules of engagement)
Difficulty	381 (Level 1)
Credited response	"It sounds as though People should be Alice's subject. Zach, are you OK with that?"

9.   This Level 1 task requires a simple evaluation of the reasons provided by each team member for wanting to select "People" as their subject area for the contest. This is not overly difficult given that Alice has explained her knowledge of the area ("That's mostly what I read about"), which will be an advantage for the team. The credited response is also clearly collaborative as it asks for Zach's agreement with the proposed approach.

1.2.3. Part 2, Item 3: Choosing Subjects

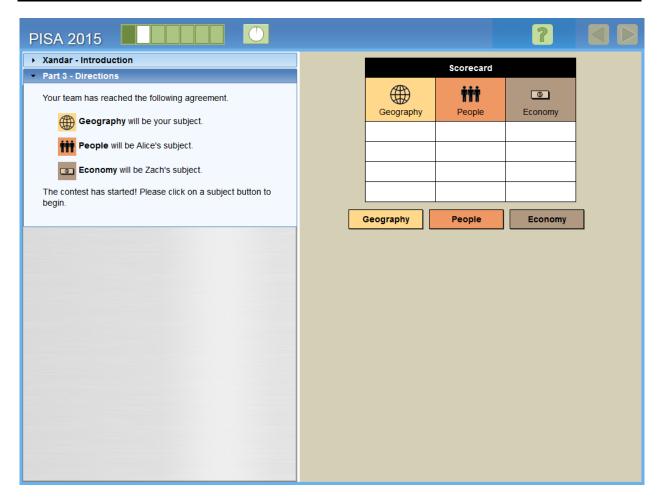| Item	CC100203
Collaborative competency	Establishing and maintaining team organisation
Problem-solving process	Representing and formulating
Collaborative problem-solving skill	Describe roles and team organisation (communication protocol/rules of engagement)
Difficulty	537 (Level 2)
Credited response	"I'll take Geography."

10.   In this item, students must recognise the time limits presented in the scenario and assume responsibility for identifying the one remaining subject area that needs to be claimed based on the team's agreement in Part 1. While "Geography" is the only subject area that has not yet been claimed, making this a relatively easy task, the fact that the credited response does not sound collaborative makes this a harder Level 2 item. The credited response is correct because it confirms the remaining subject area and helps the team move forward. With the subject areas assigned, the team moves on to playing the game.

1.3. Part 3: Playing the Game Effectively

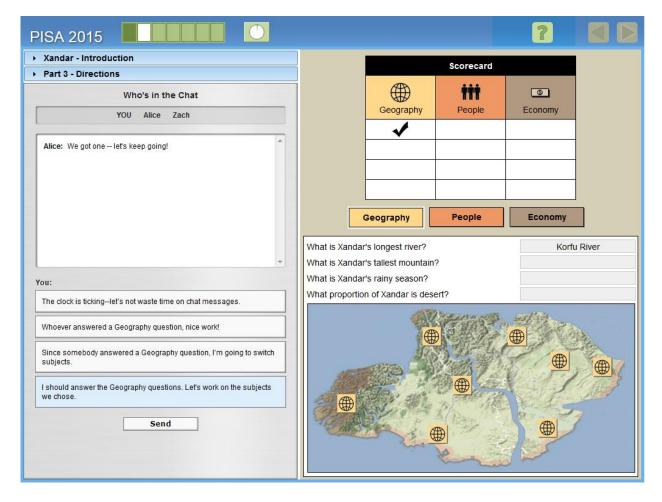### 1.3.1. Part 3, Item 1: Directions

Item	CC100301
Collaborative competency	Establishing and maintaining team organisation
Problem-solving process	Planning and executing
Collaborative problem-solving skill	Following rules of engagement (e.g., prompting other team members to perform their tasks)
Difficulty	357 (Level 1)
Credited action	Student clicks on the "Geography" button.

11.   This is the second item in this unit where an action in the problem space is required. The problem space includes a very simple display with only 3 possible buttons to click. This is an easy Level 1 item because students must simply act based on the agreed-upon role, respond to the directions on the screen, and click the correct button.

1.3.2. Part 3, Unit 2: Playing the Game

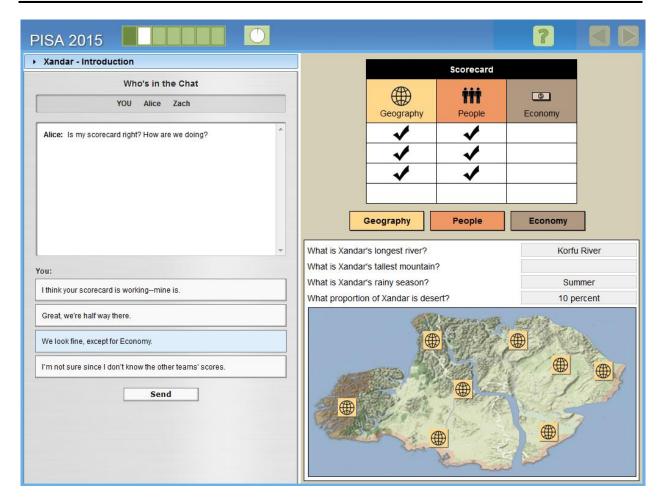| Item	CC100302
Collaborative competency	Establishing and maintaining shared understanding
Problem-solving process	Monitoring and reflecting
Collaborative problem-solving skill	Monitoring and repairing the shared understanding
Difficulty	992 (Level 4)
Credited response	"I should answer the Geography questions. Let's work on the subjects we chose."

12.   Before the student has a chance to try and answer a question in the Geography category, an answer to the first Geography question displays along with a checkmark on the scorecard in the Geography column. Alice comments that a question has been answered. This Level 4 item is one of the most difficult items in the CPS assessment because it requires students to track not only the chat but a change in status in the problem space. That is, students must notice that the event in the problem space violates the agreement that each team member would take one of the subjects. In addition, the credited response does not sound overtly collaborative, which makes this more difficult. The response is correct because it balances the problem solving demands and the team's assigned roles in the game.

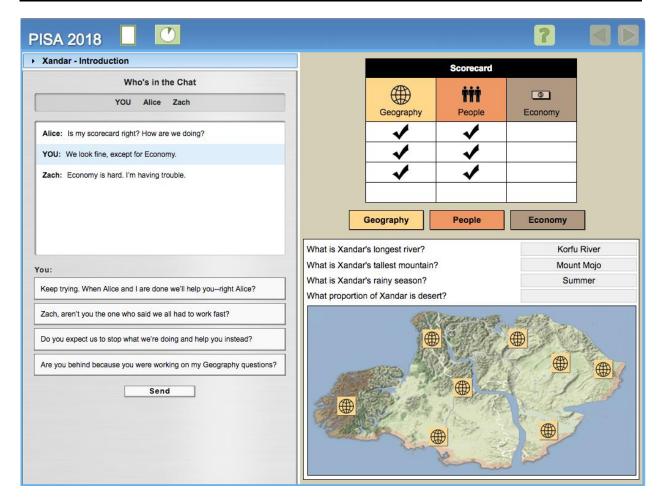## 1.4. Part 4: Assessing Progress

1.4.1. Part 4, Item 1: Introduction

Item	CC100401
Collaborative competency	Taking appropriate action to solve the problem
Problem-solving process	Monitoring and reflecting
Collaborative problem-solving skill	Monitoring the results of actions and evaluating success in solving the problem
Difficulty	730 (Level 4)
Credited response	"We look fine, except for Economy."

13.   This item requires that students respond to a question from one team member and also provide additional information about how team is progressing. The additional requirement to identify gaps that have not yet been filled makes this a more difficult Level 4 item. Students must use the information displayed in the problem space, along with an understanding of how the game works, to respond correctly. The credited response acknowledges that the team has made progress in some subjects, as shown on the scorecard, but that there are still no correct responses in the Economy subject area. Another response ("Great, we're half way there") is technically correct, but does not help the team identify the one area that has not yet been addressed.

1.4.2. Part 4, Item 2: Assessing Progress

Item	CC100402
Collaborative competency	Establishing and maintaining team organisation
Problem-solving process	Monitoring and reflecting
Collaborative problem-solving skill	Monitoring, providing feedback and adapting the team organisation and roles
Difficulty	593 (Level 3)
Credited response	"Keep trying. When Alice and I are done we'll help you – right Alice?"

14.　　The credited response presents a proposal that is most effective in working towards the problem solution as it allows "you" and Alice to first finish the assigned tasks while still assuring Zach that he will receive help if he needs it. This reflects the Level 3 skill of being able to orchestrate roles within a team and identify an approach to solve the presented problem.

2. COLLABORATIVE PROBLEM-SOLVING SKILLS

15.   Four individual problem-solving processes were identified. These were the same as those that were identified for the PISA 2012 assessment of individual problem solving:

- *exploring and understanding*: exploring the problem situation by observing it, interacting with it, searching for information and finding limitations or obstacles; and demonstrating understanding of the information given and the information discovered while interacting with the problem situation
- *representing and formulating*: using tables, graphs, symbols or words to represent aspects of the problem situation; and formulating hypotheses about the relevant factors in a problem and the relationships between them to build a coherent mental representation of the problem situation
- *planning and executing*: devising a plan or strategy to solve the problem; executing the strategy; and perhaps clarifying the overall goal and setting subgoals
- *monitoring and reflecting*: monitoring progress, reacting to feedback, and reflecting on the solution, the information provided with the problem, or the strategy adopted.

16.   Three collaborative problem-solving competencies were also identified. These are unique to PISA 2015:

- *establishing and maintaining shared understanding*: identifying the knowledge and perspectives that other group members hold and establishing a shared vision of the problem states and activities
- *taking appropriate action to solve the problem*: identifying the type of collaborative problem solving-related activities that are needed to solve the problem and carrying out these activities to achieve the solution
- *establishing and maintaining team organisation*: understanding one's own role and the roles of other agents, following the rules of engagement for one's role, monitoring group organisation, and facilitating the changes required to optimise performance or to handle a breakdown in communication or other obstacles to solving the problem.

17.   The three collaborative problem-solving competencies were crossed with the four individual problem-solving processes to form a matrix of twelve specific skills, as illustrated below. Each item within the collaborative problem-solving evaluation assessed one (or sometimes more than one) of these specific skills. The assessment as a whole was developed to measure all 12 specific skills over the various tasks.

		Collaborative problem-solving competencies		
		(1) Establishing and maintaining shared understanding	(2) Taking appropriate action to solve the problem	(3) Establishing and maintaining team organisation
Problem-solving processes	(A) Exploring and understanding	(A1) Discovering perspectives and abilities of team members	(A2) Discovering the type of collaborative interaction to solve the problem, along with goals	(A3) Understanding roles to solve the problem
	(B) Representing and formulating	(B1) Building a shared representation and negotiating the meaning of the problem (common ground)	(B2) Identifying and describing tasks to be completed	(B3) Describing roles and team organisation (communication protocol/rules of engagement)
	(C) Planning and executing	(C1) Communicating with team members about the actions to be/being performed	(C2) Enacting plans	(C3) Following rules of engagement (e.g. prompting other team members to perform their tasks)
	(D) Monitoring and reflecting	(D1) Monitoring and repairing the shared understanding	(D2) Monitoring results of actions and evaluating success in solving the problem	(D3) Monitoring, providing feedback and adapting the team organisation and roles

3. LEVELS OF PROFICIENCY IN COLLABORATIVE PROBLEM SOLVING

18. PISA 2015 provides one overall collaborative problem-solving proficiency scale, drawing on all the questions in the collaborative problem-solving assessment. The collaborative problem-solving scale was constructed to have a mean score of 500 among OECD countries, with about two-thirds of students across OECD countries scoring between 400 and 600. To help interpret what students' scores mean in substantive terms, the scale is divided into five proficiency levels. Four of these (Levels 1 to 4) are described based on the skills needed to successfully complete the items that are located within them; the last (below Level 1) is defined based on the absence of these skills.

19. Level 1 is the lowest described level and corresponds to an elementary level of collaborative problem-solving skills; Level 4 corresponds to the highest level of collaborative problem-solving skills. Students with a score within the range of Level 1 are expected to complete most Level 1 items successfully but are unlikely to be able to successfully complete items at higher levels. By contrast, students with scores in the Level 4 range are likely to be able to successfully complete any item included in the PISA assessment of collaborative problem solving.

20. The table below describes the skills that students at Levels 1 through 4 are expected to display, and provides the score intervals that demarcate each level.

Level	Score range	What students can typically do
4	Equal to or higher than 640 score points	At Level 4, students can successfully carry out complicated problem-solving tasks with high collaboration complexity. They can solve complex problems with multiple constraints, keeping relevant background information in mind. These students maintain an awareness of group dynamics and take actions to ensure that team members act in accordance with their agreed-upon roles. At the same time, they can monitor progress towards a solution and identify obstacles to overcome or gaps to be bridged. Level 4 students take initiative and perform actions or make requests to overcome obstacles and to resolve disagreements and conflicts. They can balance the collaboration and problem-solving aspects of a presented task, identify efficient pathways to a solution, and take actions to solve the given problem.
3	540 to less than 640 score points	At Level 3, students can complete tasks with either complex problem-solving requirements or complex collaboration demands. These students can perform multi-step tasks that require integrating multiple pieces of information, often in complex and dynamic problems. They orchestrate roles within the team and identify information needed by particular team members to solve the problem. Level 3 students can recognise the information needed to solve a problem, request it from the appropriate team member, and identify when the provided information is incorrect. When conflicts arise, they can help team members negotiate a solution.
2	440 to less than 540 score points	At Level 2, students can contribute to a collaborative effort to solve a problem of medium difficulty. They can help solve a problem by communicating with team members about the actions to be performed. They can volunteer information not specifically requested by another team member. Level 2 students understand that not all team members have the same information and can consider differing perspectives in their interactions. They can help the team establish a shared understanding of the steps required to solve a problem. These students can request additional information required to solve a problem and solicit agreement or confirmation from team members about the approach to be taken. Students near the top of Level 2 can take the initiative to suggest a logical next step, or propose a new approach, to solve a problem.
1	340 to less than 440 score points	At Level 1, students can complete tasks with low problem complexity and limited collaboration complexity. They can provide requested information and take actions to enact plans when prompted. Level 1 students can confirm actions or proposals made by others. They tend to focus on their individual role within the group. With support from team members, and when working on a simple problem, these students can help find a solution to the given problem.