

**PISA 2015 RELEASED FIELD TRIAL
COGNITIVE ITEMS**

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Produced by ETS (Core 3 Contractor)



PISA 2015 Contractors



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Scientific Literacy – Overview

Thirty-five new Science items from the 2015 Field Trial were approved by the Scientific Literacy Expert Group for release as sample items. The items are presented in this document in two groups:

- **Standard units**, which consist of static materials including text, graphics, tables, and graphs and associated questions.
- **Interactive units**, which include interactive stimulus materials and associated questions.

The question intent is provided for each released item, showing how the item was classified according to the construct categories in the 2015 Scientific Literacy draft framework. These categories include: **competencies**, **types of scientific knowledge**, **contexts**, and **cognitive demand**. Each was explained more fully in the draft framework, as shown below.

COMPETENCIES

The boxes below provide an elaborated description of the kinds of performance expected for a display of the three competencies required for scientific literacy. The descriptions, framed as actions, are intended to convey the idea that the scientifically literate person both understands and is capable of undertaking a basic set of practices which are essential for scientific literacy.

1. Explain Phenomena Scientifically
<p>Recognise, offer and evaluate explanations for a range of natural and technological phenomena demonstrating the ability to:</p> <ul style="list-style-type: none"> ▪ Recall and apply appropriate scientific knowledge; ▪ Identify, use, and generate explanatory models and representations; ▪ Make and justify appropriate predictions; ▪ Offer explanatory hypotheses; ▪ Explain the potential implications of scientific knowledge for society.

2. Evaluate and design scientific enquiry

Describe and appraise scientific enquiries and propose ways of addressing questions scientifically demonstrating the ability to:

- Identify the question explored in a given scientific study;
- Distinguish questions that are possible to investigate scientifically;
- Propose a way of exploring a given question scientifically;
- Evaluate ways of exploring a given question scientifically;
- Describe and evaluate a range of ways that scientists use to ensure the reliability of data and the objectivity and generalisability of explanations.

3. Interpret data and evidence scientifically

Analyse and evaluate scientific information, claims and arguments in a variety of representations and draw appropriate conclusions by demonstrating the ability to:

- Transform data from one representation to another;
- Analyse and interpret data and draw appropriate conclusions;
- Identify the assumptions, evidence and reasoning in science-related texts;
- Distinguish between arguments which are based on scientific evidence and theory and those based on other considerations;
- Evaluate scientific arguments and evidence from different sources (e.g., newspaper, Internet, journals).

TYPES OF SCIENTIFIC KNOWLEDGE

The ability of students to demonstrate these competencies is dependent on three types of scientific knowledge. These are defined as:

- **Content knowledge**, knowledge of the content of science (including physical systems, living systems, and earth and space science),
- **Procedural knowledge**, knowledge of the diversity of methods and practices that are used to establish scientific knowledge as well as its standard procedures, and
- **Epistemic knowledge**, knowledge of how our beliefs in science are justified as a result of understanding the functions of scientific practices, their justifications, and the meaning of terms such as theory, hypothesis, and observation

CONTEXTS

The PISA 2015 assessment requires evidence of these competencies and knowledge in a range of contexts including:

- health,
- natural resources,
- the environment,
- hazards, and
- the frontiers of science and technology

in

- personal,
- local/national, and
- global settings.

COGNITIVE DEMAND

A key new feature of the 2015 PISA framework is the definition of levels of cognitive demand within the assessment of scientific literacy and across all three competences of the framework. The difficulty of any item is a combination both of the degree of complexity and range of knowledge it requires and the cognitive operations that are required to process the item. The levels defined for this assessment include:

- **Low**
Carry out a one-step procedure, for example recall of a fact, term, principle or concept or locate a single point of information from a graph or table.
- **Medium**
Use and apply conceptual knowledge to describe or explain phenomena, select appropriate procedures involving two or more steps, organise/display data, interpret or use simple data sets or graphs.
- **High**
Analyse complex information or data, synthesise or evaluate evidence, justify, reason given various sources, develop a plan or sequence of steps to approach a problem.

Unit CS600 Bee Colony Collapse Disorder
Unit Overview

This released unit deals with the phenomenon known as bee colony collapse disorder. The stimulus materials include a short text introducing the phenomenon and a graph showing results of a study investigating the relationship between the insecticide imidacloprid and bee colony collapse disorder.

Unit CS600 Bee Colony Collapse Disorder
Released Item #1

PISA 2015

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Bee Colony Collapse Disorder

Question 1 / 5


Refer to "Bee Colony Collapse Disorder" on the right. Type your answer to the question.

Understanding colony collapse disorder is important for people who keep and study bees, but colony collapse disorder also has an effect beyond the bees. People who study birds have identified an impact. The sunflower is a food source for both bees and certain birds. Bees feed on the nectar of the sunflower, while the birds feed on the seeds.

Given this relationship, why might the disappearance of bees result in a decline in the bird population?

BEE COLONY COLLAPSE DISORDER

An alarming phenomenon is threatening bee colonies around the world. This phenomenon is called colony collapse disorder. Colony collapse occurs when bees abandon the beehive. Separated from the hive, the bees die, so colony collapse disorder has caused the death of tens of billions of bees. Researchers believe that there are a number of causes for colony collapse.



To correctly answer this question, students must provide an explanation that states or implies that a flower cannot produce seeds without pollination. The competency for this item is ‘Explain Phenomena Scientifically,’ as students are asked to recall appropriate scientific knowledge.

<i>Item Number</i>	CS600Q01
<i>Competency</i>	Explain Phenomena Scientifically
<i>Knowledge – System</i>	Content – Living
<i>Context</i>	Local/National – Environmental Quality
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Open Response – Human Coded

**Unit CS600 Bee Colony Collapse Disorder
Released Item #2**

PISA 2015

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Bee Colony Collapse Disorder
Question 2 / 5

Refer to "Exposure to Imidacloprid" on the right. Select from the drop-down menus to complete the sentence.

Describe the researchers' experiment by completing the following sentence.

The researchers tested the effect of

on

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BEE COLONY COLLAPSE DISORDER Exposure to Imidacloprid

Scientists believe that there are multiple causes for colony collapse disorder. One possible cause is the insecticide imidacloprid, which may cause bees to lose their sense of orientation when outside the hive.

Researchers tested whether exposure to imidacloprid leads to colony collapse. In a number of hives, they added the insecticide to the bees' food for three weeks. Different hives were exposed to different concentrations of the insecticide, measured in micrograms of insecticide per kilogram of food ($\mu\text{g}/\text{kg}$). Some hives were not exposed to any insecticide.

None of the colonies collapsed immediately after exposure to the insecticide. However, by week 14, some of the hives had been abandoned. The following graph records the observed results:

Weeks After Exposure	0 $\mu\text{g}/\text{kg}$	20 $\mu\text{g}/\text{kg}$	400 $\mu\text{g}/\text{kg}$
10	0%	0%	0%
12	0%	0%	0%
14	0%	25%	50%
16	0%	25%	50%
18	0%	25%	100%
20	25%	75%	100%
22	25%	100%	100%

Students are asked to select from among three options in each drop-down menu to demonstrate their understanding of the question being explored in the researchers' experiment. Those options include:

- collapse of bee colonies
- concentration of imidacloprid in food
- bee immunity to imidacloprid

The response that the researchers tested the effect of *concentration of imidacloprid in food* on *collapse of bee colonies* correctly identifies the independent and dependent variables in the experiment.

<i>Item Number</i>	CS600Q02
<i>Competency</i>	Evaluate and Design Scientific Enquiry
<i>Knowledge – System</i>	Procedural
<i>Context</i>	Local/National – Environmental Quality
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Complex Multiple Choice – Computer Scored

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**Unit CS600 Bee Colony Collapse Disorder
Released Item #3**

PISA 2015

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Bee Colony Collapse Disorder
Question 3 / 5

Refer to "Exposure to Imidacloprid" on the right. Click on a choice to answer the question.

Which one of the following conclusions matches the results shown in the graph?

- Colonies exposed to a higher concentration of imidacloprid tend to collapse sooner.
- Colonies exposed to imidacloprid collapse within 10 weeks of exposure.
- Exposure to imidacloprid at concentrations below 20 µg/kg does not harm colonies.
- Colonies exposed to imidacloprid cannot survive for more than 14 weeks.

BEE COLONY COLLAPSE DISORDER
Exposure to Imidacloprid

Scientists believe that there are multiple causes for colony collapse disorder. One possible cause is the insecticide imidacloprid, which may cause bees to lose their sense of orientation when outside the hive.

Researchers tested whether exposure to imidacloprid leads to colony collapse. In a number of hives, they added the insecticide to the bees' food for three weeks. Different hives were exposed to different concentrations of the insecticide, measured in micrograms of insecticide per kilogram of food (µg/kg). Some hives were not exposed to any insecticide.

None of the colonies collapsed immediately after exposure to the insecticide. However, by week 14, some of the hives had been abandoned. The following graph records the observed results:

Weeks After Exposure	0 µg/kg	20 µg/kg	400 µg/kg
10	0%	0%	0%
12	0%	0%	0%
14	0%	25%	50%
16	0%	25%	50%
18	0%	25%	100%
20	25%	75%	100%
22	25%	100%	100%

This question requires interpretation of a graph that presents data related to the relationship between concentrations of the insecticide and the rate of colony collapse over time.

The correct response is the first option (*Colonies exposed to a higher concentration of imidacloprid tend to collapse sooner*) as the graph shows that the percentage of colonies that collapsed is higher when the hives were exposed to a concentration of 400 µg/kg of the insecticide as compared with 20 µg/kg during weeks 14-20 of the experiment.

<i>Item Number</i>	CS600Q03
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Procedural
<i>Context</i>	Local/National – Environmental Quality
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Simple Multiple Choice – Computer Scored

**Unit CS600 Bee Colony Collapse Disorder
Released Item #4**

PISA 2015

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Bee Colony Collapse Disorder
Question 4 / 5

Refer to "Exposure to Imidacloprid" on the right. Type your answer to the question.

Look at the result in week 20 for the hives that the researchers did not expose to imidacloprid (0 µg/kg). What does it indicate about causes of collapse among the studied colonies?

BEE COLONY COLLAPSE DISORDER Exposure to Imidacloprid

Scientists believe that there are multiple causes for colony collapse disorder. One possible cause is the insecticide imidacloprid, which may cause bees to lose their sense of orientation when outside the hive.

Researchers tested whether exposure to imidacloprid leads to colony collapse. In a number of hives, they added the insecticide to the bees' food for three weeks. Different hives were exposed to different concentrations of the insecticide, measured in micrograms of insecticide per kilogram of food (µg/kg). Some hives were not exposed to any insecticide.

None of the colonies collapsed immediately after exposure to the insecticide. However, by week 14, some of the hives had been abandoned. The following graph records the observed results:

Weeks After Exposure	0 µg/kg	20 µg/kg	400 µg/kg
10	0%	0%	0%
12	0%	0%	0%
14	0%	25%	50%
16	0%	25%	50%
18	0%	25%	100%
20	25%	75%	100%
22	25%	100%	100%

Students must provide a hypothesis for the collapses among the control colonies. A correct response indicates either that there must be another natural cause of colony collapse for the studied colonies or that the hives in the control group were not properly protected from exposure.

<i>Item Number</i>	CS600Q04
<i>Competency</i>	Explain Phenomena Scientifically
<i>Knowledge – System</i>	Content – Living
<i>Context</i>	Local/National – Environmental Quality
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Open Response – Human Coded

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Unit CS600 *Bee Colony Collapse Disorder*
Released Item #5

PISA 2015

Bee Colony Collapse Disorder
Question 5 / 5

Click on a choice to answer the question

Scientists have proposed two additional causes for colony collapse disorder:

- A virus that infects and kills the bees.
- A parasitic fly that lays its eggs in the abdomen of the bees.

Which of the following findings supports the claim that bees die because of a virus?

Eggs of another organism were found in hives.

Insecticides were found inside the bees' cells.

Non-bee DNA was found inside the bees' cells.

Dead bees were found in hives.

Students must use appropriate scientific content knowledge about the viral infections to explain the phenomenon described in this item. The correct response is the third option: *Non-bee DNA was found inside the bees' cells.*

<i>Item Number</i>	CS600Q05
<i>Competency</i>	Explain Phenomena Scientifically
<i>Knowledge – System</i>	Content – Living
<i>Context</i>	Local/National – Environmental Quality
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Simple Multiple Choice – Computer Scored

Unit CS613 Fossil Fuels**Unit Overview**

This released unit explores the relationship between the burning of fossil fuels and CO₂ levels in the atmosphere. The stimulus material includes a diagram illustrating how carbon cycles in the environment and a short text describing strategies for reducing the amount of CO₂ released into the atmosphere, a table comparing the characteristics of ethanol and petroleum when used as fuel, and a graph illustrating the results of a mathematical model that calculates carbon capture and storage at three different ocean depths.

Unit CS613 Fossil Fuels**Released Item #1**

PISA 2015

Fossil Fuels
Question 1 / 4

Refer to "Fossil Fuels" on the right. Click on a choice to answer the question.

Using biofuels does not have the same effect on atmospheric levels of CO₂ as using fossil fuels. Which of the statements below best explains why?

- Biofuels do not release CO₂ when they burn.
- Plants used for biofuels absorb CO₂ from the atmosphere as they grow.
- As they burn, biofuels take in CO₂ from the atmosphere.
- The CO₂ released by power plants using biofuels has different chemical properties than that released by power plants using fossil fuels.

FOSSIL FUELS

Many power plants burn carbon-based fuel and emit carbon dioxide (CO₂). CO₂ released into the atmosphere has a negative impact on global climate. Engineers have used different strategies to reduce the amount of CO₂ released into the atmosphere.

One such strategy is to burn biofuels instead of fossil fuels. While fossil fuels come from long-dead organisms, biofuel comes from plants that lived and died recently.

Another strategy involves trapping a portion of the CO₂ emitted by power plants and storing it deep underground or in the ocean. This strategy is called carbon capture and storage.

The diagram shows the carbon cycle for biofuels and fossil fuels. On the left, a cornfield is labeled 'Biofuel'. An arrow labeled 'CO₂ Used During Photosynthesis' points from the atmosphere to the plants. On the right, a power plant is labeled 'Power Plant CO₂ Emissions'. An arrow labeled 'Released to Atmosphere' points from the power plant to the sky. Below the power plant, an arrow labeled 'Stored in Ocean' points to the ocean. On the bottom left, an oil pumpjack is labeled 'Fossil Fuel'. An arrow labeled 'Power Plant Fuels' points from the fossil fuel to the power plant.

Students must use appropriate scientific content knowledge to explain why the use of plant-based biofuels does not affect atmospheric levels of CO₂ in the same manner as burning fossil fuels. The second option is the correct response: *Plants used for biofuels absorb CO₂ from the atmosphere as they grow.*

<i>Item Number</i>	CS613Q01
<i>Competency</i>	Explain Phenomena Scientifically
<i>Knowledge – System</i>	Content – Physical
<i>Context</i>	Global – Natural Resources
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Simple Multiple Choice – Computer Scored

Unit CS613 Fossil Fuels
Released Item #2

PISA 2015

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Fossil Fuels
Question 2 / 4

Refer to "Fossil Fuels" on the right. Type your answers to the questions.

Despite the advantages of biofuels for the environment, fossil fuels are still widely used. The following table compares the energy and CO₂ released when petroleum and ethanol are burned. Petroleum is a fossil fuel, while ethanol is a biofuel.

Fuel Source	Energy Released (kJ of energy/g of fuel)	Carbon Dioxide Released (mg of CO ₂ /kJ of energy produced by the fuel)
Petroleum	43.6	78
Ethanol	27.3	59

According to the table, why might someone prefer using petroleum instead of ethanol, even if their cost is the same?

According to the table, what is an environmental advantage of using ethanol instead of petroleum?

FOSSIL FUELS

Many power plants burn carbon-based fuel and emit carbon dioxide (CO₂). CO₂ released into the atmosphere has a negative impact on global climate. Engineers have used different strategies to reduce the amount of CO₂ released into the atmosphere.

One such strategy is to burn biofuels instead of fossil fuels. While fossil fuels come from long-dead organisms, biofuel comes from plants that lived and died recently.

Another strategy involves trapping a portion of the CO₂ emitted by power plants and storing it deep underground or in the ocean. This strategy is called carbon capture and storage.

The diagram illustrates the carbon cycle. On the left, a cornfield represents 'Biofuel'. A blue arrow labeled 'CO₂ Used During Photosynthesis' points from the 'Released to Atmosphere' area to the cornfield. On the right, a power plant is shown. A blue arrow labeled 'Power Plant CO₂ Emissions' points from the power plant to the 'Released to Atmosphere' area. Another blue arrow labeled 'Power Plant CO₂ Emissions' points from the power plant to the 'Stored in Ocean' area. At the bottom left, an oil pumpjack represents 'Fossil Fuel'. A green arrow labeled 'Power Plant Fuels' points from the fossil fuel source to the power plant.

The item asks students to analyse data presented in a table to compare ethanol and petroleum as fuel sources. Students should determine that people might prefer using petroleum over ethanol because it releases more energy for the same cost and that ethanol has an environmental advantage over petroleum because it releases less carbon dioxide.

<i>Item Number</i>	CS613Q02
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Procedural
<i>Context</i>	Local/National – Natural Resources
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Open Response – Human Coded

Unit CS613 Fossil Fuels
Released Item #3¹

PISA 2015

Fossil Fuels

Question 3 / 4

Refer to "Carbon Capture and Storage" on the right. Type your answer to the question.

Use the data in the graph to explain how depth affects the long-term effectiveness of storing CO₂ in the ocean.

FOSSIL FUELS

Carbon Capture and Storage

Carbon capture and storage involve trapping a portion of the CO₂ emitted by power plants and storing it where it cannot be released back into the atmosphere. One possible place to store the CO₂ is in the ocean, because the CO₂ dissolves in the water.

Scientists have developed a mathematical model to calculate the percentage of CO₂ that continues to remain stored after CO₂ is pumped into the ocean at three different depths (800 metres, 1 500 metres, and 3 000 metres). The model assumes that the CO₂ is pumped into the ocean in the year 2000. The graph below shows the results of this model.

Year	800 m depth (%)	1 500 m depth (%)	3 000 m depth (%)
2000	100	100	100
2050	75	95	98
2100	55	85	95
2150	40	75	90
2200	30	65	85
2250	25	55	80
2300	22	48	75
2350	20	42	70
2400	18	38	65
2450	16	35	62
2500	15	30	60

Students must interpret data presented in a graph to provide an explanation that summarises the overall finding that storing carbon dioxide deeper in the ocean leads to better retention rates over time than storing it at shallower depths.

<i>Item Number</i>	CS613Q03
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Procedural
<i>Context</i>	Global – Natural Resources
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Open Response – Human Coded

¹ Note that the fourth item in this unit, CS613Q04, is not included among the released items.

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Unit CS644 Volcanic Eruptions
Unit Overview

This released unit focuses on the distribution pattern of volcanoes and the impact of volcanic eruptions on climate and the atmosphere. Stimulus materials include a map showing the location of volcanoes and earthquakes around the globe and graphs illustrating the impact that volcanic eruptions have on the amount of solar radiation that reaches Earth’s surface and on carbon dioxide concentrations in the atmosphere.

Unit 644 Volcanic Eruptions
Released Item #1

PISA 2015

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Volcanic Eruptions

Question 1 / 4


Refer to "Volcanic Eruptions" on the right. Click on a choice to answer the question.

Select the location on the map below that is **least** likely to experience volcanic activity or earthquakes.




VOLCANIC ERUPTIONS

Volcanic eruptions and earthquakes affect people in many parts of the world. Map 1 shows the location of volcanoes. Map 2 shows the location of earthquakes. A region called the Ring of Fire is shown on both maps.



Map 1 - Volcanoes



Map 2 - Earthquakes

Students must interpret data presented on a map to identify the location least likely to experience volcanic activity or earthquakes. The correct response is map location *D*, over northern Europe.

<i>Item Number</i>	CS644Q01
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Procedural
<i>Context</i>	Global – Hazards
<i>Cognitive Demand</i>	Low
<i>Item Format</i>	Simple Multiple Choice – Computer Scored

Unit 644 Volcanic Eruptions
Released Item #2²

PISA 2015

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Volcanic Eruptions
Question 3 / 4

Refer to "Effects on Solar Radiation" on the right. Type your answer to the question.

Why does the percentage of solar radiation that reaches Earth's surface change after volcanic eruptions?

VOLCANIC ERUPTIONS
Effects on Solar Radiation

When volcanoes erupt, they emit volcanic ash and sulphur dioxide into the atmosphere. The graph below shows the effect that these emissions have on the amount of solar radiation that reaches Earth's surface.

Solar Radiation Reaching Earth's Surface Over Time

Year	Percentage of Solar Radiation Reaching Earth's Surface (%)
1960	93
1970	93
1980	93
1982	78
1985	93
1990	93
1991	82
1992	85
1995	93
2000	93

Students must correctly interpret the graphed data as showing that the percentage of solar radiation reaching Earth's surface is reduced during major volcanic eruptions, and provide an explanation indicating or implying that volcanic emissions reflect or absorb solar radiation.

<i>Item Number</i>	CS644Q03
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Content – Earth and Space
<i>Context</i>	Global – Hazards
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Open Response – Human Coded

² Note that the second item in this unit, CS644Q02, is not included among the released items.

Unit 644 Volcanic Eruptions
Released Item #3

PISA 2015

Volcanic Eruptions
 Question 4 / 4

Refer to "Atmospheric Carbon Dioxide" on the right. Click on a choice to answer the question.

Based on the information provided, what effect do volcanic eruptions have on the concentration of carbon dioxide in the atmosphere?

- A major effect, because there have been many eruptions.
- A major effect, because each eruption ejects large amounts of material.
- A minor effect, because volcanoes release little CO₂ compared to other sources.
- A minor effect, because CO₂ levels in the atmosphere decrease during eruptions.

VOLCANIC ERUPTIONS
Atmospheric Carbon Dioxide

Volcanoes emit carbon dioxide (CO₂) during eruptions. The graph below shows atmospheric carbon dioxide concentrations that scientists have measured since 1960.

CO₂ in the Atmosphere Over Time

The table below shows the relative contribution of different sources to the carbon dioxide in the atmosphere.

Source	Contribution to CO ₂ in the Atmosphere
Volcanic emissions	< 1%
Human-caused emissions	20%
Plant respiration	40%
Microbial respiration and decomposition	40%

Students must interpret the provided data as supporting the third response which says that volcanoes have a minor effect on the concentration of carbon dioxide in the atmosphere because they release little CO₂ compared to other sources.

<i>Item Number</i>	CS644Q04
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Procedural
<i>Context</i>	Global – Hazards
<i>Cognitive Demand</i>	Low
<i>Item Format</i>	Simple Multiple Choice – Computer Scored

Unit 655 Groundwater Extraction and Earthquakes

Unit Overview

This unit focuses on natural and human processes that may lead to earthquakes. The stimulus materials include a text and graphic illustrating the relationship of faults to earthquakes, a map showing levels of stress in one region of Earth, and a short text about an earthquake believed to have been caused by groundwater extraction.

Unit 655 Groundwater Extraction and Earthquakes

Released Item #1

PISA 2015

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Groundwater Extraction and Earthquakes

Question 1 / 4

Refer to "Groundwater Extraction and Earthquakes" on the right. Type your answer to the question.

Stress builds up naturally at faults. Why does this happen?

GROUNDWATER EXTRACTION AND EARTHQUAKES

The rocky crust is the uppermost layer of Earth. The crust is broken up into tectonic plates that ride on a layer of rock that is partially melted. The plates contain breaks called faults. Earthquakes happen when stress accumulated along the fault is released, causing parts of the crust to shift. An example of a shift along a fault is shown below.

Using the description and representation of faults provided in the stimulus, students must provide an explanation that indicates or implies that the movement of tectonic plates leads to the build-up of stress and/or that rock or land moving in different directions is stopped by friction at a fault.

<i>Item Number</i>	CS655Q01
<i>Competency</i>	Explain Phenomena Scientifically
<i>Knowledge – System</i>	Content – Earth and Space
<i>Context</i>	Local/National – Hazards
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Open Response – Human Coded

Unit 655 Groundwater Extraction and Earthquakes
Released Item #2

PISA 2015

Groundwater Extraction and Earthquakes
 Question 2 / 4

Refer to "Stress in Earth's Crust" on the right. Use drag and drop to answer the question.

The map on the right shows the levels of stress in Earth's crust in a region. Four locations within the region are identified as A, B, C, and D. Each location is on or near a fault that runs through the region.

Put the locations in order from lowest risk to highest risk of earthquake.

A B C D

Highest risk:

Lowest risk:

GROUNDWATER EXTRACTION AND EARTHQUAKES
Stress in Earth's Crust

Levels of Stress in Earth's Crust

Students must apply their understanding of the relationship between stress in Earth’s crust and earthquakes to predict the risk of earthquakes in four specific locations that are near faults. The location with the highest risk is the one labelled “D” on the diagram, followed by “B”, “C” and finally “A”, which has the lowest risk because it has the lowest level of stress.

<i>Item Number</i>	CS655Q02
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Procedural
<i>Context</i>	Local/National – Hazards
<i>Cognitive Demand</i>	Low
<i>Item Format</i>	Complex Multiple Choice – Computer Scored

Unit 655 Groundwater Extraction and Earthquakes
Released Item #3

The screenshot shows a digital assessment interface for PISA 2015. At the top left, it says 'PISA 2015' with a progress indicator. The main content area is divided into two panels. The left panel is titled 'Groundwater Extraction and Earthquakes' and 'Question 3 / 4'. It contains the instruction: 'Refer to "The 2011 Earthquake In Lorca" on the right. Click on a choice to answer the question.' Below this is the question: 'Which observation supports the geologists' hypothesis?' followed by four radio button options. The right panel is titled 'GROUNDWATER EXTRACTION AND EARTHQUAKES' and 'The 2011 Earthquake In Lorca'. It contains a paragraph of text describing the earthquake in Lorca, Spain, and the geologists' hypothesis that groundwater extraction contributed to the stress on a nearby fault.

Students must identify the one observation that supports the hypothesis presented in the stimulus that groundwater extraction triggered an earthquake by contributing to stress on a nearby fault. The second option (*Movement along the fault was greatest in areas where the pumping created the greatest stress*) is the correct response as it supports an association between the water extraction and the earthquake.

<i>Item Number</i>	CS655Q03
<i>Competency</i>	Explain Phenomena Scientifically
<i>Knowledge – System</i>	Content – Earth and Space
<i>Context</i>	Local/National – Hazards
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Simple Multiple Choice – Computer Scored

Unit 655 Groundwater Extraction and Earthquakes
Released Item #4

The screenshot shows a digital assessment interface for PISA 2015. At the top, it says 'PISA 2015' and has navigation icons. The main content area is titled 'GROUNDWATER EXTRACTION AND EARTHQUAKES' and 'The 2011 Earthquake In Lorca'. On the left, there is a question box with the text: 'Refer to "The 2011 Earthquake In Lorca" on the right. Click on one or more boxes to answer the question.' Below this, a paragraph describes a student's concern about earthquakes in his town due to groundwater extraction. A note says 'Remember to select one or more boxes.' There are four multiple-choice options, each with an unchecked checkbox:

- Does the crust in the region contain faults?
- Is the crust in the region subject to stress from natural causes?
- Is water pumped from the ground in the region polluted?
- What are the average daily temperatures in the region?

On the right, the text reads: 'Lorca, Spain, is located in a region that experiences earthquakes relatively often. One earthquake occurred in Lorca in May 2011. Geologists believe that unlike previous earthquakes in the region, this earthquake may have been caused in part by human activity, specifically by the pumping of groundwater. According to the geologists' hypothesis, extracting water from underground contributed to stress on a nearby fault, which triggered a shift that resulted in the earthquake.'

In this item, students must use their understanding of earthquakes and the provided information about the earthquake in Lorca to identify the question or questions most likely to provide information about the risk of earthquakes in a particular region. Both the first and second questions would provide that information: *Does the crust in the region contain faults?* and *Is the crust in the region subject to stress from natural causes?*

<i>Item Number</i>	CS655Q04
<i>Competency</i>	Explain Phenomena Scientifically
<i>Knowledge – System</i>	Content – Earth and Space
<i>Context</i>	Local/National – Hazards
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Complex Multiple Choice – Computer Scored

Unit 639 Blue Power Plant Unit Overview

This released unit focuses on a power plant that uses the differences in the salt concentration between salt water and fresh water to generate electricity. The stimulus includes text describing this process and an animation showing the movement of water through the plant and the movement of water molecules across a semipermeable membrane.

PISA 2015


Blue Power Plant

Introduction

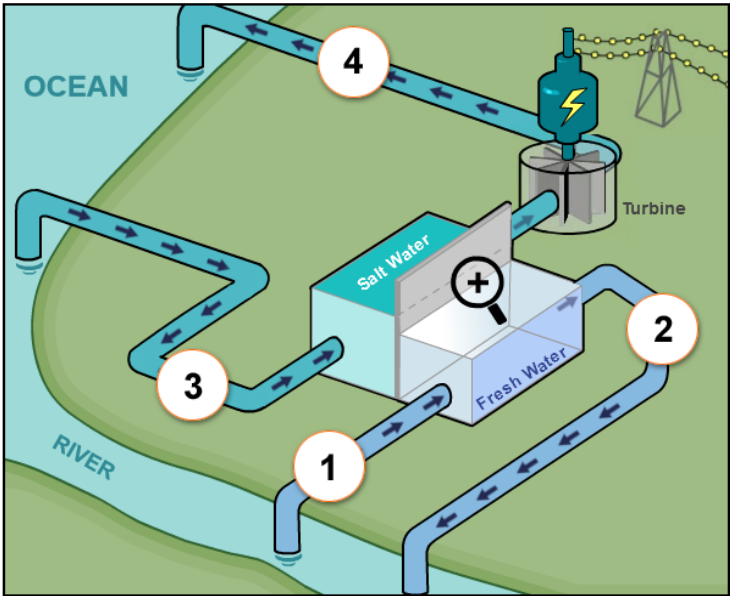
Read the introduction. Then click on the NEXT arrow.

This animation shows a new kind of power plant that is located where a freshwater river and water from the ocean meet. The power plant uses the differences in the salt concentrations in the two bodies of water to produce electricity. In the power plant, fresh water from the river is pumped through a pipe into one container. Salt water from the ocean is pumped into another container. The two containers are separated by a membrane that allows only water molecules to move through it.

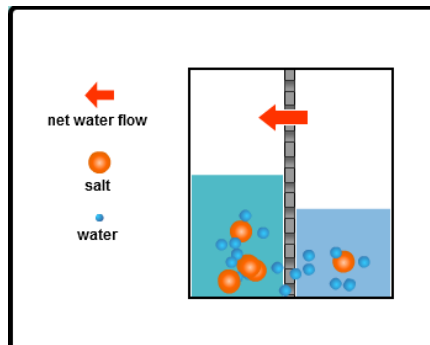
Water molecules naturally move through the membrane from the container of low salt concentration to the container of high salt concentration. This increases the volume and pressure of the water in the container of salt water.

Click on the magnifying glass  to observe this movement of water molecules.

The high pressure water in the salt water container then flows through a pipe, moving a turbine to generate electricity.



View with the magnifying glass:



Unit 639 Blue Power Plant
Released Item #1

PISA 2015

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Blue Power Plant
Question 1 / 4

Refer to "Blue Power Plant" on the right. Click on one or more boxes to answer the question.

Four locations in the power plant have been numbered. Water is pumped from the river to location 1, marked on the screen.

✓ Remember to select **one or more** boxes.

In which locations could water molecules that come from the river be found later in the process?

Location 2

Location 3

Location 4

Blue Power Plant

The diagram shows a power plant situated between an OCEAN and a RIVER. A pipe labeled '1' draws water from the RIVER. This water goes to a desalination unit that separates 'Salt Water' from 'Fresh Water'. The 'Fresh Water' is collected in a tank labeled '2'. The 'Salt Water' is pumped to a turbine labeled '3'. The turbine is connected to a generator labeled '4' which produces electricity. The turbine also pumps water back to the OCEAN.

Students must apply their understanding of how water moves through the power plant presented in the diagram to identify *Location 2* and *Location 4* as containing water molecules from the river.

<i>Item Number</i>	CS639Q01
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Content – Physical
<i>Context</i>	Local/National – Frontiers
<i>Cognitive Demand</i>	Low
<i>Item Format</i>	Complex Multiple Choice – Computer Scored

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Unit 639 Blue Power Plant
Released Item #2

PISA 2015

Blue Power Plant
 Question 2 / 4

Click on the magnifying glass to see what happens to the water molecules and dissolved salt in the containers. Select from the drop-down menus to complete the sentence.

River water has a low concentration of salt. As the molecules move through the membrane, the salt concentration in the container of fresh water

Select and the salt concentration in the container of salt water .

Blue Power Plant

The diagram shows a 'Blue Power Plant' situated between a 'RIVER' and an 'OCEAN'. A pipe labeled '1' draws water from the river into a container labeled 'Salt Water'. A membrane separates this container from another labeled 'Fresh Water'. A pipe labeled '2' draws water from the 'Fresh Water' container to a 'Turbine'. A pipe labeled '3' returns water from the 'Salt Water' container to the river. A pipe labeled '4' draws water from the ocean to the turbine. A magnifying glass is positioned over the membrane. A legend in the bottom right shows 'net water flow' with a red arrow pointing left, 'salt' with an orange circle, and 'water' with a blue circle.

Students are asked to use the animation to determine the effect the movement of water across the membrane on the salt concentration of the fresh water and the salt water. The correct response is: As the molecules move through the membrane, the salt concentration in the container of fresh water *increases* and the salt concentration in the container of salt water *decreases*.

<i>Item Number</i>	CS639Q02
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Procedural
<i>Context</i>	Global – Frontiers
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Complex Multiple Choice – Computer Scored

Unit 639 Blue Power Plant
Released Item #3

PISA 2015
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Blue Power Plant
 Question 3 / 4

Refer to "Blue Power Plant" on the right. Select from the drop-down menus to answer the question.

Several energy conversions occur within the power plant. What kind of energy conversion occurs in the turbine and generator?

The turbine and generator convert
 to

The diagram, titled "Blue Power Plant", illustrates a process involving water from a river and the ocean. A river flows into a desalination plant (labeled "Salt Water" and "Fresh Water") at point 1. Water then moves to point 2, then to a turbine and generator at point 3, and finally to point 4 where it returns to the ocean. A magnifying glass is positioned over the desalination plant. The turbine and generator are connected to a power line tower.

Each drop-down menu in this item lists four types of energy: gravitational, potential, kinetic and electrical. Students must correctly interpret the animated diagram and specify that the turbine and generator convert *kinetic* to *electrical* energy.

<i>Item Number</i>	CS639Q04
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Content – Physical
<i>Context</i>	Local/National – Frontiers
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Complex Multiple Choice – Computer Scored

Unit 639 Blue Power Plant
Released Item #4

PISA 2015
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Blue Power Plant
 Question 4 / 4

Refer to "Blue Power Plant" on the right. Type your answer to the question.

Many electric power plants use fossil fuels, such as oil and coal, as their energy source.

Why is this new power plant considered to be more environmentally friendly than power plants that use fossil fuels?

Blue Power Plant

Students must provide an explanation that identifies a way in which plants that burn fossil fuel are more harmful to the environment than the new power plant illustrated in this unit, or identify a feature of the new power plant that makes it more environmentally friendly.

<i>Item Number</i>	CS639Q05
<i>Competency</i>	Explain Phenomena Scientifically
<i>Knowledge – System</i>	Content – Physical
<i>Context</i>	Global – Frontiers
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Open Response – Human Coded

Unit 621 Adjustable Glasses**Unit Overview**

This released unit describes an innovative type of eyeglasses that use fluid to adjust the shape of the lenses. The interactive portion of the unit first allows students to investigate the effect of adjusting the amount of fluid in the lens on the shape of the lens. Students are then able to investigate the effect of the lens adjustments on the vision of three different people: one with normal vision, one with farsighted vision, and one with nearsighted vision.


PISA 2015

Adjustable Glasses
Introduction






Read the introduction. Then click on the NEXT arrow.

ADJUSTABLE GLASSES

A new technology, called **adjustable glasses**, has been developed to help people without access to eye doctors to correct their vision. The lenses of these glasses contain a fluid. The shape of the lens changes as the amount of fluid in the lens is adjusted.



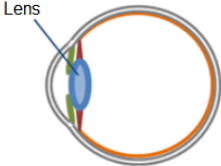
Unit 621 Adjustable Glasses
Released Item #1

PISA 2015     

Adjustable Glasses
 Question 1 / 5

Click on a choice to answer the question.

The idea of adjustable lenses is not new. The human eye also has a lens that is adjustable.



The shape of the eye's lens is adjusted by muscle action. Why is it important for the eye's lens to change shape?

- To facilitate seeing objects that have different brightnesses
- To facilitate seeing objects that have different colours
- To facilitate seeing objects that are at different distances
- To facilitate seeing objects that have different sizes

Students must use content knowledge to correctly identify the third option, that the eye's lens must change shape to *facilitate seeing objects at different distances*.

<i>Item Number</i>	CS621Q01
<i>Competency</i>	Explain Phenomena Scientifically
<i>Knowledge – System</i>	Content – Living
<i>Context</i>	Personal – Health and Disease
<i>Cognitive Demand</i>	Low
<i>Item Format</i>	Simple Multiple Choice – Computer Scored

Unit 621 Adjustable Glasses
Released Item #2

PISA 2015

Adjustable Glasses
 Question 2 / 5

Use the slider to change the amount of fluid in the lens.
 Select from the drop-down menus to answer the question.

How does adding fluid affect the shape of the glasses' lens?

When fluid is added to a flat lens, the sides of the lens curve
 select because the net force exerted by the fluid
 on the lens sides is select .

A side view of a pair of adjustable glasses is shown below. The initial shape of the lens is flat.

The options in the drop-down menus are outward and inward for the first menu and more and less for the second. Using the simulated adjustable glasses, students are asked to determine that when fluid is added to a flat lens, the sides of the lens curve *outward* and then interpret the simulation to specify that this is because the net force exerted by the fluid on the lens is *more*.

<i>Item Number</i>	CS621Q02
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Content – Physical
<i>Context</i>	Personal – Frontiers
<i>Cognitive Demand</i>	Low
<i>Item Format</i>	Complex Multiple Choice – Computer Scored

Unit 621 *Adjustable Glasses*

Introduction to second simulation

The introduction provides information about the vision of three students, each of whom will be investigated using the simulation.




PISA 2015

Adjustable Glasses
Investigations

Read the information below. Then click on the **NEXT** arrow.

ADJUSTABLE GLASSES INVESTIGATIONS

Three students with different vision experiment with a pair of adjustable glasses.

-  Anna sees both near and distant objects **in focus**.
-  Daniel sees distant objects **in focus** but near objects appear **out of focus**.
-  Maria sees near objects **in focus** but distant objects appear **out of focus**.

Unit 621 Adjustable Glasses
How to Run the Simulation


Before beginning this part of the unit, students are provided with a brief introduction to the controls in the simulation and are allowed to practice setting each control. Help messages display if students do not take the requested actions within 1 minute. If students time out by not acting at all within 2 minutes, they are shown what the simulation would look like if the controls were set as specified. As explained in the orientation, reminders about how to use the controls are available on subsequent screens by clicking on the “How to Run the Simulation” tab.

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Adjustable Glasses
Running the Simulation

In this simulation, you will be able to see how the amount of fluid in the lens affects the students' ability to see a tree clearly from each of the three distances shown below.








To see how all the controls in this simulation work, follow these steps:


1. Move the slider for **amount of fluid in lens**.
2. Select the **distance from tree**.
3. Click the "Run" button to see whether the tree will appear in focus or out of focus to the student. The results will be recorded in the table.



in focus


out of focus



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Amount of Fluid in Lens



Distance from Tree

near
 midway
 distant

Run

		Amount of Fluid in Lens				
		-2	-1	0	+1	+2
Distance from Tree	Near					
	Midway					
	Distant					

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Unit 621 Adjustable Glasses
Released Item #3

PISA 2015

Adjustable Glasses
 Question 3 / 5

How to Run the Simulation

Run the simulation to collect data based on the information below. Select from the drop-down menu to answer the question.

Anna sees both near and distant objects in focus.

How do adjustments to the glasses affect Anna's vision?

Adding fluid to the lens makes objects appear out of focus.

Removing fluid from the lens makes objects appear out of focus.

		Amount of Fluid in Lens				
		-2	-1	0	+1	+2
Distance from Tree	Near					
	Midway					
	Distant					

The two drop-down menus have the same options: distant and near. Students are asked to use the simulation and the data they generate to identify that adding fluid makes *distant* objects appear out of focus for Anna and removing fluid makes *near* objects appear out of focus.

<i>Item Number</i>	CS621Q03
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Procedural
<i>Context</i>	Personal – Frontiers
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Complex Multiple Choice – Computer Scored

Unit 621 Adjustable Glasses
Released Item #4

PISA 2015

Adjustable Glasses
 Question 4 / 5

▶ **How to Run the Simulation**

Run the simulation to collect data based on the information below. Click on one or more boxes to answer the question.

Daniel sees distant objects in focus but near objects appear out of focus.

What adjustments to the glasses allow Daniel to see near objects in focus?

✓ Remember to select **one or more** boxes.

+2 Adding the full amount of fluid
 +1 Adding some fluid
 -1 Removing some fluid
 -2 Removing the full amount of fluid

The simulation interface includes a lens with a fluid level slider from -2 to 2, a 'Daniel's View' window showing a tree, and a data table. The data table is as follows:

		Amount of Fluid in Lens				
		-2	-1	0	+1	+2
Distance from Tree	Near					
	Midway					
	Distant					

Students are asked to use the simulation to identify the adjustments that will improve Daniel’s near vision. There are two correct responses: +2 *Adding the full amount of fluid* and +1 *Adding some fluid*.

<i>Item Number</i>	CS621Q04
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Procedural
<i>Context</i>	Personal – Frontiers
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Complex Multiple Choice – Computer Scored

Unit 621 Adjustable Glasses
Released Item #5

PISA 2015

Adjustable Glasses
 Question 5 / 5

How to Run the Simulation

Run the simulation to collect data based on the information below. Click on a choice to answer the question.

Maria sees near objects in focus but distant objects appear out of focus.

What adjustment to the glasses will allow Maria to see in focus at all three distances?

- +2 Adding the full amount of fluid
- +1 Adding some fluid
- 1 Removing some fluid
- 2 Removing the full amount of fluid

The simulation interface includes a lens with a red and black handle. A 'Maria's View' window shows a tree. Below the lens is a slider for 'Amount of Fluid in Lens' ranging from -2 to 2, with a blue marker at 0. To the right are radio buttons for 'near', 'midway', and 'distant' distances. A 'Run' button is located below the sliders.

		Amount of Fluid in Lens				
		-2	-1	0	+1	+2
Distance from Tree	Near					
	Midway					
	Distant					

Students are asked to use the simulation and the data they generate to identify the adjustments that will improve Maria’s distant vision. In this case there is one correct response: *-1 Removing some fluid*

<i>Item Number</i>	CS621Q05
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Procedural
<i>Context</i>	Personal – Frontiers
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Simple Multiple Choice – Computer Scored

Unit 623 *Running in Hot Weather*

Unit Overview

This released unit presents a scientific enquiry related to thermoregulation using a simulation that allows students to manipulate the air temperature and air humidity levels experienced by long-distance runners, as well as whether or not the simulated runner drinks water. The student selects the air temperature, air humidity, and whether the runner is drinking water (yes/no). After running the simulation the runner's sweat volume, water loss and body temperature are displayed. When the conditions trigger dehydration or heat stroke, those health dangers are highlighted in the display.

PISA 2015

Running in Hot Weather
Introduction

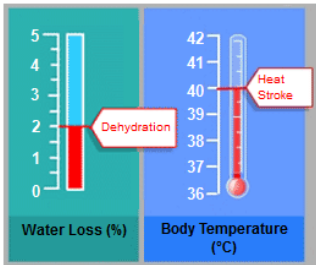
Read the introduction. Then click on the NEXT arrow.

RUNNING IN HOT WEATHER

During long-distance running, body temperature rises and sweating occurs.

If runners do not drink enough to replace the water they lose through sweating, they can experience dehydration. Water loss of 2% of body mass and above is considered to be a state of dehydration. This percentage is labeled on the water loss meter shown below.

If the body temperature rises to 40°C and above, runners can experience a life-threatening condition called heat stroke. This temperature is labeled on the body temperature thermometer shown below.



The image shows two meters side-by-side. On the left is a 'Water Loss (%)' meter with a scale from 0 to 5. A red bar indicates a value of 2, with a callout box labeled 'Dehydration'. On the right is a 'Body Temperature (°C)' thermometer with a scale from 36 to 42. The red liquid in the thermometer reaches the 40 mark, with a callout box labeled 'Heat Stroke'.

Meter	Scale	Value	Label
Water Loss (%)	0 to 5	2	Dehydration
Body Temperature (°C)	36 to 42	40	Heat Stroke

Unit 623 Running in Hot Weather
How to Run the Simulation

Before beginning the unit, students are provided with a brief introduction to the controls in the simulation and are allowed to practice setting each control. Help messages display if students do not take the requested actions within 1 minute. If students time out by not acting at all within 2 minutes, they are shown what the simulation would look like if the controls were set as specified. As explained in the orientation, reminders about how to use the controls, as well as how to select or delete a row of data, are available on subsequent screens by clicking on the “How to Run the Simulation” tab.

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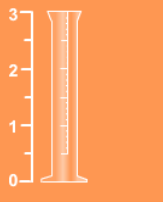
Running in Hot Weather
Introduction

This simulation is based on a model that calculates the volume of sweat, water loss, and body temperature of a runner after a one-hour run.

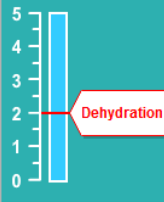
To see how all the controls in this simulation work, follow these steps:

1. Move the slider for **Air Temperature**.
2. Move the slider for **Air Humidity**.
3. Click on either "Yes" or "No" for **Drinking Water**.
4. Click on the "Run" button to see the results. Notice that a water loss of 2% and above causes dehydration, and that a body temperature of 40°C and above causes heat stroke. The results will also display in the table.

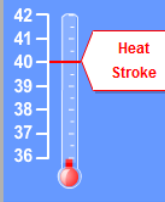
Note: The results shown in the simulation are based on a simplified mathematical model of how the body functions for a particular individual after running for one hour in different conditions.



Sweat Volume (Litres)



Water Loss (%)



Body Temperature (°C)

Air Temperature (°C) 20 25 30 35 40

Air Humidity (%) 20 40 60

Drinking Water Yes No

Run

Air Temperature (°C)	Air Humidity (%)	Drinking Water	Sweat Volume (Litres)	Water Loss (%)	Body Temperature (°C)

Unit 623 Running in Hot Weather
Released Item #1

PISA 2015

Running in Hot Weather

Question 1 / 6

How to Run the Simulation

Run the simulation to collect data based on the information below. Select from the drop-down menus to answer the question.

A runner runs for one hour on a hot, dry day (air temperature 40°C, air humidity of 20%). The runner does not drink any water.

What health danger does the runner encounter by running under these conditions?

The health danger that the runner encounters is .

This is shown by the of the runner after a one-hour run.

Air Temperature (°C)
 Air Humidity (%)
 Drinking Water Yes No

Run

Air Temperature (°C)	Air Humidity (%)	Drinking Water	Sweat Volume (Litres)	Water Loss (%)	Body Temperature (°C)

Students are asked to use the simulation to determine whether the person running under the described conditions is in danger of either dehydration or heat stroke. They are also asked to specify whether this is shown by the runner’s sweat volume, water loss or body temperature. The available options in the drop-down menus are: dehydration/heat stroke and sweat volume/water loss/body temperature.

The correct response is that the health danger is *dehydration* as shown by the runner’s *water loss*.

<i>Item Number</i>	CS623Q01
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Procedural
<i>Context</i>	Personal – Health and Disease
<i>Cognitive Demand</i>	Low
<i>Item Format</i>	Complex Multiple Choice – Computer Scored

Unit 623 Running in Hot Weather
Released Item #2

PISA 2015

Running in Hot Weather

Question 2 / 6

How to Run the Simulation

Run the simulation to collect data based on the information below. Click on a choice and then select data in the table to answer the question.

A runner runs for an hour on a hot and humid day (air temperature 35°C, air humidity of 60%) without drinking any water. This runner is at risk of both dehydration and heat stroke.

What would be the effect of drinking water during the run on the runner's risk of dehydration and heat stroke?

- Drinking water would reduce the risk of heat stroke but not dehydration.
- Drinking water would reduce the risk of dehydration but not heat stroke.
- Drinking water would reduce the risk of both heat stroke and dehydration.
- Drinking water would not reduce the risk of either heat stroke or dehydration.

★ Select two rows of data in the table to support your answer.

Air Temperature (°C) 20 25 30 35 40
 Air Humidity (%) 20 40 60
 Drinking Water Yes No

Air Temperature (°C)	Air Humidity (%)	Drinking Water	Sweat Volume (Litres)	Water Loss (%)	Body Temperature (°C)

Students are asked to run the simulation holding the air temperature and humidity constant while varying whether or not the runner drinks water. They must use the data they generate to identify that the second option is correct: *Drinking water would reduce the risk of dehydration but not heat stroke.* In support of their response, they must also select two rows of data where drinking water is set to “No” in one case and “Yes” in the other, with an air temperature of 35°C and air humidity of 60% for both rows.

<i>Item Number</i>	CS623Q02
<i>Competency</i>	Explain Phenomena Scientifically
<i>Knowledge – System</i>	Content – Living
<i>Context</i>	Personal – Health and Disease
<i>Cognitive Demand</i>	Low
<i>Item Format</i>	Simple Multiple Choice and Open Response - Computer Scored

Unit 623 Running in Hot Weather
Released Item #3

PISA 2015

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Running in Hot Weather

Question 3 / 6

▶ How to Run the Simulation


Run the simulation to collect data based on the information below. Click on a choice, select data in the table, and then type an explanation to answer the question.

When the air humidity is 60%, what is the effect of an increase in air temperature on sweat volume after a one-hour run?


Sweat volume increases
 Sweat volume decreases

★ Select two rows of data in the table to support your answer.

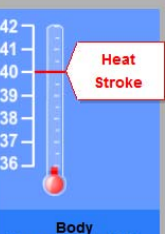
What is the biological reason for this effect?



Sweat Volume (Litres)



Water Loss (%)



Body Temperature (°C)

Air Temperature (°C)

Air Humidity (%)

Drinking Water Yes No

Run

Air Temperature (°C)	Air Humidity (%)	Drinking Water	Sweat Volume (Litres)	Water Loss (%)	Body Temperature (°C)

This item includes two separately coded questions: CS623Q03 includes the multiple-choice question and selection of data to support that answer; CS623Q04. asks students to explain the reason that sweat volume increases under the specified conditions. Unlike the previous questions, only humidity is specified. Students must investigate how varying air temperatures impact sweat volume. The correct response for CS623Q03 is that *sweat volume increases* when air temperature increases at 60% humidity and the selected rows of data must include one row with a temperature set to a lower number and one to a higher number, with both at a 60% humidity level (e.g., 20°C at 60% and 25°C at 60% or 35°C at 60% and 40°C at 60%) For CS623Q04, students must explain that sweating is a mechanism used by the body to lower body temperature as the biological reason for this increase in sweat volume at higher temperatures.

<i>Item Number</i>	CS623Q03 and CS623Q04
<i>Competency</i>	Q03: Evaluate and Design Scientific Enquiry Q04: Explain Phenomena Scientifically
<i>Knowledge – System</i>	Q03: Procedural Q04: Content – Living
<i>Context</i>	Personal – Health and Disease
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Q03: Simple Multiple Choice and Open Response – Computer Scored Q04: Open Response – Human Coded

Unit 623 Running in Hot Weather
Released Item #4

PISA 2015

Running in Hot Weather
Question 4 / 6

How to Run the Simulation

Run the simulation to collect data based on the information below. Click on a choice, select data in the table, and then type an explanation to answer the question.

Based on the simulation, when the air humidity is 40%, what is the highest air temperature at which a person can run for one hour without getting heat stroke?

20°C
 25°C
 30°C
 35°C
 40°C

★ Select two rows of data in the table to support your answer.

Explain how this data supports your answer.

The simulation interface includes four gauges:

- Sweat Volume (Litres):** A vertical scale from 0 to 3.
- Water Loss (%):** A vertical scale from 0 to 5, with a red arrow pointing to 2 labeled "Dehydration".
- Body Temperature (°C):** A vertical scale from 36 to 42, with a red arrow pointing to 40 labeled "Heat Stroke".

Air Temperature (°C) 20 25 30 35 40
 Air Humidity (%) 20 40 60
 Drinking Water Yes No

Air Temperature (°C)	Air Humidity (%)	Drinking Water	Sweat Volume (Litres)	Water Loss (%)	Body Temperature (°C)

Students are asked to use the simulation to identify the highest temperature at which a person can run without getting heat stroke when the humidity is 40%. The correct response is 35°C and students must select the following two rows of data to support their response: 35°C air temperature - 40% humidity and 40°C air temperature - 40% humidity. They must further explain how the selected rows of data support their answer by indicating that at 40% humidity moving the air temperature up from 35°C to 40°C causes heat stroke.

<i>Item Number</i>	CS623Q05
<i>Competency</i>	Evaluate and Design Scientific Enquiry
<i>Knowledge – System</i>	Procedural
<i>Context</i>	Personal – Health and Disease
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Open Response – Human Coded

Unit 623 Running in Hot Weather
Released Item #5³

PISA 2015

Running in Hot Weather
 Question 5 / 6

► **How to Run the Simulation**

Run the simulation to collect data based on the information below. Click on a choice, select data in the table, and then type an explanation to answer the question.

The simulation allows you to choose 20%, 40% or 60% for air humidity.

Do you expect that it would be safe or unsafe to run while drinking water with the air humidity at 50% and air temperature of 40°C?

Safe
 Unsafe

★ Select two rows of data to support your answer.

Explain how this data supports your answer.

Air Temperature (°C) 20 25 30 35 40
 Air Humidity (%) 20 40 60
 Drinking Water Yes No

Run

Air Temperature (°C)	Air Humidity (%)	Drinking Water	Sweat Volume (Litres)	Water Loss (%)	Body Temperature (°C)

Students use the simulation to develop a hypothesis about the safety of running at 40°C at 50% humidity (a humidity value that cannot be set on the slider). By testing the humidity levels below and above 50% at 40°C, students can conclude that it would be *unsafe* to run at 40°C, even while drinking water. To support this response, they must select one row with 40% humidity at 40°C with drinking water set to “Yes” and a second with 60% humidity at 40°C with drinking water set to “Yes”. The explanation must indicate that, given that the runner would suffer from heat stroke at both 40% and 60% humidity at 40°C while drinking water; there is a risk of heat stroke at 50% humidity under those same conditions.

<i>Item Number</i>	CS623Q06
<i>Competency</i>	Evaluate and Design Scientific Enquiry
<i>Knowledge – System</i>	Procedural
<i>Context</i>	Personal – Health and Disease
<i>Cognitive Demand</i>	High
<i>Item Format</i>	Open Response – Human Coded

³ Note that the last item in this unit, CS623Q08, is not included among the released items.

Unit 633 *Energy-Efficient House*

Unit Overview

This released unit focuses on how different roof colours affect energy consumption. The simulation allows students to investigate the effect of roof colour on the amount of energy needed to heat or cool a house to a constant temperature of 23°C. For each trial, the student selects a roof colour and outside temperature. After pressing “Run,” the simulation displays energy consumption at the selected colour and temperature.

PISA 2015

Energy-Efficient House
Introduction

Read the introduction. Then click on the NEXT arrow.

ENERGY-EFFICIENT HOUSE

There is a growing interest worldwide in building energy-efficient houses. A reduction in energy consumption can save money for owners and can reduce greenhouse gas emissions to the atmosphere. Architects can use simulations to investigate the effect on energy consumption of different choices made in the design of a house.



Unit 633 Energy-Efficient House
How to Run the Simulation

Before beginning the unit, students are provided with a brief introduction to the controls in the simulation and are allowed to practice setting each control. Help messages display if students do not take the requested actions within 1 minute. If students time out by not acting at all within 2 minutes, they are shown what the simulation would look like if the controls were set as specified. As explained in the orientation, reminders about how to use the controls, as well as how to select or delete a row of data, are available on subsequent screens by clicking on the “How to Run the Simulation” tab.

PISA 2015

⏻

?
⏪
⏩

Energy-Efficient House

Introduction


This simulation allows you to explore how different roof colours affect energy consumption. Some solar radiation hitting the roof will be reflected. Some solar radiation will be absorbed and heat up the house.

The simulated house will consume energy both for heating and for cooling in order to maintain the house at a comfortable indoor temperature of 23°C across a range of outdoor temperatures.

To see how all the controls in this simulation work, follow these steps:

1. Click on a **roof colour**.
2. Click on an **outdoor temperature**.
3. Click on the “Run” button to see what happens to energy consumption. The results will display in the table.

Note: Energy consumed is measured in watt-hours. A watt-hour is equal to one watt of power supplied for one hour.



Energy Consumption

Watt-hours

Roof Colour

Indoor Temperature 23 °C

Outdoor Temperature (°C)

Run

Outdoor Temperature (°C)	Roof Colour	Energy Consumption (watt-hours)

Unit 633 Energy-Efficient House
Released Item #1

PISA 2015

Energy-Efficient House
 Question 1 / 4

How to Run the Simulation

Run the simulation to collect data based on the information below. Use drag and drop and then select data in the table to answer the question.

Some houses will be built in an area that has a very hot climate, with outdoor temperatures often at 40°C and above. You have been asked to help decide which roof colour is best to use on the houses.

Put the three roof colours in order of **decreasing** energy consumption for a house being cooled to 23°C in a very hot climate.

White Red Black

Energy Consumption

Highest → Lowest

Highest Middle Lowest

★ Select three rows of data in the table to support your answer.

Roof Colour: White Red Black
 Indoor Temperature 23 °C
 Outdoor Temperature (°C): 0 10 20 30 40

Run

Outdoor Temperature (°C)	Roof Colour	Energy Consumption (watt-hours)

Students are asked to select an outside temperature of 40°C and use the simulation results to put the roof colours in order from highest to lowest in terms of energy consumption as well as identify the data that support their selections. The correct response is: *black* (highest energy consumption at this temperature), *red* (middle), *white* (lowest) and the 3 supporting rows of data include ones with the outdoor temperature set to a constant 40°C and each of three roof colours selected (red, black and white).

<i>Item Number</i>	CS633Q01
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Procedural
<i>Context</i>	Local/National – Natural Resources
<i>Cognitive Demand</i>	Low
<i>Item Format</i>	Open Response – Computer Scored

Unit 633 Energy-Efficient House
Released Item #2

Students are asked to use the simulation to compare the energy consumption of a house with a white roof versus one with a black roof at at 10°C. This item includes two separate coded questions: CS633Q02 includes the multiple-choice question and the selection of data to support that answer; CS633Q03 asks students to explain the how roof colour affects the reflection and absorption of solar radiation.

CS633Q02 includes both a drop-down selection and data selection. The white roof uses *more* energy than the black roof to heat the house to 23°C when the outdoor temperature is 10°C. The supporting data include two rows with the outdoor temperature of 10°C – one with a white roof selected and the other with a black roof selected.

To explain this phenomenon in CS633Q03, students must indicate or imply that sunlight is a source of energy, or heat, and that the black roof absorbs more solar radiation than the white roof.

<i>Item Number</i>	CS633Q02 and CS633Q03
<i>Competency</i>	Q02: Interpret Data and Evidence Scientifically Q03: Explain Phenomena Scientifically
<i>Knowledge – System</i>	Q02: Procedural Q03: Content – Physical
<i>Context</i>	Local/National – Natural Resources
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Q02: Open Response – Computer Scored Q03: Open Response – Human Coded

Unit 633 Energy-Efficient House
Released Item #3

Energy-Efficient House
 Question 3 / 4

How to Run the Simulation

Run the simulation to collect data based on the information below. Select from the drop-down menus to answer the question.

According to the simulation, how does the energy consumption of a house with a red roof compare to the energy consumption of a house with a white roof?

At 10°C and below, a house with a red roof has energy consumption than a house with a white roof.

At 20°C and above, a house with a red roof has energy consumption than a house with a white roof.

Roof Colour: White Red Black

Indoor Temperature 23 °C
 Outdoor Temperature (°C): 0 10 20 30 40

Outdoor Temperature (°C)	Roof Colour	Energy Consumption (watt-hours)

Students are asked to run the simulation to compare the energy consumption of a house with a red roof versus one with a white roof first at 10°C and then at 20°C. Students should determine that a house with a red roof has *lower* energy consumption than one with a white roof at temperatures of 10°C or below, but *higher* energy consumption at temperatures of 20°C or above.

<i>Item Number</i>	CS633Q04
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Procedural
<i>Context</i>	Local/National – Natural Resources
<i>Cognitive Demand</i>	Medium
<i>Item Format</i>	Complex Multiple Choice – Computer Scored

Unit 633 Energy-Efficient House
Released Item #4

PISA 2015

Energy-Efficient House
 Question 4 / 4

► **How to Run the Simulation**

Run the simulation to collect data based on the information below. Click on a choice to answer the question.

Based on the simulation, what can you conclude about the relationship between the outdoor temperature and energy consumption for the full range of temperatures for all three roof colours?

- When the outdoor temperature increases, energy consumption increases.
- When the outdoor temperature decreases, energy consumption increases.
- When the difference between the outdoor temperature and the indoor temperature increases, energy consumption increases.
- When the difference between the outdoor temperature and the indoor temperature decreases, energy consumption increases.

The simulation interface includes a central illustration of a house with a person sitting inside. To the right is an 'Energy Consumption' meter labeled 'Watt-hours'. Below the house is a control panel with 'Roof Colour' options (white, red, black) and 'Indoor Temperature 23 °C'. The 'Outdoor Temperature (°C)' is set to 0, with options for 10, 20, and 40. A 'Run' button is present.

Outdoor Temperature (°C)	Roof Colour	Energy Consumption (watt-hours)

Students are asked to select a statement about the relationship between outdoor temperature and energy consumption that is supported by the simulation. The correct response is the third option: *When the difference between the outdoor temperature and the indoor temperature increases, energy consumption increases.*

<i>Item Number</i>	CS633Q05
<i>Competency</i>	Interpret Data and Evidence Scientifically
<i>Knowledge – System</i>	Content – Physical
<i>Context</i>	Local/National – Natural Resources
<i>Cognitive Demand</i>	High
<i>Item Format</i>	Simple Multiple Choice – Computer Scored

Collaborative Problem Solving – Overview

One Collaborative Problem Solving unit from the 2015 Field Trial was approved for release by the Collaborative Problem Solving Expert Group. This unit, The Visit, included 44 measurable student actions (or “items”) and was completed by students during the Field Trial in a mean time of about 17 minutes. A total of six units were developed for the Field Trial and five were moved forward for inclusion in the 2015 Main Study.

As the innovative domain for PISA 2015, Collaborative Problem Solving (CPS) is defined in the draft framework as “the capacity of an individual to effectively engage in a process whereby two or more agents attempt to solve a problem by sharing the understanding and effort required to come to a solution and pooling their knowledge, skills and efforts to reach that solution.” The framework identifies three core collaborative competences:

- Establishing and maintaining a shared understanding
- Taking appropriate action to solve the problem
- Establishing and maintaining team organisation

Additionally, the CPS construct includes core problem solving competencies including:

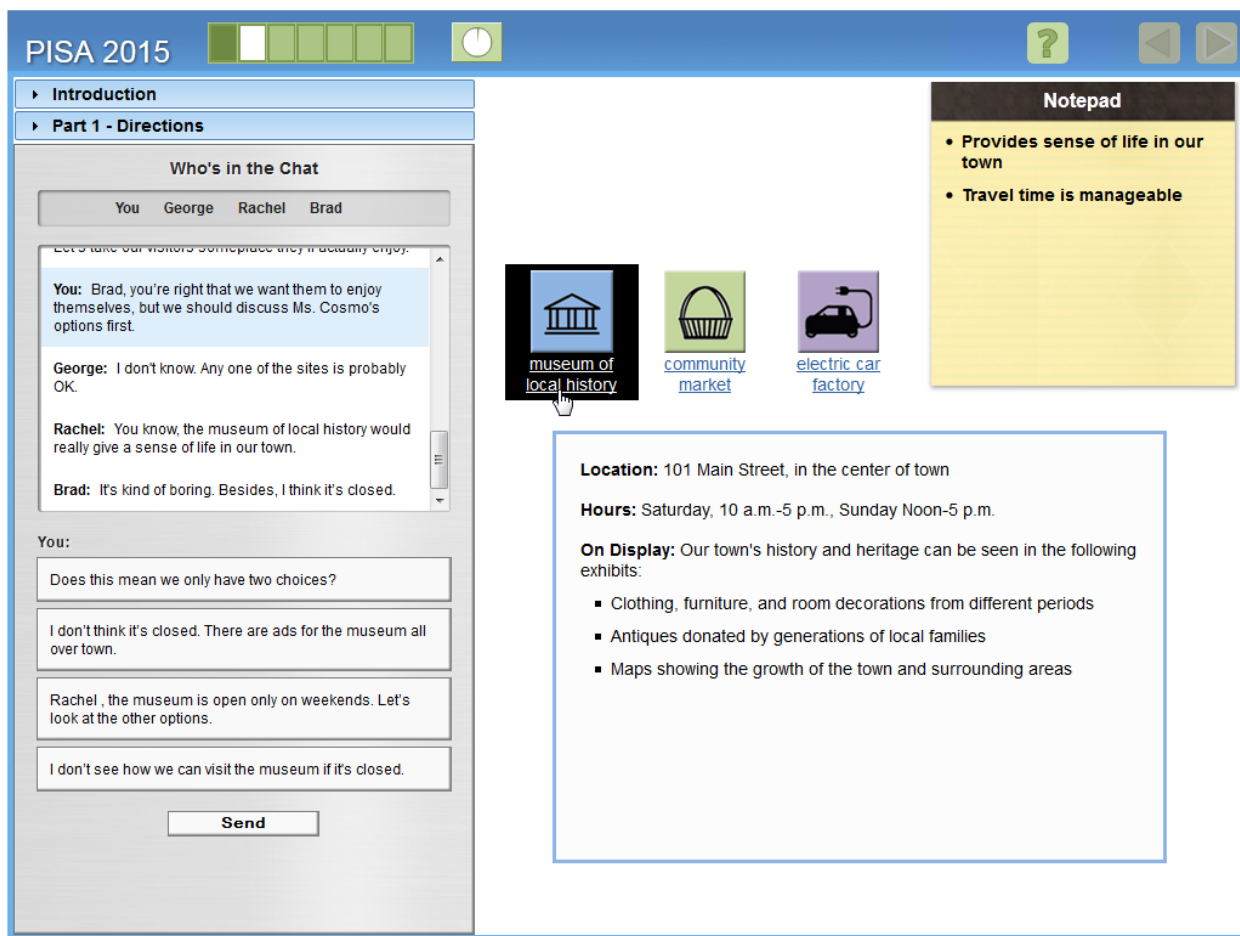
- Exploring and understanding
- Representing and formulating
- Planning and executing
- Monitoring and reflecting.

Taken together, these form a matrix of CPS competencies, as shown in the figure below. Across the CPS units, items were developed to fit all cells in that matrix.

	(1) Establishing and maintaining shared understanding	(2) Taking appropriate action to solve the problem	(3) Establishing and maintaining team organisation
(A) Exploring and Understanding	(A1) Discovering perspectives and abilities of team members	(A2) Discovering the type of collaborative interaction required and establishing goals	(A3) Understanding roles to solve 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 performed	(C2) Enacting plans	(C3) Following rules of engagement
(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

The CPS units include chat-based tasks where students interact with one or more agents, or simulated team members, to solve a presented problem. Students are presented with a set of chat options and are asked to select the most appropriate choice. Once selected, the choice displays in the chat history area, and then responses from one or more agents follow. Students can scroll through the history to review chat as needed. Responses from agents are based on student selections. As a result, there are multiple paths through each unit. To ensure that any incorrect or non-optimal selections will not penalise students as they progress through the task, each unit is designed with convergence, or rescue, points. At these points, one of the agents provides necessary information or helps advance the collaborative problem solving process so that students can continue to progress through the task.

In addition to the chat interactions, the CPS units include a task area on the right side of the screen where students can take actions, view notes recorded by agents, or keep track of progress through the task. In the sample screen from part 1 of The Visit shown below, the task area includes clickable links to three websites with information that is needed to solve the problem that has been assigned to the team as well as a notepad where key information is recorded by teammates.



↑
Chat Space

↑
Task Space

Format for this Released Unit

Because there are multiple paths through CPS units it is not possible to provide screen shots for each screen in the unit in a clearly understandable way. The screen shots provided show the optimal path through each part of the unit. Descriptions are provided for all alternate paths and their associated items.

For each item, the following information is provided:

<i>Item Number</i>	
<i>Credited Response</i>	
<i>Classification</i>	

Item Number: Each number includes the designation used for CPS (CC), the unit number (101), the part designation (1, 2 or 3) followed by a two-digit item ID.

Credited response: Each credited response, or responses, is listed. For each chat-based item, the correct response can also be identified in the screen shot by the blue highlighting that displays on screen when students select an option. Where more than one response is credited, that is noted in the descriptive text.

Classification: The framework classification for each item is also listed. A letter/number combination references the CPS competencies matrix, as shown on page 47.

The Visit**Unit Overview**

The premise for this unit is that a group of international students is coming to visit a school. The student must collaborate with 3 agent teammates and a faculty advisor to plan the visit, assign visitors to guides, and respond to an unexpected problem that arises.

Part 1: Overview

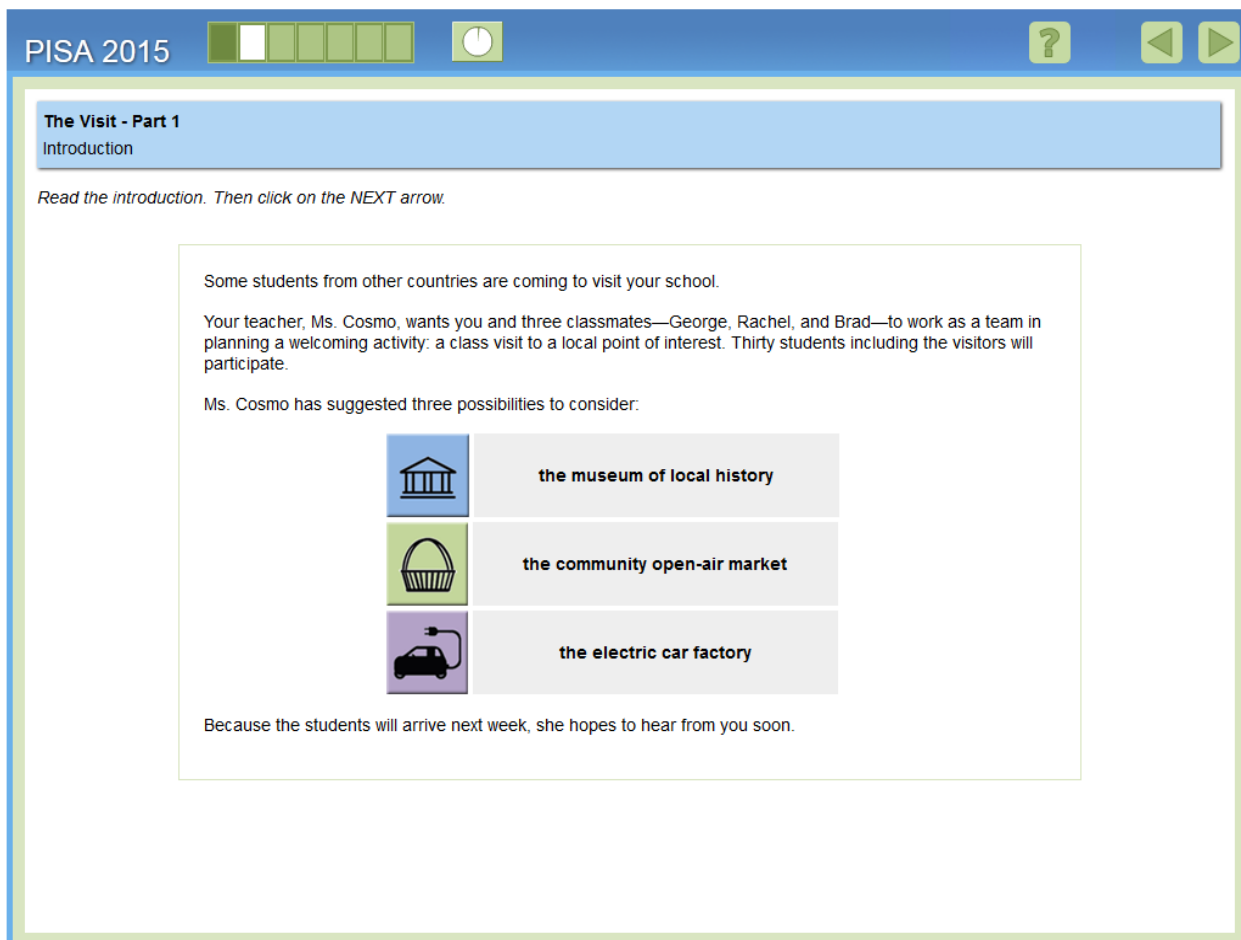
In Part 1 of The Visit, the student and three teammates collaborate to identify an appropriate trip to a local point of interest for the visitors. In order to make their recommendation, the team needs to share and discuss their preferences, repair a misunderstanding about when one of the sites is open, and make a final selection.

Challenges requiring collaborative skills include the need for the student to:

- solicit and take into account criteria for assessing the outing options
- clarify statements made by other teammates
- correct misinformation and avoid an impasse
- prompt team members to perform their tasks
- ensure that the final recommendation meets all specified criteria

Part 1 Introduction

The opening screen provides an overview for students. The goal for Part 1 is defined and students learn that there are three potential sites to be considered for the trip.



PISA 2015




The Visit - Part 1
Introduction

Read the introduction. Then click on the NEXT arrow.

Some students from other countries are coming to visit your school.

Your teacher, Ms. Cosmo, wants you and three classmates—George, Rachel, and Brad—to work as a team in planning a welcoming activity: a class visit to a local point of interest. Thirty students including the visitors will participate.

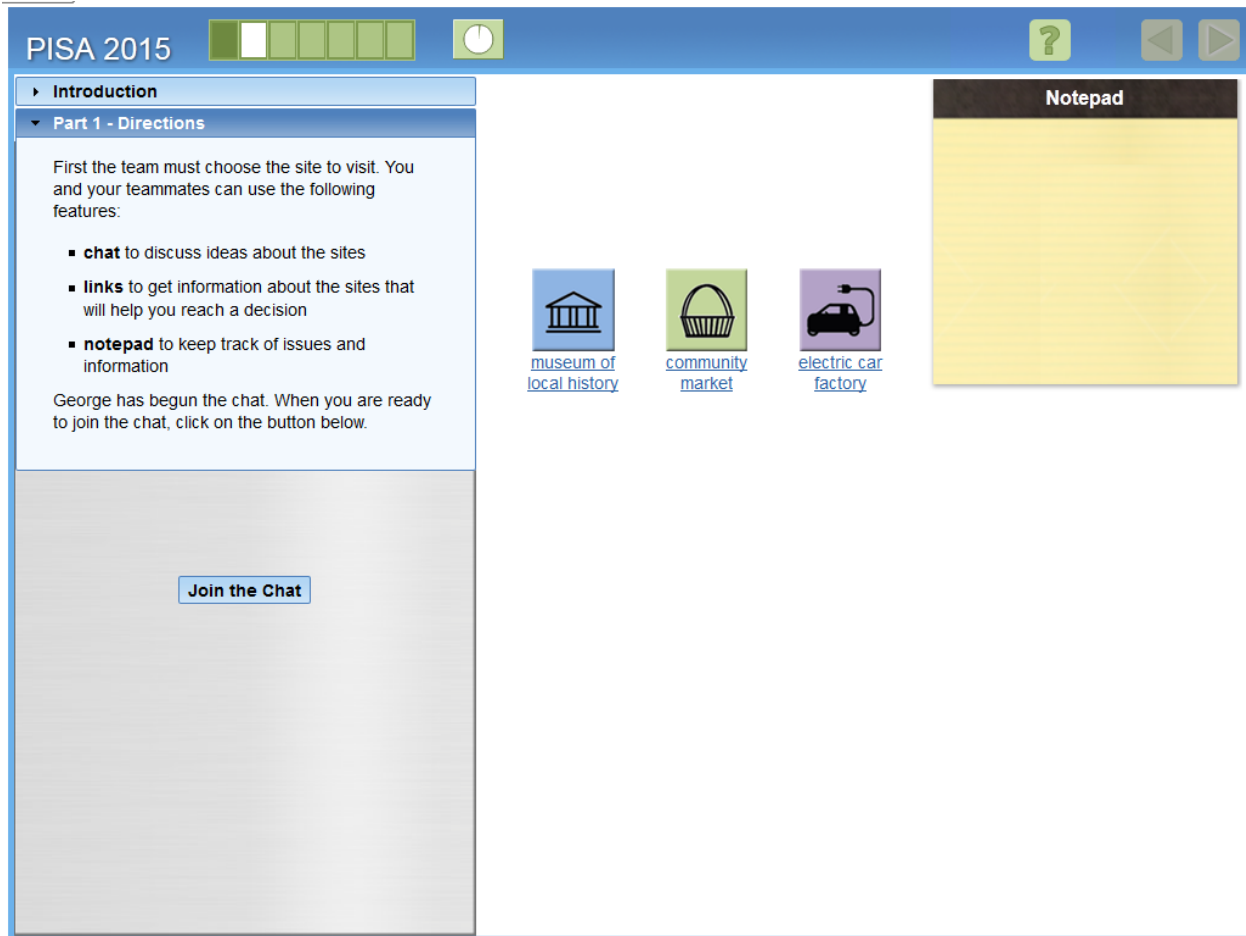
Ms. Cosmo has suggested three possibilities to consider:

-  **the museum of local history**
-  **the community open-air market**
-  **the electric car factory**

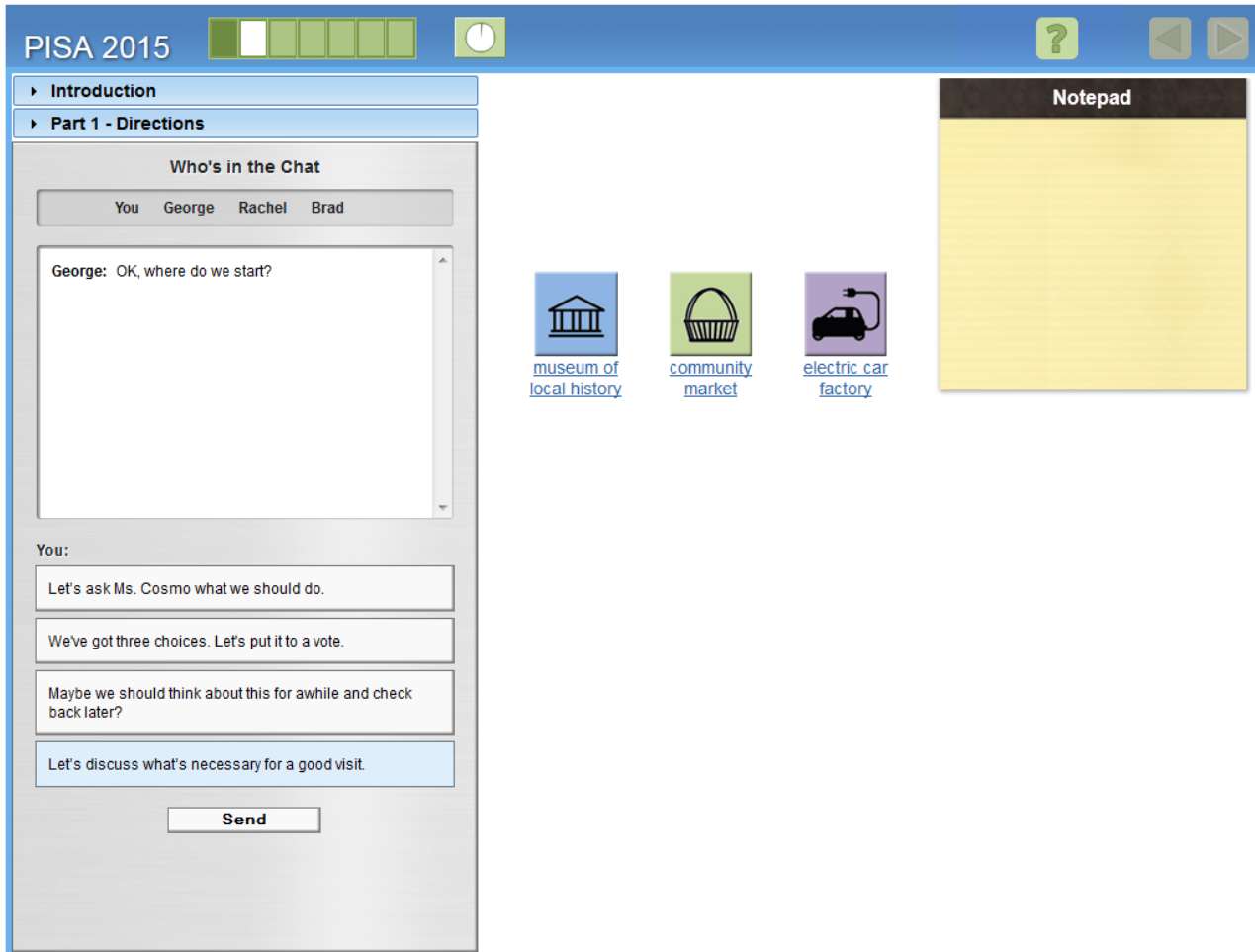
Because the students will arrive next week, she hopes to hear from you soon.

Part 1 Directions

Directions for the task are presented on the left side of the screen, as shown below. The task pane on the right includes a notepad, where key points from the chat will display, and links to the three local sites under consideration. Clicking on a link displays a brief list of relevant information for each site (location, hours of operation, tour information, and what visitors can see there).



Part 1 – Sample Screen #1



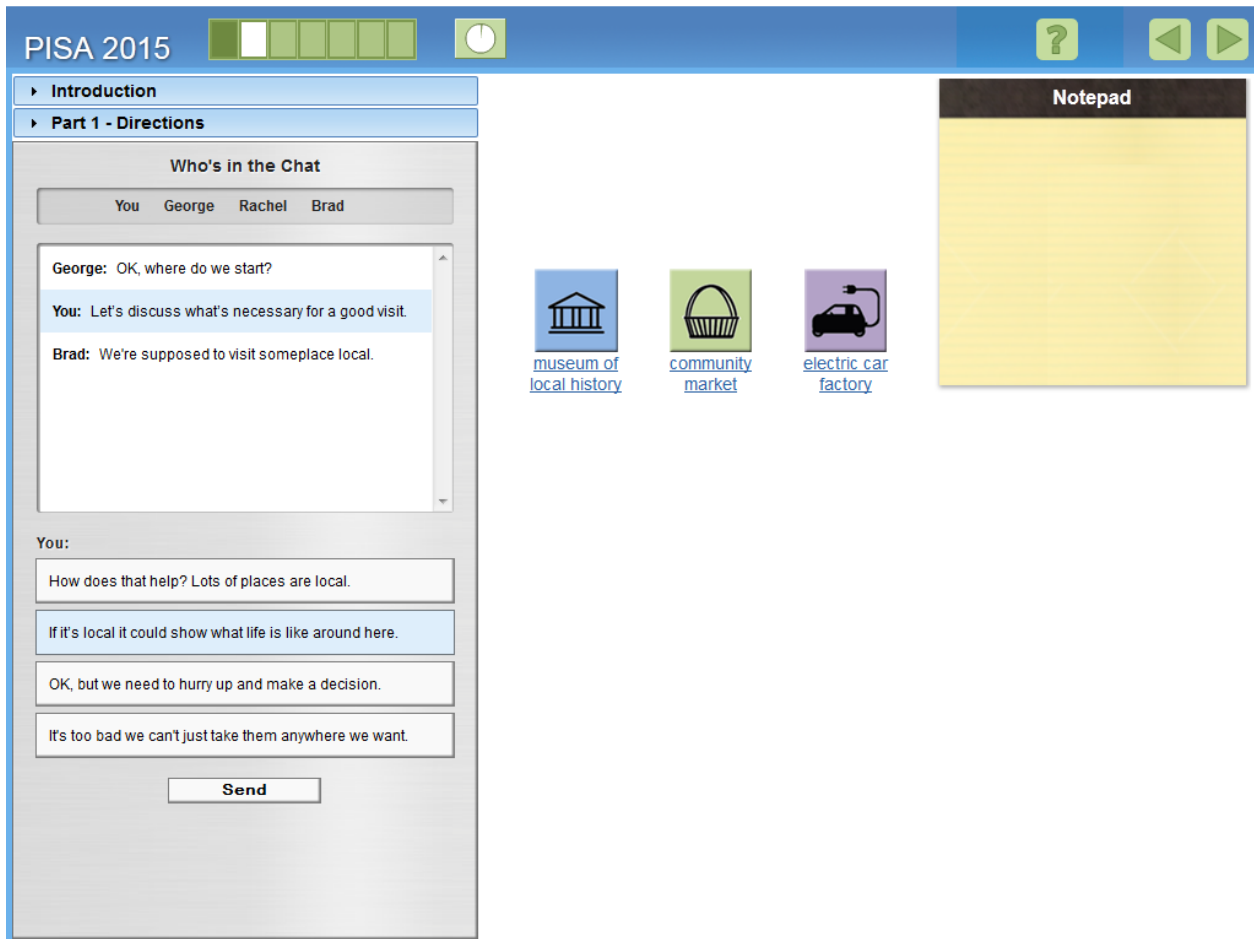
<i>Item</i>	CC101101
<i>Credited Response</i>	Let's discuss what's necessary for a good visit.
<i>Classification</i>	(B2) Identifying and describing tasks to be completed

The student must select from among four chat choices to respond to George’s open-ended question about where to begin. The first and third options are not credited because they are both attempts to avoid taking action. While the second option (“We’ve got three choices. Let’s put it to a vote”) might sound collaborative, it does not really help the team solve the presented problem as they do not yet have enough information to select a site. Therefore this option is not credited as correct.

If the student does not select the credited response, Rachel rescues by saying “We need to make a decision soon. Let’s talk about what a visit site should be like.”

Part 1 – Sample Screen #2

Brad mentions that the group is supposed to visit someplace local.



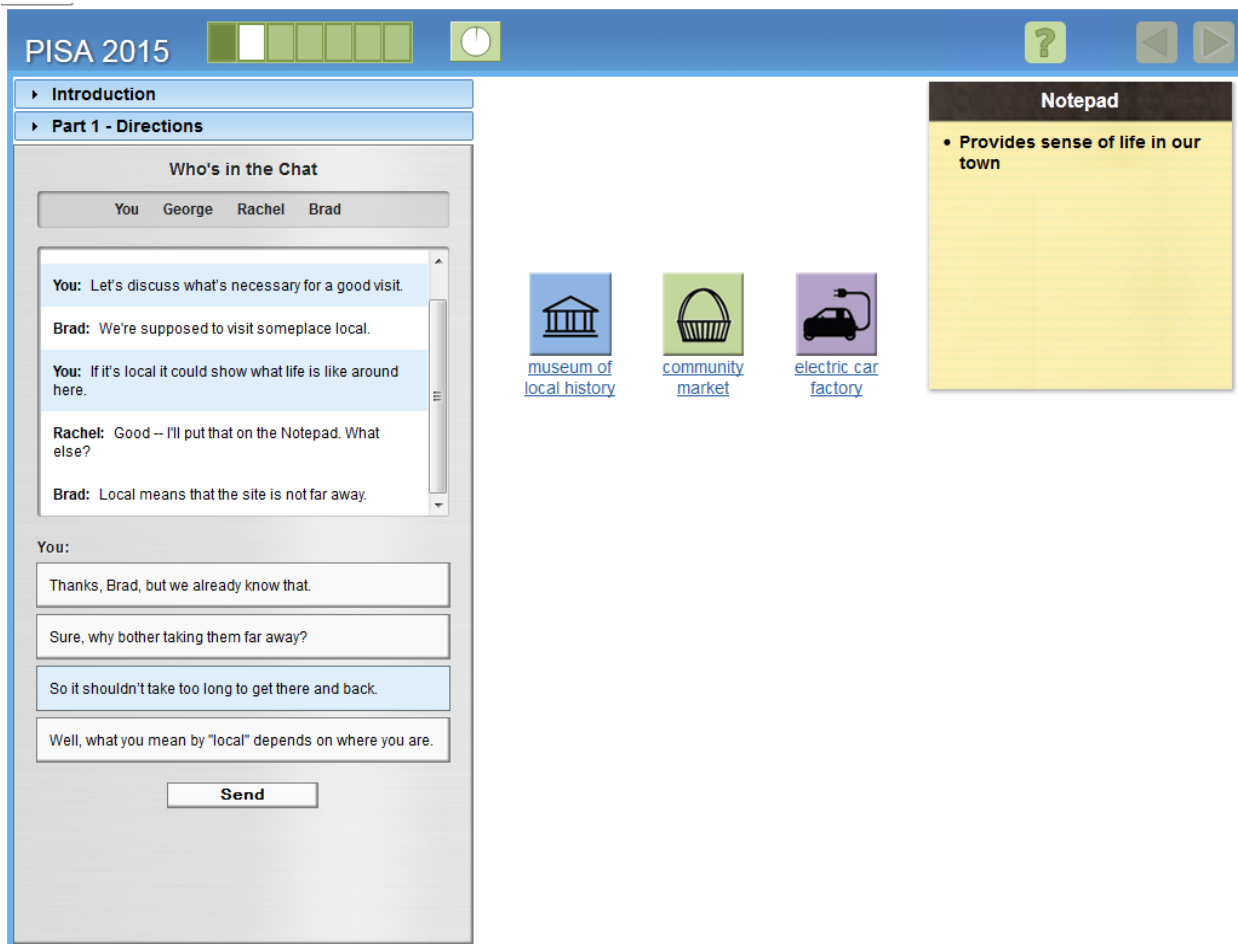
<i>Item</i>	CC101102
<i>Credited Response</i>	If it's local it could show what life is like around here.
<i>Classification</i>	(B1) Building a shared representation and negotiating the meaning of the problem (common ground)

The second response is credited because it is the only one of the four that helps advance the group's shared understanding of what "local" might mean.

If the student does not select the credited response, George rescues by saying, "So maybe it should give a sense of what our town is like."

Part 1 – Sample Screen #3

Rachel adds a note to the notepad confirming that the site should “provide sense of life in our town.”
 Brad comments that, “Local means that the site is not far away.”



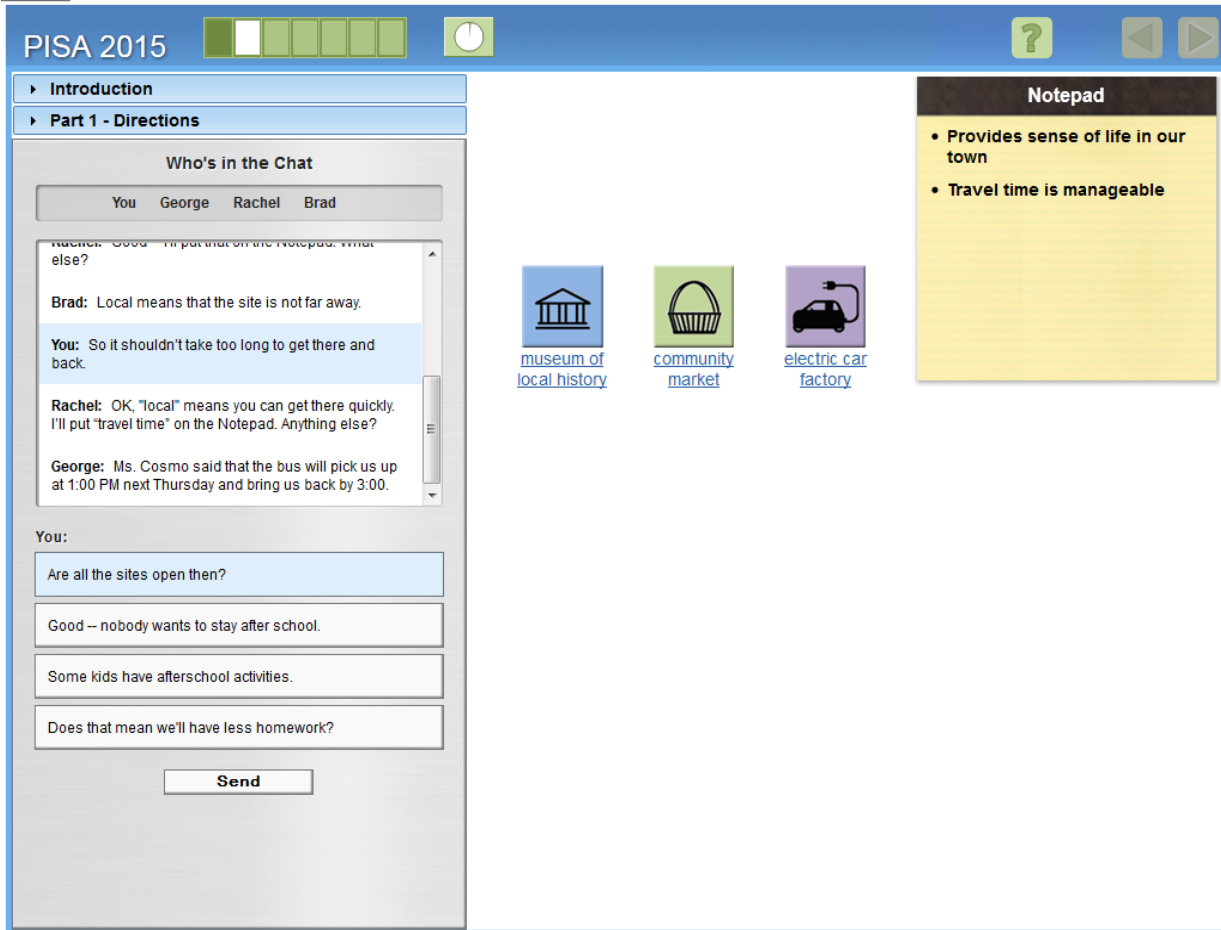
<i>Item</i>	CC101103
<i>Credited Response</i>	So it shouldn't take too long to get there and back.
<i>Classification</i>	(C1) Communicating with team members about the actions performed

The credited response helps advance the shared understanding by clarifying one criterion the selected site must meet.

Part 1 – Sample Screen #4

Regardless of the student response for the previous item, Rachel makes an entry on the notepad and answers by saying, “OK, ‘local’ means you can get there quickly. I’ll put ‘travel time’ on the Notepad. Anything else?”

George responds by bringing up the schedule that must be met. “Ms. Cosmo said that the bus will pick us up at 1:00 PM next Thursday and bring us back by 3:00.”

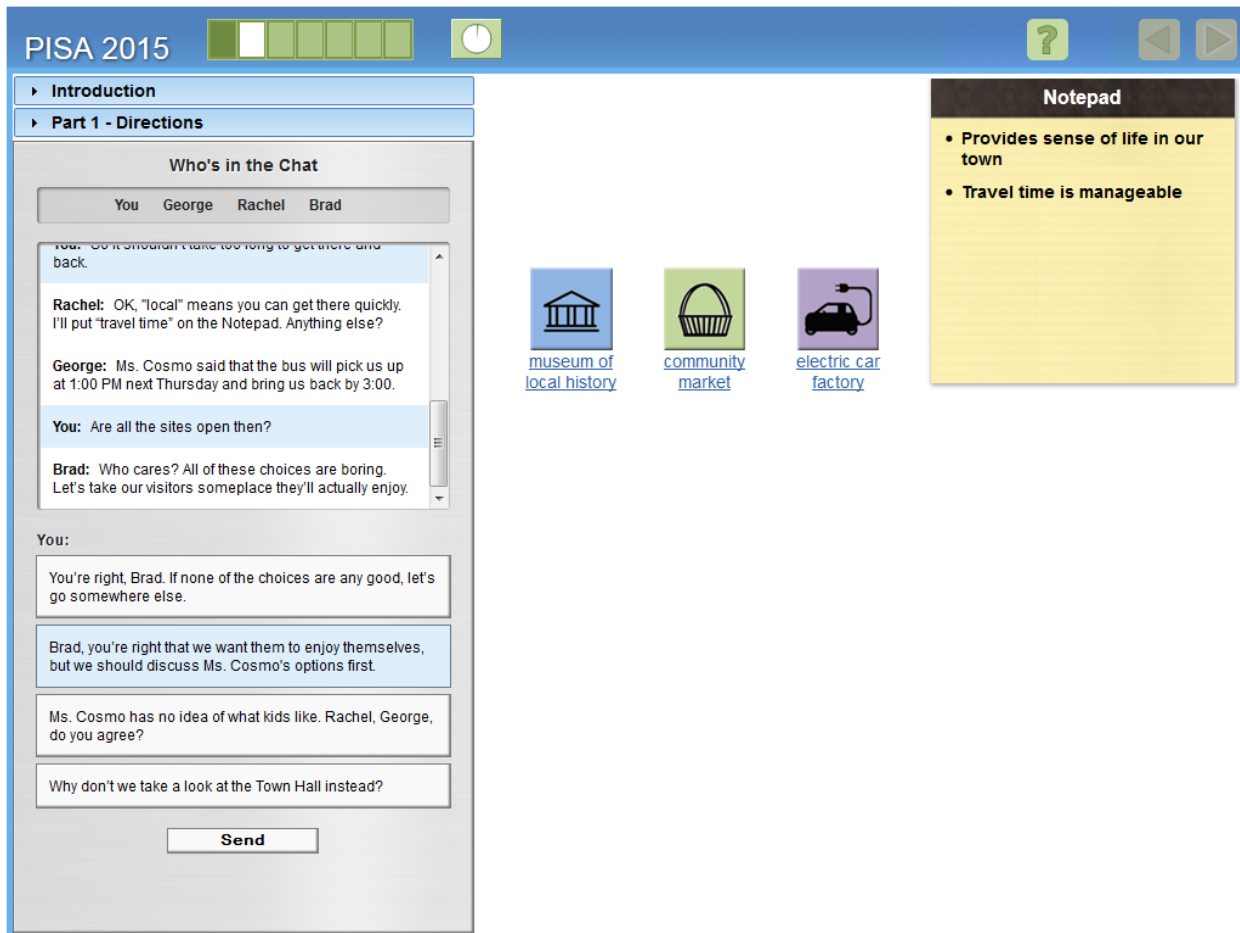


<i>Item</i>	CC101104
<i>Credited Response</i>	Are all the sites open then?
<i>Classification</i>	(C3) Following rules of engagement, (e.g., prompting other team members to perform their tasks)

In this case, the credited response helps move the problem solving process forward, pointing out to the team that they need to be sure the selected site meets the schedule defined by Ms. Cosmo.

Part 1 – Sample Screen #5

Any selection made by the student is followed by a comment from Brad. He goes off task a bit, saying, “Who cares? All of these choices are boring. Let’s take our visitors someplace they’ll actually enjoy.”

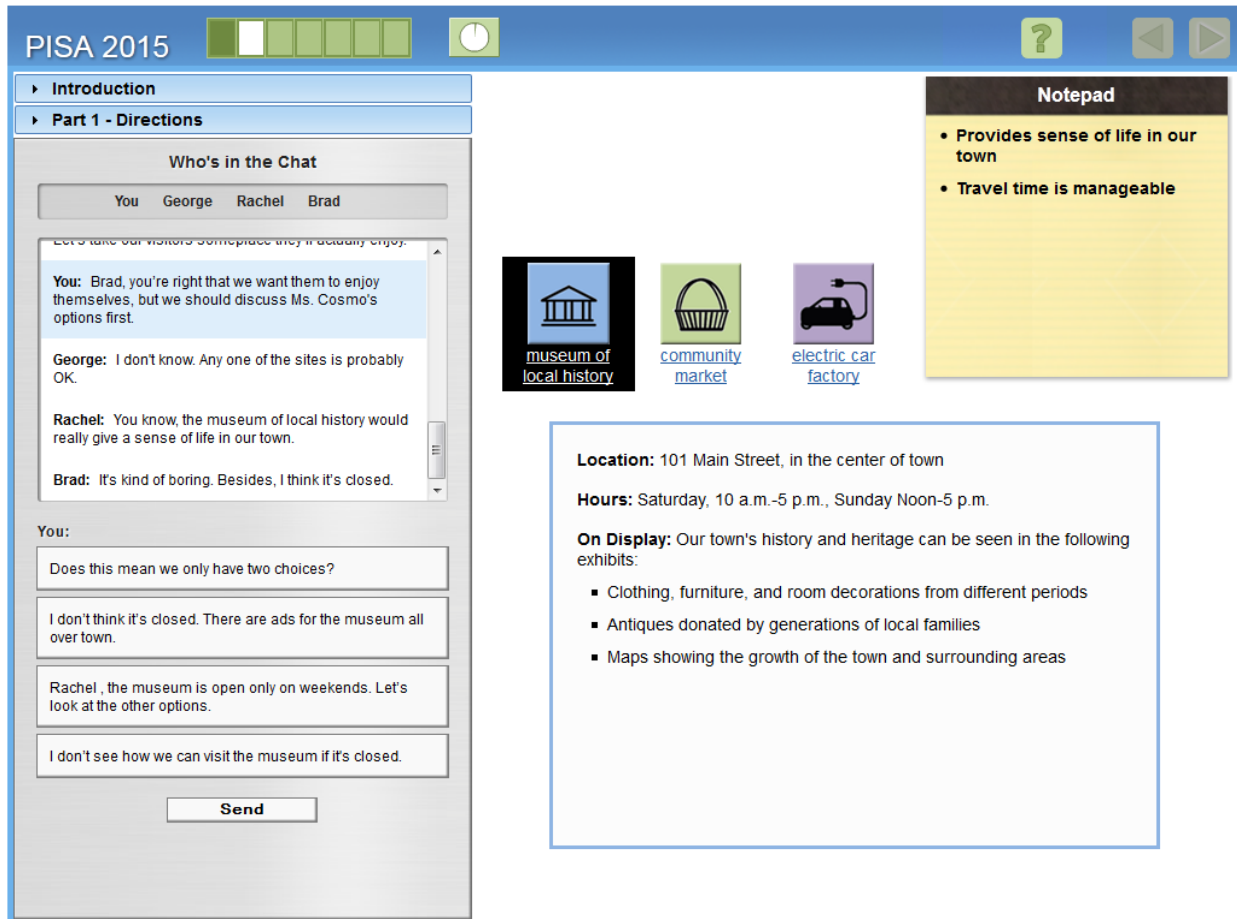


<i>Item</i>	CC101105
<i>Credited Response</i>	Brad, you’re right that we want them to enjoy themselves, but we should discuss Ms. Cosmo's options first.
<i>Classification</i>	(D1) Monitoring, providing feedback and adapting the team organisation and roles

The credited response acknowledges Brad’s statement while reminding him about the team’s task, providing feedback to keep the discussion focused.

Part 1 – Sample Screen #6

Each team member expresses an opinion about the site selection. George states that any site is probably ok, Rachel suggests the museum of local history, and Brad says the museum is boring and that he thinks it is closed.

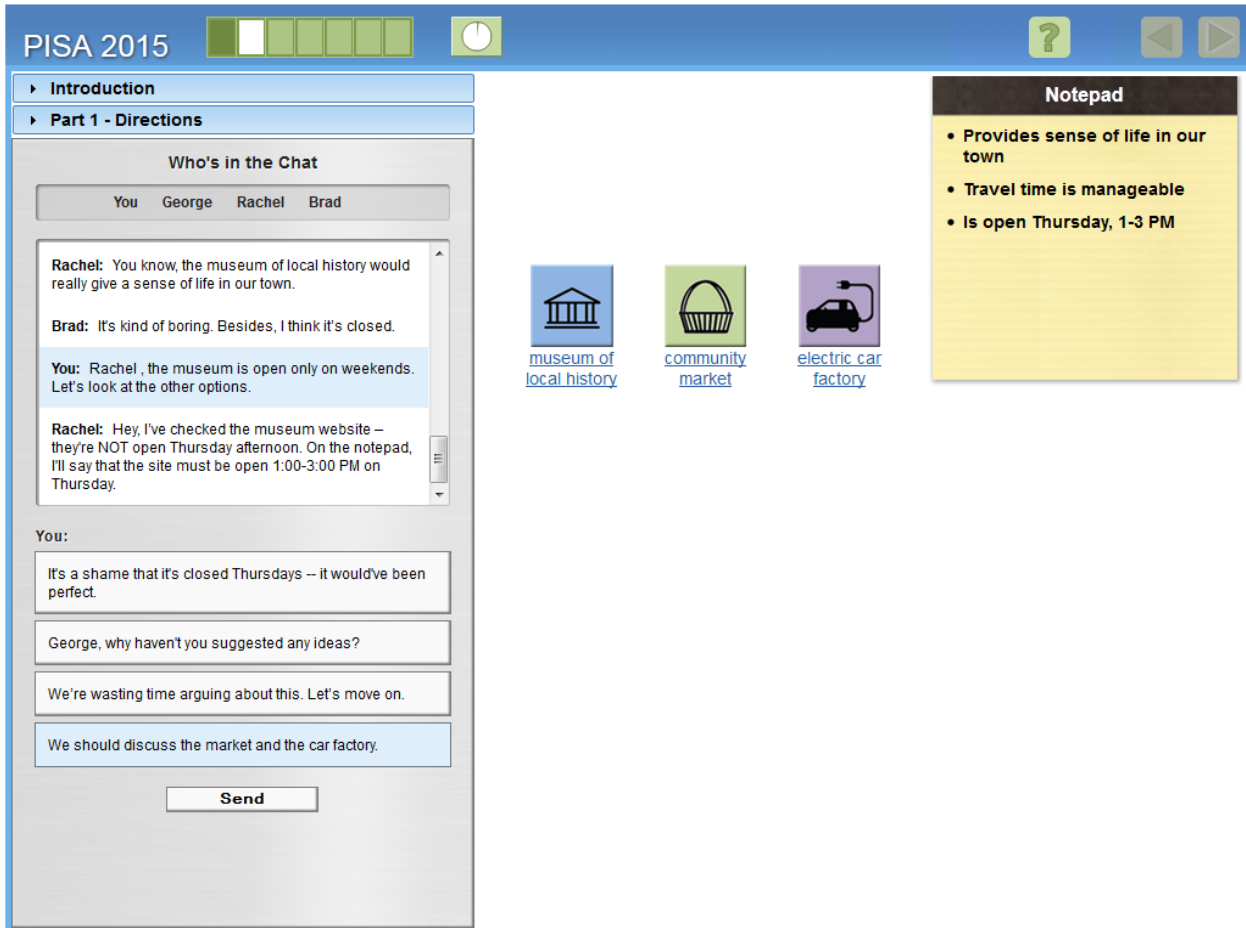


<i>Item</i>	CC101106
<i>Credited Response</i>	The student must click on the museum website, as shown above, in order to receive either full or partial credit. Full credit response: Rachel , the museum is open only on weekends. Let's look at the other options Partial credit response: I don't see how we can visit the museum if it's closed.
<i>Classification</i>	(C1) Communicating with team members about the actions performed

For this item, the student must use the simulated web link in the task area to check when the museum is open and then choose the response that communicates the implications of that information to the team. Therefore, to gain full credit, the student must respond to Rachel's proposal and Brad's misinformation, clarifying that the museum is not open on the day scheduled for the class visit.

Part 1 – Sample Screen #7

Rachel confirms that the museum is not open on Thursday afternoon (rescuing any students who do not answer the previous item correctly). She adds a note to the notepad that the selected site must be open on Thursdays from 1-3 pm.

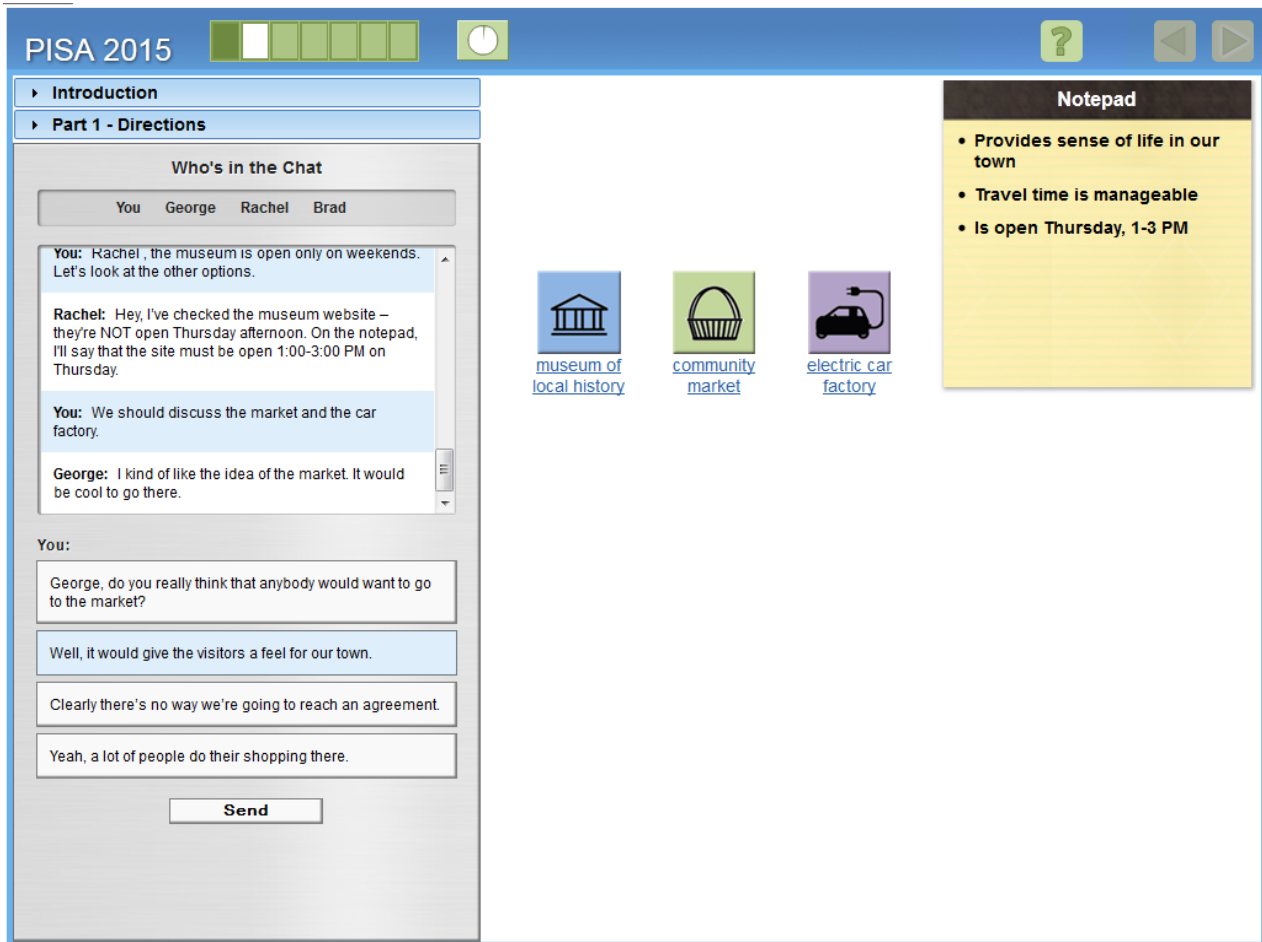


<i>Item</i>	CC101107
<i>Credited Response</i>	We should discuss the market and the car factory.
<i>Classification</i>	(C1) Communicating with team members about the actions to be/ being performed

The credited response reminds team members that they have two additional choices to consider, given that the museum is not open on the required day.

Part 1 – Sample Screen #8

Regardless of the student selection for the previous item, George states that he likes the idea of going to the market.

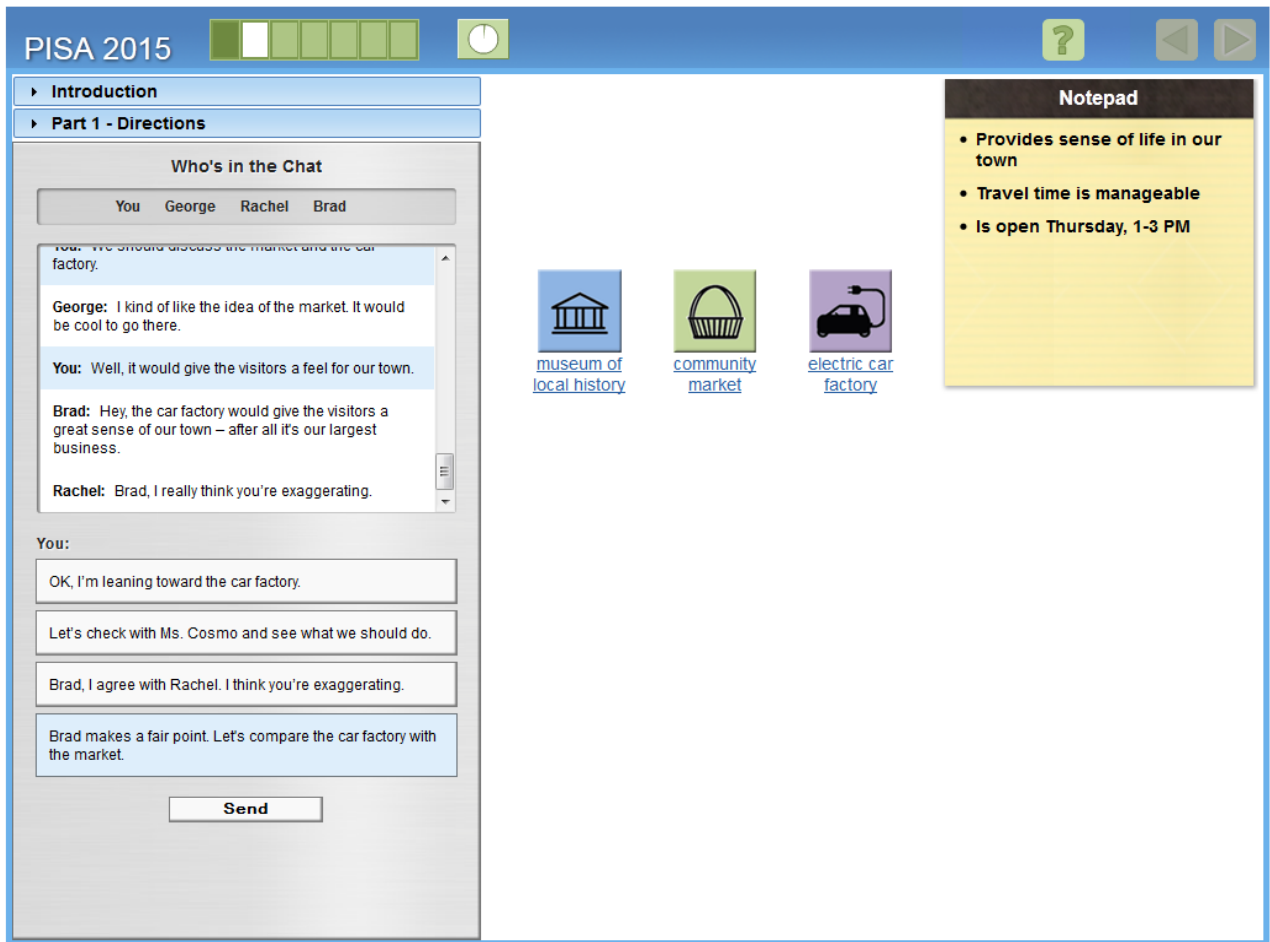


<i>Item</i>	CC101108
<i>Credited Response</i>	Well, it would give the visitors a feel for our town.
<i>Classification</i>	(B1) Building a shared representation and negotiating the meaning of the problem (common ground)

The credited response acknowledges that George’s suggestion meets one of the specified criteria.

Part 1 – Sample Screen #9

Brad proposes the car factory, saying it, too, would give the visitors a great sense of the town – although Rachel disagrees with his statement that it is the town’s largest business.

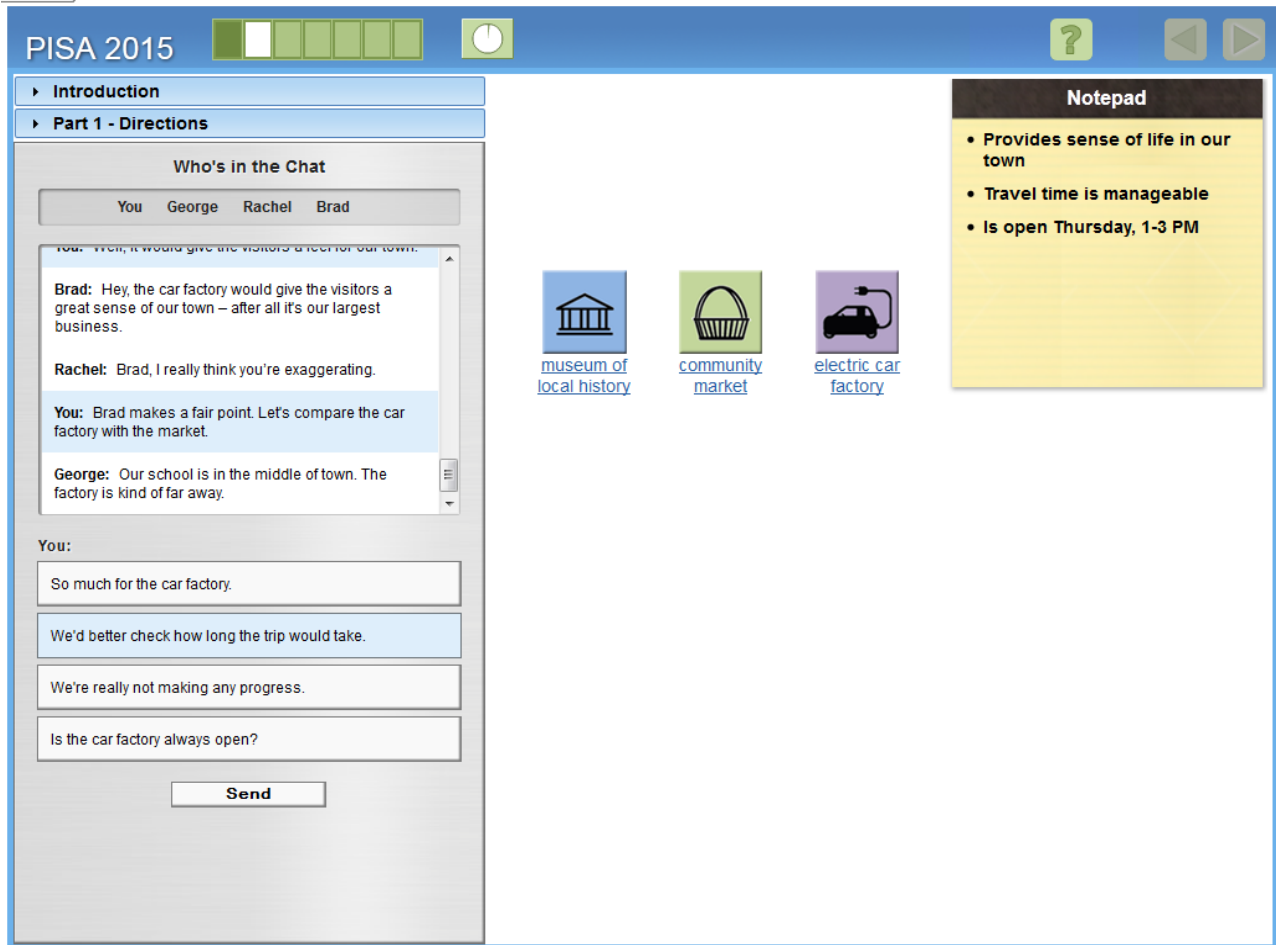


<i>Item</i>	CC101109
<i>Credited Response</i>	Brad makes a fair point. How does the car factory compare with the market?
<i>Classification</i>	(C3) Following rules of engagement

The credited response supports Brad’s suggestion, promoting group collaboration, and moves the team forward by prompting the team to compare the remaining options.

Part 1 – Sample Screen #10

George raises a new consideration, noting that the factory is not located near the school.



<i>Item</i>	CC101110
<i>Credited Response</i>	We'd better check how long the trip would take.
<i>Classification</i>	(C1) Communicating with team members about the actions performed

The credited response communicates that George’s point requires further investigation, keeping the team on task.

Part 1 – Sample Screen #11

Rachel says that she has checked the car factory website and thinks it would be ok, but asks the team to double check.

Who's in the Chat
 You George Rachel Brad

Chat History:
 Rachel: Brad, I really think you're exaggerating.
 You: Brad makes a fair point. Let's compare the car factory with the market.
 George: Our school is in the middle of town. The factory is kind of far away.
 You: We'd better check how long the trip would take.
 Rachel: I've looked at the web page for the car factory. I think a visit there would be OK, but could you guys double check to see if there's a problem?
 You:
 Rachel thinks the factory is OK, so let's decide between the factory and the market.
 The factory has guided tours, so that could be interesting.
 According to the web page the factory is about 45 minutes from the school.
 There's not enough time to get there and back and have everyone take the tour.

Notepad

- Provides sense of life in our town
- Travel time is manageable
- Is open Thursday, 1-3 PM

electric car factory

Location: 45 minutes from town at the intersection of Highway 13 and Highway 26

Hours open to the public: Monday through Friday, 2:00 p.m. to 5:00 p.m.

Guided tours: Learn about electric cars and see how they're made!

- A one-hour tour starts at 2:00, 3:00, and 4:00 p.m.
- Maximum group size is 15 per tour.
- The tour is free, but reservations are suggested.

<i>Item</i>	CC101111
<i>Credited Response</i>	Student must click on car factory website in order to receive credit for this response: There's not enough time to get there and back and have everyone take the tour.
<i>Classification</i>	(B1) Building a shared representation and negotiating the meaning of the problem (common ground)

The credited response recognises that the thirty visitors will need to be divided into two tour groups (since the maximum size of a tour group at the factory is 15) This implies that there will have to be two consecutive tours. The need to have two tours, combined with the bus schedule means that the factory fails to meet the constraints set by Ms. Cosmo.

Part 1 – Sample Screen #12

George provides the needed information about the time required for a visit to the car factory. Rachel expresses that she is losing track of the details that have been discussed to this point.

<i>Item</i>	CC101112
<i>Credited Response</i>	We should summarize what we've found out about each site.
<i>Classification</i>	(C2) Enacting plans (C3) Following rules of engagement

The credited response focuses on summarising the team’s discussion to reach a final choice.

Part 1 – Sample Screen #13

The student is tasked with summarising what the team has learned about the sites and making a recommendation. The chat history is available to review as is the information from the website for the museum, market and car factory.

PISA 2015

Introduction

Part 1 - Directions

The team has asked you to record what it has learned about each site and make a recommendation based on that information.

- Complete the table by clicking on the appropriate boxes.
- Click on the site to recommend for the visit.
- When you are finished, click on Send.

George: Our school is in the middle of town. The factory is kind of far away.

You: We'd better check how long the trip would take.

Rachel: I've looked at the web page for the car factory. I think a visit there would be OK, but could you guys double check to see if there's a problem?

You: There's not enough time to get there and back and have everyone take the tour.

George: Visiting the factory would take three hours, half of it on the bus.

Rachel: Where does that leave us? I'm starting to lose track of the details.

You: We should summarize what we've found out about each site.

Museum **Market** **Factory**

Location: 101 Main Street, in the center of town

Hours: Saturday, 10 a.m.-5 p.m., Sunday Noon-5 p.m.

On Display: Our town's history and heritage can be seen in the following exhibits:

- Clothing, furniture, and room decorations from different periods
- Antiques donated by generations of local families
- Maps showing the growth of the town and surrounding areas

Notepad

- Provides sense of life in our town
- Travel time is manageable
- Is open Thursday, 1-3PM

SEND

To: Team

From: You

Subject: Our choice for class visit

Team:
Here's what we found out about the sites:

Site	Museum	Market	Factory
Gives a sense of town life	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Is open when needed	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
Can be visited in two hours	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>

We should tell Ms. Cosmo that we recommend visiting the following site:

- the museum of local history
- the community open-air market
- the electric car factory

Thanks, guys!

<i>Item</i>	CC101113
<i>Credited Response</i>	On the table: all 3 boxes checked for the Market and 5 of the 6 buttons correctly checked for the Factory and Museum Radio buttons: Community open-air market selected
<i>Classification</i>	(C2) Enacting plans (C3) Following rules of engagement

Part 2: Overview

The opening screen of Part 2 presents an email from the faculty advisor, Ms. Cosmo. She presents an overview of the task and defines the key roles.

The screenshot shows a software interface for 'PISA 2015'. At the top, there is a blue header bar with the text 'PISA 2015' on the left, a progress indicator with five green boxes, a power button icon, a question mark icon, and left and right arrow icons. Below the header, a blue bar contains the title 'The Visit - Part 2' and the subtitle 'Introduction'. The main content area has a light blue background and contains the following text:

Read the introduction. Then click on the NEXT arrow.

You have received the following email message from Ms. Cosmo:

To: You

From: Ms. Cosmo

Subject: Assigning Guides to Visitors

Thanks for recommending a place for our class visit. While the visiting students are at our school they will need guides to help them find their way around, understand what's expected of them, and generally have a positive experience.

Since you took the lead in planning the outing, you don't need to be a guide. Please let George take the lead in suggesting assignments but give him any help he might need.

On the next screen, you will see some instructions to help you with this assignment.

Part 2: Directions

The directions for Part 2 summarise the key criteria that need to be considered when selecting the student-visitor groupings.

- Each team member can act as a guide to a maximum of three visitors
- Each visitor must be assigned to a guide who has studied the visitor’s native language
- Guides must be of equal or higher class rank than the visitors assigned to them

The advisor also mentions that it would be desirable to match visitors and guides with respect to outside interests and favorite subjects, but that this is not a requirement.

Note that the attributes for the guides and visitors are such that there are multiple assignment possibilities that will fulfill the three essential conditions.

On the right side of the screen, the table shown below displays. Over the course of the chat, as new information is added and assignments are proposed, the display reflects that conversation.

The screenshot shows a software interface for a PISA 2015 activity. On the left is a chat window with instructions. On the right is a table with two sections: 'Guides' and 'Visitors'.

Chat Window Content:

Introduction

Part 2 - Directions

Help George assign visitors to himself, Rachel and Brad. There are 8 visitors who don't have guides. Their names and some information about them are shown on the right.

Ms. Cosmo has given you the following instructions:

"Make sure that every visitor has a guide who has studied that visitor's native language. We also don't want any visitors to be guided by someone from a lower year than they are in. And no one should be a guide to more than three visitors."

"It would be good if you could match the interests of guides and visitors, but that's not absolutely necessary."

You and your teammates can use the **chat** and the information about the **visitors** and **guides** on the right to decide which visitors should be assigned to George, Rachel and Brad. As you discuss possible assignments in the chat, the visitors will be sorted under the guides they are assigned to.

[Click Here to Continue](#)

Guides Table:

Guides		
George 2nd year Interest: Sports	Rachel 2nd year Interest: Movies	Brad 1st year Interest: Computer Games

Visitors Table:

Francoise 1st Year Interest: Sports Language: French	Raul 1st Year Interest: Computer Games Language: Spanish	Helene 1st Year Interest: Sports Language: French
Pablo 2nd Year Interest: Computer Games Language: Spanish	Zhang 1st Year Interest: Movies Language: Mandarin	Sara 1st Year Interest: Movies Language: Spanish
Yao 2nd Year Interest: Movies Language: Mandarin	Gerard 1st Year Interest: Computer Games Language: French	

Part 2 – Sample Screen #1

The screenshot shows the PISA 2015 interface. On the left is a chat window titled 'Who's in the Chat' with participants 'You', 'George', 'Rachel', and 'Brad'. The chat history shows a message from George: 'So, what should we do first?'. Below the chat are three message options: 'OK everyone, Ms. Cosmo has asked George to make some suggestions.', 'George, before you suggest some assignments, can you tell everyone what languages you have studied?', and 'It would help to know what languages each of you has studied.' A 'Send' button is at the bottom of the chat area. On the right is a 'Guides' table with columns for George (2nd year, Interest: Sports), Rachel (2nd year, Interest: Movies), and Brad (1st year, Interest: Computer Games). Below the guides is a 'Visitors' table with columns for Francoise (1st Year, Interest: Sports, Language: French), Raul (1st Year, Interest: Computer Games, Language: Spanish), Helene (1st Year, Interest: Sports, Language: French), Pablo (2nd Year, Interest: Computer Games, Language: Spanish), Zhang (1st Year, Interest: Movies, Language: Mandarin), Sara (1st Year, Interest: Movies, Language: Spanish), Yao (2nd Year, Interest: Movies, Language: Mandarin), and Gerard (1st Year, Interest: Computer Games, Language: French).

<i>Item</i>	CC101201
<i>Credited Response</i>	<p>Full credit: It would help to know what languages each of you has studied.</p> <p>Partial credit: George, before you suggest some assignments, can you tell everyone what languages you have studied?</p> <p>Partial credit: Rachel and Brad, what languages have you studied?</p>
<i>Classification</i>	(A1) Discovering perspectives and abilities of team members

Credited responses focus on collecting information about team members’ language experience, as guides need to have studied the language(s) of their assigned visitors. The full credit response focuses on all 3 team members; partial credit responses focus just on George or just on Rachel and Brad.

Item associated with alternate path:

While the first option does not move the problem solving forward, it does restate information provided by Ms. Cosmo. If the student selects the first option, George delivers a partial rescue by mentioning his own language abilities. The student then has a second opportunity to suggest that the team provide information about language skills (**item 202**) with chat options similar to those presented in item 201.

Part 2 – Sample Screen #2

Each team member specifies the language(s) he or she has studied and these display under their names, along with their class year and interests.

PISA 2015

Introduction

Part 2 - Directions

Who's in the Chat

You George Rachel Brad

George: So, what should we do first?

You: It would help to know what languages each of you has studied.

George: I've studied French and Mandarin.

Rachel: And I've studied Spanish and French.

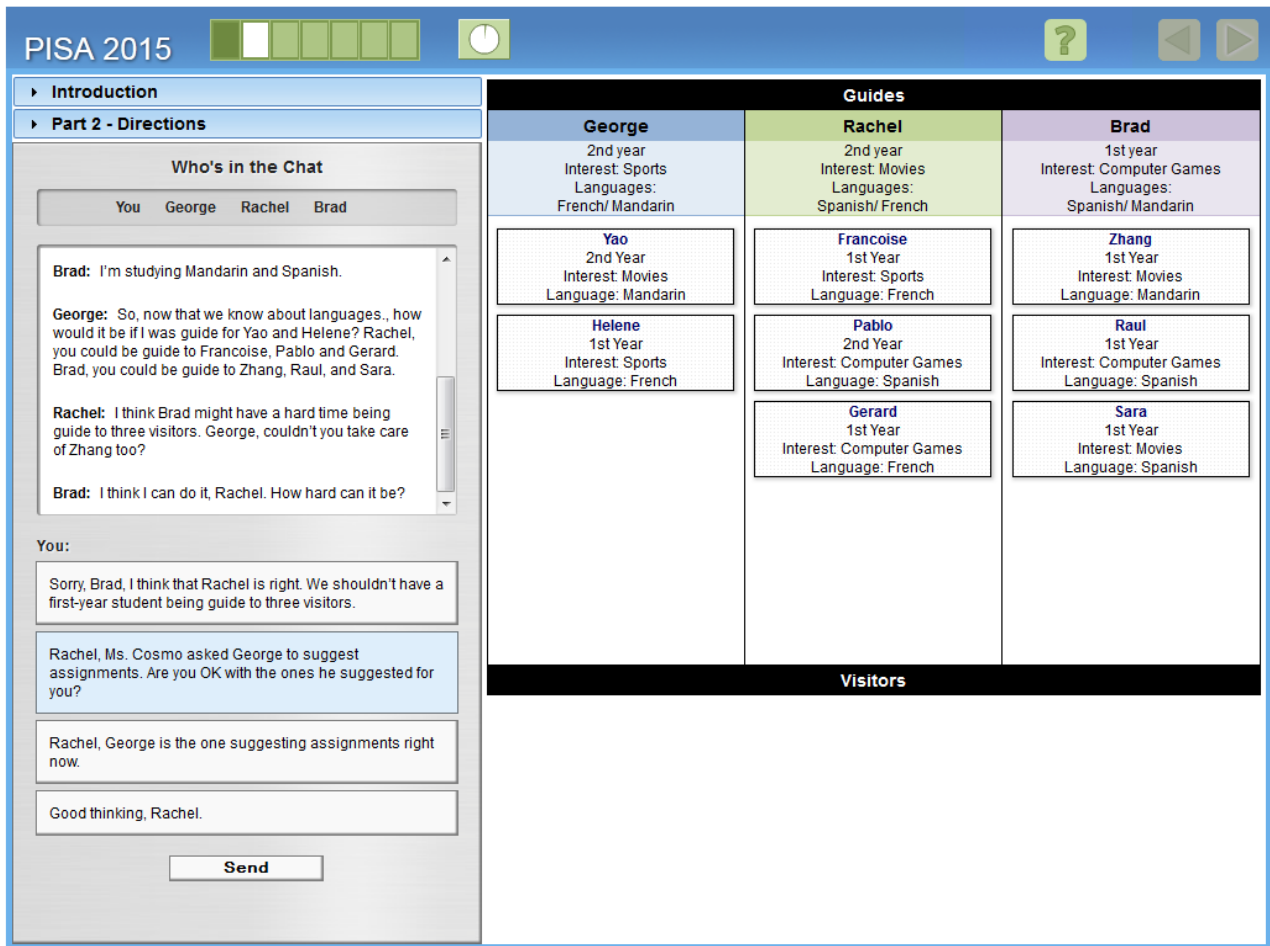
Brad: I'm studying Mandarin and Spanish.

Guides		
George 2nd year Interest: Sports Languages: French/ Mandarin	Rachel 2nd year Interest: Movies Languages: Spanish/ French	Brad 1st year Interest: Computer Games Languages: Spanish/ Mandarin

Visitors		
Francoise 1st Year Interest: Sports Language: French	Raul 1st Year Interest: Computer Games Language: Spanish	Helene 1st Year Interest: Sports Language: French
Pablo 2nd Year Interest: Computer Games Language: Spanish	Zhang 1st Year Interest: Movies Language: Mandarin	Sara 1st Year Interest: Movies Language: Spanish
Yao 2nd Year Interest: Movies Language: Mandarin	Gerard 1st Year Interest: Computer Games Language: French	

Part 2 – Sample Screen #3

George suggests visitor assignments and these display under each team member’s name. Rachel points out that Brad might have difficulty guiding 3 visitors.



<i>Item</i>	CC101203
<i>Credited Response</i>	Rachel, Ms. Cosmo asked George to suggest assignments. Are you OK with the ones he suggested for you?
<i>Classification</i>	(C3) Following rules of engagement

The credited response prompts the team to respect Ms. Cosmo’s assignment of George as the leader for this task.

Items associated with alternate paths:

If the student selects the first option, George rescues by stating that, “That’s not one of the rules Ms. Cosmo gave us.”. The student then has a second chance to ask Rachel if she is ok with George’s choices (**item 204**).

If the student selects the third option, Rachel rescues by acknowledging that George should make the assignments. The student then has a second chance to ask Rachel if she is ok with George’s choices (**item 205**).

Part 2 – Sample Screen #4

Rachel agrees to the visitors she was assigned and Brad agrees that he can act as a guide to two, rather than three, visitors but thinks that he would be a better match for Pablo and Raul based on languages and interests. The display of assignments changes accordingly.

The screenshot shows the PISA 2015 interface. On the left is a chat window titled 'Who's in the Chat' with participants 'You', 'George', 'Rachel', and 'Brad'. The chat history includes:

- Rachel:** I guess I'm fine with the three you assigned me, George. We don't really know much about them yet, so what's the difference?
- Brad:** Well, I guess I could guide just two of the visitors. Maybe Raul and Pablo. They both speak Spanish and like computer games. They'd have a great time!
- George:** I guess so.
- Rachel:** Maybe it's a good idea. Pablo might relate better to Brad, since they have the same interests.

The chat input area shows three messages:

- I don't see why not.
- OK, Ms. Cosmo did say we should help the visitors have a positive experience and this might really improve Pablo's.
- But Pablo's older than Brad.

The chat window has a 'Send' button. On the right is a grid of 'Guides' and 'Visitors'.

Guides:

- George:** 2nd year, Interest: Sports, Languages: French/ Mandarin
- Rachel:** 2nd year, Interest: Movies, Languages: Spanish/ French
- Brad:** 1st year, Interest: Computer Games, Languages: Spanish/ Mandarin

Visitors:

- Yao:** 2nd Year, Interest: Movies, Language: Mandarin
- Francoise:** 1st Year, Interest: Sports, Language: French
- Raul:** 1st Year, Interest: Computer Games, Language: Spanish
- Helene:** 1st Year, Interest: Sports, Language: French
- Gerard:** 1st Year, Interest: Computer Games, Language: French
- Pablo:** 2nd Year, Interest: Computer Games, Language: Spanish
- Sara:** 1st Year, Interest: Movies, Language: Spanish
- Zhang:** 1st Year, Interest: Movies, Language: Mandarin

<i>Item</i>	CC101206
<i>Credited Response</i>	I can see you all like the idea, but Ms. Cosmo told us we can't have a first year student as a guide for a second-year visitor.
<i>Classification</i>	(D1) Monitoring and repairing the shared understanding

The credited response reminds the team about Ms. Cosmo's requirement that guides must be of equal or higher class rank than the visitors assigned to them, helping to ensure that the assignments meet the specified criteria.

If a student selects one of the first two responses, Rachel rescues, saying "Well, we forgot that Brad is a first year and Pablo is a second-year. It won't work."

Item associated with alternate path:

If student selects the third option, Brad asks why that matters and the student has a second chance to remind the team that a first year student cannot act as a guide for a second year visitor (**item 207**).

Part 2 – Sample Screen #5

Brad says he didn't realise that Pablo was a second-year student and George suggests the team go with his original suggestion.

PISA 2015

Introduction

Part 2 - Directions

Who's in the Chat

You George Rachel Brad

George: I guess so.

Rachel: Maybe it's a good idea. Pablo might relate better to Brad, since they have the same interests.

You: I can see you all like the idea, but Ms. Cosmo told us we can't have a first year student as a guide for a second-year visitor.

Brad: OK, I didn't notice he was a second year student.

George: So, let's go with my original suggestion?

You:

Good idea. Let's get this done.

Are you OK with George's idea, Brad?

Can you make another suggestion, George? I think other possibilities might work.

Send

Guides		
George 2nd year Interest: Sports Languages: French/ Mandarin	Rachel 2nd year Interest: Movies Languages: Spanish/ French	Brad 1st year Interest: Computer Games Languages: Spanish/ Mandarin
Yao 2nd Year Interest: Movies Language: Mandarin	Francoise 1st Year Interest: Sports Language: French	Zhang 1st Year Interest: Movies Language: Mandarin
Helene 1st Year Interest: Sports Language: French	Pablo 2nd Year Interest: Computer Games Language: Spanish	Raul 1st Year Interest: Computer Games Language: Spanish
	Gerard 1st Year Interest: Computer Games Language: French	Sara 1st Year Interest: Movies Language: Spanish

Visitors

<i>Item</i>	CC101208
<i>Credited Response</i>	Are you OK with George's idea, Brad?
<i>Classification</i>	(D2) Monitoring results of actions and evaluating success in solving the problem

The credited response prompts one team member to confirm another's suggestion.

Part 2 – Sample Screen #6

The team members continue to discuss the selections, finally agreeing with George’s plan. George notes that this task took longer than necessary and wonders how the team could do better next time.

The screenshot shows the PISA 2015 interface. On the left is a chat window titled "Who's in the Chat" with participants "You", "George", "Rachel", and "Brad". The chat history includes messages from Brad, Rachel, Brad, and George. Below the chat is a "You:" section with four text input boxes containing suggestions like "Maybe we could respond to each other faster." and "Maybe we should pay more attention to what Ms. Cosmo required." A "Send" button is at the bottom of the chat.

On the right is a "Guides" section with a grid of profiles:

George	Rachel	Brad
2nd year Interest: Sports Languages: French/ Mandarin	2nd year Interest: Movies Languages: Spanish/ French	1st year Interest: Computer Games Languages: Spanish/ Mandarin
Yao 2nd Year Interest: Movies Language: Mandarin	Francoise 1st Year Interest: Sports Language: French	Zhang 1st Year Interest: Movies Language: Mandarin
Helene 1st Year Interest: Sports Language: French	Pablo 2nd Year Interest: Computer Games Language: Spanish	Raul 1st Year Interest: Computer Games Language: Spanish
	Gerard 1st Year Interest: Computer Games Language: French	Sara 1st Year Interest: Movies Language: Spanish

Below the grid is a "Visitors" section which is currently empty.

<i>Item</i>	CC101209
<i>Credited Response</i>	Maybe we should pay more attention to what Ms. Cosmo required.
<i>Classification</i>	(D3) Monitoring, providing feedback and adapting the team organisation and roles

The credited response allows the student to reflect on the process and affirm the importance of attending to provided criteria in order to efficiently solve the problem.

If a student selects one of the other options, George concludes part 2, saying, “Well, at least we could agree. I’m looking forward to meeting them.”

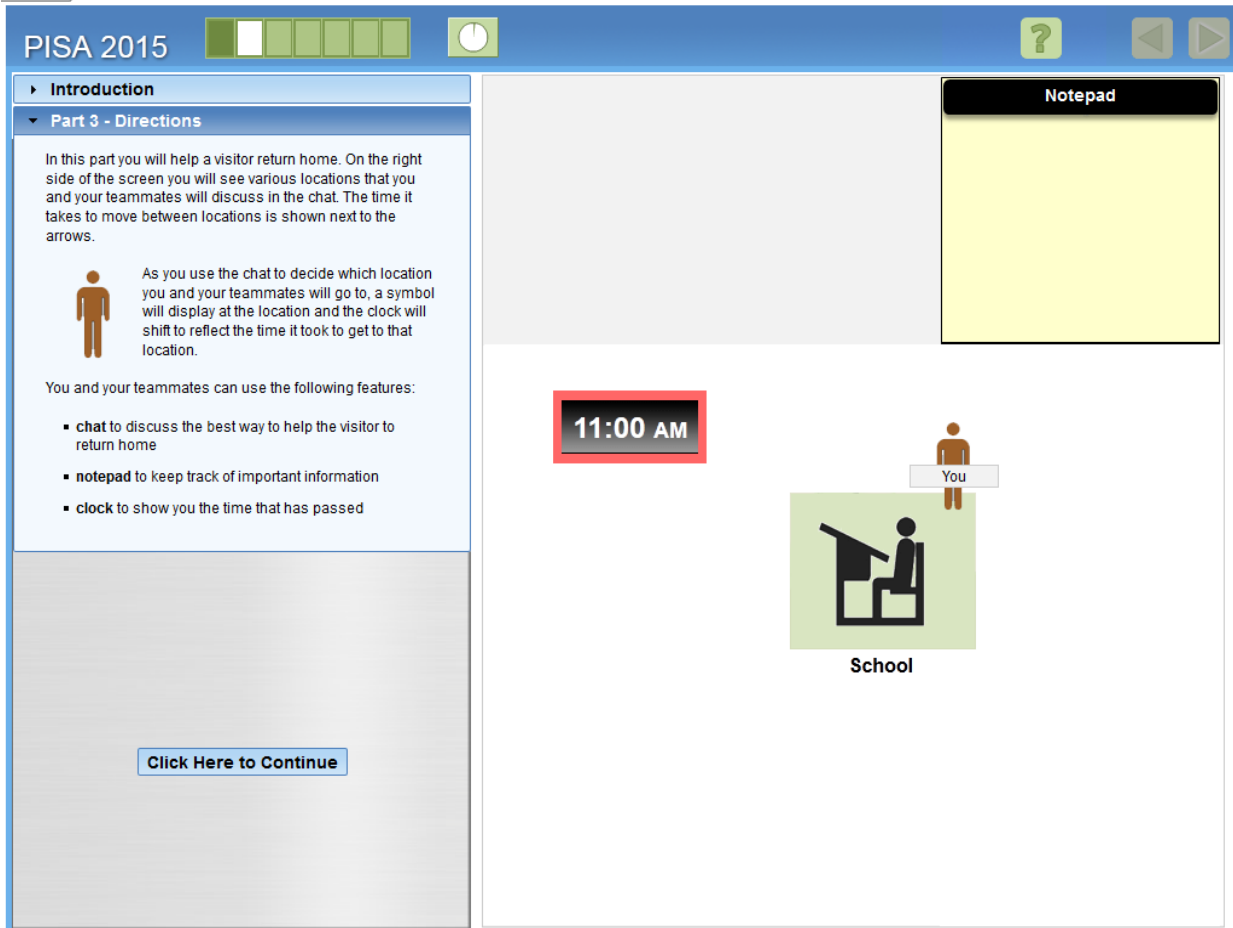
Part 3: Overview

Part 3 focuses on the task of helping one of the visitors who needs to return home unexpectedly. The previously-made arrangements for taking the visitor to the airport have been upset and the student and agents must intervene. The team must first share information regarding the whereabouts of the visitor and attempt to rendezvous with him and, if possible, locate his lost mobile phone. After the rendezvous, the student and the agents must collaborate to determine the best way to get the visitor to the airport, subject to various constraints.

The screenshot shows a software interface for the PISA 2015 assessment. At the top, there is a blue header bar with the text 'PISA 2015' on the left, a progress indicator consisting of five green squares (the first is white), a power button icon, a question mark icon, and left and right arrow navigation icons. Below the header, a light blue box contains the title 'The Visit - Part 3' and the subtitle 'Introduction'. Underneath this box, the instruction 'Read the introduction. Then click on the NEXT arrow.' is displayed. The main content area features a white text box with the following text: 'It's 11:00 AM Saturday after the visitors have arrived. You are just leaving school when you, Brad, and George all get a message from Rachel.'

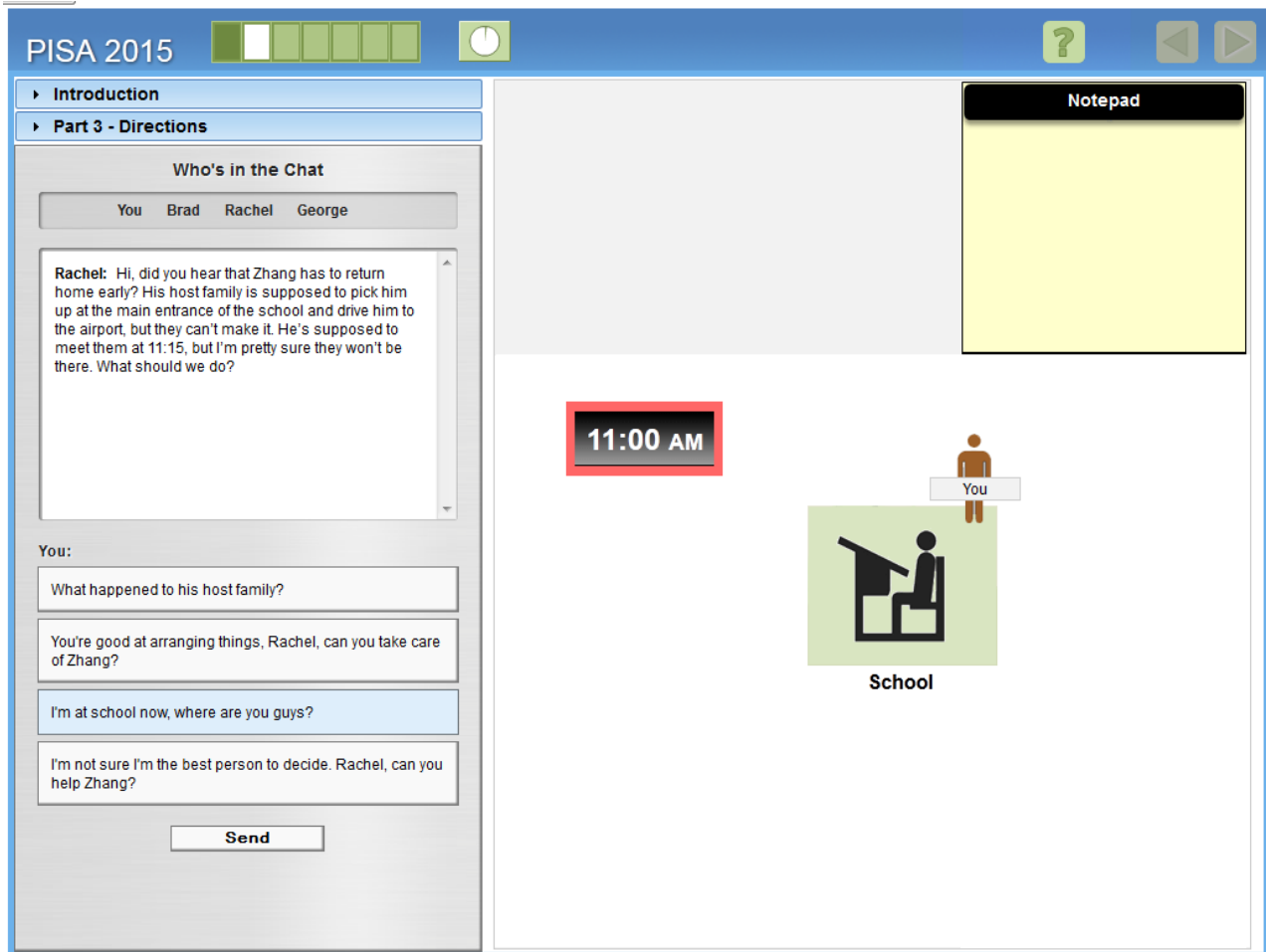
Part 3: Directions

The directions specify the team’s task: to help one of the visitors return home. The information that will display in the task area is also explained: locations of the team members will be shown, the clock will show the time, and notepad will display important information.



Part 3 – Sample Screen #1

Rachel’s message displays and sets out the basics of the problem to be solved by the team.



<i>Item</i>	CC101301
<i>Credited Response</i>	I'm at school now, where are you guys? (full credit)
<i>Classification</i>	(B3) Describing roles and team organisation (communication protocol/rules of engagement)

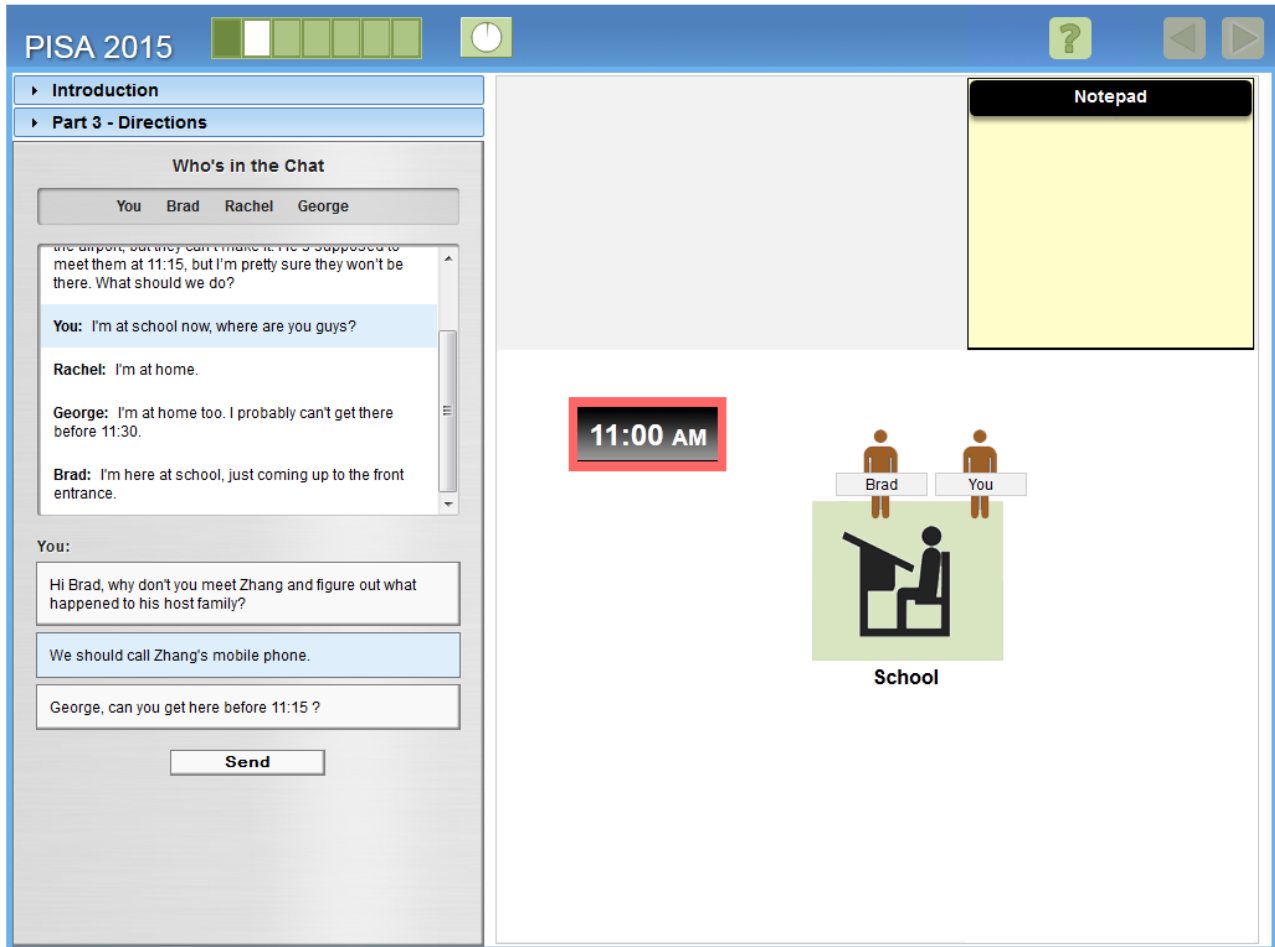
The credited response focuses the team on the first task, determining where everyone is.

Items associated with alternate paths:

- If the student selects the first option, Rachel rescues saying she doesn't know what happened to his host family and asking if you are at school. The student has a second chance to respond about his or her location: "I'm at school, where are you?" (**Item 302** – partial credit)
- If the student selects the second or fourth options, Rachel says she is at home. The student can respond by asking where everyone else is. (**Item 303** – partial credit)

Part 3 – Sample Screen #2

Regardless of the path taken, Brad joins in, saying he is at the school and his icon displays in the task area.



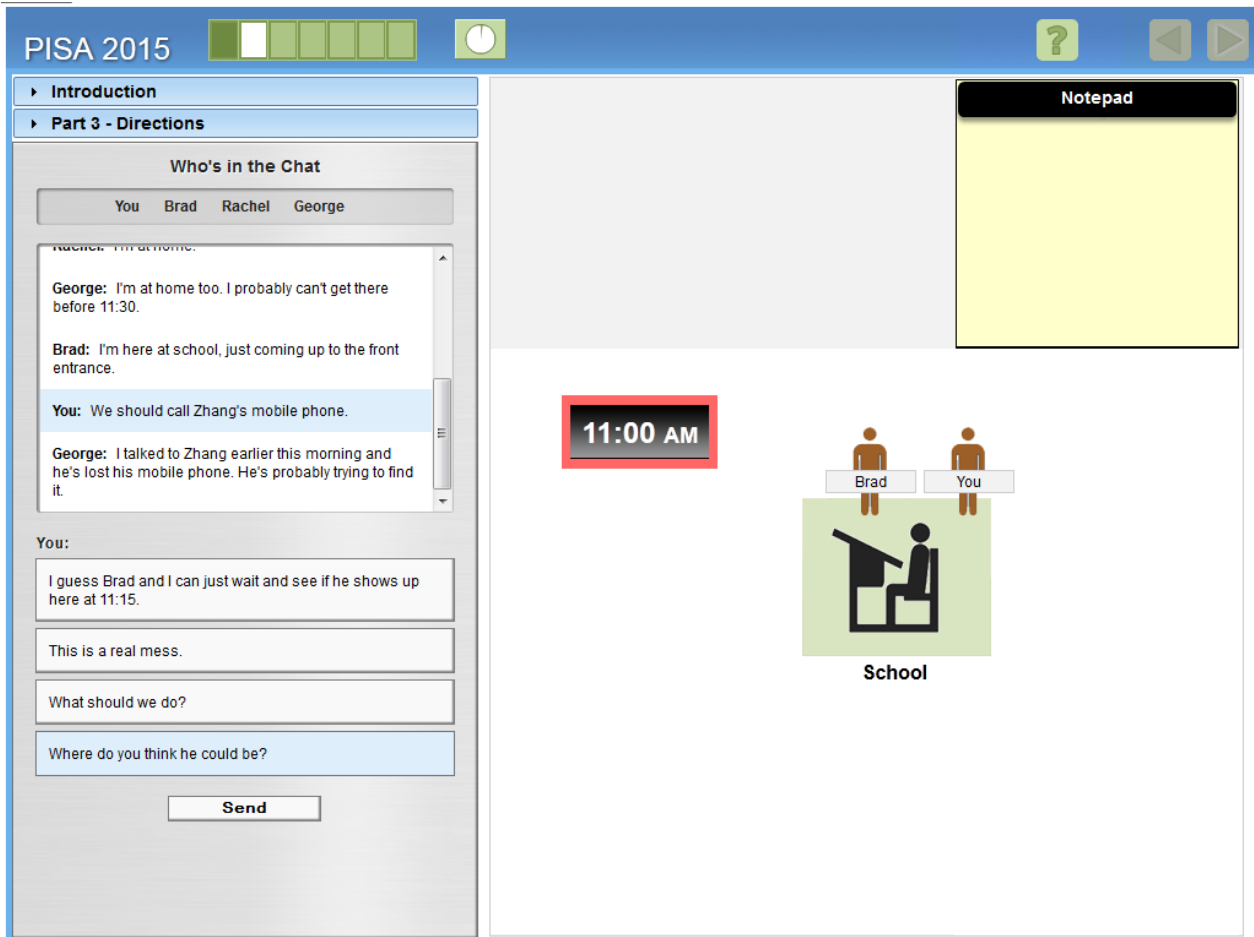
<i>Item</i>	CC101304
<i>Credited Response</i>	Full credit: We should call Zhang's mobile phone. Partial credit: Hi Brad, why don't you meet Zhang and figure out what happened to his host family?
<i>Classification</i>	(A1) Discovering perspectives and abilities of team members

Item associated with alternate path:

If the student selects the third option, George says he can't get to school until 11:30 and the student has a second chance to suggest they try to call Zhang on his cell phone (**item 305**).

Part 3 – Sample Screen #3

George lets the team know that Zhang lost his cell phone and is trying to find it.



<i>Item</i>	CC101306
<i>Credited Response</i>	Two responses are equally credited: What should we do? Where do you think he could be?
<i>Classification</i>	(B1) Building a shared representation and negotiating the meaning of the problem (common ground)

Each of credited responses will elicit an idea from George about how the team should proceed.

Part 3 – Sample Screen #4

George suggests that Zhang is trying to find his phone.

The screenshot displays the PISA 2015 collaborative problem-solving interface. On the left, a chat window shows a conversation between 'You', Brad, Rachel, and George. The chat history includes: 'You: We should call Zhang's mobile phone.', 'George: I talked to Zhang earlier this morning and he's lost his mobile phone. He's probably trying to find it.', 'You: Where do you think he could be?', 'George: Zhang's probably looking for his phone at the Internet Cafe or the Food Court at the mall. He's really going to need his phone for the trip home.', and 'You: Brad, why don't you go look for Zhang at the Food Court and I'll go to the Internet Cafe.', 'Brad, why don't you go look for Zhang at the Internet Cafe and I'll go to the Food Court.', 'Brad, why don't you wait here for Zhang, while I go to the Internet Cafe and then the Food Court?', and 'Brad, let's just wait here until 11:15.' Below the chat is a 'Send' button. The 'Who's in the Chat' section lists 'You', 'Brad', 'Rachel', and 'George'. A 'Notepad' is visible on the right. The main area features a map with three locations: 'School' (top), 'Food Court' (bottom left), and 'Internet Cafe' (bottom right). A clock shows '11:00 AM'. Arrows indicate travel times: 15 minutes from School to Food Court, 15 minutes from School to Internet Cafe, and 15 minutes from Food Court to Internet Cafe. Brad and You are shown at the School location.

<i>Item</i>	CC101307
<i>Credited Response</i>	Full credit: Brad, why don't you wait here for Zhang, while I go to the Internet Cafe and then the Food Court? Partial credit: Brad, let's just wait here until 11:15.
<i>Classification</i>	(C2) Enacting plans

Items 308 – 311 are associated with a series of alternate actions taken by the student, George and Brad as they decide who should go where to try and find Zhang and his phone.

Part 3 – Sample Screen #5

Regardless of the path taken, Zhang ends up at the school and his phone is located. George brings up a new aspect of the problem – Zhang has missed his ride and needs to get to the airport.

The screenshot shows the PISA 2015 interface. On the left is a chat window titled 'Who's in the Chat' with participants 'You', Brad, Rachel, and George. The chat history includes messages from Brad, You, Brad, George, and You. The task area on the right shows a map with a clock at 11:45 AM and four people icons (Zhang, Brad, You, George) positioned above a 'School' icon. Arrows indicate 15-minute travel times from the School to the Food Court, Internet Cafe, and a central location. A double-headed arrow between the Food Court and Internet Cafe also indicates a 15-minute travel time. A 'Notepad' icon is visible in the top right of the task area.

<i>Item</i>	CC101312
<i>Credited Response</i>	Maybe he should, but a taxi will be expensive. Brad, does he have enough money?
<i>Classification</i>	(C2) Enacting plans

The credited response raises a question that the team must take into account when considering transportation options.

Item associated with alternate path:

If the student selects the first or second options, Brad reports that Rachel said the host family wasn't coming and George raises the point that a taxi could be expensive. If the student selects the last option, George mentions that a taxi could be expensive. The student has a second chance to ask if Zhang has enough money for a taxi (**item 313**).

Part 3 – Sample Screen #6

Brad shares the information that Zhang does not have enough money for a taxi.

<i>Item</i>	CC101314
<i>Credited Response</i>	What time is his flight?
<i>Classification</i>	(B1) Building a shared representation and negotiating the meaning of the problem (common ground)

The credited response focuses the team on key information needed to solve the problem.

If the first option is selected, George rescues by asking how long the team should wait.

Selecting the third option leads to Brad’s comment, shown on the following page.

Part 3 – Sample Screen #7

Brad provides information about when Zhang’s flight is scheduled to leave.

The screenshot displays the PISA 2015 interface for 'Part 3 - Directions'. On the left, a chat window titled 'Who's in the Chat' shows participants 'You', 'Brad', 'Rachel', and 'George'. The chat history includes: 'You: Maybe he should, but a taxi will be expensive. Brad, does he have enough money?', 'Brad: Zhang only has a little money, not nearly enough for a taxi.', 'George: What should we do?', 'You: What time is his flight?', and 'Brad: His flight is at four PM.' Below the chat is a 'Send' button. On the right, a yellow notepad is visible. The central diagram shows a 'School' node at the top, with four participant icons (Zhang, Brad, You, George) above it. A clock shows '11:45 AM'. Below the School node are two other nodes: 'Food Court' (with a fork and knife icon) and 'Internet Cafe' (with a coffee cup icon). Arrows indicate 15-minute travel times from the School to both the Food Court and the Internet Cafe, and a 15-minute travel time between the Food Court and the Internet Cafe.

<i>Item</i>	CC101315
<i>Credited Response</i>	So what other ways are there to get to the airport?
<i>Classification</i>	(B1) Building a shared representation and negotiating the meaning of the problem (common ground)

The credited response helps formulate the problem by asking the team to consider the range of transportation options.

If the student selects any of the other options, George rescues by saying, “We should think of other ways for Zhang to get to the airport.”

Part 3 – Sample Screen #8

Brad says that Zhang could take the bus or train, but they are slower. The clock updates to 12:00 and the train station and bus station icons display.

The screenshot shows a software interface for a collaborative problem-solving task. On the left is a chat window titled 'Who's in the Chat' with participants 'You', 'Brad', 'Rachel', and 'George'. The chat history shows:

- George: What should we do?
- You: What time is his flight?
- Brad: His flight is at four PM.
- You: So what other ways are there to get to the airport?
- Brad: He could take the bus or the train, but they are a lot slower than a taxi.

 Below the chat is a text input field with a 'Send' button. The main area contains a map with a clock showing '12:00 PM'. The map shows a 'School' location with four people icons (Zhang, Brad, You, George) above it. Below the school are three locations: 'Food Court', 'Internet Cafe', and 'Internet Cafe'. Travel times are indicated: 15 minutes from School to Food Court, 15 minutes from School to Internet Cafe, and 15 minutes between the two Internet Cafes. Above the map are icons for 'Train Station' and 'Bus Station'. A 'Notepad' icon is in the top right.

<i>Item</i>	CC101316
<i>Credited Response</i>	How many hours before his flight should he get to the airport?
<i>Classification</i>	(D1) Monitoring and repairing the shared understanding

The credited response to this item advances the shared understanding of the group by seeking a clarification of the actual time constraints.

Part 3 – Sample Screen #9

Brad says that Zhang needs to arrive at the airport at least two hours before his flight.

The screenshot shows a PISA 2015 interface for a collaborative problem-solving task. On the left is a chat window titled 'Who's in the Chat' with participants 'You', 'Brad', 'Rachel', and 'George'. The chat history shows:

- Brad: He could take the bus or the train, but they are a lot slower than a taxi.
- You: How many hours before his flight should he get to the airport?
- Brad: Well, he needs to get there at least two hours before the flight.
- George: I took the bus to airport once and it took an hour and a half. I'm sure the train is faster, so either way is good.

 The main workspace contains a map with a clock at 12:00 PM. Four avatars (Zhang, Brad, You, George) are positioned above a 'School' icon. The 'School' is connected to a 'Food Court' (15 minutes), an 'Internet Cafe' (15 minutes), and a 'Train Station' (15 minutes). The 'Food Court' and 'Internet Cafe' are also connected to each other (15 minutes). Above the map are icons for 'Train Station' and 'Bus Station'. A 'Notepad' is on the right. The chat input field contains the text: 'How far away from here are the bus and train stations? Does anybody know?' with a 'Send' button below it.

<i>Item</i>	CC101317
<i>Credited Response</i>	Two equally credited responses: How far away from here are the bus and train stations? Does anybody know? We should check the schedules.
<i>Classification</i>	(D1) Monitoring and repairing the shared understanding

Items associated with alternate paths:

- If the student selects the first credited response (How far away. . .), the student gets a second chance to suggest that the team check the schedules (**item 319**).
- If the student selects the second credited response (We should check the schedules) or the other two responses, Brad provides information about the bus schedule (one leaves at 12:15 and arrives at 1:45) and the student is able to ask if there is enough time to get to the bus station (**item 318**).

Part 3 – Sample Screen #10

Regardless of the path taken, the information about the bus schedule is shared and recorded on the notepad. Brad identifies a potential problem: there may not be enough time to travel by bus.

The screenshot displays the PISA 2015 collaborative problem-solving interface. On the left is a chat window titled "Who's in the Chat" with participants "You, Brad, Rachel, George". The chat history shows Brad mentioning a bus to the airport at 12:15, You asking about the time, George explaining the 15-minute walk to the bus station, and Brad expressing concern about the time. Below the chat is a "Send" button. The central area features a map with a "School" at the center. Four locations are connected to the school by 15-minute paths: "Train Station" (top-left), "Bus Station" (top-right), "Food Court" (bottom-left), and "Internet Cafe" (bottom-right). A clock shows "12:00 PM". On the right is a "Notepad" with the text: "• 12:15 bus arrives airport at 1:45." The interface also includes a "PISA 2015" header, navigation buttons, and a help icon.

<i>Item</i>	CC101320
<i>Credited Response</i>	How about the train?
<i>Classification</i>	(C2) Enacting plans

The credited response recognises that the last transportation option should be considered given the potential problem with the bus.

The incorrect responses lead to a rescue by Brad, who suggests that they consider the train.

Part 3 – Sample Screen #11

PISA 2015

Introduction

Part 3 - Directions

Who's in the Chat

You Brad Rachel George

That's too late. I'll make a note.

You: Is there enough time to get to the bus station?

George: Well, it takes about 15 minutes to walk to the bus station and about the same to the train station.

Brad: I don't think there's enough time for the bus.

You: How about the train?

George: Good idea!

You:

The train might be a good idea.

OK, can you check the train schedule, Brad?

I still think there's enough time to catch the bus if he leaves right now.

Send

Train Station **Bus Station**

12:00 PM

Zhang Brad You George

School

Food Court **Internet Cafe**

Notepad

- 12:15 bus arrives airport at 1:45.

<i>Item</i>	CC101321
<i>Credited Response</i>	OK, can you check the train schedule, Brad?
<i>Classification</i>	(C2) Enacting plans

The credited response moves the task forward by asking a team member to find information needed to make a decision about the train.

Selecting one of the incorrect options leads to a rescue by George, who asks Brad to check the train schedule.

Part 3 – Sample Screen #12

Brad provides information about the train schedule and that information is recorded on the notepad.

PISA 2015

Introduction
Part 3 - Directions

Who's in the Chat
 You Brad Rachel George

bus station and about the same to the train station.
Brad: I don't think there's enough time for the bus.
You: How about the train?
George: Good idea!
You: OK, can you check the train schedule, Brad?
Brad: There's a train to the airport at 1:00. It gets there at 2:00. I'll make a note.

You:
 Thanks Brad, that looks like a good option.
 Maybe Zhang would enjoy the bus ride more.
 How much does a train ticket cost?
 That's better, let's take him to the train station.

Send

12:00 PM

Train Station **Bus Station**

School

Food Court **Internet Cafe**

Notepad

- 12:15 bus arrives airport at 1:45.
- 1:00 train arrives airport at 2:00.

<i>Item</i>	CC101322
<i>Credited Response</i>	How much does a train ticket cost?
<i>Classification</i>	(C2) Enacting plans

The credited response is correct because it has been established that that team needs to consider both travel time and cost.

Part 3 – Sample Screen #13

George rescues to resolve the cost issue saying he will lend Zhang the money if needed and Part 3 is concluded.

The screenshot displays the PISA 2015 interface. On the left, a chat window titled "Who's in the Chat" lists participants: You, Brad, Rachel, and George. The chat history shows:

- Brad: There's a train to the airport at 1:00. It gets there at 2:00. I'll make a note.
- You: How much does a train ticket cost?
- George: I have enough for a train ticket. I'll lend it to him.
- Brad: That's great. Let's go.

Below the chat, it says "Click the 'Continue' button." On the right, a "Notepad" contains:

- 12:15 bus arrives airport at 1:45.
- 1:00 train arrives airport at 2:00.

The main map area shows a central "School" icon with four people (Zhang, Brad, You, George) standing in front of it. A red clock icon shows "12:00 PM". Arrows indicate travel times:

- 15 minutes from School to Train Station
- 15 minutes from School to Bus Station
- 15 minutes from School to Food Court
- 15 minutes from School to Internet Cafe
- 15 minutes between Food Court and Internet Cafe