

Chapter 17

Questionnaire Design and Computer-Based Questionnaire Platform

INTRODUCTION

Questionnaires have been important components of the PISA survey from its beginning. They aid in delivering information about the learning contexts in countries and providing stand-alone reporting indicators in addition to merely explaining the “background” for reporting cognitive test results. The format and design of the questionnaires have changed across the last several PISA cycles, and the transition from paper-based to computer-based assessment began slowly for the questionnaires since PISA 2012. While optional online administration for the School Questionnaire was already introduced in PISA 2012, PISA 2018 made all the questionnaires – except for the Parent Questionnaire – available on computer.

As shown in Table 17.1, several questionnaires, both compulsory and optional, were implemented in PISA 2018.

Table 17.1: PISA 2018 Questionnaires

Questionnaire	Mode of delivery	Compulsory
Student Questionnaire	Computer and paper	Yes
School Questionnaire	Computer and paper	Yes
Educational Career Questionnaire	Computer only	No
Financial Literacy Questionnaire	Computer Only	No
ICT Questionnaire	Computer only	No
Teacher Questionnaire	Computer only	No
Parent Questionnaire	Paper only	No
Well Being Questionnaire	Computer only	No

Computer-based delivery was the standard and recommended administration format for PISA 2018, though a minority of countries still used paper-based delivery for all tests and questionnaires. The student questionnaires were delivered as part of the Student Delivery Platform and presented using participating schools’ computers. The School Questionnaire and the optional Teacher Questionnaires were also administered online. The use of an all-electronic assessment allowed for additional improvements over the PISA 2015 cycle, but the major

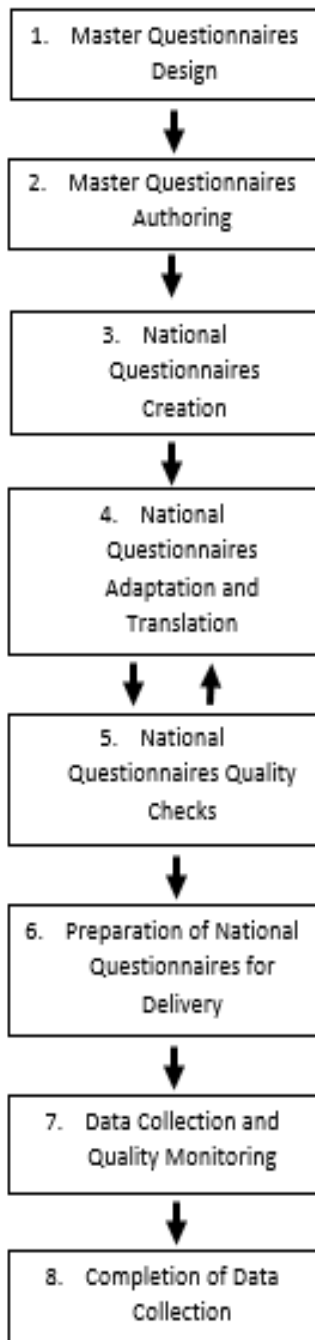
purpose of transitioning to an all-electronic platform was to increase the data quality and the response rate for this cycle.

After providing a global overview of the questionnaire implementation process used for PISA 2018, this chapter explains the PISA 2018 design for both the paper-based and the computer-based questionnaires in the Field Trial and the Main Survey. The next sections describe the computer-based questionnaires, the PISA questionnaire platform and its different functionalities.

GENERAL QUESTIONNAIRE PROCESS

The questionnaire life-cycle in PISA follows a process that can be split in eight major steps. These steps are described in Figure 17.1.

Figure 17.1: PISA 2015 questionnaire life cycle



Step 1: The **Master Questionnaires are designed** in collaboration with the Questionnaire Expert Group. These questionnaires are first created as Microsoft Word documents that will become the Master Paper-Based Questionnaires.

Step 2: For the Computer Based version, the **Master questionnaires are authored** using a unique authoring tool in the PISA questionnaire platform. They are produced in English before being verified and validated.

Step 3: The verified Master Questionnaires are duplicated for the different countries and languages. These questionnaires, called **National Questionnaires, are created** and made available to countries for adaptation and translation.

Step 4: The **adaptation and translation of National Questionnaires** is performed by members of the national centres. The adaptations take the form of adding or suppressing questions or changing parts of questions as required by the national context. At the same time, the text of the national questionnaires is translated into the language(s) of assessment.

Step 5: The **quality of the translated and adapted National Questionnaires needs be checked** against the original Master Questionnaire. The quality of adaptation and translation is important for guaranteeing that the collected results are comparable at the international level.

Step 6: When a questionnaire has successfully passed all the quality and technical checks, it can be **prepared for the field**. The deployment can be online (via a connection to Internet) or offline (distribution on USB sticks).

Step 7: During the data collection periods, **data are collected** either online or in the schools, depending on the distribution method of the questionnaires.

Step 8: At the **end of the data collection**, the online National Questionnaires are deactivated and respondents can no longer access them. Final data files are exported for data cleaning and analysis.

For each cycle of the PISA survey, this sequence of steps takes place twice: once for the Field Trial (FT) and once for the Main Survey (MS). During the Field Trial, the whole platform (i.e. the tools, computer servers, network access, etc.) and the material (i.e. the questionnaires) are tested on a limited sample of respondents. Between the Field Trial and Main Survey, the collected results and feedback are analysed. Then, for the Main Survey, the sequence is started for a second time and each step integrates all necessary adjustments in terms of process, questionnaires material, and tooling. This double-phase cycle provides better data quality.

In the following sections, each step of this process is explained in more detail.

STEP 1: MASTER QUESTIONNAIRES DESIGN

Starting with the first cycle in 2000, PISA has emphasised the importance of collecting context information from students and schools along with the assessment of student achievement. A Student Questionnaire (StQ – approximately 30 minutes) and a School Questionnaire (ScQ – approximately 35 minutes) cover a broad range of contextual variables. The content of these questionnaires – especially the content of the Student Questionnaire – has changed considerably between cycles, but the design has remained stable: every student participating in the PISA assessment completes the StQ, and every school principal (one per school) completes the ScQ. (Please also see Chapter 3 about the context questionnaire development).

PISA has also included several international options, i.e. additional instruments that countries could administer on a voluntary basis. For PISA 2018, it included a Parent Questionnaire (PAQ) as well as optional questionnaires for the students including the Educational Career Questionnaire (ECQ), a Financial Literacy Questionnaire (FL), and ICT Familiarity Questionnaire (ICTQ). In addition, for the first time, PISA 2018 included a Well Being Questionnaire (WBQ) as an international option into its design. The following table (Table 17.2) summarises the participation of countries/economies in the international questionnaires.

Table 17.2: Participation in the PISA 2018 Main Study¹

The context questionnaires contribute to integral aspects of the analytical power of PISA as well as to its capacity for innovation. Therefore, the questionnaire design must meet high methodological standards, allowing for the collection of data that leads to reliable, precise and unbiased estimations of population parameters for each participating country. In addition, the design also has to ensure that important policy issues and research questions can be addressed in later analysis and reporting based on PISA data. Both the psychometric quality of the variables and indicators and the analytical power of the study have to be taken into account when proposing and evaluating a questionnaire design. This is usually done by pre-testing all questionnaire content in the Field Trial one year prior to the Main Survey assessment. Accordingly, more material is tested in the Field Trial than will be implemented later on in the Main Survey. Results are then discussed with the PISA expert groups and Main Survey material is selected.

The Field Trial and the Main Study questionnaire designs greatly differ in many respects. The goal of the Field Trial is to re-evaluate the quality of the context questionnaires used in previous cycles as well as the quality of new items developed for PISA 2018. Moreover, processes and implementation are tested for all countries, including those that are new to PISA.

In the following sections, the differences between the Field Trial and the Main Survey Design for both paper based and computer based assessment are explained in more detail.

¹ CBA denotes Computer-Based Assessment. PBA denotes Paper-Based Assessment. UH denotes “une heure” which is a shortened version of the student questionnaire.

Field trial questionnaire design

Computer-based design

For the Student Questionnaire, two parallel booklets were administered. For the School Questionnaire, as well as for the optional Parent and Teacher Questionnaires, more material than could be used in the main survey was administered, leading to a slightly longer time to complete the whole questionnaire in the Field Trial than was planned for the Main Survey.

Each Student Questionnaire included a set of core items (i.e., StQ-FT Core Items) and one of two possible booklets (i.e., StQ-FT-Booklet 1, StQ-FT-Booklet 2). The set of core items included a minimal set of student background variables – around five minutes in length – that were administered to all students. The two booklets consisted of 25-minutes of non-overlapping content. As shown in Figure 17.2, these were randomly assigned to students. The optional questionnaires for students Educational Career and ICT Familiarity questionnaires (ECQ and ICTQ) were administered following the Student Questionnaire and were available only as computer-based instruments.

The computer-based School Questionnaire in the Field Trial included trend and new material covering approximately 60 minutes.

The optional computer-based Teacher Questionnaire covered approx. 45-minutes. It included a set of core questions (10 minutes assessment time) followed by two non-overlapping modules of 35 minutes each (TCQ-FTReading and TCQ-FTGeneral). The Teacher Questionnaire was administered to at most 10 reading teachers and 15 teachers of other subjects in each school (For additional information about the sampling of teachers, please refer to Chapter 4 of this Technical Report).

Paper-based design

A paper-based Student Questionnaire was administered in countries that chose the paper-based mode of delivery. Students in these countries received both the tests and the questionnaires in paper-based forms. The paper-based Student Questionnaire took up to 30 minutes of assessment time and included mostly trend items, as well as some additional newly developed items.

The paper-based School Questionnaire included mostly trend items from previous cycles and is designed to be answered in approximately 60 minutes.

The optional Parent Questionnaire (PAQ) was administered on paper only, thus countries testing on paper as well as those testing on computer were able to implement this option. The PAQ included trend items as well as newly developed content and covered an assessment time of approximately 30 minutes.

The Field Trial questionnaire designs for the Student Questionnaire and the Teacher Questionnaire are shown in Figure 17.2 below.

Figure 17.2: Field trial computer-based design for Student (StQ) and Teacher Questionnaires (TCQ)

Student Questionnaire(s)	
StQ - Field Trial Core Items (5 minutes): gender, age, grade, educational study program, parental occupation, parental education, immigration background	
Within-school random assignment to one out of two overlapping blocks (30 minutes each)	
StQ - Booklet 1	StQ - Booklet 2
(Optional) Educational Career Questionnaire (10 minutes)	
(Optional) ICT Familiarity Questionnaire (10 minutes)	
(Optional) Financial Literacy Questionnaire (10 minutes)	
(Optional) Well-Being Questionnaire (10 minutes)	
(Optional) Teacher Questionnaire(s)	
TcQ - Field Trial Core Items (10 minutes): Teacher Background and School Climate	
TcQ - Field Trial Reading (35 minutes) Administered to the sample of Reading/Language Teachers	TcQ - Field Trial General (35 minutes) Administered to the sample of non-Reading/Language Teachers

Main survey questionnaire design

The questionnaire designs for the Field Trial and the Main Survey were different, as in PISA 2015. The Main Survey Student Questionnaire (StQ) consisted of only one booklet and the assessment time was again limited to a maximum of 35 minutes. The School Questionnaire (ScQ) content was maintained at an assessment time of approximately 60 minutes. The questionnaires in total still covered all policy modules proposed in the questionnaire framework for this cycle (see Chapter 3). The optional questionnaires for students – Educational Career, ICT Familiarity, Financial Literacy, and Well Being – were kept at 10 minutes in length each.

The mode of assessment did not change from the Field Trial to the Main Survey, i.e. countries that implemented the assessment on computer also administered the computer-based questionnaire, while paper-based testing countries administered a limited set of trend questions for students and schools. The Parent Questionnaire was once again administered in a paper format only, while the Teacher Questionnaire and other optional questionnaires were available only on computer. The Main Survey questionnaire designs for the computer-based instruments are shown in Figure 17.3 below.

Figure 17.3: Main survey computer-based design for Student and Teacher Questionnaires

Student Questionnaire (StQ)	
(n= 6300 in Computer-Based Design per country) 35 minutes	
(Optional) Educational Career Questionnaire (10 minutes)	
(Optional) ICT Familiarity Questionnaire (10 minutes)	
(Optional) Financial Literacy Questionnaire (10 minutes)	
(Optional) Well-Being Questionnaire (10 minutes)	
School Questionnaire (ScQ)	
(n= 150 per country) 35 minutes	
(Optional) Teacher Questionnaire (TcQ)	
TcQ - Main Survey Reading (25 minutes) Administered to the sample of Reading/Language Teachers	TcQ - Main Survey General (25 minutes) Administered to the sample of non-Reading/Language Teachers

As the majority of countries decided to implement the computer-based assessment for this cycle, the next paragraphs describe the computer-based questionnaires in more detail. The description of steps 2 to 8 of the questionnaire life cycle focuses on the questionnaire platform and the associated functionalities.

STEP 2: MASTER QUESTIONNAIRES AUTHORIZING

The implementation of the cycle described in the previous section is supported by a set of tools, integrated in two major subsystems within the PISA platform.

The first subsystem is the PISA portal, Step 1 (Master Questionnaires Design) and related activities (e.g. general information sharing, files sharing and global tracking of issues using the PISA platform).

The second subsystem is the PISA Questionnaire Authoring Tool (QAT), a platform focused on the specific goal of production (i.e. the definition, authoring, testing, adaptation, and validation) of questionnaires (Master and National questionnaires), and the delivery of these questionnaires to the appropriate respondents, and the management of all administrative tasks relating to them.

Consequently, the questionnaire platform is designed to reflect these goals. When users log in to the platform, they are taken to a home page as shown in Figure 17.4. This page gives users access to the many features of the tool.

Figure 17.4: Questionnaire platform home page

PISA 2018 Questionnaires [Log out](#)

HOME MONITORING AND DATA ACCESS ADMINISTRATION

View, edit and test questionnaires

Here you can preview, test and edit the questionnaires.

Please choose a questionnaire to view or edit:

- [Questionnaire Authoring Tool](#)
- [Review and Test the Questionnaire](#)
- [Export Testing Results](#)
- [Clear Testing Results](#)

Copy Items Between Questionnaires

Here you can copy items from one questionnaire to another

- [Copy Item Between Questionnaires](#)

Questionnaire Fonts and Appearance

Here you can change the fonts used in your questionnaires and make some adjustments to their appearance.

Please choose a questionnaire:

- [Update Fonts](#)

Other Links

- [Review Select Language Page](#)

Questionnaire authoring tool

Main view for questionnaire editing

The first main tool of this platform the users working on the questionnaires will see and use when they connect is the Questionnaire Authoring Tool (QAT). The QAT is used to author the computer-based questionnaires of PISA 2018. It is an online editor that allows a user to add, delete, or edit a question in a specific questionnaire of their choosing. When users open the QAT editor, they are presented with a view of the structure of an entire questionnaire. It is important to note, though, that this is not a What You See Is What You Get (WYSIWYG) view of what respondents will eventually see during the Field Trial and Main Study phases of PISA 2018. Figures 17.5 and 17.6 show the main view of the QAT for a National Project Manager (NPM).

Figure 17.5: Questionnaire Authoring Tool: Main View (with a specific question example)

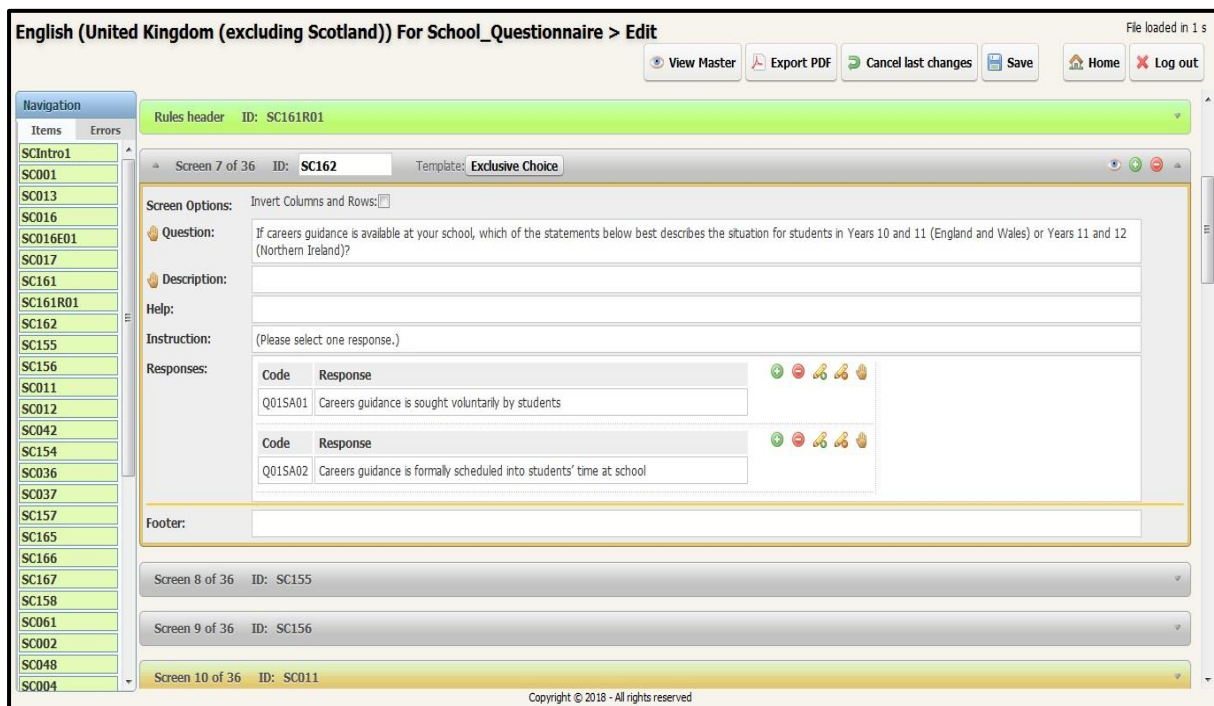
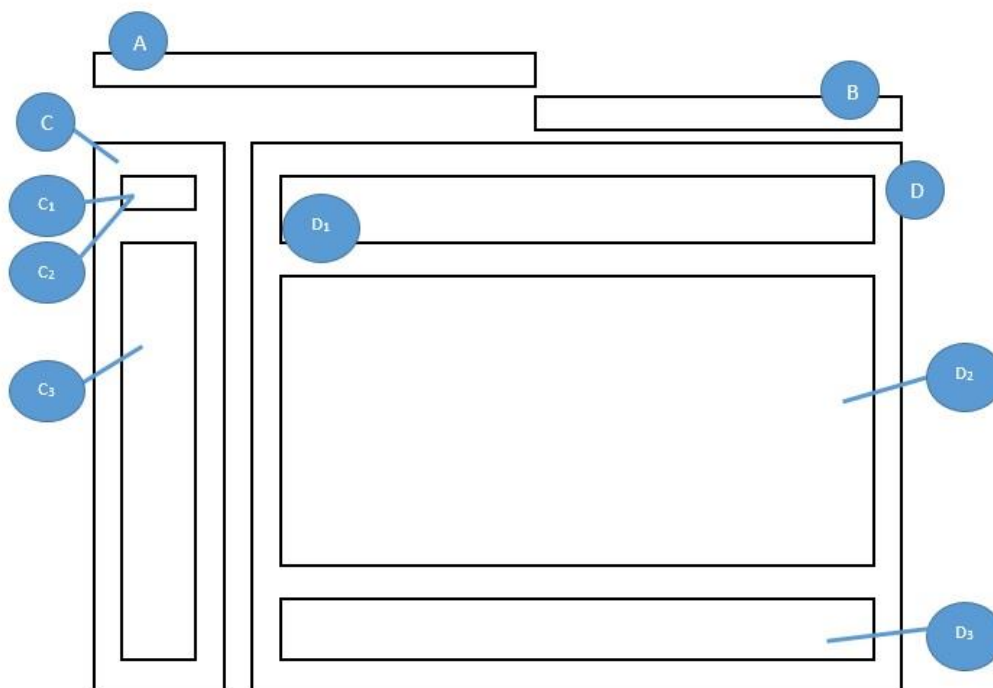


Figure 17.6: Questionnaire Authoring Tool: Organization of Main View



The organisation of the main view is the following:

A: **The Questionnaire Title** contains the questionnaire label (country, language, and type of questionnaire) and the questionnaire mode (i.e. the modes of the QAT are important to note as they define the rights of a current user. Depending on the mode, the access for modifying

questionnaires in the Questionnaire Authoring Tool editor is locked or unlocked, allowing users to work independently).

B: **The Questionnaire Toolbar** provides the following options:

- View Master – Opens the Master English version of the current questionnaire.
- Export PDF – Generates a PDF file of the current version of the questionnaire.
- Cancel Last Changes – Undoes any changes since the last time the user has saved their work on the questionnaire.
- Save – Saves the questionnaire to the database. When clicked, this action also provides a check for whether routing rules and consistency checks are correctly formatted, in the questionnaire. If the test fails, the user will receive a notification that there are currently errors in the questionnaire.
- Home – Redirects the user to the Questionnaire Authoring Tool homepage.
- Log Out – Disconnects the user from the Questionnaire Authoring Tool platform.

C: The Navigation Panel lists:

- The questionnaire items (C₁) or
- A list of errors currently present in the questionnaire (C₂)
- Quick access to questionnaire screens (C₃)

D: **The QAT Editor** displays the list of all questions (referred to as “screens”) and rules (referred to as “rules headers”) available for a questionnaire. When clicked, each part will expand or collapse a specific screen or rule window (Figure(s) D).

Questions Expanded View and Questions Preview

Figure 17.7 shows the Expanded View information (Listing all available features).

Figure 17.7: The expended view information



The features available for users in the questionnaire item screens include

A. Show/Hide Screen button can expand or collapse a specific questionnaire screen or rule header.

B. Screen Number label shows the ranking of the screen in the sequence of questionnaire items out of the total number of questionnaire screens.

C. Screen ID displays the technical identifier of the screen and rule headers.

D. Template label displays the name of the template used for editing the questionnaire screen (see section about questionnaire templates for additional information).

E. Lock/Unlock button makes a questionnaire screen editable or not for a National Project Manager. This button is not available to NPMs.

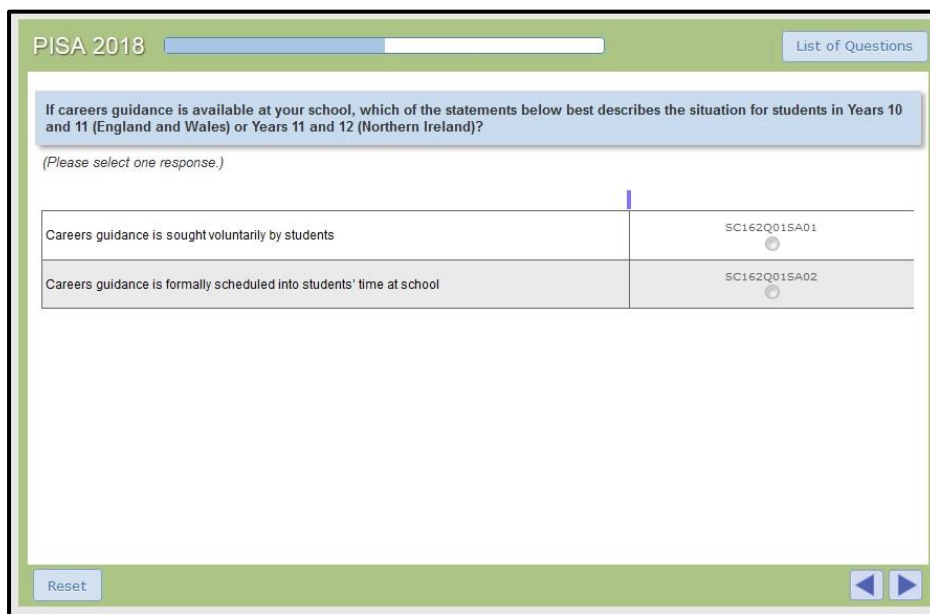
F. Preview button opens a preview of an item, giving the user a view that will reflect how respondents will see a questionnaire item.

G. Add Screen button inserts a new question or rule in the questionnaire just below the currently expanded item.

H.Delete Screen button will remove the question or rule from the questionnaire. Users who click this button will first receive a notification asking for confirmation of deletion.

The questionnaire platform offers two preview options for reviewing and checking the quality of the Masters encoded in English. These are shown in Figure 17.8.

Figure 17.8: Preview of a question in the Questionnaire Authoring Tool



The screenshot displays a preview of a questionnaire item within the PISA 2018 Questionnaire Authoring Tool. The interface includes a header with 'PISA 2018' and a 'List of Questions' button. The question text is: 'If careers guidance is available at your school, which of the statements below best describes the situation for students in Years 10 and 11 (England and Wales) or Years 11 and 12 (Northern Ireland)?'. Below the question, there is a prompt '(Please select one response.)'. Two response options are listed in a table-like format:

Careers guidance is sought voluntarily by students	SC162Q01SA01
Careers guidance is formally scheduled into students' time at school	SC162Q01SA02

Each option has a radio button next to its identifier. At the bottom of the preview panel, there is a 'Reset' button and navigation arrows.

The first option is a question preview panel that can be accessed from within the Questionnaire Authoring Tool, using the Preview button available in the expanded view of each question. In this preview mode, the identifiers of response fields are visible to help facilitate in questionnaire authoring.

The second option is a full questionnaire preview that is available via the “*Review and Test the Questionnaire*” link on the QAT homepage. This option lets users navigate through the entire questionnaire in a test environment and offers the same conditions as those that will be experienced by respondents during the Field Trial and Main Survey.

Question templates

Inside the expanded view, the user can edit the different parts of a questionnaire screen using the QAT editor: the question text, description, instruction, help, and response categories/options.

The Questionnaire Authoring Tool editor is a template-based questionnaire authoring system that supports the creation of multilingual content (this includes left-to-right and right-to-left texts, and extended character sets for Arabic, Chinese, Hebrew, Japanese, Korean, Russian, Thai, etc.), the design of the rules-based routings driving the questionnaire flow, and the enforcement of the quality of the answers via consistency checks.

The question types (i.e. Templates) that are available in the Questionnaire Authoring Tool Editor include:

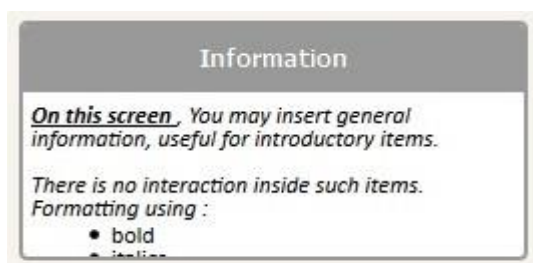
- Drop Down (Table)
- Drop Down
- Exclusive Choice
- Multiple Choice
- List of Text Inputs
- Free Text Input
- List of Exclusive Choice (Table)
- List of Multiple Choice (Table)
- Multiple List of Text Inputs (Table)
- Scale Question Type
- Information

Additionally, there are two templates for defining rules that are used within the questionnaire:

- Consistency Check Rule
- Routing Rule

A short description of each template is provided below, with examples in Figures 17.9 through 17.22.

Figure 17.9: Information Template



The Information template shown in Figure 17.9 is used to insert an introduction, a transition, or a closing page into the questionnaire. The author can use this template to present the questionnaire (e.g. its goals, structure, general recommendations and other instructions), introduce a new section of questions, and to thank the respondent at the end of the questionnaire for their participation.

Figure 17.10: Exclusive Choice Template

Exclusive Choice

How many computers are connected to...
If there is no computer in your sch...

None

From 1-5

The *Exclusive Choice* template shown in Figure 17.10 presents a question to the respondent as well as a set of mutually exclusive responses. Each response option receives an identifier. The data saved for this template includes a value of either 0 or 1 for each response option. At most, only one of these values will be 1. The presentation of this item type to the respondents uses a single set of standard radio buttons. Choosing one of the options will remove any previous choices.

Figure 17.11: Multiple Choice Template

Multiple Choice

What is the use made from computers...

Course purpose

Communication with teachers

Homework

The Multiple Choice template shown in Figure 17.11 presents a question to the respondent as well as a set of non-exclusive responses. Each response option receives an identifier. The data saved for this template includes a value, either 0 or 1, for each response option. The presentation of this template uses standard checkboxes. The checkboxes are selected when a user clicks on them, and unselects if clicked a second time.

Figure 17.12: List of Exclusive Choice (Table) Template

List of exclusive choice (table)

Forms of criminality in the school
Please select the frequency

never Once a Once a Everyday
year month

Verbal aggression

The template shown in Figure 17.12 presents the user with a set of exclusive choice questions on a single screen in a tabular format. In the default format, each row of the table is a separate response, and the columns are a set of choices for each response. In addition, the QAT editor allows the author to invert the table, so that responses are in the columns and the choices are in the rows. Typically, this template presents a single question text, and the responses are gathered in each row, indicating one specific aspect that should be evaluated by the respondent.

Figure 17.13: List of Multiple Choice (Table) Template

	Parents	Teachers	Principals	IT staff	Students
Who is involved in	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

The template shown in Figure 17.13 presents the respondent with one or more non-exclusive choice questions on a single screen in a tabular format. It is similar to the previous template; however, it uses checkboxes so that more than one choice can be selected for each row, or column if the presentation is inverted.

Figure 17.14: List of Text Inputs Template

Public funding	<input type="text"/>
Private funding	<input type="text"/>
Other	<input type="text"/>

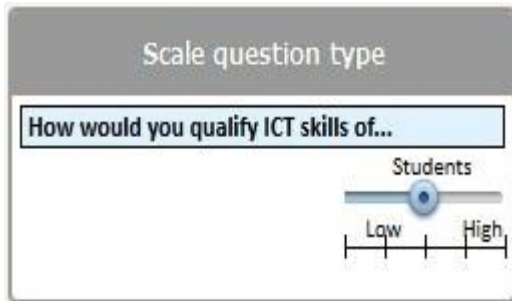
This template shown in Figure 17.14 is used for collecting short, open ended response data. The template present the respondent with one or more areas to type a response, each with a label indicating the information to be entered, the responses can be unfiltered text, or they can be limited to numeric values. Constraints of a minimum/maximum numeric value or text length can be placed on the values entered in each case.

Figure 17.15: Multiple List of Text Inputs (Table) Template

	Classic	Science
Cycle 1 students	<input type="text"/>	<input type="text"/>

This template, shown in Figure 17.15 like the previous one, is used for collecting short, open ended response data. However, in this case more than one response can be collected for each area of interest. The response areas are presented as a table. Similar to the previous template, the response values can be either text or numeric, and can be limited in their range.

Figure 17.16: Scale Question Type Template



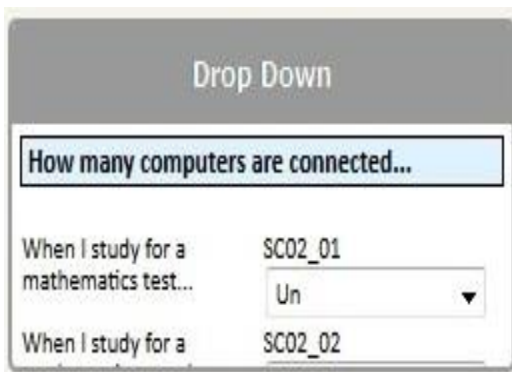
The Slider model shown in Figure 17.16 was carried over from PISA 2015. The respondent moves an indicator along a scale line to indicate where in the range their answer should be. The template allows the author to include one or more slider responses on a screen. Each slider has upper and lower limits. Step values for the sliders can be set, and the author may include labels for the left and right ends of the scale.

• *Figure 17.17: Free Text Input Template* •



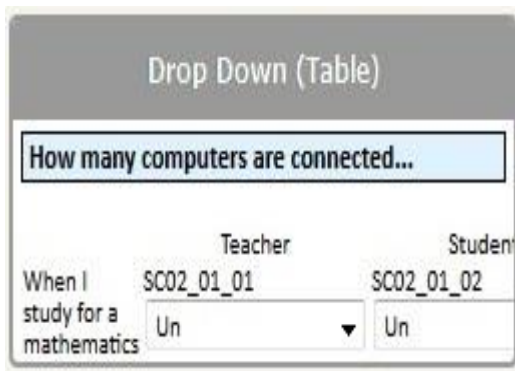
The template shown in Figure 17.17 supports an open-ended text response. The respondent is presented with a large text box in which they can enter a long response with line breaks to provide multiple paragraphs.

Figure 17.18: Drop Down Template



This template shown in Figure 17.18 presents the respondent with one or more drop down menus from which to select their response. Each menu can have a textual label to present a question or to label the contents of the menu. The contents of the menu are defined using some lists. The menus can share the same list of response values, or each can have a unique list. For instance, a question could ask for the date of birth, with three different drop down menus for the day, month, and year parts of the date.

Figure 17.19: Drop Down (Table) Template



Like the Drop Down template, this template shown in Figure 17.19 presents the respondent with one or more drop down menus for providing a response. In this template, the menus are organized into a table. The drop down menu contents themselves are defined in one or more lists. In the standard layout, each menu in a row will contain the same list of response values. However, like the other table based templates, it is possible for the author to invert the rows and columns so that columns contain the same menu values.

Consistency Check Rule

The consistency check rule template supports a rule-based approach for validating the response provided by a user. The author provides a condition (i.e. “True” or “False”) intended to represent the logic of the rule that checks the values of some response variables from different questions the respondent has answered. If the condition evaluates “True,” a notification message is displayed to the user.

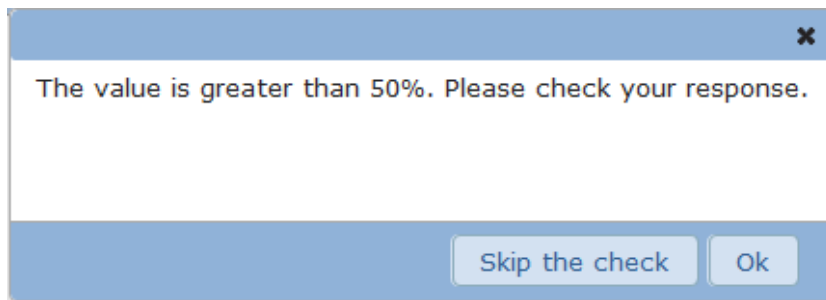
The template for defining the consistency check rule appears as follows:

Figure 17.20: Consistency Check Rule Template



The rule is evaluated when the respondent navigates away from the current question, by clicking either Forward, Back, or Log Out. When the condition is true, a message is shown like the one below:

Figure 17.21: Consistency Check Message



The respondent can click on “Ok” and go back to the current question to change their response. If the respondent clicks the “Skip the Check” button, the questionnaire will proceed as normal.

Routing Rule

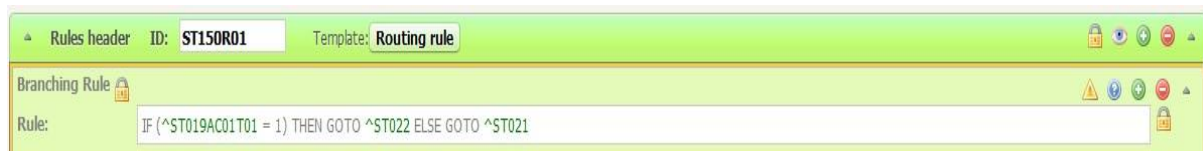
The Routing Rule allows the author to use branching within a questionnaire to direct the question flow. Routing rules appear in between questions in the questionnaire, and they are executed after the completion of the question before the rule.

The routing rules are based on specific conditions, similar to the consistency checks. The rules are defined using IF-THEN-ELSE logic. If the condition evaluates “True” the “Then” portion is executed, otherwise the “Else” part is executed. The “Then” and “Else” parts can be either another IF-THEN-ELSE rule or GOTO commands, directing the questionnaire runtime to branch to a specific question in the questionnaire.

The routing rules are typically used for skipping questions that do not make sense given a specific initial response from the respondent. A simple case is an exclusive choice question, where the last response option is “Other”. If the respondents select this option, they should be shown a question asking for more information about their answer. For example, an open response where they can type their answer.

An example of a routing rule can be seen below in Figure 17.22:

Figure 17.22: Routing Rule Template



Concept of questions and answers identifier within the QAT

An identifier (or ID) is a tag attached to an object in the Questionnaire Authoring Tool. The ID allows the object to be referenced and to be retrieved and used in a precise parameter of action, or scope. A relation between a tag and the object that it references must be unequivocal. Consequently, the label given to an identifier must be unambiguous and unique within the parameter where the referenced object can be used.

In the QAT editor, the types of objects receiving an ID are the various questions, including the rules, and all elements designed to receive and store the data provided by the respondents (i.e. answers).

The IDs are one of the key parts for the computer-based questionnaires and are the basis for the data analysis. A question (or part of a question) with an unexpected or inappropriate ID is unusable and can eventually not be analysed. Checking the consistency of IDs is one of the main important tasks done by contractors when reviewing a computer-based questionnaire.

STEP 3: CREATION OF NATIONAL QUESTIONNAIRES

As soon as the master questionnaires are authored and checked, they are duplicated for each country and national language version, so everybody starts with the same template. The questionnaires become the first version of the national questionnaires. The copy operation is performed by the technical team of the PISA Questionnaire platform using several system scripts. These national questionnaires are then put into a mode that allows the national centre to adapt and translate the content, as described in step 4 of the questionnaire life cycle.

For each national questionnaire, the users continue to have access to the corresponding version of the master questionnaire in a “read-only” mode via the “Open Master” menu entry of the questionnaire home page. To facilitate the work (i.e. reference, comparison, etc.) of the user, this “read-only” master questionnaire is displayed in a new tab-page or a new instance of the web browser.

STEP 4: NATIONAL QUESTIONNAIRE ADAPTATION AND TRANSLATION

The main work performed at this step of the questionnaire workflow is completed by the national centre within a country. Once the national questionnaires are ready, the national centre has access to the questionnaires in the QAT, where they may integrate their agreed adaptations and reconciled translations. Contrary to the cognitive assessments, the use of professional text translation formats (e.g. XLIFF formats) is not used for the questionnaires as the very last version of the translated questionnaires is directly integrated in the QAT editor. Much like for authoring the master questionnaires, the national centre has access to the same functionalities in the QAT editor, such as adding new national questions and adapting existing questions, as well as the functionalities for previewing the questions. A functionality called “Copy item Between Questionnaires” can also be used in order to copy some questions from one questionnaire to another. Thus, the same translated question only needs to be integrated once in the Questionnaire Authoring Tool editor.

When opening the questionnaire, the national centre can see the master questionnaire texts in English as well as some of the national questions (or parts of questions) already translated and locked. These locked questions are called “trend questions” and represent the questions used in previous PISA cycles. Maintaining the quality and integrity of the trend questions over time is important to be able to analyze the data across cycles. To accomplish this, verifiers take the paper version of the questions from the previous PISA cycle and manually transfer it in the QAT editor before the national centre gets access to the national questionnaires. Then, using the lock buttons, the verifier locks the questions. These questions will appear in orange and indicate that they cannot be edited further. If the national centre wants to modify such an item, they must negotiate the adaptations or requested changes with the questionnaire content experts for these trend questions. If these changes are accepted, the verifier will make the changes for

the national centre and again lock these questions afterwards. This translation and verification process is described in more detail in chapter 5 of this report.

By default, the questionnaire software proposes a set of automatic formatting adapted for the PISA questionnaires such as questions displayed in bold, instructions in italic, etc. However, some of this automatic formatting might need to be adapted by the national centres according to their cultural specificities. For example, a standard font size fit to Latin-based character sets may be too small to display the intricacies of Chinese Kanji characters. Therefore, the questionnaire software includes a function that allows the national centre to customize settings in their language. With this functionality, the user can specify the text reading direction, the font family, the font size, the text styles (bold, italic, underline, etc.), the line height and the text alignment. These configurations are accessible via the “Update Fonts” link on the QAT home page.

For the table templates, the users are also able to adjust the column widths to optimize the display of each question. This feature can be useful for languages that have long words such as the German language. These adjustments are available when previewing the individual questions in the Questionnaire Authoring Tool editor, in a WYSIWYG mode. It is the only screen layout changes that are permitted for the computer-based questionnaires.

When all the translations have been inserted, the fonts are validated and the layout is checked, the national centre can test their questionnaires and validate their work. This part can be done via the “Review and Test the Questionnaire” link on the QAT home page.

STEP 5: NATIONAL QUESTIONNAIRES QUALITY CHECK

The quality of the national questionnaires must be checked according to different criteria: the quality of the translations, the accuracy of the translation compared to the English master version, the respect of the agreed adaptations and the technical validity of the questionnaires.

At this step, most of the checks are done manually and each contractor gets access to the questionnaire platform in a read access mode. The translation and adaptation discrepancies are documented in an Excel file which is delivered to the national centre for their review. The national centre is therefore able to accept or refuse these comments and can update their questionnaires accordingly. (See Chapter 5 for a more detailed description of the translation validation).

The Questionnaire technical team is also involved in this step to manually check all the questionnaires according to several criteria: making sure a user is able to go through the questionnaire from the beginning until the end without a software error due to, for instance, errors in routing rules; check if the number of questions match the number of agreed questions; check if all questions and messages are translated; check if all the parts of the interface are translated and well integrated and check all IDs to make sure they are in agreement with the master. As explained in step 2 of the PISA questionnaire cycle, IDs are the key identification point for the data analysis and an error in this part might result in loss of data.

National centres are provided testing scenarios for each questionnaire in order to validate the accuracy of their work. These testing scenarios describe different ways in which a respondent could answer a questionnaire following every possible routing. National centres are asked to test the questionnaires several times based on these scenarios. When national centres are done

with their testing, they need to send their results to the Questionnaire Technical Team, who will then analyse all of the files and make sure that no technical problems are detected, as it is the last step before going to the field.

As all activities performed by the national centre are carefully saved, the Questionnaire Technical Team is able at any time to monitor the different activities and assist countries if technical issues are encountered. The technical support provided required 24/7 availability due to the different time zones covered in PISA.

STEP 6: PREPARATION OF NATIONAL QUESTIONNAIRES FOR DELIVERY

After the different checks and controls are performed, the translation and verification of the questionnaires are completed; all is ready to be delivered to the respondents. At this step, the QAT administrators and technical team make a number of checks and system setups using the questionnaire platform's administrative interface shown in Figure 17.23.

Figure 17.23: Questionnaire Platform – Administrative View

The screenshot shows the administrative interface for the PISA 2018 Questionnaires. At the top, the title "PISA 2018 Questionnaires" is displayed on the left, and a "Log out" button is on the right. Below the title is a navigation bar with three tabs: "HOME", "MONITORING AND DATA ACCESS", and "ADMINISTRATION", which is currently selected. The main content area is divided into three sections:

- Questionnaires and Designs**: Contains two sub-items: "Profiles Administration" and "Manage Designs".
- Setup Country For Questionnaire. (Select a country to apply to all operations)**: Features a dropdown menu with the text "Please select a country".
- Others**: Contains seven sub-items: "Import Sampling Files", "Manage School Questionnaire Manual", "Manage monitoring access", "Get Schools and Teachers Logins & Passwords", "Check Questionnaires", "Show Translation State", "Questionnaire versions and diffs", "Questionnaire ZIP Export (for VeryFire)", "Active QAT Users", "QAT Login History", "Country export", and "Cluster History".

There are two modes of delivery used for the questionnaires in PISA 2018. For student questionnaires, including the optional ICT, EC, Financial Literacy, and Well Being questionnaires, these questionnaires run in an offline, standalone mode as part of the PISA student delivery system (SDS). The School and Teacher Questionnaires are delivered online over the web to respondents around the world. Both of these delivery modes share a common code base and database structure, but the preparation for delivery follows different procedures.

For the Student Questionnaires, the preparation step primarily involves exporting the completed national questionnaires for each country, as well as the questionnaire software and user interface translations, in a form that can be loaded onto and accessed from USB drives. Unnecessary components, such as the Questionnaire Authoring Tool, are removed from the

questionnaire platform at this stage, and a database image with the national questionnaires is created. These exported files are directly integrated into the PISA SDS software for a country, and then tested and validated. See Chapter 18 for more information regarding the PISA 2018 Student Delivery System (SDS).

The online School and Teacher Questionnaires require more steps to prepare for the PISA Field Trials. The first critical step in this process is to import the sampling information from each computer-based testing country into the questionnaire platform so that the selected schools and teachers will be known to the system and can be identified when they connect to complete the questionnaires online. To do this, the “Sampling Task 5” document (specific to the Field Trial) or “Sampling Task 11” (specific to the Main Study) output files are taken from KeyQuest – the system used for sampling within countries, and for the generation of Teacher Questionnaire login credentials (see Chapter 4 for more details on Sampling). These files contain the list of schools selected from the sampling process, using anonymous ID codes. They also contain information that describes the range of IDs that will be assigned to the teachers if the participating countries choose to participate in the optional Teacher Questionnaire. The files are imported into the Questionnaire Platform, which then creates logins and passwords for each sampled school (which will make up the first portion of the teacher logins as well). These logins and passwords are then sent to the national centre, which distributes them to the selected schools and teachers, accordingly.

The countries participating in the online questionnaires in PISA 2018 are spread out across the world. For the Field Trial, in an effort to improve performance for end users and build on the successes of PISA 2015, servers were set up on several continents (shown below in Figure 17.24). This helped to reduce the network latency that users experienced when responding to the questionnaires, and improved the perceived performance. Server installations for this cycle of PISA were located in Germany, Singapore, Australia, and the United States.

Figure 17.24: Distribution of the PISA 2018 servers [To be included]

The countries were assigned in a transparent way to one of these above server locations. Respondents were given a URL which would connect them to the primary PISA server. Based on the ID used to log in to this server, the system could then determine the country where the user was based, and which server they should be assigned to. The respondent was then automatically redirected to the appropriate server, where they could then take the questionnaire.

In addition, one country, the United States, delivered the online questionnaires from their own national server. This server was completely standalone, so respondents connected to it directly, as were not rerouted through the central PISA server.

Each location in this network of servers was composed of a tandem of servers mounted in a Master-Slave mode with failover database mechanics, guaranteeing the security of the data in case of a Denial of Service attack or because of a system software failure. The slave server was also used for generation of results files (see step 8) for performance reasons.

STEP 7: DATA COLLECTION AND QUALITY MONITORING

In step 7 of the questionnaire life cycle, results are collected from students, school principals, and teachers. The respondents then proceed through the questionnaire, seeing the same rendering and behaviours as the QAT authors did while previewing and testing the

questionnaires in the questionnaire platform. For the students, this is done as part of the PISA Student Delivery System, typically running from USB drives on school computers. The questionnaire software runs offline, in a standalone mode on the school computer, and all results are saved back to the USB drive. The students do not need to login to start the questionnaire. Identification and authorization of the students is performed by the Student Delivery System.

For the online questionnaires for school principals and teachers, delivery is performed over the Internet. This requires the principals and teachers to identify themselves prior to beginning the questionnaires. Respondents are assigned login IDs and passwords as part of the sampling process in Step 6. When they first connect to the questionnaire platform, they must enter this ID and password. The questionnaire software will then select the appropriate questionnaire based on this ID. In countries with multiple language versions of their questionnaires, users must also select which language they would like to use while completing the questionnaires before proceeding further.

As respondents complete the questionnaires, data is collected by the questionnaire platform. The original data saved is the response to each question. This data depends on the template used for each question. For questions that use radio buttons or checkboxes, a data value is saved for each of these controls on the screen. The value will be zero or one depending on whether the control has been selected. For sliders, dropdown menus, and textual responses, the value selected or entered is saved. If no response is selected or entered, a value of “null” is saved.

Along with the response data, additional data is saved for each respondent. The final valid path taken by the respondent in the questionnaire is saved. This allows one to determine which questions are valid and were presented to the respondent based on the routings that were taken. Also, a log of actions by the respondent and the questionnaire system is saved. This log includes events such as those shown in Table 17.3.

Table 17.3: List of Logged Events

Event	Description
SESSION_START	The user starts or resumes a questionnaire.
ITEM_START	The user starts an item.
HELP	The user clicks on the Help button.
RESET	The user clicks the Reset button to clear previously entered answers.
LIST_OF_ITEMS	The user clicks the List of Items button to see the questions that have already been visited in the questionnaire.
SELECTED_JUMP	The user clicks on one of the questions in the List of Items to jump to that item.
SELECTED_FORWARD	The user clicks the Next button to move forward in the questionnaire.
SELECTED_BACK	The user clicks the Back button.
SELECTED_LOG_OUT	The user clicks the Logout button to leave the questionnaire.
MOVE_FORWARD	The system moves forward to the next question.
MOVE_BACK	The system moves back to the previous question.
MOVE_JUMP	The system jumps to a new question
LOG_OUT	The system logs off the user.
ANSWER_SELECTION	An answer is selected or entered.
RANGE_CHECK	The answer entered triggered a range check.
CONSISTENCY	A consistency error message is displayed.
CONSISTENCY_CANCEL	The move action is canceled due to the consistency error.
CONSISTENCY_SKIP	The consistency error is skipped and the move action proceeds.

During this phase, for online questionnaires, the National Project Managers and administrators of the questionnaire platform can monitor the activity of the questionnaire respondents. The monitoring shows which respondents have connected to the questionnaire platform and how far they have progressed through the questionnaire. The platform also supports generating a PDF file for a respondent, showing the questionnaire including all the responses that have been saved. The overall status information can be exported to a spreadsheet for further sorting and filtering.

In the Main Study, the sampling process selects schools that are chosen to participate in the PISA survey, along with replacement schools if the originally samples schools refuse or are unable to participate. Through the monitoring tools available in the questionnaire platform, the NPMs are able to activate and disable these schools to control access on their status. Additionally, some countries used this feature to disable schools after they have completed their questionnaires.

The administrators of the questionnaire platform have additional tools available for monitoring the progress of the respondents. These include a view of all currently connected users, as well as a history of the logins, both successful and unsuccessful. These reports are important in supporting users who report problems and also monitoring performance issues on the servers. Additionally, the questionnaire platform saves many different logs, which the administrators use for detecting problems and troubleshooting them. All these servers are monitored and must be up 24/7.

STEP 8: COMPLETION OF DATA COLLECTION

Following a negotiated agenda depending on a country's testing date, the access to the online questionnaires is closed. The production phase of the national questionnaires is then ended. This fixed end date allows the final export of results data for inclusion in the PISA analysis. After the access is closed, respondents who attempt to login receive a message indicating that the questionnaires are currently not available and asking them to contact their national centre for further information.

Each country's result data is exported on a weekly basis. Due to the large volume of data, the data generation is performed only once a week to reduce the load on the system. The national centres can download the latest results in a single compressed file, which is imported directly into the Data Management Expert system.

The access to the servers and the questionnaire software is available several weeks after the end of the data collection to allow some time for the NPMs to retrieve the data but also ask questions in case of problems with the data collected.

DEVELOPMENT PROCESS OVERVIEW AND TECHNICAL INFRASTRUCTURE

This section describes the technical aspects of the software and hardware used to support the computer based PISA 2018 Questionnaires.

The PISA Questionnaire platform is a complex and relatively large software system. The development followed standard software development processes. A modified Agile process (see https://en.wikipedia.org/wiki/Agile_software_development) was used, implementing multiple releases in the course of developing the platform. An open source project management platform (Redmine, <http://www.redmine.org>) was used to track and document the work.

The PISA Questionnaire software was written primarily in PHP on the server side and JavaScript within the web browser. The Apache web server was used for delivery of web content, and data was saved using the MySQL database system. The questionnaire content was structured using custom XML markup.

The online questionnaire servers were Linux based, using Ubuntu 12.04 LTS. The student questionnaires were delivered as part of the PISA Student Delivery System, which was based on XAMPP. For the Main Study, multiple servers were deployed using the Amazon Web Services EC2 system.

The methods of software testing evolved as the project progressed. Aspects of unit testing (using the Jenkins system, <https://wiki.jenkins-ci.org>) were implemented, but the fundamental testing was functional and integration testing performed by developers and project managers. A system of automated functional testing using a farm of more than 40 computers running various web browsers and OS's was also deployed. Finally, load testing of the online questionnaires was implemented using the JMeter system (<http://jmeter.apache.org/>).

SUMMARY

As we saw with the description of the steps of the PISA 2018 questionnaire life cycle, having computer-based questionnaires provided several advantages: flexibility to accommodate language constraints, easy monitoring and check of the work done by the users, a more efficient and reliable data collection process, and collected data available quickly and cleaner for the final analysis. While the advantages of switching to the computer-based questionnaires are important and are a significant motivator to make the PISA cycles more innovative, it is important to also recognize the challenges that countries faced with online delivery of questionnaires. Having access to the Internet and a Web browser, which is a basic part of a modern society in 2018, is a necessary but not sufficient requirement to be a part of a computer-based study. The major challenge with delivering online questionnaires taken by thousands of people around the world who can be anywhere (at home, at work, in a cybercafé...) is that the environment is not controlled at all and all problems cannot be anticipated. For example, what kind of definition should we give for “reliable Internet connection”? Just having a look on Wikipedia) for the average connection speed in different countries shows the huge range of Internet infrastructure in the PISA countries.²

For PISA 2018, several national centres had to deal with “technical issues” such as users who were unable to have access to a computer with the minimum Web browser version supported by the study, or users who refused to continue to answer the questionnaire due to a very slow Internet connection. Other technical challenges encountered by users included network filters in schools that interfered with access to the questionnaires and web browser extensions that interfered with the web pages that implement the questionnaires. Finally, some users could not meet the relatively modest requirements for browser versions. In general, these problems are common to any large scale web application.

The consequences of these problems are a reduction in response rates and lost data as users are reluctant to take part in a questionnaire which is seen as difficult to answer. Some national centres had to send paper versions of the questionnaires to principals and teachers to increase response rates. This increased the workload of the national centre and reduced the value of an online survey.

While most countries already realize the benefits of transitioning from paper-based to computer-based questionnaires, paper-based questionnaires still have their place in PISA, and

² https://en.wikipedia.org/wiki/List_of_countries_by_Internet_connection_speeds

will for the foreseeable future as some countries still need further development of the infrastructure required to support online questionnaires.