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OVERVIEW OF ROLES AND RESPONSIBILITIES

PISA was co-ordinated in each country by a National Project Manager (NPM) who implemented the procedures specified by the international contractor responsible for PISA implementation. Each NPM typically had several assistants, working from a base location that is referred to throughout this report as a National Centre. For the school level operations the NPM co-ordinated activities with school level staff, referred to in PISA as School Co-ordinators. Trained Test Administrators administered the PISA assessment in schools.

National Project Managers

NPMs were responsible for implementing the project within their own country. They:

- attended NPM meetings and received training in all aspects of PISA operational procedures;
- negotiated nationally specific aspects of the implementation of PISA with the international contractor, such as national and international options, oversampling for regional comparisons, additional analyses and reporting, e.g. by language group;
- established procedures for the security and prospecting confidentiality of materials during all phases of the implementation;
- prepared a series of sampling forms documenting sampling related aspects of the national educational structure;
- prepared the school sampling frame and submitted this to the international contractor for the selection of the school sample;
- organised for the preparation of national versions of the test instruments, questionnaires, manuals and coding guides;
- identified School Co-ordinators from each of the sampled schools (nominated by the school principal or a volunteer from the school staff) and worked with them on school preparation activities;
- selected the student sample from a list of eligible students provided by the School Co-ordinators;
- recruited and trained Test Administrators according to the Technical Standards for PISA 2012, Standards 6.1, 6.2, and 6.3 to administer the tests within schools (see Annex F);
- nominated suitable persons to work on behalf of the international contractor as external quality monitors to observe the test administration in a selection of schools;
- recruited and trained coders to code the open-ended items;
- arranged for the data entry of the test and questionnaire responses, and submitted the national database of responses to the international contractor; and
- submitted a written review of PISA implementation activities following the assessment.

A *National Project Manager's Manual* provided detailed information about the duties and responsibilities of the NPM. Supplementary manuals, with detailed information about particular aspects of the project, were also provided. These included:

- a *School Sampling Preparation Manual*, which provided instructions to the NPM for documenting school sampling related issues such as the definition of the target population, school level exclusions, the proportion of small schools in the sample and so on. Instructions for the preparation of the sampling frame, i.e. the list of all schools containing PISA eligible students, were detailed in this manual; and
- a *Data Management Manual*, which described all aspects of the use of *KeyQuest*, the data entry software prepared by ACER for the data entry of responses from the tracking instruments, test booklets and questionnaires.

School Co-ordinators

School Co-ordinators co-ordinated school-related activities with the National Centre and the Test Administrators.

The School Co-ordinator :

- established the testing date and time in consultation with the NPM;
- prepared the student listing form with the names of all eligible students in the school and sent it to the NPM so that the NPM could select the student sample;



- received the list of sampled students on the student tracking form from the NPM and updated it if necessary, including identifying students with disabilities or limited test language proficiency who could not take the test according to criteria established by the international contractor;
- received, distributed and collected the School Questionnaire;
- received and distributed the Parent Questionnaire in the countries that implemented this international option (the Test Administrator distributes the Parent Questionnaire to students on the assessment day or 1-2 weeks before the assessment to deliver it to the parents to complete);
- informed school staff, students and parents of the nature of the test and the test date by sending a letter or organising a meeting, and secured parental permission if required by the school or education system;
- informed the NPM and Test Administrator of any test date or time changes; and
- assisted the Test Administrator with room arrangements for the test day.

On the test day, the School Co-ordinator was expected to ensure that the sampled students attended the test session(s). If necessary, the School Co-ordinator also made arrangements for a follow-up session and ensured that absent students attended the follow-up session.

A School Co-ordinator's *Manual* was prepared by the international contractor, that described in detail the activities and responsibilities of the School Co-ordinator.

Test Administrators

The Test Administrators were primarily responsible for administering the PISA test fairly, impartially and uniformly, in accordance with international standards and PISA procedures. To maintain fairness, a Test Administrator could not be the reading, mathematics or science teacher of the students being assessed and it was preferred that they not be a staff member at any participating school (see Standards 6.1, 6.2, and 6.3 in Annex F). Prior to the test date, Test Administrators were trained by National Centres. Training included a thorough review of the *Test Administrator's Manual*, prepared by the international contractor, and the script to be followed during the administration of the test and questionnaire. Additional responsibilities included:

- ensuring receipt of the testing materials from the NPM and maintaining their security;
- co-operating with the School Co-ordinator ;
- contacting the School Co-ordinator one to two weeks prior to the test to confirm plans;
- completing final arrangements on the test day;
- conducting a follow-up session, if needed, in consultation with the School Co-ordinator ;
- reviewing and updating the student tracking form (a form designed to record sampled students with their background data);
- completing the session attendance form (a form designed to record sampled students attendance and instruments allocation), and the session report form (a form designed to summarise session times, any disturbance to the session, etc.);
- ensuring that the number of tests and questionnaires collected from students tallied with the number sent to the school;
- obtaining the School Questionnaire from the School Co-ordinator ; and
- sending the School Questionnaire, the Student Questionnaires and all test materials (both completed and not completed) to the NPM after the testing was carried out.

School associates

In some countries, one person undertook the roles of both School Co-ordinator and Test Administrator. In these cases, the person was referred to as the school associate and the same Standards 6.1, 6.2, and 6.3 apply as for the Test Administrator. A *School Associate's Manual* was prepared by the international contractor, combining the source material provided in the individual School Co-ordinator and Test Administrator manuals to describe in detail the activities and responsibilities of the school associate.



THE SELECTION OF THE SCHOOL SAMPLE

NPMs used the detailed instructions in the *School Sampling Preparation Manual* to document their school sampling plan and to prepare their school sampling frame.

The national target population was defined, school and student level exclusions were identified, and aspects such as the extent of small schools (a small school is defined as any school whose approximate enrolment falls below the target cluster size of 35 students, or fewer than target cluster size of 35 students plus 8 students if doing financial literacy) and the homogeneity of students within schools were considered in the preparation of the school sampling plan.

For all but a small number of countries, the sampling frame was submitted to the international contractor who selected the school sample. Having the international contractor select the school sample minimised the potential for errors in the sampling process, and ensured uniformity in the outputs for more efficient data processing later (student sampling, data analysis). It also relieved the burden of this task from National Centres. NPMs worked very closely with the international contractor throughout the process of preparing the sampling documentation, ensuring that all nationally specific considerations related to sampling were thoroughly documented and incorporated into the school sampling plan.

All countries were required to thoroughly document their school sampling plan. If there was any deviation noted the National Centre was required to explain in detail the sampling methods used, to ensure that they were consistent with those used by the international contractor. In this case, the standard procedure the international contractor used to check that the national school sampling had been implemented correctly was to draw a parallel sample using its international procedures and compare the two samples. Further details about sampling for the Main Survey are provided in Chapter 4.

PREPARATION OF TEST BOOKLETS, QUESTIONNAIRES AND MANUALS

As described in Chapter 2, 13 different test booklets had to be assembled with clusters of test items arranged according to the test booklet design specified by the international contractor. Test items were presented in units (stimulus material and items relating to the stimulus) and each cluster contained several units. Test units and questionnaire items were initially sent to NPMs several months before the testing dates, allowing adequate time for items to be translated. Units allocated to clusters and clusters allocated to booklets were provided a few weeks later, together with detailed instructions to NPMs about how to assemble their translated or adapted clusters into booklets.

For reference, source versions of all booklets were provided to NPMs in both English and French and were also available through a secure website. NPMs were encouraged to use the cover design provided by the OECD. In formatting translated or adapted test booklets, they had to follow as far as possible the layout of the source versions, including allocation of items to pages.

NPMs were required to submit their cognitive material in units, along with a form documenting any proposed national adaptations for verification by the international contractor. NPMs incorporated feedback from the verifier into their material and assembled the test booklets. These were submitted once more to the international contractor, who performed a Final Optical Check of the materials. This was a verification of the layout, instructions to the student, the rendering of graphic material, etc. Once feedback from the final optical check had been received and incorporated into the test booklets, the NPM was ready to send the materials to print.

The Student Questionnaire contained one or two modules, according to whether the Information Communication Technology familiarity questionnaire or the educational career questionnaire components were being added to the core component. Forty-two countries administered the information communication technology familiarity questionnaire and 23 countries administered the questionnaire on educational career.

The core component had to be presented first in the questionnaire booklet.

Eleven countries also administered the optional Parent Questionnaire. The online administration of the School Questionnaire was implemented by nineteen countries.

As with the test material, source versions of the questionnaire instruments in both French and English were provided to NPMs for translation into the languages of the test.

NPMs were permitted to add questions of national interest as national options to the questionnaires. Proposals and text for these were submitted to the international contractor for approval as part of the process of reviewing adaptations to



the questionnaires. It was required that the additional material should be placed at the end of the international modules. The student questionnaire was modified more often than the school questionnaire.

NPMs were required to submit a form documenting all proposed national adaptations to questionnaire items to the international contractor for approval. Following approval of adaptations, the material was verified by the international contractor. NPMs implemented feedback from verification in the assembly of their questionnaires, which were submitted once more in order to conduct a final optical check of the layout, etc. Following feedback from the Final Optical Check, NPMs made final changes to their questionnaires prior to printing.

The *School Co-ordinator's Manual* and *Test Administrator's Manual* (or the *School Associate Manual* for those countries that combined the roles of the School Co-ordinator and Test Administrator) were also required to be translated into the languages of instructions. Only English source versions of each manual were provided by the international contractor. NPMs were required to submit a form documenting all proposed national adaptations to the manuals to the international contractor for approval. Following approval of the adaptations, the manuals were prepared and submitted to the international contractor. A verification of key elements called 'specified parts' of the manuals – those related to the coding of the tracking instruments and the administration of the test – was conducted. NPMs implemented feedback from the verifier into their manuals prior to printing. A Final Optical Check was not required for the manuals.

In countries with multiple languages, the test instruments and manuals needed to be translated into each test language. For a small number of countries, where Test Administrators were bilingual in the test language and the national language, it was not required for the whole of the manuals to be translated into both languages. However in these cases it was a requirement that the test script, included within the Test Administrator manual was translated into the language of the test.

THE SELECTION OF THE STUDENT SAMPLE

Following the selection of the school sample by the international contractor, the list of sampled schools was returned to National Centres. NPMs then contacted these schools and requested a list of all PISA-eligible students from each school. This was provided on the *List of Students*, and was used by NPMs to select the student sample.

NPMs were required to select the student sample using *KeyQuest*, the PISA student sampling and data entry software prepared by the international contractor. *KeyQuest* generated the list of sampled students for each school, known as the *Student Tracking Form* and the *Session Attendance Form* that served as the central administration documents for the study and linked students, test booklets and Student Questionnaires.

PACKAGING AND SHIPPING MATERIALS

Regardless of how materials were packaged and shipped, the following needed to be sent either to the Test Administrator or to the school:

- test booklets and Student Questionnaires for the number of students sampled;
- student tracking form;
- two copies of the Session attendance form for both paper-based and computer-based assessments;
- two copies of the Session report form for both paper-based and computer-based assessments;
- test delivery USB sticks for the computer-based assessment;
- computer-based assessment Student logon form;
- results for the school's computer system diagnostic report to determine the suitability of running the computer-based assessment from USB;
- materials reception form;
- materials return form;
- additional materials, e.g., rulers, pens and calculators, as per local circumstances; and
- additional School and Student Questionnaires and a bundle of extra test booklets.

Of the 13 separate test booklets, one was pre-allocated to each student by the *KeyQuest* software from a random starting point in each school. *KeyQuest* was then used to generate the school's session attendance form, which contained the number of the allocated booklet alongside each sampled student's name.



It was recommended that labels be printed, each with a student identification number and test booklet number allocated to that identification, as well as the student's name if this was an acceptable procedure within the country. Two or three copies of each student's label could be printed, and used to identify the test booklet, the questionnaire, and a packing envelope if used.

NPMs were allowed some flexibility in how the materials were packaged and distributed, depending on national circumstances. It was specified however that the test booklets for a school be packaged so that they remained secure, possibly by wrapping them in clear plastic and then heat-sealing the package, or by sealing each booklet in a labelled envelope. Three scenarios, summarised here, were described as illustrative of acceptable approaches to packaging and shipping the assessment materials:

- Country A: All assessment materials shipped directly to the schools; school staff (not teachers of the students in the assessment) to conduct the testing sessions; materials assigned to students before packaging; materials labelled and then sealed in envelopes also labelled with the students' names and identification numbers.
- Country B: Materials shipped directly to the schools; external Test Administrators employed by the National Centre to administer the tests; the order of the booklets in each bundle matches the order on the session attendance form; after the assessment has been completed, booklets are inserted into envelopes labelled with the students' names and identification numbers and sealed.
- Country C: Materials shipped to Test Administrators employed by the National Centre; bundles of 35 booklets sealed in plastic, so that the number of booklets can be checked without opening the packages; Test Administrators open the bundle immediately prior to the session and label the booklets with the students' names and ID numbers from the student tracking form.

TEST ADMINISTRATION

On the assessment day after arriving at the school, Test Administrators were required to check whether the copy of the student tracking form was identical with the School Co-ordinator's copy and then to set up the room and materials for the assessment session following the steps below:

- allocate a desk and seat to each participating student;
- prepare one test booklet (according to the previous random assignment specified on the session attendance form) and one Student Questionnaire for each student, labelled with the student's name and identification number;
- write the testing date on a board visible to all students;
- ask the students to write it on their test booklet covers in the required format DD/MM/YYYY at the beginning of the session; and
- set aside the materials for students who had any non-participant codes recorded on the student tracking form or did not attend the administration session from the very beginning.

To obtain comparable and reliable data Test Administrators were asked to strictly follow the anticipated timing of the paper-based assessment, especially the administration of the cognitive test booklet material (2 x 1 hour exactly) shown in Figure 6.1 below.

■ Figure 6.1 ■

Timing of test administration session

Activity	Time
Distributing the materials and reading the General Directions	10-15 minutes (approximately)
The test booklet	1 hour (exactly)
Short break	<No more than 5 minutes>
The test booklet	1 hour (exactly)
Break	<15 minutes>
The Student Questionnaire	<35 minutes> (approximately)
Collecting the materials and ending the session	3-5 minutes (approximately)
Total	<3 hours and 15 minutes> (approximately)

NPMs were allowed to adapt the length of the short break between the two 1-hour test booklet sessions referring to the national practice and policy. In a few cases countries preferred not to have any break during the Test Administration.



All suggested adaptations to the timing had to be negotiated and approved by ACER within the manuals' adaptation negotiation procedures. Adaptation to the timing of the Student Questionnaire session was more flexible in order to maximise the contextual data obtained from students.

Test Administrators were also responsible for monitoring the assessment session. They had to pay special attention to the student attendance. Students had to attend the beginning of the first part of the administration session to participate in the assessment and could not be admitted to the session once the booklet or questionnaire directions began. They were not allowed to leave the session unless it was absolutely necessary. In case a student could not complete the session for any reason the Test Administrator had to collect the student's test material. If the student was absent for more than 10 minutes from the test booklets session, the Test Administrator had to record this student as "partially present" on the session attendance form.

The script for spoken instructions had to be read to the students word-for-word to maintain standardised assessment procedures across all participating countries. Test Administrators were not allowed to provide any help with the cognitive items in the test booklet. However, they could answer questions about items in the student questionnaire. Observers were limited to necessary staff members and the PISA Quality Monitors if in attendance at the session.

At the end of the scheduled time when the paper-based administration was completed Test Administrators had to collect the assessment materials from all students as well as the completed School Questionnaire from the School Co-ordinator in case its paper-based form was administered in the school. The assessment material from each administration session had to be bundled together with the corresponding session attendance form, session report form, unused test booklets and student questionnaires and their spare copies prepared for shipment to the National Centre.

RECEIPT OF MATERIALS AT THE NATIONAL CENTRE AFTER TESTING

It was recommended that the National Centre establish a database of schools before testing began to record the shipment of materials to and from schools, tallies of materials sent and returned, and to monitor the progress of the materials throughout the various steps in processing booklets after the testing.

It was recommended that upon receipt of materials back from schools, the counts of completed and unused booklets also be checked against the participation status information recorded on the student tracking form by the Test Administrator.

CODING OF THE TESTS AND QUESTIONNAIRES

This section describes PISA's coding procedures, including multiple coding, and makes brief reference to pre-coding of responses to a few items in the Student Questionnaire. Overall, 27% of the cognitive items across the reading, mathematics, and science domains required manual coding by trained coders.

This was a complex operation, as booklets had to be randomly assigned to coders and, for the minimum recommended sample size per country of 5 200 students, more than 26 000 responses had to be evaluated. An average of five items from each of the thirteen booklets required evaluation.

It is crucial for comparability of results in a study such as PISA that students' responses are scored uniformly from coder to coder and from country to country. Comprehensive criteria for coding, including many examples of acceptable and unacceptable responses, were prepared by the international contractor and provided to NPMs in coding guides for each of the three core domains; mathematics, reading, science, and also the financial literacy as an optional domain.

Preparing for coding

In setting up the coding of students' responses to open-ended items, NPMs had to carry out or oversee several steps:

- adapt or translate the coding guides as needed and submit these to the international contractor for verification;
- recruit and train coders;
- locate suitable local examples of responses to use in training and practice;
- organise booklets as they were returned from schools;
- select booklets for multiple coding;



- do the single coding of booklets according to the international design (see Figures 6.2, 6.3, 6.4, 6.5, 6.6, 6.7 and 6.8); and
- do the multiple coding of a selected sub-sample of booklets for the reliability study according to the international design (see Figures 6.2, 6.9, 6.10 and 6.11) once the single coding was completed.

Detailed instructions for each step were provided in the *Procedures for Coding Paper-based Constructed-Response Items MS12 (Cdg_Procedures_PB_MS12_2.docx)*. Key aspects of the process are included here.¹

International coder training

Representatives from each National Centre were required to attend two international coder training sessions – one immediately prior to the Field Trial and one immediately prior to the Main Survey. At the training sessions, international contractor staff familiarised National Centre staff with the coding guides and their interpretation.

Staffing

NPMs were responsible for recruiting appropriately qualified people to carry out the single and multiple coding of the test booklets. In some countries, pools of experienced coders from other projects could be called on. It was not necessary for coders to have high-level academic qualifications, but they needed to have a good understanding of either mid-secondary level mathematics and science or the language of the test, and to be familiar with ways in which secondary-level students express themselves. Teachers on leave, recently retired teachers and senior teacher trainees were all considered to be potentially suitable coders. An important factor in recruiting coders was that they could commit their time to the project for the duration of the coding, which was expected to take up to one month.

The international contractor provided a coder recruitment kit to assist NPMs in screening applicants. These materials were similar in nature to the coding guides, but were much briefer. They were designed so that applicants who were considered to be potentially suitable could be given a brief training session, after which they coded some student responses. Guidelines for assessing the results of this exercise were supplied. The materials also provided applicants with the opportunity to assess their own suitability for the task. The number of coders required was governed by the design for multiple coding (described in a later section). For the Main Survey, it was recommended to have 12 coders to code mathematics/financial literacy, 8 coders to code science, and additional 8 coders to code reading. The coding design was prepared for both standard and easier set of booklets, as detailed in a document *Paper-based coding design MS12 (Cdg_design_PB_MS12_2.xlsx)*.² These numbers of coders were considered to be adequate for countries testing between 4 500 (the minimum number required) and 6 000 students to meet the timeline of submitting their data within three months of testing.

For larger numbers of students or in cases where coders would code across different combinations of domains, NPMs could prepare their own design and submit it to the international contractor for approval. A minimum of four coders were required in each domain to satisfy the requirements of the multiple coding design. Given that several weeks were required to complete the coding, it was recommended that at least two back-up coders of mathematics/financial literacy, and one back-up science and reading coder be trained and included in at least some of the coding sessions.

The coding process was complex enough to require a full-time overall supervisor of activities who was familiar with the logistical aspects of the coding design, the procedures for checking coder reliability, the coding schedules and the content of the tests and coding guides.

NPMs were also required to designate persons with subject-matter expertise, familiarity with the PISA tests and, if possible, experience in coding student responses to open-ended items to act as table leaders during the coding. Table leaders were expected to participate in the actual coding and spend extra time monitoring consistency. Good table leaders were essential to the quality of the coding, as their main role was to monitor coders' consistency in applying the coding criteria. They also assisted with the flow of booklets, and fielded and resolved queries about the coding guide and about particular student responses in relation to the guide, consulting the supervisor as necessary when queries could not be resolved. The supervisor was then responsible for checking such queries with the international contractor.

People were also needed to unpack, check and assemble booklets into labelled bundles so that coders could respect the specified design for randomly allocating sets of booklets to coders.



Consortium coding query service

A coding query service was provided by the international contractor in case questions arose about particular items that could not be resolved at the National Centre. Responses to coding queries were placed on the website, accessible to the NPMs from all participating countries.

Confidentiality forms

Before seeing or receiving any copies of PISA test materials, prospective coders were required to sign a confidentiality form, obligating them not to disclose the content of the PISA tests beyond the groups of coders and trainers with whom they would be working.

National training

Anyone who coded the PISA Main Survey test booklets had to participate in specific training sessions, regardless of whether they had had related experience or had been involved in the PISA Field Trial coding. To assist NPMs in carrying out the training, the international contractor prepared training materials in addition to the detailed coding guides. Training within a country could be carried out by the NPM or by one or more knowledgeable persons appointed by the NPM. Subject matter knowledge was important for the trainer as was an understanding of the procedures, which usually meant that more than one person was involved in leading the training.

The recommended allocation of booklets to coders assumed coding by cluster. This involved completing the coding of each item separately within a cluster within all of the booklets allocated to the coder before moving to the next item, and completing one cluster before moving to the next.

Coders were trained by cluster for the seven mathematics clusters, two financial literacy clusters (in case they implemented the financial literacy option), the three science clusters and the three clusters of reading. During a training session, the trainer reviewed the coding guide for a cluster of units with the coders, and then had the coders assign codes to some sample items for which the appropriate codes had been supplied by the international contractor. The trainer reviewed the results with the group, allowing time for discussion, querying and clarification of reasons for the pre-assigned codes. Trainees then proceeded to code independently some local examples that had been carefully selected by the supervisor of coding in conjunction with National Centre staff. It was recommended that prospective coders be informed at the beginning of training that they would be expected to apply the coding guides with a high level of consistency, and that reliability checks would be made frequently by table leaders and the overall supervisor as part of the coding process.

Ideally, table leaders were trained before the larger groups of coders since they needed to be thoroughly familiar with both the test items and the coding guides. The coding supervisor explained these to the point where the table leaders could code and reach a consensus on the selected local examples to be used later with the larger group of trainees. They also participated in the training sessions with the rest of the coders, partly to strengthen their own knowledge of the coding guides and partly to assist the supervisor in discussions with the trainees of their pre-agreed codes to the sample items. Table leaders received additional training in the procedures for monitoring the consistency with which coders applied the criteria.

Length of coding sessions

Coding responses to open-ended items is mentally demanding, requiring a level of concentration that cannot be maintained for long periods of time. It was therefore recommended that coders work for no more than six hours per day on actual coding, and take two or three breaks for coffee and lunch. Table leaders needed to work longer on most days so that they had adequate time for their monitoring activities.

Logistics prior to coding

Sorting booklets

When booklets arrived back at the National Centre, they were first tallied and checked against the session participation codes on the session attendance form. Unused and used booklets were separated; used booklets were sorted by student identification number if they had not been sent back in that order and then were separated by booklet number; and school bundles were kept in school identification order, filling in sequence gaps as packages arrived. Session attendance forms were copied, and the copies filed in school identification order. If the school identification number order did not



correspond with the alphabetical order of school names, it was recommended that an index of school name against school identification be prepared and kept with the binders.

Because of the time frame within which countries had to have all their coding done and data submitted to the international contractor, it was usually impossible to wait for all materials to reach the National Centre before beginning to code. In order to manage the design for allocating booklets to coders, however, it was recommended to start coding only when at least half of the booklets had been returned.

Selection of booklets for multiple coding

Each country was required to set aside 100 of each booklet from a standard set of booklets (1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, and 13) or from an easier set of booklets (8, 9, 10, 11, 12, 13, 21, 22, 23, 24, 25, 26, 27) and 50 of each booklet from four financial literacy booklets (71, 72, 73, 74) if applicable for multiple coding for the main language. For the PISA Main Survey 2012, only items from the first cluster in each booklet were multiple coded. This meant that there were three clusters left over from these multiple coded booklets that needed to be single coded. Because of the complexity of the single coding operation the yellow and blue batches were introduced:

- a) The batches of booklets selected for the single coding operation were called 'The Yellow Batches' and they were labelled by numbers 1 to 12.
- b) The batches of booklets selected for the multiple coding operation were called 'The Blue Batches' and they were labelled by letters A, B, C, and D.

The main principle in setting aside the booklets for multiple coding was that the selection needed to ensure a wide spread of schools and students across the whole sample and to be random as far as possible. The simplest method for carrying out the selection was to use a ratio approach based on the expected total number of completed booklets.

In most countries, approximately 400 of each booklet were expected to be completed, so the selection of booklets to be set aside for multiple coding required that approximately one in four booklets was selected. Depending on the actual numbers of completed booklets received, the selection ratios needed to be adjusted so that the correct numbers of each booklet were selected from the full range of participating schools.

In a country where booklets were provided in more than one language, if the minority language represented 20% or more of the target population, the country had to include at least 50 of each booklet form of that verified language. Multiple coding was not required for minority languages representing less than 20% of the target population.

Booklets for single coding

Single coding was required for all clusters within booklets in the yellow batches (single coding stage 1) and for the second, third and fourth clusters within booklets in the blue batches selected for multiple coding (single coding at stage 2). Some items requiring coding did not need to be included in the multiple coding. These were closed constructed response items that required a coder to assign a right or wrong code, but did not require any coder judgement. The coders in the single-coding process at stage 2 coded these items in the booklets set aside for multiple coding, as well as the items requiring single coding from the remaining second, third, and fourth clusters. Other items such as multiple-choice response items required no coding and were directly data-entered.

How codes were shown

A string of small code numbers corresponding to the possible codes for the item as delineated in the relevant coding guide appeared in the upper right-hand side of each item in the test booklets. For booklets being processed by a single coder, the code assigned was indicated directly in the booklet by circling the appropriate code number alongside the item. Tailored coding record sheets were prepared for each booklet for the multiple coding and used by all but the last coder so that each coder undertaking multiple coding did not know which codes other coders had assigned.

For all reading clusters and the majority of the mathematics/financial literacy and science clusters, item codes were often just 0, 1, and 9, indicating incorrect, correct and missing, respectively. Provision was made for some of the open-ended items to be coded as partially correct, usually with '2' as fully correct and '1' as partially correct.



For the mathematics/financial literacy and science clusters, a two-digit coding scheme was adopted for the items requiring constructed responses (8% of mathematics items, 26% of financial literacy items, and 21% of science items). The first digit represented the degree of correctness code; the second indicated the content of the response or the type of solution method used by the student.

Coder identification numbers

Coder identification numbers were assigned according to a standard three-digit format specified by the international contractor. The first digit showed the combination of domains that the coder would be working across, and the second and third digits had to uniquely identify the coders within their set. For example, twelve coders coding across the domains of mathematics/financial literacy and science were given identification numbers 501 to 512. Eight coders who coded just science were given identification numbers 301 to 308. Coder identification numbers were used for two purposes: implementing the design for allocating booklets to coders and monitoring coder consistency in the multiple-coding exercises.

Coding Operation

The whole coding operation had four stages (see Figure 6.2).

■ Figure 6.2 ■

PISA 2012 Main Survey coding design

PISA 2012 MAIN SURVEY CODING DESIGN			
Single Coding (SC)		Multiple Coding (MC)	
Stage 1	Stage 2	Stage 3	Stage 4
Mathematics/financial literacy, science and reading clusters in yellow batches 1-12	Mathematics/financial literacy, science and reading clusters in blue batches A, B, C, D	Mathematics/financial literacy, science and reading clusters in blue batches A, B, C, D	Mathematics/financial literacy, science and reading clusters in blue batches A, B, C, D
Booklets selected for single coding	Booklets selected for multiple coding	Booklets selected for multiple coding	Booklets selected for multiple coding
Clusters 1, 2, 3, 4	Clusters 2, 3, 4	Cluster 1	Cluster 1
		Groups of 4 coders	Groups of 4 coders
		First three rounds of coding into multiple coding record sheets	Fourth round of coding directly into test booklets

The single coding consisted of two stages. In stage 1, coders worked only with the yellow batches 1 to 12 and they coded all mathematics/financial literacy, science and reading clusters from booklets selected only for single coding. In stage 2 coders worked only with the blue batches A, B, C, and D. They single coded all second, third, and fourth mathematics/financial literacy, science and reading clusters from booklets selected only for multiple coding.

The multiple coding also consisted of two stages. In stage 3 coders worked only with the blue batches A, B, C, and D and they coded first mathematics/financial literacy, science and reading clusters from booklets selected only for multiple coding. Groups of four coders recorded the first three rounds of coding into multiple coding record sheets. In stage 4 coders worked only with the blue batches and again they coded first mathematics/financial literacy, science and reading clusters from booklets selected only for multiple coding. Groups of four coders recorded the fourth round of coding directly into the test booklets.

Single coding design

The design was organised so that all appearances of each cluster type involved in the single coding were coded together. This arrangement entailed coders working with several booklet types at the same time, and at times required space for partly coded booklets to be stored while other booklets were being worked on. However organising the coding this way had the substantial benefits of:

- obtaining more accurate and consistent coding (because training and coding are more closely linked); and
- minimising effects of coder leniency or harshness (more than one coder codes each booklet; coders code across the range of schools sampled).

Coding operation could be conducted in two waves. The first wave begins when, say, 60 % of the booklets are returned to the centre. After receiving all remaining 40 % booklets from schools the second wave begins.



Step 1 in Figure 6.3, for example, represents the training and coding sequence. Coding of all items in the cluster identified in one row should be completed before proceeding to training of the cluster identified in the following row. Each cluster from booklets 1-13 occurs in four booklets, and so several booklets are sometimes required for a coding step (i.e. a row of the Figure). Four booklets are included in the coding of PM1 cluster in this step. At stage 1 the blue batches are not used.

Once wave 1 is completed, and the remaining 40 % booklets are back, wave 2 of the single coding operation begins. At stage 1 each of the yellow batches is specifically allocated to a particular coder. At stage 2 the blue batches are needed. The familiar coding steps shown at each row of the Figure involve the single coding of clusters from the blue batches.

If wave 1 begins when 60% of the booklets have been returned to the centre, with a typical sample size of around 5200 students, there will be 3120 booklets coded during wave 1, so there will be about $3125/13 = 240$ of each booklet type. 60 of each booklet type will have been selected for the multiple coding (i.e. 60% of the 100 of each booklet type required). For the moment these are just set aside. (At the start of wave 2, when all 100 of each booklet type are available, these booklets are allocated into the blue batches.) The remaining 180 booklets will be allocated to the yellow batches. There are 12 single coding batches, so there should be around 15 books in each batch. Each coder is allocated 4 of these batches. For example coder 101 is allocated batch 1 of booklets 5, 10, 13 and 6. So each coder will have around 60 booklets.

Once the wave 1 single coding has been completed, i.e. all of the clusters from 180 x 13 booklet types in the yellow batches have been single coded, wave 2 begins.

In wave 2, there should be around 2080 booklets, around 160 of each booklet. 40 more of each booklet will be selected out for multiple coding to make up the 100 booklets required. Each of the 100 books for each booklet type selected for multiple coding are allocated into 4 blue batches of 25 books each. The remaining 120 booklets from wave 2 are allocated into 12 yellow batches (average of 10 per batch).

At stage 1 of wave 2 the coders get 4 yellow batches, so around 40 booklets to code. At stage 2, each blue batch has around 25 booklets, so the coding for this stage should be a little quicker than for the first stage.

Single coding of mathematics/financial literacy

In order to code by cluster, each coder needed to handle four of the thirteen booklet types at a time. For example, mathematics cluster 1 (PM1) occurred in booklets 5, 10, 13, and 6. Each of these occurrences had to be coded before another cluster was started. Moreover, since coding was done item by item, the item was coded across these different booklet types before the next item was coded.

A design to ensure the random allocation of booklets to coders was prepared based on the recommended number of 12 coders and the minimum sample size of 4 500 students from 150 schools. With 150 schools and 12 coders, each coder had to code a cluster within a booklet from twelve or thirteen schools ($150 / 12 \approx 13$). Figure 6.3 shows how booklets needed to be assigned to coders for the single coding. Further explanation of the information in this figure is presented below.

According to this design, cluster PM1 in yellow batch 1 (subset of schools 1 to 12) was to be coded by coder 101, cluster PM1 in yellow batch 2 (subset of schools 13 to 24) was to be coded by coder 102, and so on. For cluster PM2, coder 101 was to code all from yellow batch 2 (subset of schools 25 to 36) and coder 102 was to code all from batch 3 (subset of schools 37 to 48), and so on.

If booklets from all participating schools were available before the coding began, implementing this design involves the following steps at stage 1 (Figure 6.3). It is assumed here that training is conducted separately for each cluster prior to the start of its coding:

- The coders are trained in the coding of the items to be coded from cluster PM1.
- Coders then work through the locally prepared practice exercises. The coding of these items is monitored by the trainers and table leaders as described earlier.
- PM1 appears in booklets 5, 10, 13 and 6, so coders will be working with these four booklets at this step.
- Coder 101 takes batch 1 of booklets 5, 10, 13 and 6; Coder 102 takes batch 2 of these booklets, and so on through to Coder 112 who takes batch 12.



■ Figure 6.3 ■

Design for the single coding of mathematics/financial literacy, stage 1

SINGLE CODING STAGE 1															
12 Mathematics/Financial Literacy coders															
MATHEMATICS/FINANCIAL LITERACY CLUSTERS															
				Yellow batches											
				1	2	3	4	5	6	7	8	9	10	11	12
	Step	Cluster	Booklets selected for single coding	Coder											
ALL COUNTRIES	1	PM1	5, 10, 13, 6	101	102	103	104	105	106	107	108	109	110	111	112
	2	PM2	6, 7, 11, 12	112	101	102	103	104	105	106	107	108	109	110	111
	3	PM3	3, 7, 9, 10	111	112	101	102	103	104	105	106	107	108	109	110
	4	PM4	4, 8, 10, 11	110	111	112	101	102	103	104	105	106	107	108	109
	5	PM5	1, 5, 9, 11	109	110	111	112	101	102	103	104	105	106	107	108
	6	PM6A	1, 3, 4, 6	108	109	110	111	112	101	102	103	104	105	106	107
	7	PM7A	2, 4, 5, 7	107	108	109	110	111	112	101	102	103	104	105	106
FL COUNTRIES	8	PM5	71, 72, 73, 74	106	107	108	109	110	111	112	101	102	103	104	105
	9	PF1	71, 72, 73, 74	105	106	107	108	109	110	111	112	101	102	103	104
	10	PF2	71, 72, 73, 74	104	105	106	107	108	109	110	111	112	101	102	103
FLUH COUNTRIES	11	PFUH	FLUH (70)	103	104	105	106	107	108	109	110	111	112	101	102
	12	PMUH	FLUH (70)	102	103	104	105	106	107	108	109	110	111	112	101
UH COUNTRIES	13	PMUH	UH (20)	101	102	103	104	105	106	107	108	109	110	111	112

- Coders then code all of the first PM1 item requiring coding in the booklets that they have.
- Note that PM1 appears in all four booklets, but in different locations within these four booklet types. So the question numbers for the same PM1 items will be different in these two booklet types. The same will be true for all clusters.
- Next, the second PM1 item is coded in each of the booklets held by the coder, followed by the third PM1 item, and so on until all of the PM1 items have been coded.
- Following the completion of this step (i.e. the first row), one PM1 cluster within the booklet 5's, 10's, 13's and 6's will have been coded.
- Training and then practice with local examples is then conducted in relation to cluster PM2.
- For the second step, booklets 6, 7, 11 and 12 are required. The booklets 5's, 10's and 13's used in the first step are not required for this step and so can be returned to the administration area.
- The batch 1 of booklet 6 that coder 101 used in the first step is now passed to coder 112. This coder is also provided with batch 1 of booklets 7, 11 and 12. Similarly, coder 101 receives the batch 2 of booklets 6 and also batch 2 of booklets 7, 11 and 12, coder 102 receives the batch 3 and so on, as shown in the second row.
- The items requiring coding from these clusters are coded item by item as described above, until all items have been coded.
- Training is now conducted for clusters PM3. Following training and practice using local examples, coder 111 takes batch 1 of booklets 3, 7, 9 and 10; coder 112 takes batch 2 of booklets 3, 7, 9 and 10, and so on according to the third row, and codes the items in the manner described above.
- The booklet batches should be kept intact with their batch header sheets throughout this operation. For some of the booklet types, the same batches will also be used during the multiple coding.

As a result of this procedure, the 12 mathematics/financial literacy coders will each process some booklets from seven of the twelve batches, and therefore will have coded across a wide range of schools. Each coder will have coded every mathematics/financial literacy cluster, and will therefore be well prepared for multiple coding.

At stage 2 the blue batches are needed. The familiar coding steps shown at each row of Figure 6.4 involve the single coding of clusters from the blue batches. There are only 12 blue batches to be coded for mathematics/financial literacy clusters at each step. For example, for cluster PM1, the batches needing coding are batches A-D of booklet 5; batches A-D of booklet 10; and batches A-D of booklet 13. Batches A-D of booklet 6 are not coded at this stage. They will be coded later, during the multiple coding operation.

■ Figure 6.4 ■

Design for the single coding of mathematics/financial literacy, stage 2

SINGLE CODING STAGE 2								
12 Mathematics/Financial Literacy coders								
MATHEMATICS/FINANCIAL LITERACY CLUSTERS								
				Blue batches				
				A	B	C	D	
				Coder				
	Step	Cluster	Booklets selected for multiple coding					
ALL COUNTRIES	1	PM1	5, 10, 13	Any available Maths/FL coder				PM1 from the blue batches of booklet 6 is NOT coded until multiple coding
	2	PM2	6, 11, 12	Any available Maths/FL coder				PM2 from the blue batches of booklet 7 is NOT coded until multiple coding
	3	PM3	3, 7, 9	Any available Maths/FL coder				PM3 from the blue batches of booklet 10 is NOT coded until multiple coding
	4	PM4	4, 8, 10	Any available Maths/FL coder				PM4 from the blue batches of booklet 11 is NOT coded until multiple coding
	5	PM5	5, 9, 11	Any available Maths/FL coder				PM5 from the blue batches of booklet 1 is NOT coded until multiple coding
	6	PM6A	1, 3, 6	Any available Maths/FL coder				PM6A from the blue batches of booklet 4 is NOT coded until multiple coding
	7	PM7A	2, 4, 7	Any available Maths/FL coder				PM7A from the blue batches of booklet 5 is NOT coded until multiple coding
FL COUNTRIES	8	PF1	72	Any available Maths/FL coder				PF1 from the blue batches of booklet 71 is NOT coded until multiple coding
	9	PF2	71	Any available Maths/FL coder				PF2 from the blue batches of booklet 72 is NOT coded until multiple coding

While the yellow batches are specifically assigned to coders, any available coder can be assigned the blue batches. Faster coders who finish stage 1 more quickly can be assigned one of the blue batches at stage 2 and do not need to wait for slower coders. If necessary, two (slower) coders could share a batch so that all 12 coders are occupied.

Single coding of science and reading

A similar design was prepared for the single coding of science and reading clusters. The same procedure applies at stage 1 described in the Figures 6.5, 6.6, 6.7 and 6.8. The recommended number of coders for each science (8) and reading (8) was one third less coders that recommended for coding mathematics items. First four coders (301-304) were allocated “two yellow batches’ worth” of schools and last four coders (305-308) only “one yellow batch” at step 1. At step 2 in reverse, coders 301-304 were allocated one yellow batch, whereas coders 305-308 were allocated two yellow batches. Also, as there were just three different clusters of both reading and science, each of which appeared in nine booklet types, each coder coded all four appearances of a cluster. This ensured that a wider range of coders was used for each school subset. For the coding of cluster PS1, for example, coder 301 coded this cluster in booklets 12, 3, 5 and 8 from yellow batches 1 (i.e. schools 1-12) and 9 (i.e. schools 97-108) at step 1, then PS2 cluster in booklets 8, 1, 13 and 7 from yellow batch 5 (i.e. schools 49-60) at step 2, and finally PS3 cluster in booklets 10, 2, 1 and 12 from yellow batches 1 (i.e. schools 1-12) and 9 (i.e. schools 97-108). Coder 302 coded PS1 cluster from booklets 12, 3, 5 and 8 from yellow batches 2 (i.e. schools 13-24) and 10 (i.e. schools 109-120) at step 1, then PS2 cluster in booklets 8, 1, 13 and 7 from yellow batch 6 (i.e. schools 61-72), and so on.

■ Figure 6.5 ■

Design for the single coding of science, stage 1

SINGLE CODING STAGE 1															
8 Science coders															
SCIENCE CLUSTERS															
				Yellow batches											
				1	2	3	4	5	6	7	8	9	10	11	12
	Step	Cluster	Booklets selected for single coding	Coder											
ALL COUNTRIES	1	PS1	12, 3, 5, 8	301	302	303	304	305	306	307	308	301	302	303	304
	2	PS2	8, 1, 13, 7	305	306	307	308	301	302	303	304	305	306	307	308
	3	PS3	10, 2, 1, 12	301	302	303	304	305	306	307	308	301	302	303	304
UH COUNTRIES	4	PSUH	UH (20)	305	306	307	308	301	302	303	304	305	306	307	308



■ Figure 6.6 ■

Design for the single coding of science, stage 2

SINGLE CODING STAGE 2								
8 Science coders								
SCIENCE CLUSTERS								
				Blue batches				
				A	B	C	D	
	Step	Cluster	Booklets selected for multiple coding	Coder				
ALL COUNTRIES	1	PS1	3, 8, 5	Any available Science coder				PS1 from the blue batches of booklet 12 is NOT coded until multiple coding
	2	PS2	1, 7, 13	Any available Science coder				PS2 from the blue batches of booklet 8 is NOT coded until multiple coding
	3	PS3	1, 10, 12	Any available Science coder				PS3 from the blue batches of booklet 2 is NOT coded until multiple coding

■ Figure 6.7 ■

Design for the single coding of reading, stage 1

SINGLE CODING STAGE 1															
8 Reading coders															
READING CLUSTERS															
				Yellow batches											
				1	2	3	4	5	6	7	8	9	10	11	12
	Step	Cluster	Booklets selected for single coding	Coder											
ALL COUNTRIES	1	PR1	13, 12, 4, 9	201	202	203	204	205	206	207	208	201	202	203	204
	2	PR2	9, 2, 6, 8	205	206	207	208	201	202	203	204	205	206	207	208
	3	PR3	2, 11, 13, 3	201	202	203	204	205	206	207	208	201	202	203	204
FL COUNTRIES	4	PR2	71, 72, 73, 74	205	206	207	208	201	202	203	204	205	206	207	208
UH COUNTRIES	5	PRUH	UH (20)	201	202	203	204	205	206	207	208	201	202	203	204

■ Figure 6.8 ■

Design for the single coding of reading, stage 2

SINGLE CODING STAGE 2								
8 Reading coders								
READING CLUSTERS								
				Blue batches				
				A	B	C	D	
	Step	Cluster	Booklets selected for multiple coding	Coder				
ALL COUNTRIES	1	PR1	4, 9, 12	Any available Reading coder				PR1 from the blue batches of booklet 13 is NOT coded until multiple coding
	2	PR2	2, 8, 6	Any available Reading coder				PR2 from the blue batches of booklet 9 is NOT coded until multiple coding
	3	PR3	2, 11, 13	Any available Reading coder				PR3 from the blue batches of booklet 3 is NOT coded until multiple coding

Countries implementing the optional UH booklet

Countries using the shorter, special purpose UH booklet (the *une heure* booklet see Chapter 2 for more details on UH booklet) were advised to process this separately from the remaining booklets. Small numbers of students used this booklet, only a few items required coding, and they were not arranged in clusters. NPMs were cautioned that booklets needed to be allocated to several coders to ensure uniform application of the coding criteria for UH booklet, as for the main coding.

Multiple coding

For PISA 2012, all booklet types, test booklets 1-13 for the standard set and test booklets 8-13 and 21-27 for the easier set, were involved in the multiple coding exercise. The first of the four clusters from all booklets were each independently coded by four separate coders according to the recommended design. The other three clusters from these booklets were already coded as part of the single coding design at stage 2 discussed above.



Multiple coding was done at or towards the end of the coding period, after coders had familiarised themselves with and were experienced in using the coding guides. As noted earlier, the first three coders of the selected booklets circled codes on separate record sheets, tailored to booklet type and domain (mathematics/financial literacy, science or reading), using one page per student. The coding supervisor checked that coders correctly entered student identification numbers and their own identification number on the sheets, which was crucial to data quality. The UH booklet was not included in the multiple coding.

While coders would have been thoroughly familiar with the coding guides by the time of multiple coding, they may have most recently coded a different booklet from those allocated to them for multiple coding. For this reason, they needed to have time to re-read the relevant coding guide before beginning the coding. It was recommended that time be allocated for coders to refresh their familiarity with the guides and to look again at the additional practice material before proceeding with the multiple coding. As in the single coding, coding was to be done item by item. For manageability, items from the first clusters within a booklet type were coded before moving to another booklet type, rather than coding by cluster across several booklet types. It was considered that coders would be experienced enough in applying the coding criteria by this time that coding by booklet would be unlikely to detract from the quality of the data.

Multiple coding of mathematics/financial literacy

The specified multiple coding design for mathematics/financial literacy, shown in Figure 6.9 assumed 12 coders with identification numbers 101 to 112. The importance of following the design exactly as specified was stressed, as it provided for links between clusters and coders. Figure 6.9 shows 12 coders grouped into four groups of four, with Group 1 comprising the first four coders (101-104), Group 2 the next four (105-108), and Group 3 the remaining four coders (109-112). The four codings were to be carried out by rotating the booklets to the four coders assigned to each group.

■ Figure 6.9 ■

Design for the multiple coding of mathematics/financial literacy, stages 3 and 4

MULTIPLE CODING STAGES 3 and 4							
12 Mathematics/Financial literacy Coders							
MATHEMATICS/FINANCIAL LITERACY CLUSTERS							
	Step	Clusters for multiple coding	Booklets selected for multiple coding	Blue batches			
				A	B	C	D
				Coder IDs			
ALL COUNTRIES	1	PM1	6	101, 102, 103, 104			
		PM2	7	105, 106, 107, 108			
		PM3	10	109, 110, 111, 112			
	2	PM4	11	101, 102, 103, 104			
		PM5	1	105, 106, 107, 108			
		PM6A	4	109, 110, 111, 112			
		PM7A	5	101, 102, 103, 104			
3	PF1	71	105, 106, 107, 108				
	PF2	72	109, 110, 111, 112				

In this scenario, with all 12 coders working, booklets 6, 7 and 10 were to be coded at the same time in the first step. The 100 booklet 6's, for example, were to be divided into four bundles of 25 and rotated among coders 101, 102, 103 and 104, so that each coder eventually would have coded clusters PM1 from all of the 100 booklets. Similarly, coders 105, 106, 107 and 108 coded PM2 cluster in booklets 7, and coders 109, 110, 111 and 112 coded PM3 cluster in booklets 10 in the first step. As described earlier, the first three coders recorded their codes on the separate multiple coding record sheets, while the fourth coder recorded his or her codes in the booklets themselves. The fourth coder had to also record his or her coder ID on the front cover of the booklet. After booklets 6, 7 and 10 had been put through the multiple-coding process, Group 1 (coders 101, 102, 103, 104) continued with coding of PM4 cluster in booklets 11, Group 2 (coders 105, 106, 107, 108) with PM5 in booklets 1, and Group 3 (coders 109, 110, 111, 112) with PM6A in booklets 4. Allocating booklets to coders for multiple coding was quite complex and the coding supervisor had to monitor the flow of booklets throughout the process.



Multiple coding of science and reading

The multiple-coding design for science shown in Figure 6.10 assumed eight coders with identification numbers 301 to 308 and for reading shown in Figure 6.11 assumed also eight coders with identification numbers 201 to 208.

■ Figure 6.10 ■

Design for the multiple coding of science, stages 3 and 4

MULTIPLE CODING STAGES 3 and 4							
8 Science coders							
SCIENCE CLUSTERS							
				Blue batches			
				A	B	C	D
				Coder IDs			
	Step	Clusters for multiple coding	Booklets selected for multiple coding				
ALL COUNTRIES	1	PS1	12	301, 302, 303, 304			
		PS2	8	305, 306, 307, 308			
	2	PS3	2	301, 302, 303, 304			

■ Figure 6.11 ■

Design for the multiple coding of reading, stages 3 and 4

MULTIPLE CODING STAGES 3 and 4							
8 Reading coders							
READING CLUSTERS							
				Blue batches			
				A	B	C	D
				Coder IDs			
	Step	Clusters for multiple coding	Booklets selected for multiple coding				
ALL COUNTRIES	1	PR1	13	201, 202, 203, 204			
		PR2	9	205, 206, 207, 208			
	2	PR3	3	201, 202, 203, 204			

If different coders were used for science or reading, a different multiple-coding design was necessary. The NPM would negotiate a suitable proposal with the international contractor. The minimum allowable number of coders coding a domain was four; in this case each booklet had to be coded by each coder.

Managing the coding process

Booklet flow

To facilitate the flow of booklets, it was important to have ample table surfaces on which to place and arrange them by type and school subset. The bundles needed to be clearly labelled. For this purpose, it was recommended that each bundle of booklets be identified by a batch header for each booklet type (standard set of booklets 1 to 13, easier set of booklets 8 to 13 and 21 to 27), with spaces for the number of booklets and school identification numbers in the bundle to be written in. In addition, each header sheet was to be pre-printed with a list of the clusters in the booklet, with columns alongside which the date and time, coder's name and identification number, and table leader's initials could be entered as the bundle was coded and checked.

Separating the coding of mathematics/financial literacy, science and reading

While consideration of the possibility that coders from different domains would require the same booklets at the same time was factored into the design of the single coding scheme, there was still the potential for this clash to occur. To minimise the risk of different coders requiring the same booklets, so that an efficient flow of booklets through the coding process could be maintained, it was recommended that the coding of mathematics/financial literacy and the coding of science and reading be done at least partly at different times (for example, mathematics/financial literacy coding could start a week or two ahead).

Familiarising coders with the coding design

The relevant design for allocating booklets to coders was explained either during the coder training session or at the beginning of the first coding session (or both). The coding supervisor was responsible for ensuring that coders adhered to the design and used clerical assistants if needed. Coders could better understand the process if each was provided with a card indicating the bundles of booklets to be taken and in which order.



Consulting table leaders

During the initial training, practice and review, it was expected that coding issues would be discussed openly until coders understood the rationale for the coding criteria (or reached consensus where the coding guide was incomplete). Coders were not permitted to consult other coders or table leaders during the additional practice exercises (see next subsection) undertaken following the training to gauge whether all or some coders needed more training and practice.

Following the training, coders were advised to work quietly, referring queries to their table leader rather than to their neighbours. If a particular query arose often, the table leader was advised to discuss it with the rest of the group.

For the multiple coding, coders were required to work independently without consulting other coders.

Monitoring single coding

The steps described here represented the minimum level of monitoring activities required. Countries wishing to implement more extensive monitoring procedures during single coding were encouraged to do so.

The supervisor, assisted by table leaders, was advised to collect coders' practice papers after each cluster practice session and to tabulate the codes assigned. These were then to be compared with the pre-agreed codes: each matching code was considered a hit and each discrepant code was considered a miss. To reflect an adequate standard of reliability, the ratio of hits to the total of hits plus misses needed to be 0.85 or more. This reliability was to be assessed on the first digit of the two-digit codes where applicable (some mathematics/financial literacy and science items). A ratio of less than 0.85, especially if lower than 0.80, was to be taken as indicating that more practice was needed, and possibly more training.

Table leaders played a key role during each coding session and at the end of each day, by spot-checking a sample of booklets or items that had already been coded to identify problems for discussion with individual coders or with the wider group, as appropriate. All booklets that had not been set aside for multiple coding were candidates for this spot-checking. It was recommended that, if there were indications from the practice sessions that one or more particular coders might be consistently experiencing problems in using the coding guide, then more of those coders' booklets should be included in the checking. Table leaders were advised to review the results of the spot-checking with the coders at the beginning of the next day's coding. This was regarded primarily as a mentoring activity, but NPMs were advised to keep in contact with table leaders and the coding supervisor if there were individual coders who did not meet criteria of adequate reliability and would need to be removed from the pool.

Table leaders were to initial and date the header sheet of each batch of booklets for which they had carried out spot-checking. Some items/booklets from each batch and each coder had to be checked.

Cross-national bias analysis

Cross-national comparability in assigning codes was explored through an inter-country coder reliability study (see Chapter 13).

Questionnaire coding

The main coding required for the Student Questionnaire internationally was the mother's and father's occupation. Four-digit International Standard Classification of Occupations (ISCO-08) codes (International Labour Organisation, 2007) were assigned to these two variables. In several countries, this could be done in a number of ways. NPMs could use a national coding scheme with more than 100 occupational title categories, provided that this national classification could be recoded to ISCO. In majority of cases (84%) ISCO-08 was the countries' choice of the occupational classification.

Given the update from ISCO-88 to ISCO-08 in PISA 2012, in addition to specific training sessions at NPM and coder meetings, NPMs were sent information on the structure of the new ISCO codes and the translation documents from ISCO-88 to ISCO-08 to clarify any questions in relation to the new scheme.

In their national options, countries may also have needed to pre-code responses to some items before data from the questionnaire were entered into the software.



DATA ENTRY, DATA CHECKING AND FILE SUBMISSION

Data entry

The international contractor provided participating countries with *KeyQuest* data entry software. *KeyQuest* contained the database structures for all of the booklets, questionnaires and tracking forms used in the Main Survey. Variables could be added or deleted as needed for national options. Approved adaptations to response categories could also be accommodated. Student response data were entered directly from the test booklets and questionnaires. Information regarding the participation of students, recorded by the School Co-ordinator and Test Administrator on the session attendance form, was entered directly into *KeyQuest*. Several questions from the session report form, such as the timing of the session, were also entered into *KeyQuest*.

KeyQuest performed validation checks as data were entered. Importing facilities were also available if data had already been entered into text files, but it was strongly recommended that data be entered directly into *KeyQuest* to take advantage of its PISA-specific features. A *Data Management Manual* provided complete instructions specific to the Main Survey regarding data entry, data management and validity checks.

Data checking and submission

NPMs were responsible for ensuring that checks of the quality of their country's data were made before the data files were submitted to the international contractor. These checks were explained in detail in the *Data Management Manual*, and could be simply applied using the *KeyQuest* software. The checking procedures required that the list of sampled schools and the session attendance form for each school were already accurately completed and entered into *KeyQuest*. Any errors had to be corrected before the data were submitted. Copies of the cleaning reports were to be submitted together with the data files. More details on the cleaning steps are provided in Chapter 10.

Data were submitted through the ACER *KeyQuest* database.

After data were submitted

NPMs were required to designate a data manager who would work actively with the international contractor's data processing centre at ACER during the international data cleaning process. Responses to requests for information by the processing centre were required within three working days of the request.

THE MAIN SURVEY REVIEW

NPMs were required to complete a structured review of their Main Survey operations. The review was an opportunity to provide feedback to the international contractor on the various aspects of the implementation of PISA, and to provide suggestions for areas that could be improved. It also provided an opportunity for the NPM to formally document aspects such as the operational structure of the National Centre, the security measures that were implemented, and the use of contractors for particular activities and so on.

The Main Survey review was submitted to the international contractor four weeks after the submission of the national database.

Notes

1. The document *Procedures for coding paper-based constructed-response items MS12* is available at www.oecd.org/pisa.
2. Coding design options are discussed in the document *Procedures for coding paper-based constructed-response items MS12* available at www.oecd.org/pisa.

Reference

International Labour Organization (ILO) (2007), "ILO plans to support implementation of ISCO-08 in national and regional activities", Paper for discussion by the United Nations Expert Group on International Economic and Social Classifications, New York, April 16-18, 2007.