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9. FIELD OPERATIONS.....9-1

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9. Field Operations

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9.1 OVERVIEW

The TIMSS field operations comprised the activities and responsibilities of National Research Coordinators (NRCs), School Coordinators, and Test Administrators for the execution of the study in their countries. In particular, the NRC was responsible for:

- Translating and preparing the test instruments
- Selecting the sample of schools
- Obtaining cooperation from the sampled schools

- Identifying and instructing School Coordinators and Test Administrators
- Sampling and tracking classes and students within schools and identifying their teachers
- Assigning test instruments and questionnaires to students and teachers
- Preparing, packaging, and sending assessment materials to the schools
- Scoring the free-response items
- Arranging for data entry and data management, and verifying the data and the data collection materials
- Returning the verified data files to the IEA Data Processing Center along with a report on the survey activities.

Under the direction of the NRC, the School Coordinators and Test Administrators were responsible for:

- Organizing the testing sessions and preparing the testing materials for administration
- Returning the assessment materials to the national center after data collection.

The TIMSS field operations were designed by the IEA Data Processing Center (DPC) in Hamburg in cooperation with Statistics Canada and the International Study Center, to ensure that high-quality, comparable data would be available for the analyses. The TIMSS field operations were based on procedures used successfully in previous IEA studies and enhanced on the basis of experiences in the TIMSS field trial.

To facilitate the national field operations, NRCs were provided with software systems for within-school sampling, preparation of survey tracking forms, and data entry and verification. Quality control measures were implemented throughout all phases of the main study.

This chapter briefly describes the procedures for sampling schools, outlines the rationale for the field operations, describes the procedures for sampling and tracking classes, teachers, and students, and summarizes the other main steps undertaken between the first contact with the selected schools and the verification of data files and materials after data collection. The procedures for the translation and adaptation of the instruments are described in Chapter 8, and those for scoring free-response items are described in Chapter 7.

9.2 DOCUMENTATION

NRCs were provided with the following manuals detailing the procedures for carrying out the TIMSS field operations.

- The *Survey Operations Manuals* (TIMSS, 1994g, 1994h) describes the activities and responsibilities of NRCs from the moment the testing materials arrived at the national center to the moment the cleaned data files and accompanying documentation were submitted to the IEA Data Processing Center. It includes instructions for using the computer programs provided by the DPC.
- The *Sampling Manual* (TIMSS, 1994d) defines the TIMSS target populations and sampling goals and describes the procedures for the sampling of schools.

- The *School Coordinator Manuals* (TIMSS, 1994e, 1994f) describes the activities of the School Coordinator from the time the survey tracking forms and testing materials arrived at the school to the time the completed testing materials were returned to the national center.
- The *Test Administrator Manual* (TIMSS, 1994i) covers the procedures from the beginning of testing to the return of the testing materials and completed Student Tracking Forms to the School Coordinator.
- The *Guide to Checking, Coding, and Entering the TIMSS Data* (TIMSS, 1995c) provides information to enable the coding and data entry personnel in the national centers to code, enter, and verify the data.
- The *International Codebooks* (TIMSS, 1994b, 1995d) define the variables and file formats in the data files and assisted NRCs in the analysis of their data.
- The *Coding Guide for Free-Response Items* (TIMSS, 1995a, 1995b) contains instructions for scoring the short-answer and extended-response test items.
- The *Performance Assessment Administration Manual* (TIMSS, 1994c) provides instructions for sampling and administering the TIMSS performance assessment.
- The *Coding Guide for Performance Assessment* (TIMSS, 1994a) contains instructions and coding guides for scoring the performance assessment tasks.

Two software packages were supplied by the IEA Data Processing Center to assist NRCs in the main study:

- The DATAENTRYMANAGER, a computer program for data entry and data verification
- The field operations software, designed to help NRCs select the within-school sample, prepare the Survey Tracking Forms, and assign the test booklets to students.

In addition to the manuals and software, NRCs received hands-on training in the procedures and use of the software from staff from the International Study Center, the IEA Data Processing Center, and Statistics Canada.

9.3 SELECTING THE SCHOOL SAMPLE

The procedure for sampling schools is presented in Chapter 4. This chapter describes the within-school sampling procedures. To avoid nonresponse bias as much as possible, it was important to get maximum cooperation from the schools in the sample. After the sample of schools was drawn, the schools were contacted, with the permission of the relevant authorities. They received a letter describing the goals of TIMSS, requesting their cooperation, outlining what the school's participation would involve and the benefits of participation, and arranging for the appointment of a School Coordinator and the necessary further contacts. The procedures are described in detail in the *Survey Operations Manuals* (TIMSS, 1994g, 1994h).

9.4 IMPLICATIONS OF THE TIMSS DESIGN FOR WITHIN-SCHOOL FIELD OPERATIONS

The within-school sampling procedures were based on the TIMSS study design and took into account the structure of national education systems as well as various national

administrative and economic constraints. The features of the TIMSS study design that influenced within-school sampling and tracking of students, classes, and teachers are described below.

- For Populations 1 and 2, the study design anticipated relational analyses between student achievement and teacher-level data at the class level. For field operations, this meant that intact classes had to be sampled, and that for each sampled class the mathematics and science teachers had to be tracked and linked to their students. The linkage between teachers and students was established with two tracking forms, the Teacher-Student Linkage Form and the Teacher Tracking Form. Each teacher was linked to the class(es) he or she taught by a seven-digit identification code composed of the three-digit School ID, plus a two-digit sequential identification of the teacher within the school, plus a two-digit number, referred to as the “Teacher Link Number,” which uniquely identified each occurrence of a teacher in the Teacher Tracking Form. Each occurrence represented a different linkage of a teacher with a class.
- For Population 3, no teacher-level data were obtained, and therefore no teacher-student linkage was required. In terms of procedures, this meant that the most efficient approach to within-school sampling was to take a simple random sample of students; fewer forms were needed to sample and track students within schools; and no teacher-level questionnaires were administered.
- For purposes of parameter estimation, Population 3 should be thought of as consisting of three populations: the general population (i.e., all students at this level), and two subpopulations—the students at this level taking advanced courses in mathematics, and those taking courses in physics. The two subpopulations form overlapping subsets of the general population. However, for the purpose of sampling operations, it was necessary to separate Population 3 students into four nonoverlapping groups or subpopulations: those taking advanced courses in mathematics and courses in physics, those taking advanced courses in mathematics but not physics, those taking courses in physics but not advanced mathematics, and those not taking either advanced mathematics or physics. Schools were asked to assign each student to one of the four subpopulations, and students were sampled within subpopulations.
- Because of the great differences in academic preparation among the subpopulations of Population 3, separate sets of test booklets had to be developed for each group. This in turn necessitated a separate booklet rotation scheme within each subpopulation. Thus, separate Student Tracking Forms had to be prepared for each subpopulation within a school to ensure correct booklet assignment and to facilitate test administration.

The field operations comprising within-school sampling, preparing the Survey Tracking Forms, and assigning test instruments to students, teachers, and school principals could be carried out either manually, using the preprinted forms included in the *Survey Operations Manuals*, or electronically, using the field operations software designed by the IEA Data Processing Center.

9.5 WITHIN-SCHOOL SAMPLING PROCEDURES FOR POPULATIONS 1 AND 2

Since the within-school sampling for Populations 1 and 2 was based on intact classes, a key step in the TIMSS field operations was the construction within each school of an exhaustive and mutually exclusive sampling framework—that is, a list of classes in which each student in the target grades was assigned to one and only one class. In education

systems in which mathematics and science classes did not form identical partitions (that is, where the students who attended a mathematics class did not all also attend the same science class), classes were defined on the basis of mathematics instruction for sampling purposes. The TIMSS instruments then had to be administered to students from the sampled mathematics classes and to the mathematics and science teachers associated with these students.

Three variations on the procedure for within-school sampling were developed, reflecting different classroom organization within the participating countries. Each procedure ensured that every student in the target grades would be assigned to one and only one class so that all students had a known chance of being included in the sample. The NRC chose the procedure most suited to the country, in consultation with the sampling and field operations consultants.

The General Procedure was designed to apply in all possible circumstances, but it had the disadvantage of being operationally very complex and demanding for School Coordinators. Nevertheless, it had to be used in cases where the mathematics classes in the target grades were not exhaustive and mutually exclusive with respect to the target population and no other class with these properties could be identified.

As a simplified alternative, Procedure B could be used if the population of mathematics classes was exhaustive and mutually exclusive; that is, if each student in the target population belonged to one and only one mathematics class, and all students in the class were taught by the same mathematics teacher(s). With Procedure B, however, students in the mathematics class might be taught by different science teachers and belong to different science classes.

As a further simplification, Procedure A could be used if each student in the target grades belonged to one and only one mathematics class and all students in the class were taught by the same mathematics *and* science teachers.

9.5.1 SURVEY TRACKING FORMS IN POPULATIONS 1 AND 2

Survey Tracking Forms were provided for sampling classes and students; for tracking schools, classes, teachers, and students; for linking students and teachers; and for recording information during test administration. They are described below. Copies of the forms are provided in Appendix C.

- The School Tracking Form keeps track of the sampled schools and their replacement schools.
- The Class Tracking Form lists all mathematics classes in the target grades of a selected school and is used in all three procedures for sampling classes within schools.
- The Teacher-Student Linkage Form is a matrix linking teachers (in the columns) and students (in the rows). This is essential in all cases where the composition of a class changes from one subject and/or teacher to another. It is not necessary with Procedure A. In Procedure B, this form is prepared only for the selected classes. In the General Procedure, it is prepared so that all students in the target grades in the selected schools

are listed, so as to identify, for sampling purposes, groups of students that are exhaustive and mutually exclusive.

- The Student Tracking Form lists all students in the sampled classes. It is used in all three procedures, but there are differences (with respect to whether the national center or the School Coordinator fills in certain information) between Procedure A on the one hand and Procedure B and the General Procedure on the other hand. When students are subsampled within classes, an additional worksheet, the Student Subsampling Form, is used for the random selection of students before the assignment of booklets, so that booklets are assigned only to the selected students and not to all the students listed in the Student Tracking Form.
- The Teacher Tracking Form lists the teachers who taught the students in the sampled classes in mathematics and/or science. It is essential when entering the data for linking students in the sampled classes to teachers.
- The Test Administration Form is used by Test Administrators to record information about the administration and timing of the testing sessions.
- The Student Response Rate Form is used by School Coordinators to calculate students' response rates in the regular and makeup sessions.

Although the general functions of these forms are the same in the three procedures for within-school class sampling, each procedure has its own version of the forms, tailored to its specific needs. Not all forms are needed in all procedures, and the order in which forms are used differs across procedures.

The following sections present the steps taken by national centers and schools in each procedure.

9.6 THE GENERAL PROCEDURE FOR WITHIN-SCHOOL SAMPLING

In the General Procedure, the list of mathematics teachers provided by the School Coordinators was used to prepare the Teacher-Student Linkage Forms for *all* classes in the target grades in the selected schools. This was necessary if there were some students in the target grades who attended more than one of the classes, and/or others who attended none of the classes. From these forms, the School Coordinator filled in the students' names and the linkages between students and mathematics teachers, and the national center prepared the Class Tracking Forms. The Teacher-Student Linkage Forms for the selected classes were sent back to the School Coordinators, who added the science teachers' names and their linkages with students. The information from these forms was then used to prepare the Student Tracking Forms and the Teacher Tracking Forms.

Table 9.1 shows the steps taken in the General Procedure. (Steps 5b and 6 could be omitted if the information on the science teachers for all the classes in the target grades was collected in step 1.)

Table 9.1 Sequence of Steps in the General Procedure, Populations 1 and 2

National Centers	Schools
1. Ask the sampled schools for a list of mathematics teachers who teach students in the target grades	
	2. Send the list of mathematics teachers who teach students in target grades to the national center
3. Prepare Teacher-Student Linkage Forms for each target grade with header and mathematics teacher columns completed (based on information in the list of math teachers provided by schools)	
	4. Enter name, sex, birth date, and exclusion status for each student in the target grade on the Teacher-Student Linkage Forms and indicate which mathematics teacher teaches which students. Then return this form to the national center
5a. Identify mathematics classes 5b. Prepare Class Tracking Forms for sampling classes and select the sample of mathematics classes 5c. Prepare Teacher-Student Linkage Forms for the sampled classes with information on students and on mathematics teachers and send these to schools	
	6. Enter the information for the science teachers on the Teacher-Student Linkage Forms and return them to the national center
7. Prepare Student Tracking Forms and Teacher Tracking Forms (filled out with all information obtained from Teacher-Student Linkage Forms) and send copies to the schools with the testing materials	
	8. After the test administration return Student Tracking Forms and Teacher Tracking Forms (with participation status filled in) and testing materials to the national center

9.7 PROCEDURE A FOR WITHIN-SCHOOL SAMPLING

In Procedure A, the Class Tracking Forms for sampling classes were prepared, based on the list of the mathematics classes and their mathematics and science teachers that each sampled school prepared. There was no need for School Coordinators to prepare Teacher-Student Linkage Forms. Student Tracking Forms and Teacher Tracking Forms needed to be prepared only for the selected classes.

The main steps taken in Procedure A are summarized in the following table.

Table 9.2 Sequence of Steps in Sampling Procedure A, Populations 1 and 2

National Centers	Schools
1. Ask the sampled schools for a list of mathematics classes in the target grades with the names of their mathematics and science teachers	
	2. Send the list of mathematics classes in the target grades with the names of their mathematics and science teachers to the national center
3a. Prepare Class Tracking Forms for sampling classes and select the sample of mathematics classes 3b. Prepare Student Tracking Forms for the sampled classes and send them to the schools	
	4. Enter name, sex, birth date, and exclusion status for each student in the sampled classes on Student Tracking Forms and return them to the national center
5. Complete the Student Tracking Forms (with Student IDs and booklet assignments) and Teacher Tracking Forms (with Teacher IDs, and teacher questionnaire assignments) and send copies to the schools along with the testing materials	
	6. After the test administration, return the Student Tracking Forms and Teacher Tracking Forms (with participation status filled in) along with completed testing materials to the national center

9.8 PROCEDURE B FOR WITHIN-SCHOOL SAMPLING

In Procedure B, the Class Tracking Forms for sampling classes were also prepared based on the list of the mathematics classes and their mathematics and science teachers that each sampled school prepared, because, as in Procedure A, the population of mathematics classes was exhaustive and mutually exclusive. However, in this case, the Teacher-Student Linkage Forms were necessary, because the entire group of students forming the mathematics class was not taught by a single science teacher. The Student Tracking Forms and Teacher Tracking Forms were produced with the information from the Teacher-Student Linkage Forms.

Table 9.3 shows the steps taken in Procedure B.

Table 9.3 Sequence of Steps in Sampling Procedure B, Populations 1 and 2

National Centers	Schools
1. Ask the sampled schools for a list of mathematics classes in the target grades along with the names of their mathematics (and science) teachers	
	2. Send the list of mathematics classes in the target grades and the names of their mathematics (and science) teachers to the national center
3a. Prepare Class Tracking Forms for sampling classes and select the sample of mathematics classes 3b. Prepare Teacher-Student Linkage Forms for the sampled classes, indicating names of mathematics (and science) teachers and classes they teach in the headers (based on information in list of mathematics classes provided by the schools) and send copies to the schools	
	4. Enter name, sex, birth date, and exclusion status for each student in the sampled classes on the Teacher-Student Linkage Forms and indicate which teachers teach which students. Then return this form to the national center
5. Prepare Student Tracking Forms (with Student IDs and assigned booklets) and Teacher Tracking Forms (with Teacher IDs, teacher link numbers, and assigned questionnaires) and send copies to the schools with the test instruments	
	6. After the test administration, return Student Tracking Forms and Teacher Tracking Forms (with participation status filled in) and testing materials to the national center

9.9 EXCLUDING STUDENTS FROM TESTING

The target population included all students enrolled in the target grades. However, certain students were, for various reasons, ineligible for the TIMSS testing. In some education systems, these students were in special schools or special classes, and it was possible to exclude these schools or classes from the sample. However, when that was not

possible, these students had to be excluded by the school principal or other qualified staff member; detailed instructions therefore had to be given to the School Coordinators.

The following guidelines define general categories for the exclusion of students within schools. NRCs were asked to follow these guidelines carefully within the context of each educational system.

- *Educable mentally disabled students.* These are students who are considered, in the professional opinion of the school principal or other qualified staff members, to be educable mentally disabled, or who have been so diagnosed in psychological tests. This includes students who are emotionally or mentally unable to follow even the general instructions of the TIMSS test. It does not include students solely because of poor academic performance or discipline problems.
- *Functionally disabled students.* These are students who are permanently physically disabled in such a way that they cannot perform in the TIMSS tests. Functionally disabled students who can perform should be included in the testing.
- *Non-native-language speakers.* These are students who cannot read or speak the language of the test and so could not overcome the language barrier of testing. Typically, a student who has received less than one year of instruction in the language of the test should be excluded, but this definition should be adapted in different countries.

9.10 CLASS, STUDENT, AND TEACHER ID AND TEACHER LINK NUMBER

Within each school, a Class ID was assigned to each class in the target grades listed on the Class Tracking Form. The Class ID consisted of the three-digit School ID plus a two-digit identification number for the class within the school. To allow each class and each student to be uniquely identified later, it was essential that the same Class ID not be assigned to two classes in different target grades in the same school. Therefore, although the two-digit ID could be simply a sequential number, it was preferable to add further classifying information, such as the grade.

Each student listed on the Student Tracking Form was assigned a Student ID: a seven-digit number consisting of the five-digit Class ID plus the two-digit sequential number of the student within the class (corresponding to his or her entry in the Student Tracking Form). All students listed on the Student Tracking Form, including those marked for exclusion, had to be assigned a Student ID.

All mathematics and science teachers of the selected classes (those listed on the Teacher Tracking Form) were assigned a Teacher ID. This consisted of the three-digit School ID plus a two-digit sequential number of the teacher within the school. The teacher questionnaire included sections on professional and academic background and on teaching practices and implemented curriculum that were specific to each class/subject the teacher taught. Thus one entry in the Teacher Tracking Form had to be made for each teacher/class and teacher/subject combination. Teachers teaching more than one selected class (e.g., two classes in different target grades), or, in the case of Population 2, teaching both mathematics and science, were listed more than once on the Teacher Tracking Form. So that multiple entries for a teacher could be distinguished and that teacher linked to the correct group of

students, the five digits of the Teacher ID were followed by a two-digit number, the Teacher Link Number. The five-digit Teacher ID referred to the teacher as an individual and was therefore identical for multiple entries for the same teacher. The two-digit Teacher Link Number allowed each occurrence of a teacher in the Teacher Tracking Form to be identified uniquely.

Careful implementation of these procedures was necessary so that later each class could be linked to a teacher and student outcomes could be analyzed in relation to teacher-level variables. A teacher might teach more than one class and therefore be represented by more than one entry in the Teacher Tracking Form, but complete only one questionnaire on one of his/her courses. In that case the combination of Teacher ID and Teacher Link Number made it possible to link personal information about the teacher (like age or sex) to all related students, without falsely linking course-related information to other courses.

To cater for students who joined the class after the Student Tracking Form was created, NRCs were asked to add three further entries to the list of students in the Student Tracking Form. These entries had to be assigned Student IDs and booklets, so that Test Administrators could easily use them when required.

9.10.1 ASSIGNING TESTING MATERIALS TO STUDENTS

Before assigning test booklets and questionnaires to students, NRCs and School Coordinators had to decide whether the test should be administered to the students marked for exclusion or not.

Eight booklets were rotated within classrooms in both Populations 1 and 2. The first eligible student on the Student Tracking Form was assigned a booklet (by selecting a random number from the table of random numbers, multiplying it by 8, adding 1 to the result and using the integer part of the resulting number to identify the booklet). For subsequent eligible students, booklet numbers were assigned sequentially, continuing from the first class to all subsequent ones.

9.10.2 ASSIGNING QUESTIONNAIRES TO TEACHERS

Each teacher listed on the Teacher Tracking Form was assigned at least one teacher questionnaire. NRCs decided whether to assign multiple questionnaires to teachers teaching more than one of the selected classes or teaching both mathematics and science. If teachers represented by multiple entries were assigned only one questionnaire, it was recommended that teachers of both subjects be linked to all students; but it was more important to cover both subjects at the upper grade than to cover both grades. Detailed instructions were provided to assist in the assignment of questionnaires.

9.11 WITHIN-SCHOOL SAMPLING PROCEDURES FOR POPULATION 3

The most cost-effective within-school sampling procedures for Population 3 involved selection of a simple random sample of students within schools. Given that students had to be sampled within subpopulations, assigning students to subpopulations was a key step.

Before they could be sampled, each eligible student had to be identified and assigned to one and only one subpopulation.

There were two procedures for within-school sampling of individual students, depending on the structure of the education system at the Population 3 level.

Procedure 1 applied to tracked education systems with only one subpopulation per school type so that student assignment to a subpopulation was known before within-school sampling. This procedure was appropriate, for example, for a two-track system composed of academic schools, where only students taking courses in both advanced mathematics and physics could be found, and vocational schools, whose students do not take such courses.

Procedure 2 applied to education systems in which more than one track or stream was found in the same school, such that students had to be assigned to subpopulations during within-school sampling. This procedure was appropriate for an education system where students taking advanced courses in mathematics or physics could be found in any school. In this case, each student in the target population in each sampled school would be assigned to the relevant subpopulation and an equal number of students would be sampled from each available subpopulation in a given school.

Some education systems contain both schools in which all the students belong to one subpopulation, and schools that contain students from more than one subpopulation. In these mixed systems, it was permissible to use different procedures for different schools.

Although the Population 3 sampling design required the sampling of individual students, in some countries it was necessary for administrative reasons to sample intact classes. Variants of Procedures 1 and 2, known as Procedure 1C, Procedure 2C, and Procedure 3C, were developed for that purpose. Procedure 1C could be used in tracked education systems in which all classes in a given school type were composed of students from the same subpopulation. Procedure 2C could be used in systems in which different classes in the same school were composed of students from different subpopulations (but students within a class belonged to the same subpopulation), so that the assignment of classes to subpopulations took place during within-school sampling. Finally, Procedure 3C could be used if students from different subpopulations were in the same class.

However, countries were warned that sampling classes (Procedure 1C, 2C, and 3C) instead of students could become rather expensive; a sample of N students from a given class is likely to have a higher intraclass correlation than a sample of N students selected from the whole eligible population within a school. Countries in which sampling classes was the only feasible way to proceed had to factor this clustering effect into calculation of their sample size.

9.11.1 SURVEY TRACKING FORMS IN POPULATION 3

The following Survey Tracking Forms were provided for sampling students (or classes); for tracking schools and students; and for recording information during test administration. Copies of the forms are provided in Appendix C.

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- The School Tracking Form kept track of the selected schools and their replacement schools. It was used to assign replacement schools, establish the school identification codes, and track the sampled schools throughout the study.
 - The Student Listing Form provided a list of all students in the target population of a selected school and was used in all procedures when individual students were sampled within schools (Procedures 1 and 2).
 - The Class Listing Form provided a list of all classes in the target population of a selected school and was used in all procedures when intact classes were sampled within schools (Procedures 1C, 2C, and 3C).
 - The Student Tracking Form listed all sampled students and was used when either individual students or intact classes were sampled. Depending on whether the national center or the School Coordinator filled in certain pieces of information, there were differences between Procedures 1 and 2 on the one hand and Procedures 1C, 2C, and 3C on the other.
 - The Test Administration Form was used by Test Administrators to record information about the administration and timing of the testing sessions.
 - The Student Response Rate Form was used by School Coordinators to calculate students' response rates in the regular and makeup sessions.

Again, the general functions of the forms were the same across procedures for within-school sampling, but each procedure has its own version of the forms, tailored to its specific needs.

9.11.2 PROCEDURE 1

In schools where Procedure 1 was appropriate (i.e., in tracked systems with only one student subpopulation per school where student assignment to subpopulation was known before sampling), NRCs did not need to ask School Coordinators to assign students to subpopulations.

With this procedure, the sampled schools listed all students in the target population on the Student Listing Form. The required number of students was then sampled and a Student Tracking Form, including Student IDs and booklet assignments, was prepared for the selected students at the national center. Only one such form needed to be prepared since there is only one subpopulation in each sampled school. Schools then completed the Student Tracking Form by entering the sex and birth date of each student and his or her participation status in the testing sessions.

The main steps taken in Procedure 1 are summarized in Table 9.4.

Table 9.4 Sequence of Steps in Sampling Procedure 1, Population 3

National Center	Schools
1. Ask the sampled schools to fill out the Student Listing Form with the names of all students in the target population (and their class name/location and exclusion status, if necessary)	
	2. Send the Student Listing Form (completed with the indications of the class names/locations and exclusion status) to the national center
3a. Sample the appropriate number of students from the Student Listing Form 3b. Prepare a Student Tracking Form for the sampled students (with Student IDs and booklet assignments) and send it to the school along with the assessment materials	
	4a. Enter sex and birth date of each sampled student on the Student Tracking Form 4b. After test administration, return the Student Tracking Form (with the participation status filled in for each student) and the completed testing materials to the national center

9.11.3 PROCEDURE 2

In many education systems, schools offer more than one option for mathematics and physics courses, so students cannot be grouped into the four subpopulations in advance. In such systems, students must be assigned to subpopulations during within-school sampling. Procedure 2 was developed for this situation. NRCs provided School Coordinators with a clear operational definition of the four subpopulations and asked them to assign each Population 3 student to one subpopulation.

After School Coordinators had listed the students in their schools for each subpopulation, NRCs sampled the required number of students from each subpopulation. They then prepared a Student Tracking Form for each subpopulation and assigned Student IDs and test booklets to students. The School Coordinator/Test Administrator entered, for each student, sex and birth date and participation status in the testing sessions.

The main steps taken in Procedure 2 are summarized in Table 9.5.

Table 9.5 Sequence of Steps in Sampling Procedure 2, Population 3

National Center	Schools
1a. Provide the sampled schools with an operational definition of the four subpopulations 1b. Ask them to fill out the Student Listing Form with the names of all students in the target population, assigning each of them to the correct subpopulation (and indicating the class name/ location and exclusion status, if necessary)	
	2. Send the Student Listing Form with the student assignment to subpopulations (and the indication of the class names or locations and exclusion status) to the national center
3a. For each subpopulation present in a school, sample the appropriate number of students 3b. Prepare separate Student Tracking Forms (with Student IDs and booklet assignments) for the sampled students in each subpopulation and send them to the school along with the assessment materials	
	4a. Enter sex and birth date of each sampled student on the Student Tracking Forms 4b. After test administration, return the Student Tracking Forms (with the participation status filled in for each student) and the completed testing materials to the national center

9.11.4 PROCEDURE 1C

In tracked education systems with only one subpopulation per school, it was sometimes necessary to sample intact classes rather than individual students. Procedure 1C was developed to meet this situation.

With this procedure, only one class per school was sampled. A Student Tracking Form was prepared for the sampled class, and the School Coordinator entered the name of each student in that class, along with birth date, sex, and exclusion status, if necessary. The form was then returned to the national center, where Student IDs and booklets were assigned. Finally, the Student Tracking Form was sent with the testing materials to the schools for test administration.

The steps taken in Procedure 1C are summarized in Table 9.6.

Table 9.6 Sequence of Steps in Sampling Procedure 1C, Population 3

National Center	Schools
1. Ask the sampled schools to fill out the Class Listing Form with all classes in the target population	
	2. Return the Class Listing Form with all classes in the target population to the national center
3a. Sample one class from the Class Listing Form 3b. Prepare a Student Tracking Form for the sampled class and ask the School Coordinator to list all students in that class, along with the sex, birth date, and exclusion status of each	
	4. Return the Student Tracking Form to the national center with the required information filled in
5. Assign Student IDs and booklets to students and send the Student Tracking Form back to the school along with the assessment materials	
	6. Return the Student Tracking Form (with participation status filled in) and testing materials to the national center

9.11.5 PROCEDURE 2C

In education systems where a group of classes exists within the school such that a) each student in the school belongs to exactly one class, and b) each class contains students from a single subpopulation (multiple subpopulations may be represented within each school), it was also sometimes necessary to sample intact classes rather than use Procedure 2 to select individual students. Procedure 2C was designed to handle this situation. In this case, the list of classes in the target population sent by each school included the subpopulation to which each class belonged. NRCs then sampled one class for each subpopulation in each school.

A separate Student Tracking Form was prepared for each sampled class, and the School Coordinator again filled in the names of all students in each Student Tracking Form along with birth date, sex, and exclusion status. The forms were then returned to the national center, where Student IDs and booklets were assigned according to subpopulation. Last, the Student Tracking Forms were sent with the testing materials back to the school for test administration.

The steps taken in Procedure 2C are summarized in Table 9.7.

Table 9.7 Sequence of Steps in Sampling Procedure 2C, Population 3

National Center	Schools
1. Ask the sampled schools to fill out the Class Listing Form with all classes in the target population along with an indication of the subpopulation to which each of them belongs	
	2. Return the Class Listing Form for all classes in the target population, with their subpopulations, to the national center
3a. Sample one class for each subpopulation listed on the Class Listing Form 3b. Prepare Student Tracking Forms for the sampled classes and ask the School Coordinator to list all students in each of those classes, along with the sex, birth date, and exclusion status	
	4. Return the Student Tracking Forms to the national center with the required information filled in
5. Assign Student IDs and booklets to students on each Student Tracking Form and send these forms to the school along with the assessment materials	
	6. Return the Student Tracking Forms (with participation status filled in) and testing materials to the national center

9.11.6 PROCEDURE 3C

A different procedure was used when intact classes had to be sampled (so that Procedure 2 could not be applied) but those classes contained students from more than one subpopulation; for example, where in the same class there were students taking advanced courses in mathematics and physics and students taking advanced courses in mathematics only. In that case, the School Coordinators indicated on the Student Tracking Form for the sampled class the subpopulation to which each student should be assigned. NRCs left the students from the largest subpopulation on the original Student Tracking Form and prepared new forms for those from other subpopulations.

The steps taken in Procedure 3C are summarized in Table 9.8.

Table 9.8 Sequence of Steps in Sampling Procedure 3C, Population 3

National Center	Schools
1. Ask the sampled schools to fill out the Class Listing Form with all classes in the target population	
	2. Return the Class Listing Form with all classes in the target population to the national center
3a. Sample the class(es) from the Class Listing Form 3b. Prepare Student Tracking Form(s) for the sampled class(es) and ask the School Coordinator to list all students in each of those classes, indicating for each student the subpopulation to which he or she belongs, sex, birth date and exclusion status, if necessary	
	4. Return the Student Tracking Forms to the national center with the required information filled in
5a. For each class, keep the largest subpopulation on the original Student Tracking Form and prepare new Student Tracking Form(s) for the other subpopulation(s) in the class. 5b. Assign Student IDs and booklets to students on each Student Tracking Form and send these forms to the schools along with the assessment materials	
	6. Return the Student Tracking Forms (with participation status filled in) and testing materials to the national center

9.11.7 EXCLUDING STUDENTS FROM TESTING

The guidelines for excluding students from testing in Populations 1 and 2 also applied in Population 3.

9.11.8 STUDENT ID NUMBERS

All sampled students listed on the Student Tracking Form are assigned a unique Student ID. This was a seven-digit number consisting of the three-digit School ID plus a two-digit code for the subpopulation, plus a two-digit sequential number for the student within the school. The two-digit codes for the subpopulation are assigned as follows:

- “00” for the OO group (students not taking advanced courses in mathematics or physics — see Chapter 3 on the TIMSS test design)
- “10” for the MO group (students taking advanced courses in mathematics but not physics)
- “01” for the OP group (students taking physics, but not advanced courses in mathematics)
- “11” for the MP group (students taking advanced courses in mathematics and physics).

9.11.9 ASSIGNING TESTING MATERIALS TO STUDENTS

The number of booklets to be rotated varied by subpopulation:

- 2 booklets for the OO group (Booklets 1A and 1B)
- 5 booklets for the MO group (Booklets 1A, 1B, 3A, 3B and 3C)
- 5 booklets for the OP group (Booklets 1A, 1B, 2A, 2B and 2C)
- 9 booklets for the MP group (Booklets 1A, 1B, 2A, 2B, 2C, 3A, 3B, 3C and 4).

Booklets were rotated within subpopulations as follows. The first eligible student listed in the Student Tracking Form was assigned a booklet at random (by selecting a random number in a table of random numbers, multiplying it by the number of booklets for the subpopulation, adding 1 to the result and using the integer part of the obtained number to identify the booklet).

For subsequent eligible students, booklet numbers were assigned sequentially, continuing the sequential assignment from the first tracking form to all subsequent ones in the same subpopulation. In each Student Tracking Form, booklets (as well as Students IDs) were also assigned to three extra entries in order to facilitate the work of the Test Administrator in case of loss or damage of testing materials, or (when sampling intact classes) in case there were students in the class at the time of testing who were not included in the Student Tracking Form.

9.12 RESPONSIBILITIES OF SCHOOL COORDINATORS AND TEST ADMINISTRATORS

The School Coordinator is the person in the school responsible for administering the TIMSS tests. This could be the principal, the principal’s designee, or an outsider appointed by the NRC with the approval of the principal. The NRC was responsible for ensuring that the School Coordinators were familiar with their responsibilities.

The following were the major responsibilities of School Coordinators, as presented in the *School Coordinator Manuals* (TIMSS, 1994e, 1994f):

- Providing lists of mathematics classes in the target grades in the school and assisting the national center in completing the tracking forms
- Helping the national center determine the dates of test administration

- Selecting (in cooperation with the school principal) the Test Administrators who would conduct testing sessions for the school
- Making the necessary arrangements for testing
- Verifying that the testing materials received from the national center were complete and ensuring that they were kept in a secure place
- Acquainting the Test Administrators with the TIMSS study and providing them with the testing materials and instructions for quality assurance
- Distributing parental permission forms (if applicable) and ensuring that they were signed and returned on time
- Working with the school principal, the Test Administrators, and the teachers of the selected classes regarding logistics on the days of testing, such as room locations, classes involved, distribution of materials, availability of pens and pencils
- Distributing the teacher questionnaires to the selected teachers, ensuring that they were returned completed, and recording the participation information in the Teacher Tracking Form (Populations 1 and 2 only)
- Ensuring that Test Administrators returned all testing materials after the testing session (including the completed Student Tracking Form, the Test Administration Form, and any unused materials), and that they filled in all the required information in the Student Tracking Form
- Calculating the student response rate and arranging for makeup sessions if it was below 85%
- Preparing a report for the national center providing essential information about the test administration in the school
- Returning the completed and unused test instruments, the Student and (for Populations 1 and 2) Teacher Tracking Forms, and the report to the national center.

The following were the responsibilities of Test Administrators, as described in the *Test Administrator Manual* (TIMSS, 1994i):

- Ensuring that each student received the correct testing materials
- Administering the test according to the instructions provided in the *Test Administrator Manual*
- Ensuring the correct timing of the testing sessions using a stopwatch and recording on the Test Administration Form the time when the various sessions started and ended
- Recording student participation on the Student Tracking Form.

9.13 PACKAGING AND SENDING MATERIALS

Two packages were prepared at the national center for each sampled class in Populations 1 and 2 and for each subpopulation within a school in Population 3. One package contained the test booklets and the other the student questionnaires for all students listed in the Student Tracking Form and for the three extra entries.

For each participating school, the packages for all sampled classes or subpopulations were assembled and packed together with the Teacher Tracking Form and teacher

questionnaires (for Populations 1 and 2), the school questionnaire, and the materials prepared for briefing School Coordinators and Test Administrators. A set of labels and prepaid envelopes addressed to the national center were included to facilitate the return of testing materials.

9.14 CODING, DATA ENTRY, DATA VERIFICATION, AND SUBMISSION OF DATA FILES AND MATERIALS

Following the administration of the TIMSS tests, the NRC was responsible for:

- Retrieving the materials from the schools
- Training coders to code the free-response items
- Scoring the free-response items and the 10% reliability sample
- Entering the data from the achievement tests and background questionnaires
- Preparing a report on survey activities
- Submitting the data files and materials to the IEA Data Processing Center.

When the testing materials were received back from the schools, NRCs were to do the following:

- Check that the appropriate testing materials were received for every student listed on the Student Tracking Form
- Verify all identification codes on all instruments that were not precoded at the national center
- Check that the participation status recorded on the tracking forms matched the information on the test instruments
- Follow up on schools that did not return the testing materials or for which forms were missing, incomplete, or inconsistent.

NRCs then organized the instruments for scoring and data entry. The procedures involved were designed to maintain identification information that linked students to schools and teachers, minimize the time and effort spent handling the booklets, ensure reliability in the free-response coding, and document the reliability of the coding.

9.15 CODING THE FREE-RESPONSE ITEMS

The substantial number of free-response items in the TIMSS achievement booklets and the number of students tested in each country resulted in tens of thousands of student responses to be scored in each country. This required clear procedures for scoring, training sessions for the coders, and instructions for conducting coding sessions. The development of the coding guides is described in detail in Chapter 7 and the international training effort in Chapter 10. The following section describes the procedures used during the coding sessions, including within-country training, coding of the reliability sample, organization of the coding sessions, and monitoring of the coding (backreading).

9.15.1 WITHIN-COUNTRY TRAINING

As described in Chapter 10, the international training sessions for the coding of the free-response items were organized to train the person in each country responsible for the coding. The sessions covered the use of the TIMSS coding guides and presented a model for the national training of coders. The person who attended the international training session conducted the within-country training and was responsible for conducting the coding sessions.

The materials required for within-country training included:

- The *Coding Guide for Free-Response Items* (TIMSS, 1995a, 1995b)
- Selected examples of responses for items for which the coding guides are not straightforward
- Practice sets for the more complicated guides with responses illustrating a range of responses the coders could expect.

Coders were led through the items and their coding guides to become familiar with their content. They then completed the assembled practice papers and discussed each paper until a consensus on the appropriate use of the coding guides was achieved. The session leader monitored the application of the coding guides to ensure that the coders were using them correctly.

9.15.2 CODING THE 10% RELIABILITY SAMPLE

Since free-response items are a vital part of the TIMSS achievement tests, it was critical to document the reliability of coding. To gather information about the agreement among coders, TIMSS had each country arrange for 10% of the test booklets to be coded independently by two coders. Coders assigned to Coding Set A were to code every tenth booklet in Coding Set B, and vice versa. When coding the 10% reliability sample, coders recorded their codes on separate sheets of paper to ensure that the double coding was “blind”; that is, that one coder did not know the code given by the other. The coding of the reliability sample was done throughout the coding sessions to accurately reflect the reliability of the entire process.

9.15.3 PROCEDURES FOR MONITORING THE CODING (BACKREADING)

TIMSS recommended that coders be organized into teams of about six, headed by a team leader who monitored progress and the reliable use of the codes. It was suggested that the team leaders continually check and reread the responses coded in their team, systematically covering the daily work of each coder. In cases where a coder seemed to be having difficulty, this backreading was to be intensified. Any errors in the application of the coding guides were to be brought to the attention of the coder responsible and corrected immediately.

9.16 DATA ENTRY

Entry of the achievement and background data was facilitated by the *International Codebooks* (TIMSS, 1994b, 1995d), which define the variables and file formats in the data files; the DATAENTRYMANAGER program; and the *Guide to Checking, Coding, and Entering the TIMSS Data* (TIMSS, 1995c).

The *Guide to Checking, Coding, and Entering the TIMSS Data* (TIMSS, 1995c) outlines:

- The resources required for data entry, including estimates of time required for data entry and of data file sizes
- Guidelines on which records have to be entered into which data files
- Options to simplify entry of tracking information
- Instructions for entering some special variables
- Suggestions to facilitate data entry.

National centers were requested to verify data in order to ensure that:

- The data files were structured as specified in the *International Codebooks* (TIMSS, 1994b, 1995d)
- The data values conformed to the range validation criteria specified in the *International Codebooks* (TIMSS, 1994b, 1995d)
- There were no duplicate records in the data files
- The components of the identification codes for each record were internally consistent
- The data variables were consistent with the corresponding control and indicator variables
- There were no errors in the student-student and student-teacher linkages.

The background questionnaires were sorted by School ID and by Class ID within school. They were stored with their tracking forms so that the data entry staff could control the number of records to enter and transcribe the necessary information during data entry. NRCs were asked to arrange for double entry of a random sample of at least 5% of the test instruments and questionnaires. An error rate of 1% was considered acceptable.

9.16.1 THE NRC REPORT ON SURVEY ACTIVITIES

Following coding and data entry, the NRC was asked to prepare a report containing:

- A description of the procedures used and problems encountered in the preparation of the test instruments
- An indication of which of the within-school sampling procedures was used in which population
- The national definition of mathematics classes, mathematics and science teachers, and streams (or tracks) used for within-school sampling
- The criteria and definitions used for excluding students from testing

- A description of any problems encountered in the use of the survey tracking forms and of deviations from the recommended procedures
- An indication of the position of School Coordinators and Test Administrators in the schools and the training they received
- A description of any deviations from the prescribed timing of the testing sessions
- An indication of the procedures used for quality control and a summary of the findings from the national quality control observers
- A description of data entry and data verification problems encountered, including an indication of error rate found during the verification of double-entered data
- A description of any modifications in the international coding schemes.

9.16.2 SUBMISSION OF DATA FILES AND MATERIALS TO THE IEA DATA PROCESSING CENTER

The national centers were to send their data files and documentation to the IEA Data Processing Center three months after the last date of testing in their country. The materials they submitted were:

- Data files (and their structure files) in DATAENTRYMANAGER format
- Codebook structure files (including all changes made in the structure) for each data file, with an explanatory letter
- Copies of the national test booklets and questionnaires
- Copies all School Tracking Forms, Class Tracking Forms, and Teacher Tracking Forms
- Completed Data Management Forms indicating the names of the data files and number of diskettes submitted, the number of records in each file, the coding schemes used for optional identification variables, any country-specific changes in the questions, changes in the default validation ranges, any modification of the international coding scheme
- The report on survey activities.

The data files (and their structure files), the codebook structure file, copies of the Data Management Forms, and the report on survey activities were also submitted to the International Study Center.

9.17 CONCLUSION

This chapter presents the design of the field operations from the first contact with the sampled schools to the return of cleaned data files to the IEA Data Processing Center. The implementation of the designed procedures, major problems, deviations, and recommendations for future studies will be discussed in a later volume of the Technical Report.

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