هيئة التعليم

EDUCATION INSTITUTE

Mathematics workshop 3

for teachers of Grades 7 to 12

Trainer's notes

Developed for the Education Institute by CfBT

Acknowledgements

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The mental test referred to in Session 1 was the national test given to 14-year-olds in England in 2001. Questions from it are reproduced here with the permission of the Qualifications and Curriculum Authority.

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Contents

Introduction

These materials are intended to help School Support Organisations (SSOs) and other trainers to plan and run the third of five workshops for subject leaders and teachers of mathematics in Qatar's Independent Schools. This workshop is for teachers in Grades 7 to 12, and is designed to run in parallel with the second workshop for teachers of Grades 1 to 6. The complete pack of materials for this workshop consists of *Trainer's notes*, Parts 1 and 2 of the *Teacher's pack* and a CD-ROM with a set of PowerPoint presentations.

The purpose of the workshops is to introduce the curriculum standards for mathematics and to discuss the implications for planning the curriculum, teaching, learning and assessment. It is recommended that at least two teachers from each school attend the workshop and that the same teachers attend throughout.

This workshop consists of 16 sessions over five taught days. On the first day, there are four sessions of 90 minutes. Other days have three sessions, usually of 80 minutes each. On the third day, there are separate sessions for teachers of Grades 5 to 9 (two sessions of 120 minutes) and teachers of Grades 10 to 12 (three sessions of 80 minutes). The last session on the final day is 70 minutes.

It is assumed that the sessions will be taught in a language that all the participants understand. If interpretation is required, you may need to reduce the material in each session by up to one third, or allow longer for each session.

Before the workshop starts

You will need to prepare a programme for the workshop, making sure that enough time is allowed for prayers and refreshments.

You will also need to prepare a letter of invitation to send with the programme to each teacher attending, giving details of the venue and the times of the sessions. This letter should be agreed in advance with the Education Institute.

With your letter and the programme, you should send a copy of Part 1 of the *Teacher's pack*. Your letter should ask teachers to study this pack carefully before coming to the workshop.

You should either provide at the workshop or ask teachers to bring with them on each day their copy of *Curriculum Standards for mathematics: Grades K to 12* and *Sample lesson plans for mathematics: Grades 1 to 12*. Other materials that they need to bring are scissors, a ruler, a protractor, a pair of compasses and a sharp pencil.

Your letter should mention that there will be tasks to do to follow up the workshop.

Aims of the workshop

The purpose of the five-day mathematics workshops is to consider the curriculum standards for mathematics and to discuss the implications for planning the curriculum, teaching, learning and assessment.

The workshops aim to help subject leaders and teachers to:

- become more familiar with the new curriculum standards;
- consider the implications of the standards for planning, teaching and assessment;
- start or refine the planning of a mathematics scheme of work based on the standards, and related lesson plans;
- support colleagues as they implement the standards.

The third day of workshops 2 and 3 has different sessions, depending on the age range of students in the school.

Sample programme

Day 1: Developing reasoning

08:00	Registration	
Session 1 08:30–10:00	Mental mathematics	90 minutes
Session 2 10:30–12:00	Proportional reasoning	90 minutes
Session 3 13:00–14:30	Geometric reasoning	90 minutes
Session 4 15:00–16:30	Geometric deduction	90 minutes

Day 2: Algebra and trigonometry

10:45	Registration	
Session 5 11:10–12:30	Generating graphs	80 minutes
Session 6 13:30–14:50	Working with graphs	80 minutes
Session 7 15:10–16:30	Trigonometry	80 minutes

Day 3 (Grades 5 to 9): Number

10:45	Registration	
Session 8b 11:10–12:30 and 13:30–14:10	Fractions, decimals and percentages	120 minutes
Session 9b 14:20–16:20	Calculators	120 minutes

Day 3 (Grades 10 to 12): Foundation and advanced mathematics

10:45	Registration	
Session 8c 11:10–12:30	Proof	80 minutes
Session 9c 13:30–14:50	Understanding and using functions	80 minutes
Session 10c 15:10–16:30	Applications of calculus	80 minutes

Day 4: Data handling

10:45	Registration	
Session 11 11:10–12.30	Collecting data	80 minutes
Sessions 12–13 13:30–14:50 15:10–16:30	Working with data	160 minutes

Day 5: Probability and statistics

10:45	Registration	
Session 14 11:10–12:30	Probability	80 minutes
Session 15 13:30–14:50	Statistical inference	80 minutes
Session 16 15:10–16:30	The interactive whiteboard	70 minutes

Objectives of each session

Day 1: Developing reasoning

Session 1: Mental mathematics

By the end of the session teachers will:

- have considered what is meant by mental mathematics;
- have considered some strategies for helping students to improve their skills in doing mental mathematics.

Session 2: Proportional reasoning

By the end of the session teachers will:

- have considered strategies for teaching students about proportional reasoning;
- have seen the need for a consistent approach;
- have seen how visualisation can aid understanding.

Session 3: Geometric reasoning

By the end of the session teachers will:

- have considered some strategies for teaching students how to use implicit knowledge to reason in geometry;

- have seen how practical work can help students understand mathematical concepts, rules and formulae.

Session 4: Geometric deduction

By the end of the session teachers will:

- have considered some strategies for teaching students how to use explicit and implicit information;
- have seen how a consistent approach is essential for understanding the concept of deduction.

Day 2: Algebra and trigonometry

Session 5: Generating graphs

By the end of the session teachers will:

- have considered some strategies for teaching graphs of functions using ICT;
- have seen how visualisation can improve students' understanding of graphs.

Session 6: Working with graphs

By the end of the session teachers will:

- have considered some strategies for teaching students how to solve equations;
- have seen how visualisation can help students understand what is meant by a solution.

Session 7: Trigonometry

By the end of the session teachers will:

- have considered some strategies for teaching trigonometry;
- have seen how doing practical work and using ICT can provide visual imagery that aids memorisation.

Day 3 (Grades 5 to 9): Number

Session 8b: Fractions, decimals and percentages

By the end of the session teachers will:

- have discussed how students learn;
- have seen how visualisation is a key component in teaching fractions;
- have considered some strategies for teaching that are consistent across grades.

Session 9b: Calculators

By the end of the session teachers will:

- have considered how to teach students to use a calculator, and some of the difficulties that they can have;
- have tried out some calculator activities to use in lessons.

Day 3 (Grades 10 to 12): Foundation and advanced mathematics

Session 8c: Proof

By the end of the session teachers will:

- have considered the significance of proof;
- have considered pedagogical issues in teaching proof;
- have recognised features of different types of proof;
- have generated some proofs.

Session 9c: Understanding and using functions

By the end of the session teachers will:

- have considered the significance of functions and their applications;
- have recognised and described key features of different functions;
- have generated some functions from situations and from other functions;
- have considered some of the pedagogical issues in teaching about functions.

Session 10c: Applications of calculus

By the end of the session teachers will:

- have considered the significance of analytical calculus in mathematics and its applications;
- have used calculus to describe features of polynomial and other functions;
- have solved simple optimisation problems;
- have looked at some mathematical models.

Day 4: Data handling

Session 11: Collecting data

By the end of the session teachers will:

- have considered strategies for teaching students how to plan a statistical investigation;
- have considered data types and how to collect relevant data for a statistical investigation.

Sessions 12 and 13: Working with data

By the end of the session teachers will:

- have considered strategies for teaching students to use data in statistics;
- have discussed how data is analysed, represented and interpreted;
- have done some calculations with data.

Day 5: Probability and statistics

Session 14: Probability

By the end of the session teachers will:

- have considered difficulties students experience in learning about probability;
- have considered strategies for teaching probability;
- have discussed the language of probability;
- have looked at random variables and probability distributions;
- have done some calculations of probability.

Session 15: Statistical inference

By the end of the session teachers will:

- have been introduced to the idea of statistical inference;
- have considered some difficulties in teaching and learning statistical inference;
- have discussed introductory techniques and used the language of statistical inference;
- have made some statistical inferences.

Session 16: The interactive whiteboard

By the end of the session, teachers will:

- have viewed and discussed some ICT resources;
- have considered how the workshop should be followed up in school.

Preparing for the workshop

Before the workshop, you will need to check out practical matters such as:

- the venue, including car parking and arrangements for coffee, lunch and tea;
- workshop numbers and participating schools;
- resources needed every day, including a computer equipped with Microsoft PowerPoint, a video recorder and projection facilities (full details of the resources needed are on pages 11–13);
- furniture arrangements (preferably workshop style with tables);
- any displays that you may wish to have;
- interpretation and translation facilities.

You will also need to prepare a workshop register, with names of schools and details of whether teachers are mathematics subject leaders or other teachers.

Other preparation consists mainly of making sure that you are familiar with the workshop materials and other publications.

Teacher's pack: Parts 1 and 2

You will need to prepare one copy of the *Teacher's pack* for each teacher attending the workshop.

Part 1 should be sent to teachers in advance of the workshop together with your letter of invitation and the workshop programme.

Part 2 should be given out at the start of the first day. This contains:

- handouts for particular sessions;
- the gap tasks to be completed before the next workshop;
- reduced copies of all the slides used on the workshop.

Resources needed

On all five days

For the trainer

- *Trainer's notes*
- Copy of the *Teacher's pack*
- Computer and data projector, with Microsoft PowerPoint and *Autograph*
- Whiteboard or flipchart
- Overhead projector (OHP) and blank acetate sheets
- *Curriculum Standards for mathematics: Grades K to 12*
- *Sample lesson plans for mathematics: Grades 1 to 12*

For each teacher

- *Teacher's pack*

Either provide or ask teachers to bring each day

- *Curriculum Standards for mathematics: Grades K to 12*
- *Sample lesson plans for mathematics: Grades 1 to 12*

Day 1

For the trainer

- The PowerPoint slides for Day 1: Presentation 1.ppt, Presentation 2.ppt, Presentation 3.ppt, Presentation 4.ppt
- A few spare scissors, rulers, protractors and compasses, and a pencil sharpener
- Copies of the evaluation form for Day 1 (see back of *Trainer's notes*)

For each group

- A set of five identical cylinders
- Cardboard, sticky tape, tennis ball and rice

For each teacher:

- Scissors, ruler, protractor, compasses and sharp pencil (to be brought by teachers)

Day 2

For the trainer

- The PowerPoint slides for Day 2: Presentation 5.ppt, Presentation 6.ppt, Presentation 7.ppt
- Graphics calculator with OHP connection
- A few spare protractors, rulers and compasses, and a pencil sharpener
- Copies of the evaluation form for Day 2 (see back of *Trainer's notes*)

For each group

- Computer with *Autograph*
- Graphics calculator

For each teacher

- Compasses, sharp pencil, protractor and ruler
- Sheet of plain paper and sheet of graph paper

Day 3 (Grades 5 to 9)

For the trainer

- The PowerPoint slides for Day 3 (Grades 5 to 9): Presentation 8b.ppt, Presentation 9b.ppt
- Cups, fractions of cups and number cards
- Overhead projector calculator and blank acetate sheets
- Calculators for teachers
- Copies of the evaluation form for Day 3 (see back of *Trainer's notes*)

Day 3 (Grades 10 to 12)

For the trainer

- The PowerPoint slides for Day 3 (Grades 10 to 12): Presentation 8c.ppt, Presentation 9c.ppt, Presentation 10c.ppt
- Graphics calculator with OHP connection
- Copies of the evaluation form for Day 3 (see back of *Trainer's notes*)

For each group

- Computer with *Autograph*
- Graphics calculator

Day 4

For the trainer

- The PowerPoint slides for Day 4: Presentation 11.ppt, Presentation 12.ppt
- Interlocking cubes and a number line
- Copies of the evaluation form for Day 4 (see back of *Trainer's notes*)

For each group

- Computer with *Autograph*
- Graphics calculator

For each teacher

- Sheet of graph paper

Day 5

For the trainer

- The PowerPoint slides for Day 5: Presentation 14.ppt, Presentation 15.ppt, Presentation 16.ppt
- Interactive whiteboard and a range of software
- Copies of both evaluation forms for Day 5 (see back of *Trainer's notes*)

For each group (or pair of teachers)

- Computer with *Autograph*
- Graphics calculator or scientific calculator

Tips for new trainers

Some tips are provided here for trainers who are relatively new to the training role.

- If you are teaching the workshop with a colleague, you will need to agree how to manage your contributions. For example, you could allocate particular sessions to particular trainers, alternate contributions within a session, divide into separate groups for some or all sessions, and so on.
- If your workshop will involve interpreters, you will need to reduce the amount of material in each session by about one third, particularly if the translation is consecutive rather than simultaneous. If possible, try to brief the interpreters on key points of the training in advance. Discuss how you and the interpreter will work during presentations to the whole group and during group work.
- When you are giving a presentation, make sure that you are familiar with the notes and don't have to pause constantly in order to refer to them. Remember to leave time for any interpreter to translate. If you are sharing the teaching of a session, your partner can then check against the workshop notes while you are leading, and can mention any omitted points before they take their own turn.
- Don't read out PowerPoint slides to your audience. Instead, refer to the accompanying workshop notes to explain, elaborate or make supplementary points. It sometimes helps to annotate a photocopy of the slide to help to do this.
- If you are using video clips, practise using the video recorder before you start running the workshop, so that you are familiar with the controls.
- If you are setting individual or small group tasks, make sure that you have a suitable arrangement of tables, make the task clear and set time limits. With longer tasks, warn the groups when there are only 5 minutes left.
- For tasks that involve study of the standards, it may help to put the numbers of the pages to be studied on a flipchart before the session begins.
- When you are taking feedback from group tasks, use the workshop notes to check that all the necessary points have been mentioned. If an opinion is expressed that you think may be an isolated or minority views, it may help to check whether other teachers share that view to create debate about it.
- Work flexibly to the indicative times for each session. Without making it obvious, keep a watchful eye on the clock.
- If time for questions runs out, or if you are asked a question to which you don't know the answer, make a note of the question on a flipchart, or on a wall poster put up for the purpose, so that you can deal with it later.
- You will be working from prepared notes because it is important that all workshop members are given the same information and an opportunity to consider the same range of issues. However, there are opportunities to draw on your own and local experience as well. This will help you to feel that it is your workshop and thus make it more effective for all teachers.
- If you are likely to repeat the workshop, the evaluation forms completed by trainees should help you to make suitable adjustments.