MIICE subject guide:

Primary mathematics

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This guide is an example of how you can select from the MIICE quality framework for a particular application of learning and teaching using ICT. It is not the only way to select, but it will help those who are newcomers to the MIICE toolbox to select from the daunting collection

The MIICE partnership is grateful to Iain Midgley and Falkirk Council for recording his experience for the benefit of others

If you want to submit your own selection - for primary mathematics or another curricular area - for publication please do so

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For more information on MIICE and studies carried out using MIICE visit the website at http://www.miice.org.uk/

With thanks to Roddy Stuart for his time and support.

MIICE - an introduction

MIICE stands for Measurement of the Impact of ICT on Children's Education. MIICE's main purpose is to put into words what most recognise is good quality in learning and teaching incorporating the use of ICT. It is concerned with those qualities which cannot readily be assessed in conventional ways to contribute to the debate about the ends of more widespread use of ICT for learning and teaching. Use of ICT makes real demands - in money and time - on education authorities, schools, teachers and children. We need to be clearer about the benefits which we can anticipate.

Background

MIICE grew out of a set of case studies of evidently good practice in Scottish schools - primary, secondary and special - when using ICT undertaken by Tony van der Kuyl at the Scottish Interactive Technology Centre (SITC) in the late 1990s. From these 16 case studies, 12 learning outcomes, commonly observed to be in evidence were articulated. Tony wanted to expand this embryonic framework by tapping the experience of a wide range of colleagues from schools, education authorities and teacher education institutes. This 'partnership' had its first meeting in May 2000.

The case studies can be seen at
http://sitc.education.ed.ac.uk/Case_Studies/index.htm

MIICE quality framework

The MIICE quality framework is articulated in the MIICE toolbox and has the following structure

- Outcomes - these are the broad areas of impact of ICT use; there are 13 altogether
- Components - these are aspects of these broader areas; there are from 2 to 4 components in each outcome and 41 altogether (4 of which appear in 2 outcomes)
- Measures - these are the detailed activities about which questions might be asked; there are from 1 to 6 measures within each component.

The structure broadly mirrors that in *How good is our school?* (quality indicator, theme, illustration) but the MIICE framework is a more finely grained analysis than HGIOS.

The Primary toolbox comprises 13 learning outcomes such as (1) Learner Reflection and (2) Skills Development. The first seven of these outcomes relate to learning by pupils; numbers 8-10 relate to schools' management of effective learning; and numbers 11-13 relate to continuing professional development in the use of ICT for teachers.

This Subject Guide supports the use of the MIICE (Primary) toolbox in assessing the impact of ICT in Mathematics 5-14. It is to be used in conjunction with the Primary toolbox and not seen as a toolbox itself. The process shown reflects the experience of the author and users should adapt and refine the toolbox according to their local needs.

Selection of MIICE Learning Outcomes for Maths 5-14

In selecting learning outcomes you must first question what are you assessing. Are you assessing the pupils learning, the management of ICT or the influence of ICT on teacher productivity? The emphasis of your study will then be reflected in your choice of learning outcomes from the toolbox. The first seven of these outcomes relate to learning by pupils. Outcomes 8-10 relate to schools' management of effective learning whilst Outcomes 11-13 relate to continuing professional development in the use of ICT for teachers.

Outcome 1 - Learner Reflection
Outcome 2 - Skills Development
Outcome 3 - Managing and Manipulating data
Outcome 4 – Shared planning/organisation
Outcome 5 – Investigatory Learning
Outcome 6 – Shared learning
Outcome 7 - Motivation
Outcome 8 - Enhancing learning outcomes
Outcome 9 – Quality of Outcomes
Outcome 10 – Self-esteem/confidence
Outcome 11 – Teacher use of computers as productivity tools
Outcome 12 – Teacher facilitating the learning of ICT principals and good habits
Outcome 13 – Teacher use of ICT to enrich and make learning more effective

For mathematics, there are obvious links with Outcome 3 - managing and manipulating data - but many of the outcomes can be reflected in a study of ICT in Mathematics. For example, if you are assessing the influence of spreadsheets or databases in ICT as a productivity tool for teachers, you would use Outcome 11.

In any study, the MIICE toolkit is refined to develop a questionnaire that reviews a manageable number of outcomes. It is recommended that any study uses a maximum of 6 areas or questions.

In the recent Falkirk Council MIICE study of Mathematics 5-14 the following Outcomes were used.

Outcome 1: Learner Reflection
    assessing general learning skills
Outcome 2: Skills Development
    assessing the development of specific skills related to information handling
Outcome 3: Managing and Manipulating data
    assessing the development of specific skills related to information handling
Outcome 8: Enhancing learning outcomes
    assessing teachers' and schools' approaches

For each outcome, the toolkit has up to four components. The team refined the components of each outcome to make the questionnaire manageable and to reflect the analysis of 5-14 Mathematics. The final list of outcomes and components is as follows.

Outcome 1 - Learner Reflection
- Component 1.3 Ability to articulate evaluations of actions taken

Outcome 2 - Skills Development
- Component 2.3 Collection and analysis of Information
- Component 2.1 Effective and responsible Use of ICT

Outcome 3 - Managing and Manipulating data
- Component 3.2 A problem Solving Approach

Outcome 8 - Enhancing learning outcomes
- Component 8.1 Progression in Learning

Selection of MIICE measures for Maths 5-14

By selecting the number of outcomes and components, the measures for assessment purposes becomes manageable.

The following table gives suggested measures for Mathematics.

(outcome 1.3) - linked to National Priorities 2, 5
- Level 2 - Can learners speculate on 'what if' questions about alternative courses of action?
- Level 4 - Can learners describe the value and drawbacks of alternative approaches, both orally and in writing?

(Outcome 2.1 - linked to National Priorities 1, 2
- Level 2 – Do learners simultaneously develop their ICT skills and their skills in the learning activity?
- Level 4 - Does the development of ICT skills accelerate the development of learners' wider skills?

(Outcome 2.3) - linked to National Priority 2
- Level 2 – Do learners develop their enquiry skills – asking appropriate questions – by using ICT?
- Level 4 – Do learners continue to refine their enquiry skills by using ICT?

(Outcome 2.3) - linked to National Priority 1
- Level 2 – Does the use of ICT help learners to derive relevant information from a mass of data?
- Level 4 – Are learners able to derive relevant information and patterns of occurrence from a mass of data when using ICT?

(Outcome 2.3) - linked to National Priorities 1, 2
- Level 2 – Do learners develop their search skills by using ICT?
- Level 4 – Do learners continue to refine their search skills by using ICT?

(Outcome 3.2) - linked to National Priorities 2, 4
- Level 2 – Do learners seek appropriate help or advice from fellow learners and the teacher when working with ICT?
- Level 4 – Are learners able to apply a range of strategies in the solution of any problems they meet and are able to articulate to the teacher and others how they did it?

(Outcome 8.1) - linked to National Priority 3
- Level 2 - Are there inclusive practices ensuring involvement of all learners in ICT activity?
- Level 4 – Is there a discernible effort to ensure that all learners gain a range of experience of ICT use appropriate to their age, experience and needs?

Refining Measures for Mathematics study

Questions are used to then assess the teachers/students view of the impact of ICT.

For the purposes of the Falkirk Council study, the questions were altered to reflect the focus on ICT in 5-14 Mathematics. For example

Original MIICE version:

2.1 Does the development of ICT skills accelerate the development of learners' wider skills? eg Their collaborative skills are enhanced while using ICT to investigate and solve problems

Revised MIICE question for Falkirk Study:

2.1 Does the development of ICT skills accelerate the development of the children's wider skills in mathematics 5-14 and beyond?

The full list of questions for the Falkirk Study is as follows.

SKILLS DEVELOPMENT **2.3 Collection and analysis of information**	**LEVEL**
	1
1 Do the children develop their enquiry skills - asking the appropriate questions - by using ICT in information handling? *e.g. They can search a database using simple criteria* 2 Does the use of ICT help the children to derive relevant information from a mass of data? *e.g. They can interrogate a database, e.g. Ourselves, to find how many have brown hair*	2
	3
1 Do the children continue to refine their enquiry skills in information handling by using ICT? *e.g. They can search a database using multiple criteria* 2 Are the children able to derive relevant information and patterns of occurrence from a mass of data when using ICT? *e.g. They can interrogate a database, e.g. Ourselves, to investigate the relationship between height and weight*	4

SKILLS DEVELOPMENT **2.1 Effective and responsible use of ICT**	**LEVEL**
	1
3 Do the children simultaneously develop their ICT skills and their skills in information handling when they are using ICT?	2
	3
3 Does the development of ICT skills accelerate the development of the children's wider skills in mathematics 5-14 and beyond?	4

LEARNER REFLECTION **1.3 Ability to articulate evaluations of actions taken**	**LEVEL**
	1
2 Can the children speculate on 'what if' questions from the teacher about alternative courses of action?	2
	3
2 Can the children describe the value and drawbacks of alternative approaches, both orally and in writing?	4

MANAGING AND MANIPULATING DATA **3.2 A problem solving approach**	**LEVEL**
	1
2 Do the children seek appropriate help or advice from other children and the teacher when working with ICT for information handling?	2
	3
2 Are the children able to apply a range of strategies in the solution of any problems they meet and are they able to explain to the teacher and others how they did it?	4

ENHANCING LEARNING OUTCOMES **8.1 Progression in learning**	**LEVEL**
	1
3 Are there inclusive practices in all classes to ensure the involvement of all the children in the use of ICT for information handling?	2
	3
3 Is there a discernible effort to ensure that all the children experience a range of ICT activities within an overall programme, appropriate to their age, experience and needs?	4

Exemplification of measures for Information Handling

During the course of an interview staff are asked to give evidence and comment. Examples of comments from interviews for each of the measures are given here.

Measure 2 (outcome 1.3) National Priority 2, 5

- Level 2 - Can learners speculate on 'what if' questions about alternative courses of action.

  "P4 just starting on using Info handling. Simple questions about what they had done, how they had achieved it and how things could have changed or been done differently."

  "Once pupils start chatting and have had the idea initiated by teacher the pupils will then discuss at length about what happens or could happen."

- Level 4 - Can learners describe the value and drawbacks of alternative approaches, both orally and in writing?

  "Very confident when analysing data. They are good at talking about the data, asking questions and talking to adults."

Measure 3 (Outcome 2.1) National Priority 1, 2

- Level 2 – Do learners simultaneously develop their ICT skills and their skills in the learning activity

  "They are beginning to transfer skills. Certain parts of the software do enable pupils to ask questions about the data. They can explore changes, how they can adapt data input to show different things."

  "More able pupils are at (4). ICT is a tool which is advancing their skills but not case for majority. Spreadsheets for enterprise to keep tally of money."

- Level 4 - Does the development of ICT skills accelerate the development of learners' wider skills?

  "In exploring European Union database they were able to view information faster, to ask more questions and find answers in a shorter response time. It was much easier for pupils to retrieve information on the database - to learn more about the countries studied."

Measures 1,2 and 3 (Outcome 2.3) National Priority 1, 2

- Level 2 – Do learners develop their enquiry skills – asking appropriate questions – by using ICT?
- Level 2 – Does the use of ICT help learners to derive relevant information from a mass of data?

  "The class can use simple criteria on searches of a database. When they use a database or starting graph they begin to ask questions about the data. Teacher got the pupils to make up questions to ask other pupils. These were put up on the wall display with their graphs printed out. First session the teacher gave questions for the graphs, in the second session pupils were expected to create questions."

  "Teacher has used databases in the context of both European Union and World Tours. They were able to set up the databases for a number of fields. They carried out simple searches, usually looking at records as a whole and not using multiple criteria."

  "Asking questions on modes of transport to school, how many pupils, comparing different modes, popular, least popular routes. But only basic questions."

- Level 4 – Do learners continue to refine their enquiry skills by using ICT?
- Level 4 – Are learners able to derive relevant information and patterns of occurrence from a mass of data when using ICT?

  "Looked at a 'myself' survey using Starting Graph. 2 pupils in P3 are very proficient. They do a lot of peer tutoring."

  "They can ask questions, and develop high level skills, can interrogate numbers well."

Measure 2 (Outcome 3.2) National Priority 2, 4

- Level 2 – Do learners seek appropriate help or advice from fellow learners and the teacher when working with ICT?

  "Pupils find it very easy to seek help from a range of sources. They are very keen to share information and advice amongst peers, the class often uses a small group of more able pupils to provide information and advice. They share willingly. They use the teacher to answer basic questions."

- Level 4 – Are learners able to apply a range of strategies in the solution of any problems they meet and are able to articulate to the teacher and others how they did it?

  "Only 2 boys at P3 are very capable. They can try a range of strategies. They have been brought on by home use. The pupils work well together, sharing ideas and strategies."

Measure 3 (Outcome 8.1) National Priority 3

- Level 2 - Are there inclusive practices ensuring involvement of all learners in ICT activity?

  "Lots of reasons why the school is not at level 4. There are different teacher skills, unsure about the package or learning objectives that are achieved from the computing."

  "Still not felt to be quite up to speed with levels appropriate to age of children, partly hindered by lack of appropriate equipment, partly by some lack of expertise in some areas in some staff."

- Level 4 – Is there a discernible effort to ensure that all learners gain a range of experience of ICT use appropriate to their age, experience and needs?

  "Tasks are differentiated - they have 2 levels of tasks to do for their weekly task. Still lots of tasks that are accessed at their level. Group work often used so is peer tutoring."

  "The classroom teacher differentiates for varying abilities of children but also enhanced provision and learning support (eg through using alphasmarts - used by specific pupils but also a shared resource in a class)."