ASSESS AND PROGRESS

a resource pack for teachers of key stages 1 and 2: Using and Applying Mathematics

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AND

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A resource pack for teachers of key stages 1 and 2,
combining classroom activities and INSET modules,
focused on Using and Applying Mathematics

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CONTENTS

'Construct the Best Box'

'Patterns to Create and Explain'

ACKNOWLEDGEMENTS

Introduction

'Assess and Progress' is a resource pack concerned with the programme of study for Using and Applying Mathematics and its corresponding attainment target, AT1.

The pack contains a total of 20 classroom activities, together covering all three main subsections of the key stage 1 and key stage 2 programmes of study for Using and Applying Mathematics. Each classroom activity relates to two or three levels, so being suitable for children showing different levels of performance.

Complementing these classroom activities is a set of 18 INSET modules that can be used by teachers to develop a range of teacher assessment skills that are needed during a key stage.

By using the classroom activities with children, along with working with colleagues on a selection of the INSET modules, teachers will become more familiar with the programme of study for Using and Applying Mathematics and the level descriptions for AT1. It is important to keep in mind that the programme of study is the basis for planning work with children and everyday assessment, while the level descriptions are for making a judgement about each child's attainment at the end of a key stage.

This combination of classroom activities and INSET modules will enable teachers to decide, with confidence, on the levels of performance being shown by children.

The Importance of Using and Applying Mathematics

The programme of study for Using and Applying Mathematics comprises four subsections; one general subsection, numbered 1, and three main subsections, numbered 2 to 4.

KEY STAGE 1 PROGRAMME OF STUDY

Using and Applying Mathematics

■	**1. Pupils should be given opportunities to:**		
		a	use and apply mathematics in practical tasks, in real-life problems and within mathematics itself;
		b	explain their thinking to support the development of their reasoning.
			Pupils should be taught to:
■	**2. Making and monitoring decisions to solve problems**	a	select and use the appropriate mathematics;
		b	select and use mathematical equipment and materials;
		c	develop different mathematical approaches and look for ways to overcome difficulties;
		d	organise and check their work.
■	**3. Developing mathematical language and communication**	a	understand the language of number, properties of shapes and comparatives, *eg 'bigger than', 'next to', 'before'*;
		b	relate numerals and other mathematical symbols, *eg '+', '='*, to a range of situations;
		c	discuss their work, responding to and asking mathematical questions;
		d	use a variety of forms of mathematical presentation.
■	**4. Developing mathematical reasoning**	a	recognise simple patterns and relationships and make related predictions about them;
		b	ask questions including 'What would happen if?' and 'Why?', *eg considering the behaviour of a programmable toy*;
		c	understand general statements, *eg 'all even numbers divide by 2'*, and investigate whether particular cases match them.

Using and Applying Mathematics

■ **1. Pupils should be given opportunities to:**

    a   use and apply mathematics in practical tasks, in real-life problems and within mathematics itself;

    b   take increasing responsibility for organising and extending tasks;

    c   devise and refine their own ways of recording;

    d   ask questions and follow alternative suggestions to support the development of reasoning

    Pupils should be taught to:

■ **2. Making and monitoring decisions to solve problems**

    a   select and use the appropriate mathematics and materials;

    b   try different mathematical approaches; identify and obtain information needed to carry out their work;

    c   develop their own mathematical strategies and look for ways to overcome difficulties;

    d   check their results and consider whether they are reasonable.

■ **3. Developing mathematical language and forms of communication**

    a   understand and use the language of:

- number;
- the properties and movements of shapes;
- measures;
- simple probability;
- relationships, including 'multiple of', 'factor of' and 'symmetrical to';

    b   use diagrams, graphs and simple algebraic symbols;

    c   present information and results clearly, and explain the reasons for their choice of presentation.

■ **4. Developing mathematical reasoning**

    a   understand and investigate general statements, *eg 'wrist size is half neck size', 'there are four prime numbers less than 10';*

    b   search for pattern in their results;

    c   make general statements of their own, based on evidence they have produced;

    d   explain their reasoning.

Each of the four subsections of the key stage 1 programme of study for Using and Applying Mathematics corresponds to that for key stage 2.

Subsection 1 simply refers to the opportunities that should be given to children with regard to the different aspects of Using and Applying Mathematics.

Subsection 2 is about children choosing the mathematics they need to use, putting into practice various approaches to problem-solving and organising and checking their work.

Subsection 3 is about children discussing their work, interpreting mathematical situations, recording findings, and presenting results and conclusions in a variety of ways.

Subsection 4 is about children recognising patterns and relationships, making predictions, investigating general statements and justifying solutions to problems.

In short, Using and Applying Mathematics is about children's process skills in mathematics. These skills are particularly to the fore when children are engaged in problem-solving, investigational work and practical mathematics.

It should be remembered that Using and Applying Mathematics is not to be treated by teachers as separate from Number, Shape, Space and Measures and Data Handling. Indeed, both process and content are interrelated within any mathematical task, but teachers are generally more familiar with the assessment of content than they are of process.

While the classroom activities in this pack all combine mathematical content with process, they are especially rich with opportunities for teachers to assess children on Using and Applying Mathematics during a key stage.

The level descriptions for levels 1 to 5 of AT1 are shown below. By the end of key stage 1, the performance of the great majority of children will be within levels 1 to 3, while by the end of key stage 2 it will be within levels 2 to 5.

LEVEL DESCRIPTIONS

Attainment Target 1: Using and Applying Mathematics

■ Level 1

Pupils use mathematics as an integral part of classroom activities. They represent their work with objects or pictures and discuss it. They recognise and use a simple pattern or relationship, usually based on their experience.

■ Level 2

Pupils select the mathematics for some classroom activities. They discuss their work using familiar mathematical language and are beginning to represent it using symbols and simple diagrams. They ask and respond appropriately to questions including 'What would happen if...?'

■ Level 3

Pupils try different approaches and find ways of overcoming difficulties that arise when they are solving problems. They are beginning to organise their work and check results. Pupils discuss their mathematical work and are beginning to explain their thinking. They use and interpret mathematical symbols and diagrams. Pupils show that they understand a general statement by finding particular examples that match it.

■ Level 4

Pupils are developing their own strategies for solving problems and are using these strategies both in working within mathematics and in applying mathematics to practical contexts. They present information and results in a clear and organised way, explaining the reasons for their presentation. They search for a pattern by trying out ideas of their own.

■ Level 5

In order to carry through tasks and solve mathematical problems, pupils identify and obtain necessary information; they check their results, considering whether these are sensible. Pupils show understanding of situations by describing them mathematically using symbols, words and diagrams. They make general statements of their own, based on evidence they have produced, and give an explanation of their reasoning.

Teacher Assessment Skills

Teacher assessment involves the ongoing assessment by class teachers of children's work in the National Curriculum. Teachers are to use the programmes of study as the basis for everyday assessment, and the level descriptions for making a rounded summative judgement of each child's attainment at the end of a key stage.

Teacher assessment is not an easy matter in Using and Applying Mathematics. This is partly because the programme of study and corresponding level descriptions are difficult to interpret and apply, and partly because teachers are relatively unfamiliar with the assessment of children's process skills. Teachers need advice on the type of material to give children, and guidance concerning the assessment skills to use in the classroom. This resource pack aims to do just that, by combining a range of classroom activities focused on Using and Applying Mathematics with a set of INSET modules to develop assessment skills.

The skills that are central to effective teacher assessment are those of observation and questioning. High quality interactions between the teacher and the child can provide good evidence of children's performance.

Alongside the skills of observation and questioning, the teacher needs to have established beforehand with colleagues what is meant by the parts of the programme of study and the level descriptions. Also the teacher should have a firm idea of the type of performance from children they would expect to see at particular levels. As this type of assessment is formative, then a range of different contexts for children's work needs to be looked at during the key stage.

Other aspects of teacher assessment to consider include those of organising the class, involving children in methods of self-assessment, and obtaining evidence from the product of work. Moreover, information from teacher assessment can be used by teachers to identify strengths and weaknesses of individual children, and also to evaluate the curriculum.

In organising the class with assessment in mind, it is wise not to attempt to assess most of the children on all parts of the activity. It is better to focus on just a couple of children on a small part of the activity that is particularly relevant. On occasions when children have worked in pairs on small groups, the teacher needs to be sure about individual contributions to any group effort. Again the quality of the questioning used by the teacher, along with observation at the right time, has an important role.

All these vital areas of teacher assessment are addressed by the INSET modules in this pack. Teachers will find that by using the modules with their colleagues they will develop their skills to the benefit of themselves and their children.

Introduction to the Classroom Activities

The 20 classroom activities in this pack are arranged into six parts according to the range of levels of Using and Applying Mathematics addressed.

Levels 1/2		2	Classroom Activities	
"	1/2/3	3	"	"
"	2/3	3	"	"
"	2/3/4	4	"	"
"	3/4	4	"	"
"	3/4/5	4	"	"

Teachers will find that some of the classroom activities are likely to fit in well with the topic or theme they are following. Other activities are of an investigation type, and so relate more to particular mathematical skills and processes. Examples of the former include 'Decide and Buy' which would correspond to a topic about Shopping, 'Design a T-shirt Pattern' to one on Clothes, 'Test the 'Leaves Formula'' to Plants and Animals, and 'Examine the Newspapers' to Communication. Classroom activities that are of an investigation type include 'Discover the Possible Numbers', 'Generate Number Chains, and Investigate' and 'Patterns to Create and Explain'.

In selecting a classroom activity to use, teachers will want to consider the main subsections of the programme of study for Using and Applying Mathematics that are addressed, and how the activity corresponds to other work recently given to the children. Both the content of the classroom activity, and the skills and processes involved are important.

Using a Classroom Activity

How to use a classroom activity is described in two main parts:

The first part consists of a page, headed by the name of the activity, indicating the **Resources** needed, the **Time** taken for the activity, the **Organisation** of the children in the class, and **What to do.**

The **Resources** are generally those to be found in typical classrooms for children in key stages 1 and 2, the **Time** indicates a period in which the activity can usually be completed, and the **Organisation** specifies that which is most suitable from the view of children's involvement, and the need to carry out teacher assessment effectively and efficiently. **What to do** sets out the various stages of the classroom activity from its presentation by you to the children to its conclusion, highlighting the main action needed to be taken by you as the activity proceeds.

Along with this page is a worksheet, and any other written materials, to be used with children. These can be photocopied to provide as many copies as you require. Many of the photocopiable sheets are such that copies can be cut along a dotted line to make two worksheets. All the worksheets and other materials should be made ready before using the activity in the classroom. It is intended that worksheets complement the interaction that should take place between the teacher and children, and not be a substitute for it.

The second part consists of one or two pages entitled **Teachers' Notes.** These include references to the types of children's work to look for, and the corresponding level, within each main subsection of Using and Applying Mathematics. These subsections are:

- ■ **Making and monitoring decisions to solve problem**

- ● **Developing mathematical language and (forms of) communication**

- ◆ **Developing mathematical reasoning**

Some classroom activities address all three subsections, whereas other activities address only one or two.

The **Teachers' Notes** are headed on the right hand side by a key which indicates the various levels in the three main subsections of Using and Applying that are addressed by the classroom activity. For example, the key below shows that this classroom activity addresses:

> levels 1 and 2 in ■ (Making and monitoring decisions to solve problems)
> level 1 in ● (Developing mathematical language and communication)
> levels 1 and 2 in ◆ (Developing mathematical reasoning)

L 5

E 4

V 3

E 2

L 1

■ ● ◆
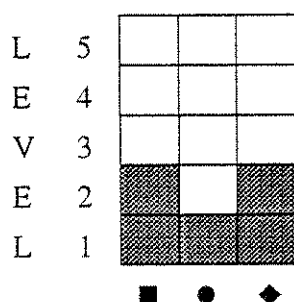
Before using the classroom activity with children, teachers will have benefited from having done it themselves, as described in INSET MODULE A. Just before using the activity in the classroom, it is a good idea to read through the **Teachers' Notes** to become familiar with some of the likely outcomes.

Introduction to the INSET Modules

There are 18 INSET modules in this pack, all concerned with Using and Applying Mathematics. Teachers will be able to develop their teacher assessment skills by selecting a combination of INSET modules which together address their needs.

INSET MODULE A and INSET MODULE B relate to all 20 classroom activities. Both these modules should be done whenever a classroom activity is used. INSET MODULE A should be done before teachers use any classroom activity with children, and INSET MODULE B done very soon afterwards.

By doing INSET MODULE A, teachers will be able to familiarise themselves with the classroom activity, and make decisions about the work expected from children, along with what this would show about children's levels of performance. By doing INSET MODULE B, teachers will be able to look back on children's work and make decisions about the levels of performance actually shown by each child.

The remaining INSET modules, INSET MODULES C to R, are organised into two categories: USE and REVIEW. Any INSET module entitled USE should be done prior to using the corresponding classroom activity with children, whereas one entitled REVIEW should be done soon afterwards.

The INSET modules in the USE category cover:

- Organising the Class for Assessment
- Asking Questions
- Observing and Capturing Ephemeral Evidence
- Involving Children in Self-Assessment

> TO BE DONE BEFORE THE CLASSROOM ACTIVITY

The INSET modules in the REVIEW category cover:

- Obtaining Evidence from the Product of Work
- Improving Assessment Skills
- Using Assessment Diagnostically

> TO BE DONE AFTER THE CLASSROOM ACTIVITY

There are six parts to this resource pack: Levels 1/2, Levels 1/2/3, Levels 2/3, Levels 2/3/4, Levels 3/4 and Levels 3/4/5. The first classroom activity in each part is followed by two or three INSET modules that are specially pertinent to it. Teachers should arrange to do these INSET modules, as well as INSET MODULE A and INSET MODULE B, at appropriate times according to the categories USE and REVIEW. The other classroom activities in each part are all followed by a page entitled INSET PROGRAMME. An example is shown below.

INSET PROGRAMME: LET'S PREDICT		
USE	Organising the Class for Assessment	Do INSET MODULE K on page 83
	Asking Questions	Do INSET MODULE F on pages 43 and 44
	Observing and Capturing Ephemeral Evidence	Do INSET MODULE N on pages 110, 111 and 112
	Involving Children in Self-Assessment	Do INSET MODULE L on pages 84 and 85
REVIEW	Obtaining Evidence from the Product of Work	Do INSET MODULE H on pages 47 and 48
	Improving Assessment Skills	Do INSET MODULE J on pages 64, 65 and 66
	Using Assessment Diagnostically	Do INSET MODULE O on pages 113 and 114

The INSET PROGRAMME lists the INSET modules that could be done should teachers decide to use the particular classroom activity. Here, it is suggested that teachers select those INSET modules that address their particular needs. For instance, teachers planning to use the classroom activity 'Let's Predict', and wanting to develop their skills of Asking Questions and Using Assessment Diagnostically, would do INSET MODULE F before using the activity in the classroom, and INSET MODULE O soon afterwards.

The following chart shows the order in which the INSET modules should be done, depending on whether you have decided to do the first classroom activity from a part of the pack or one of the other activities.

YOU HAVE DECIDED TO USE THE FIRST CLASSROOM ACTIVITY FROM A PART OF THE PACK	YOU HAVE DECIDED TO USE A CLASSROOM ACTIVITY WHICH IS NOT THE FIRST ONE FROM A PART OF THE PACK

Do INSET MODULE A

Do some, or all, of the INSET MODULES entitled USE from those that immediately follow the Teachers' Notes for the Classroom Activity	Do some, or all, of the INSET MODULES entitled USE from the INSET PROGRAMME that follows the Teachers' Notes for the Classroom Activity

USE THE CLASSROOM ACTIVITY WITH CHILDREN

Do INSET MODULE B

Do some, or all, of the INSET MODULES entitled REVIEW from those that immediately follow the Teachers' Notes for the Classroom Activity	Do some, or all, of the INSET MODULES entitled REVIEW from the INSET PROGRAMME that follows the Teachers' Notes for the Classroom Activity

Using an INSET Module

Each INSET module has three main parts:

Introduction
Action
Follow-on

The **Introduction** sets the scene with regard to important aspects of the teacher assessment skills which are the focus of the module. The **Action** indicates the various steps to be followed during the INSET session. The **Follow-on** describes what you and your colleagues should do shortly after the INSET session has been completed.

It is intended that teachers work on the INSET modules in small groups; this may be several teachers or just two. In fact, individual teachers will find that it is possible to make minor changes to an INSET module so that they can use it on their own. When there is a group of teachers working on a module, it is suggested that the one of them acts as a group leader and ensures that all the necessary materials are prepared for the INSET session. Also, this teacher should lead the session by taking the group through the various steps of the **Action** part of the module. The group leader role could be taken by the teacher who is the mathematics coordinator.

It is a good idea to keep a record of the INSET modules used, especially if teachers are planning to develop a full range of assessment skills over an extended period.

INSET MODULE A - Deciding What Counts as Evidence of Performance

Time Required: About 1 hour

Introduction

In conducting teacher assessment, it is a good idea for you and your colleagues to have established beforehand the typical performance expected from a child that is to count as evidence at each level of the classroom activity.

One way of deciding on typical performance at a particular level is first to identify parts of the programme of study addressed by the classroom activity, and then to write assessment criteria for that level. Assessment criteria should be positive statements about a child's performance. *'The child knew what equipment was needed and found a method that worked'* and *'the child could tell others important things about their investigation'* are two suggested examples of assessment criteria for level 2 of Using and Applying Mathematics. Criteria like these can be used by teachers to decide the level at which the child is performing.

When using a classroom activity, some teachers are able to remember these assessment criteria when making judgements about individual children's level of performance. Other teachers initially find it necessary to have the criteria written down or summarised on a piece of paper which can be used as an aide-memoire.

Action

Arrange for colleagues to do the classroom activity (or the main parts of it) themselves. Colleagues should work on the activity as described in **What to do.** If possible, you should all work on the activity as indicated by the **Organisation.**

When this work has been completed, as a group consider an important part of the activity. This may be a specific question asked by the teacher to which children have to provide a spoken response, or a task within the activity that the children work on. You will find the **Teachers' Notes** helpful in identifying important parts of the classroom activity and in giving some examples of typical performance at each level.

Decide what part of the programme of study is addressed by this part of the classroom activity. Here, you will find it helpful to have copies of the appropriate programme of study from either page 2 or 3. Also decide what particular level you wish to focus on.

Then discuss with colleagues the possible responses that may be made by your children to the question asked or task set.

These responses are to be classified as either:

- ACCEPTABLE as evidence of performance at the level

- NOT ACCEPTABLE as showing evidence of performance at the level

Write ACCEPTABLE or NOT ACCEPTABLE as two column headings on the board or flipchart. For each possible response suggested, first discuss it, and then classify it under the appropriate heading, as agreed by the group.

As a group, use your ACCEPTABLE and NOT ACCEPTABLE lists of responses to write assessment criteria for the part of the activity.

Repeat this process of classifying ACCEPTABLE and NOT ACCEPTABLE responses, and writing assessment criteria, for other levels or for other important parts of the classroom activity.

Follow-on

The assessment criteria you have written for the classroom activity could be linked into your recording system for children's attainment. When conducting teacher assessment, you should use the criteria to make judgements about the level at which each child is performing for each part of the activity.

Use the classroom activity with children, and then shortly afterwards do INSET MODULE B with colleagues.

INSET MODULE B - Deciding on Children's Levels of Performance

Time Required: About 1 hour

Introduction

You and your colleagues should meet soon after having used the classroom activity with children to decide on children's levels of performance. The intention here is **not** to 'level' each child's piece of work on the activity. Rather it is to look at parts of a child's work and to make judgements about the levels shown. Hence, it is possible for a piece of work to cover more than one level of Using and Applying Mathematics. For instance, for a particular piece of work a child may show level 3 performance in relation to **Making and monitoring decisions to solve problems**, and level 2 performance in relation to **Developing mathematical language and communication.**

For this INSET session, you should have the assessment criteria that you wrote when you decided as a group what was to count as evidence of performance at particular levels. You should also have children's completed worksheets, and any notes that you made about children's work while they were working.

What each child has written on the worksheet is one form of evidence, but this gives only a partial picture of their performance. The oral responses made by a child to a teacher's questions, along with how they actually worked on the various tasks within an activity, will add to this picture. This form of evidence, known as ephemeral evidence, is particularly informative when assessing children's process skills.

Action

Arrange for each colleague to have a copy of the assessment criteria written for the classroom activity (as in INSET MODULE A). Ask them to bring along to the INSET session, children's completed worksheets from the activity.

Ask each colleague to spend ten minutes on their own going through some of their children's completed worksheets. On the reverse side of the worksheets, they should write down brief details about significant aspects of the child's performance, referring to the assessment criteria. These details could relate to the child's comments or

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actions. Also ask your colleagues to write down on each worksheet the level of performance shown for each part of the activity.

Ask each colleague in turn to describe to the group the performance of one child they have assessed. Each colleague should refer to the assessment criteria, and highlight significant actions taken or comments made by the child.

Discuss, as a group, each child's performance on each part of the activity with regard to the following questions:

* Is there sufficient evidence to say that the child has shown performance at a particular level?

* If the child did anything unexpected, is this informative about their performance in relation to any part of the programme of study?

* Are colleagues able to decide whether the child has made any progress in any of the three main subsections of Using and Applying Mathematics?

Follow-on

At the end of the session, you may find that you are able to update the records of some of the children. You may also be able to refine the assessment criteria by considering how the children actually worked on the classroom activity, in addition to how you expected them to perform.

LEVELS 1/2

DECIDE AND BUY

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'Buying Balls', sets of ball cards, dice with faces showing £1, £1, £2, £2, £2 and £3, pencils.

Time: 35 - 45 minutes.

Organisation: Group of four children, first working in pairs and then as a whole group.

What to do:

Before beginning the activity, you should make a special dice with faces showing the prices £1, £1, £2, £2, £2 and £3. You can make this dice by sticking pieces of paper showing these prices onto an ordinary dice.

Give both pairs of children in the group a set of the ball cards. Ask each child questions about the pictures and prices shown on the cards.

Give each child a copy of the worksheet 'Buying Balls' and ask them to work together in their pairs to answer the question shown using the cards. Encourage them to write down their answers on the worksheet. When children have found one pair of prices that add up to £10, ask them to find all the other pairs that add up to £10. Again, encourage them to write down these pairs.

At the end of this part of the activity, ask children the question, *'Suppose Kelly only had £8 to spend on two balls, what difference would that make to what she could buy?'* Give children sufficient time to think and talk about their answers.

Then go on to the next part of the activity. From the two sets of cards take all those showing the prices £7, £8 and £10. Turn these cards upside down, mix them up on the table, and ask each child to choose one. You should also choose one of the cards, as by playing the game as well you have the opportunity to interact with the children in an unobtrusive way. Show children the special dice you have made beforehand.

Explain the game to the children by saying that players take it in turns to throw the dice. Each player is to write down the amount of money shown on the dice, and as more throws are taken so their total builds up. These amounts can be written down on the reverse side of the worksheet. The player who first gets enough money to buy the ball pictured on their card is the winner. You may decide to interact with children during this stage of the activity to help them check their work.

For assessment purposes, it is useful to play the game three or four times

BUYING BALLS

Kelly wants to buy two different balls.
She has £10 to spend.

Which two balls could she buy?

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BALL CARDS SHEET
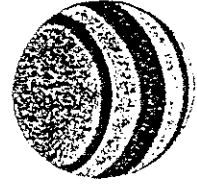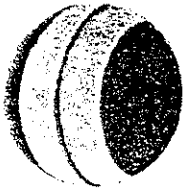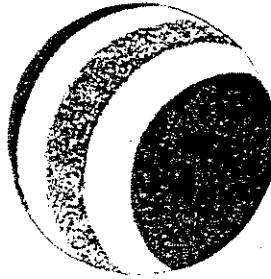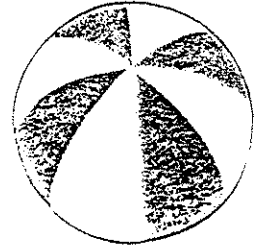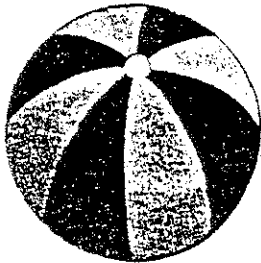
£2	£3	£4
£5	£6	£7
£8	£10	
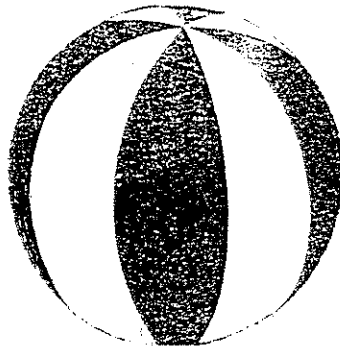
TEACHERS' NOTES:

DECIDE AND BUY

'Decide and Buy' provides many opportunities for you to interact with children by asking them questions in relation to the various subsections of Using and Applying Mathematics. This classroom activity also addresses Number.

■ Making and Monitoring Decisions to Solve Problems

When children are working out the pairs of prices that add up to £10, you should observe closely whether some children are contributing more to the solution of the task, than are their partners. This will affect your judgement of whether individual children are showing performance at level 1 or 2.

● Developing Mathematical Language and Communication

At the beginning of the activity when you give pairs of children a set of the ball cards, you should ask them questions about the pictures and prices shown. Appropriate questions include *'Which is the most expensive ball?'*, *'Which is the cheapest?'*, *'Which is the largest?'* and *'Which two balls have the same pattern?'* Typical level 1 performance entails children responding correctly to most questions of this type.

◆ Developing Mathematical Reasoning

There are many questions that you could ask to assess children's mathematical reasoning. For example, *'Suppose Kelly only had £8 to spend on two balls, what difference would that make to what she could buy?'* will lead to a range of answers from the children. An answer like *'You can't buy an £8 ball, as you have to buy two'* is typical of level 2. An answer like *'You can buy less'* will require you to explore further what the child means.

Before starting the game with the dice, it is useful to ask 'How many throws each do you think it will take before someone wins?' During the game, you should ask questions like, *'Do you think (child's name) will win on the next throw?'* After two or three goes each, you could ask *'How much money have you got so far?'* and *'How much more do you need?'* These last two questions are best asked when it is your turn to throw the dice, as then the flow of the game is not disrupted.

When playing the game again, you could ask children to look at the prices on the cards they have chosen, and ask them to consider who is the most likely to win.

INSET MODULE C

USE - Organising the Class for Assessment

Time Required: About 30 minutes

Introduction

The classroom activity entails children working in small groups. You and your colleagues will need to decide on the composition of the groups, so that children generally perform at their best, and teacher assessment is conducted effectively.

There should be a high level of interaction between the teacher and the group of children for assessment purposes. In order for this to occur, you may decide that it is necessary for just one group to work on the activity while the remaining children are engaged in other work that does not involve much input or supervision from the teacher. It may be possible to arrange for a parent helper or a teacher assistant to work with the rest of the class so that the teacher can focus on the group of children.

Action

Write on the board or flipchart some of the more common types of grouping that are possible within the class:

> same ability
> mixed ability
> friendship
> different ages
> similar ages
> same ages
> same gender
> different gender

Discuss the advantages and disadvantages of each type of grouping for the purposes of:
> - individual children performing at their best
> - teacher assessment being conducted effectively

Reach agreement on the type of grouping to be used (NB you may decide to form groups that combine two or more of these features; for example, mixed ability groups of the same gender.)

Discuss, as a group, the work the other children in the class could be given while the teacher is using the classroom activity with the group of four children. Also consider the role that any parent helper or teacher assistant could take at this time. (You may also like to discuss whether all the children, or just some of them, will work on the classroom activity at the same time, and how this might be achieved, bearing in mind that it will only be feasible to assess with accuracy a few children.)

Follow-on

Use the type of grouping you have agreed upon in this INSET session when organising your class in preparation for the classroom activity.

INSET MODULE D

USE - Observing and Capturing Ephemeral Evidence

Time Required: About 30 minutes

Introduction

Assessing with accuracy more than a few children on all the parts of the classroom activity is not really feasible. It will be necessary for the teacher to focus on particular children and on specific parts of the classroom activity.

The observation of a child's process skills needs to go beyond that of forming a general impression of what the child has done. It is important to be sure of what the child has done, to take into account what help was given by others, and to consider how the child's performance relates to their previous work on similar tasks.

It is also important for teachers to be systematic in carrying out observations of children over a period of time. For a particular classroom activity, a teacher should have clear reasons for observing particular children. These reasons may include whether or not a child has previously been assessed on the parts of the programme of study involved, or there exists contradictory evidence, or a child who had shown inappropriate behaviour in the past when being observed is now working more positively.

Action

Discuss, as a group, the various parts of the classroom activity with regard to the question:

*   Are some parts important in that a child may well do something significant which could easily be missed by a teacher?

Decide, as a group, on two parts of the classroom activity when close observation of children is very likely to provide valuable insights.

*   Which parts of the programme of study are addressed by these parts of the activity?

*   What are you expecting (or hoping) to observe?

You and your colleagues should list the names of the children you intend to observe closely during the classroom activity (this may be just a couple of children, depending on the parts of the activity and when significant work by the children is likely to occur).

Also, you and your colleagues should state the reasons why you have selected these children to be observed.

Follow-on

When using the classroom activity, assess the children you have selected in the way you have discussed and planned with colleagues in this INSET session.

INSET MODULE E

REVIEW - Using Assessment Diagnostically

Time Required: About 40 minutes

Introduction

In conducting teacher assessment within a classroom activity, teachers can often acquire information about the strengths and weaknesses of individual children. These strengths and weaknesses may be concerned with the process skills involved in the activity, and so relate to Using and Applying Mathematics. Furthermore, they may relate to the actual mathematical content, and so information on children's performance on Number, Shape, Space and Measures or Data Handling can be acquired.

Moreover, a general pattern may emerge about the strengths and weaknesses of children within a class or a year group. This information could be used by teachers to evaluate the curriculum, and to plan future work for the children.

Action

You and your colleagues should bring to the INSET session the completed worksheets from the classroom activity.

Teachers should spend ten minutes on their own going through their worksheets, sorting out those of children who had not performed as well as expected on the classroom activity.

Each teacher should select one of these worksheets, and to write brief notes on the reverse side about what the child did, and what difficulties were encountered.

Each teacher in turn should describe to the group the performance of the child on the various parts of the activity, highlighting those areas in which the child underperformed.

Discuss, as a group, the children's work with regard to the following questions:

*   Are the areas in which children are underperforming concerned with process skills or with the mathematical content?

*   Does children's performance on any particular main subsection of Using and Applying Mathematics appear to be lower than on any other subsection? If so, what can be done?

*   Does the next topic to be covered have sufficient emphasis on the main subsections of Using and Applying Mathematics where current performance is relatively low?

Follow-on

Teachers may decide to adapt the next topic to be used with children, or to incorporate different tasks so that more emphasis is placed on certain subsections of Using and Applying Mathematics. Individual children who did not perform as well as expected in certain areas could be targeted for additional help.

DESIGN A T-SHIRT PATTERN

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'Pattern', coloured crayons.

Time: 25 - 35 minutes.

Organisation: Children working as a whole class, and then individually.

What to do:

Attach a copy of the worksheet 'Pattern' to the board. Explain to the children that it is a pattern to go on the front of a T-shirt. Then hold a class discussion for 5 to 10 minutes about the pattern and the various shapes contained in it.

After the discussion has been completed, give each child a copy of the worksheet and crayons, and ask them to colour it in so that it looks attractive on a T-shirt. While they are working, or soon afterwards, you should ask individual children further questions about the pattern.

After children have finished colouring in the pattern, you could ask them to design their own patterns for T-shirts using triangles, squares and rectangles, or other shapes. They could do this on the reverse side of the worksheet, and colour it in attractively when it is finished.
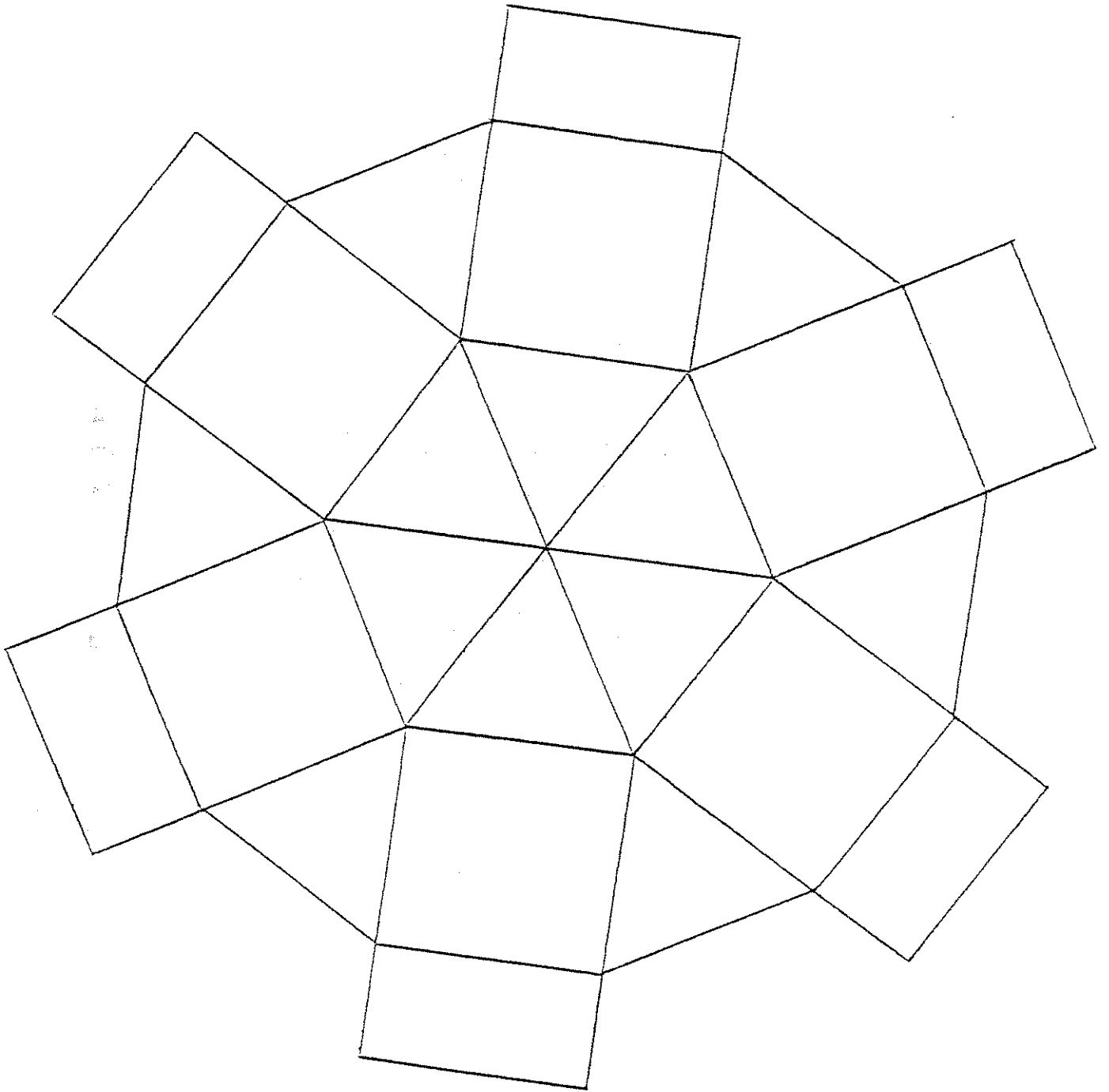
TEACHERS' NOTES:

DESIGN A T-SHIRT PATTERN

L 5
E 4
V 3
E 2
L 1

■ ● ◆
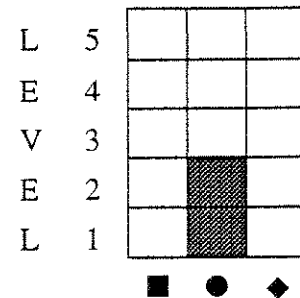
'Design a T-shirt Pattern' involves discussion between you and the children about patterns and shapes. This classroom activity also addresses Shape, Space and Measures.

● **Developing Mathematical Language and Communication**

When you hold the class discussion about the pattern and the various shapes contained in it, it is best to keep the questions you ask the children fairly open to begin with, and then to ask more focused questions later. For instance, *'What can you see in the pattern?'* is an example of an open question, whereas *'How many triangles can you see?'* is more focused.

Try to avoid using the names of the shapes, and terms like *'point'*, *'side'*, *'angle'* and *'corner'*, until children have introduced these words themselves. The correct use of these names and terms by children is typical of level 2.

INSET PROGRAMME: DESIGN A T-SHIRT PATTERN

USE	Organising the Class for Assessment	No INSET module suggested as the classroom activity simply involves children first working as a whole class, and then individually
	Asking Questions	Do INSET MODULE F on pages 43 and 44
	Observing and Capturing Ephemeral Evidence	Do INSET MODULE D on pages 28 and 29
	Involving Children in Self-Assessment	Do INSET MODULE G on pages 45 and 46
REVIEW	Obtaining Evidence from the Product of Work	Do INSET MODULE H on pages 47 and 48
	Improving Assessment Skills	Do INSET MODULE J on pages 64, 65 and 66
	Using Assessment Diagnostically	Do INSET MODULE E on pages 30 and 31

LEVELS 1/2/3

ICE-CREAM PLANNING AND PRICING

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'Two Scoop Ice-creams', copies of ice-creams sheets, crayons, pencils.

Time: 45 - 60 minutes.

Organisation: Children working in pairs.

What to do:

Give each pair of children a copy of the worksheet 'Two Scoop Ice-creams', a copy of the ice-creams sheet, and several different colour crayons (include colours that could represent the flavours vanilla, strawberry and chocolate).

Explain to the children that they have to work out all the different two scoop ice-creams that could be made with these flavours, and to work out the price of each one. They can use the ice-creams sheet and crayons, and should write the price of each ice-cream they have made underneath their picture of it on the sheet.

When children think they have found all the different possible ice-creams, you should ask them questions about their work. You should give some pairs of children a general statement to investigate, before they go on to the second part of the activity.

For the second part of the activity, ask children to choose their own flavours, and for each flavour to set an appropriate price per scoop. They should then work out all the different two scoop ice-creams that can be made with these flavours, and to work out the price of each one. Some pairs of children may need an additional copy of the ice-creams sheet for this work.

TWO SCOOP ICE-CREAMS
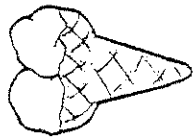
Vanilla   8p per scoop
Strawberry   10p per scoop
Chocolate   12p per scoop

What different two scoop ice-creams can you make?

What is the price of each ice-cream?

- ✂

TWO SCOOP ICE-CREAMS

Vanilla   8p per scoop
Strawberry   10p per scoop
Chocolate   12p per scoop

What different two scoop ice-creams can you make?

What is the price of each ice-cream?

ICE-CREAMS SHEET
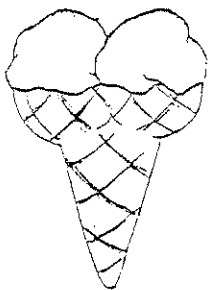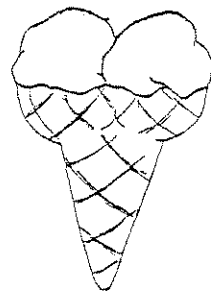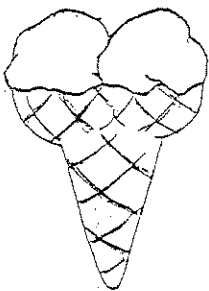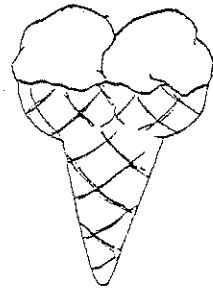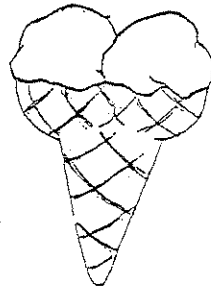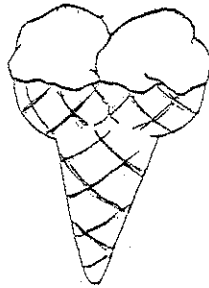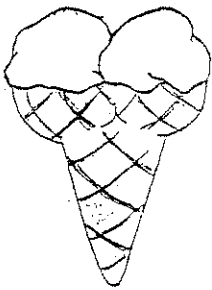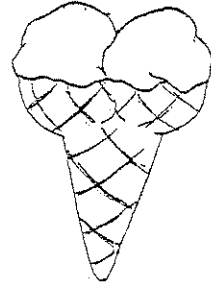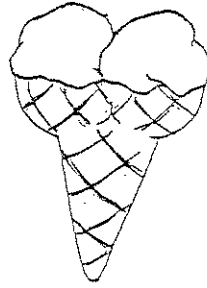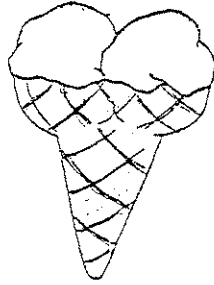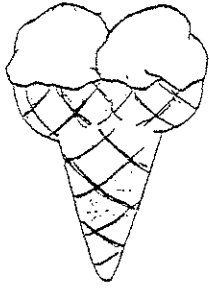
TEACHERS' NOTES:

ICE-CREAM PLANNING AND PRICING

L	5			
E	4			
V	3			▨
E	2	▨		▨
L	1	▨	▨	

■ ● ◆

'Ice-cream Planning and Pricing' entails children investigating a real-life problem and explaining their thinking. This classroom activity also addresses Number.

■ Making and Monitoring Decisions to Solve Problems

When children are working out the different two scoop ice-creams that could be made, you may find it necessary to prompt some of them that it is possible to have an ice-cream with two scoops of the same flavour.

For the second part of the activity, when children are choosing their own flavours and setting their own prices, you should observe how they go about the task, especially with regard to their decisions about prices. Many children are likely to show performance at level 2.

● Developing Mathematical Language and Communication

After children have finished the first part of the activity using the worksheet, you should ask them questions about their work. Suitable questions include, *'Which ice-cream is the most expensive?'*,' *'Which is the cheapest?'* and *'Which two cost the same?'* Typical level 1 performance entails children responding correctly to most questions of this type.

◆ Developing Mathematical Reasoning

Some pairs of children may be working at such a level that you judge it appropriate to give them a general statement to investigate. One statement you could ask them to investigate is:

> *'If the prices of two of the flavours are the same, then you can only get three different ice-cream prices.'*

Some children's work in investigating this statement is likely to be judged by you as showing performance at level 3.

INSET MODULE F

USE - Asking Questions

Time Required: About 40 minutes

Introduction

The interactions teachers make with children fall into a number of categories. For instance, the teacher may be giving instructions about the work to be carried out, introducing a new piece of work, giving encouragement, or asking questions of various types.

Teachers ask children questions about their work with the purpose of finding out what they have done and why, and also to guide children to overcome their difficulties. One way of looking at teachers' questions is to classify them into two broad groups: **Probes** and **Prompts**.

A **Probe** involves questioning children about how they reached a solution to a problem, or how they are presently working on a task, in order to determine current understanding. Probes include questions like *'How did you get that?'* and *'Why is that the largest?'*

A **Prompt** involves asking children to consider aspects of a task with the aim of helping them to reach a correct solution or to use a more appropriate method. Prompts include questions like *'Does that work for all the even numbers?'* and *'Suppose the shape was a rectangle, would that make any difference?'*

Action

If there are four or more teachers in the group, arrange for them to work in pairs or threes for about 15 minutes. If there are fewer than four, then you should all work together.

Ask each pair (or group of three), first to identify a part of the classroom activity when the teacher should definitely interact with children, and then to list some of the Probes and Prompts that could be used by the teacher at that time. For the Prompts,

it is a good idea to decide what common difficulties are likely to be encountered by children.

The Prompts can then be written with the aim of helping children overcome these difficulties.

Ask a colleague from each pair (or group of three) to tell the whole group what part of the activity they have identified for interaction with children, and to talk about the Probes and Prompts they have written. These Probes and Prompts can be collected on the flipchart or board.

Discuss, as a whole group, the Probes and Prompts with regard to the following questions:

*   Can any of the Probes be made more effective in determining children's current understanding? If so, how?

*   Do the Prompts address the common difficulties likely to be encountered by the children? If not, how might the Prompts be altered?

*   Do any of the Prompts go too far in the sense that you are, in effect, telling children what they should be doing, rather than guiding them to consider their methods?

Follow-on

When using the classroom activity with children you should use some of the Probes and Prompts you have discussed in this INSET session. Shortly afterwards, it is a good idea to meet again with colleagues to discuss the effectiveness of your Probes and Prompts, and how children's responses helped you to assess their performance.

INSET MODULE G

USE - Involving Children in Self-Assessment

Time Required: About 1 hour

Introduction

There is much to be gained, by both teachers and children, by involving children in the assessment of their own work and skills. Children can be guided to reflect on their learning, and so become more aware of their strengths and weaknesses. This can lead to children having a clearer understanding of what is expected of them by their teachers, and it can enhance children's motivation.

For the teacher, there are benefits in that the use of child self-assessment methods in the classroom can provide insights into children's skills, understanding and knowledge from the child's perspective. This can supplement teachers' own assessments. Also, valuable information can be obtained on the success of teaching approaches followed by teachers and the curriculum material used.

Action

Discuss, in pairs or groups of three, for about ten minutes, the various ways in which you currently involve children in the assessment of their own work in **any** area of the curriculum. These ways may vary from very informal approaches with no recorded outcomes to formal methods with a retainable record of the child's self-assessment. Ask each pair, or group of three, to list these approaches and methods on a piece of paper.

Ask a colleague from each pair, or group of three, in turn to describe to the whole group one of these approaches or methods. Continue this until all the different approaches and methods currently used have been described.

Collect these on the flipchart or board in a summarised form.

Discuss, as a whole group, these child self-assessment approaches and methods with respect to the following questions:

* Can any of these approaches or methods be adapted so that they are suitable for children's self-assessment of their process skills in mathematics? If so, how?

* How would the outcomes of children's self-assessment link in with your own assessments of their process skills?

As a whole group, choose one of the approaches or methods and adapt it so that you have a child self-assessment method that can be used alongside the classroom activity. This may involve rewriting parts of the programme of study for Using and Applying Mathematics so that they are easy for children to understand (see INSET MODULE L on pages 84 to 85), or describing a range of possible responses to parts of the activity with which children can compare their own work.

Follow-on

Use the child self-assessment method you have designed in this INSET session when using the classroom activity with children. After using the method, it is a good idea to meet again with colleagues to discuss its success, and possibly to adapt it further for subsequent use.

INSET MODULE H

REVIEW - Obtaining Evidence from the Product of Work

Time Required: About 40 minutes

Introduction

All the classroom activities in this resource pack have a worksheet, or other means, by which children are able to show the product of their work. The product of a child's work is one form of evidence which can be used buy teachers to make judgements about the level of each child's performance.

While the product is likely to provide evidence relating mainly to Number, Shape, Space and Measures and Data Handling, it can also provide some evidence with respect to Using and Applying Mathematics. At the very least, the product can remind teachers of the process skills used by individual children when working on the classroom activity. Furthermore, a product provides a vehicle by which the teacher can discuss with the child the work that has been done, so looking at processes, and can draw out the child's understanding.

Action

You and your colleagues should bring to the INSET session, the completed worksheets (or other product) from the classroom activity. Also bring any record of individual children's performance on the activity that was made at the time or shortly afterwards. (NB this record may be brief notes or may be of a more formal nature.)

Teachers should spend ten minutes on their own going through the worksheets referring these, where possible, to any record of individual children's performance. Ask each colleague to select a couple of the worksheets where the product has provided **additional** evidence of children's performance relating to Using and Applying Mathematics.

Each teacher should describe to the group, how the product has provided additional evidence. Comments may include reference to parts of the programme of study addressed by the product, and the degree of certainty that the product is the child's own work.

Discuss as a group:

* Whether there are similarities or differences within the group on the additional evidence found by considering the product.

* What a teacher should do when the evidence from the product appears to contradict the evidence that was obtained by making observations and discussing work with the child.

Follow-on

As a result of the INSET session, you may be able to indicate more evidence of children's performance on their individual records. You may decide to keep some of the completed worksheets as retainable evidence, especially those that show significant progress made by children. In these cases, it is a good idea to date them and to annotate your comments about the process skills used, and the parts of the programme of study addressed.

SHAPES TO THINK ABOUT

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'Shapes', scissors, crayons.

Time: 30 - 40 minutes.

Organisation: Children working in pairs.

What to do:

Give each pair of children a copy of the worksheet 'Shapes' and a pair of scissors. Ask the children in each pair to take it in turns to cut out the shapes, along the outline of each shape, from the sheet. When all 10 shapes have been cut out, ask the children to sort the shapes into groups, so that shapes of the *'same type'* are together. Tell the children that they can have as many groups as they like.

When the children have made their groups, you should ask them probing questions such as *'How did you decide to make your groups?'* In particular, focus on the features of the shapes that the children considered when making their groups.

A further stage of the activity is to ask the children to sort all the shapes into a different number of groups, with shapes the *'same type'* together. Again you should ask about the features of the shapes by which they sorted them.

Alternatively, instead of asking the children to cut out the shapes (some may find this difficult to do with reasonable accuracy), you could ask the children to colour in all the shapes on the worksheet that are the *'same type'*. Tell children that they can have as many groups as they like, and that the shapes of each group should be the same colour. You should stress to children in their pairs that they will need to discuss the shapes, and agree on their groups, before they start colouring in. Continue this alternative version of the activity by giving each pair of children a second worksheet, and asking them to sort the shapes into a different number of groups, and to colour in these groups.

SHAPES
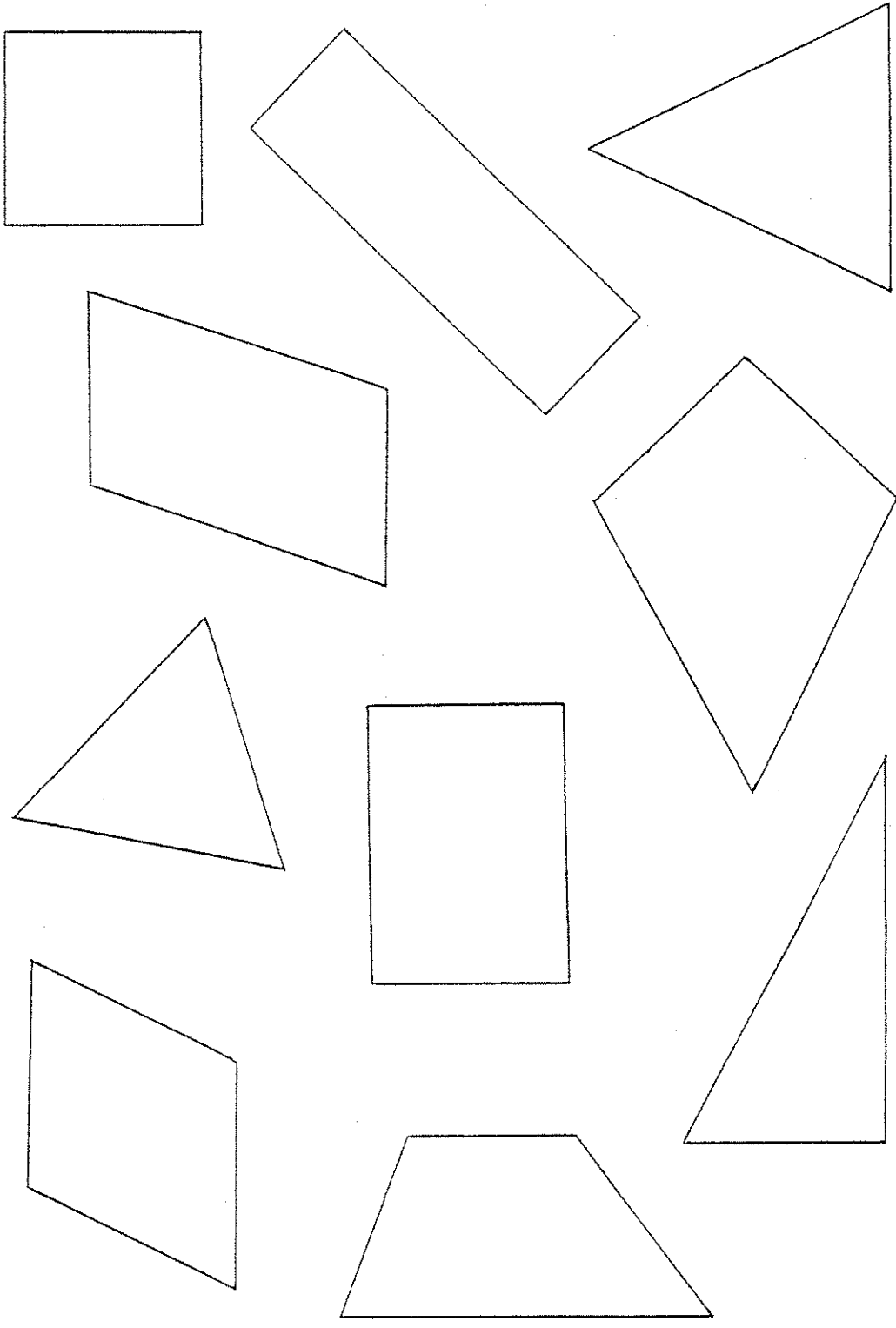
TEACHERS' NOTES:

SHAPES TO THINK ABOUT

'Shapes to Think About' is concerned with children's communication of mathematical ideas to do with properties of shapes. The 10 shapes on the worksheet are a mixture of different types of triangle (right-angled, isosceles, equilateral) and quadrilateral (oblong, square, kite, parallelogram, rhombus, trapezium). It is not expected that children should know these names, but if they do then that is typical of level 2 in Shape, Space and Measures.

● **Developing Mathematical Language and Communication**

It is important to ask children probing questions about the shapes and the groups they have sorted them into. Asking the children to sort the shapes into a different number of groups provides you with an opportunity to ask further questions. Within the class, children's answers may range from being typical of level 1 to 3.

A useful, open, question to begin with is *'Can you tell me about your groups?'* Additional questions such as *'Why did this shape go into this group?'* and *'How is this shape different from this shape?'* will provide valuable information about children's mathematical communication, as well as their concepts of the shapes.

A child who simply says, for example, that the shapes have been divided into two groups, without elaborating, is not working beyond level 1. Comments about *'angles'*, *'lines'*, *'sides'*, *'corners'* and *'points'* are typical of level 2. For level 3, it is necessary for the child to be more analytical and more descriptive about the shapes, especially in comparing one shape with another. At this level, the correct use of expressions like *'sharper angles'*, *'longer sides'*, *'square corners'*, *'parallel lines'* and *'more pointed'* is typical.

INSET PROGRAMME: SHAPES TO THINK ABOUT

USE	Organising the Class for Assessment	Do INSET MODULE K on page 83
	Asking Questions	Do INSET MODULE F on pages 43 and 44
	Observing and Capturing Ephemeral Evidence	Do INSET MODULE D on pages 28 and 29
	Involving Children in Self-Assessment	Do INSET MODULE G on pages 45 and 46
REVIEW	Obtaining Evidence from the Product of Work	No INSET module suggested, as there is no product of children's work from which to obtain evidence
	Improving Assessment Skills	Do INSET MODULE R on pages 138, 139 and 140
	Using Assessment Diagnostically	Do INSET MODULE O on pages 113 and 114

GET PINOCCHIO HOME SAFELY

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'Pinocchio', crayons, a range of measuring instruments (including metre sticks, 30cm rulers, and tape measures), unit cubes, string, different coloured wool, scissors, pencils.

Time: 45 - 60 minutes.

Organisation: Groups of four children.

What to do:

Give each child in the group a copy of the worksheet 'Pinocchio'. Explain to the children that Pinocchio has a choice of routes through the town by which he can get home.

Ask one child to indicate a route, and to draw it on their worksheet with a crayon. Ask all the other children to copy this route on their own worksheet in the same colour. Ask each child in turn to indicate another route, and to draw it with a different colour. All the other children should copy each route on their own worksheet.

When this stage of the activity is completed, each child should have four different routes in different colours on their worksheet. Ask the children to find which of these routes is the shortest, and which the longest.

Tell them that they should measure as accurately as possible with whatever equipment they choose, and that they should write down the measurements for all the routes somewhere on the worksheet. The children may work individually or in pairs at this stage.

After each child has finished this part of the activity, you should give children this general statement to investigate:

'Routes with four turns are longer than routes with three turns.'

You may have to explain to some children that a turn is the same as a change in direction, and show them a route that Pinocchio could take with four turns.

PINOCCHIO SHEET

What is the shortest way for Pinocchio to get home?
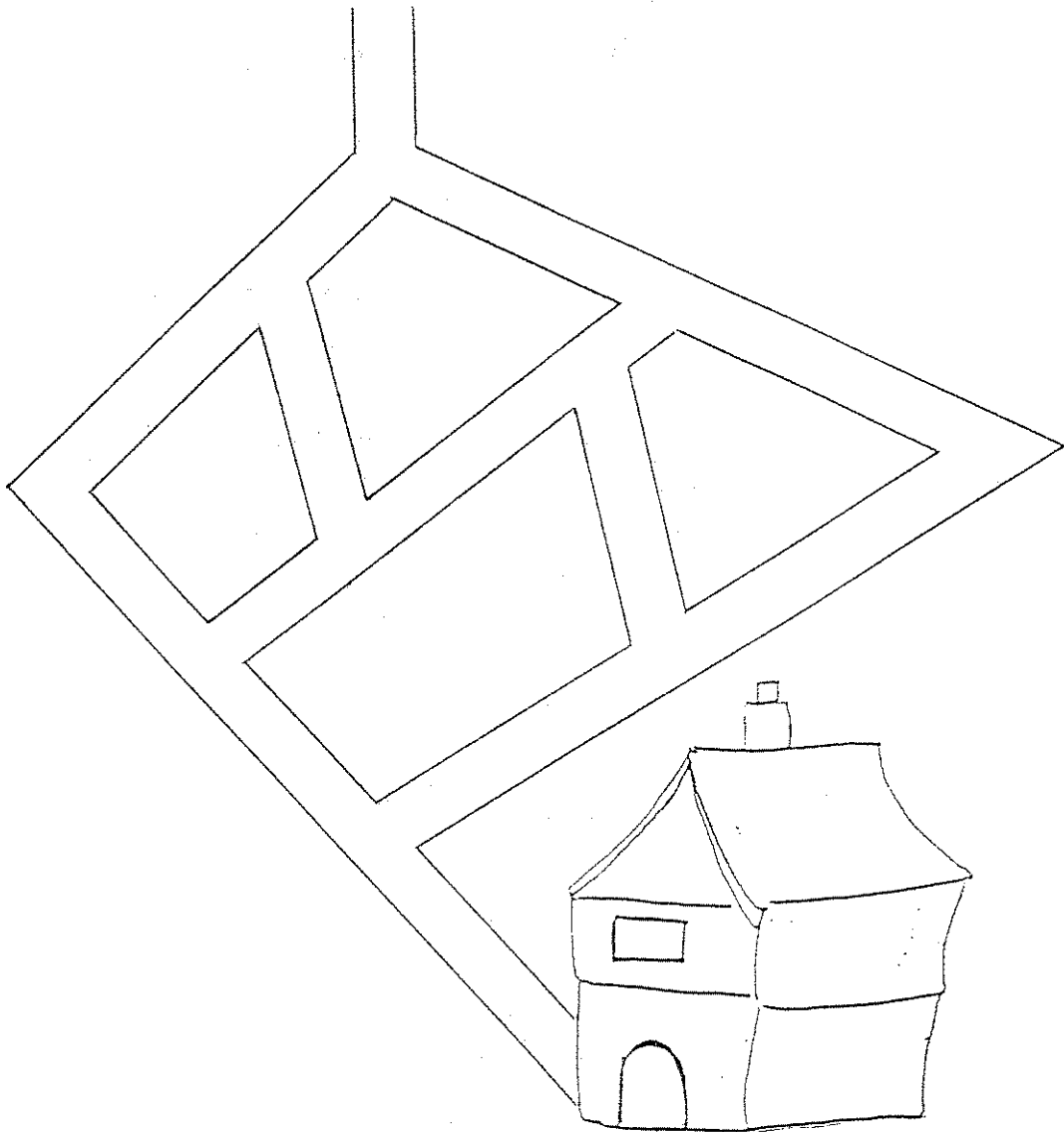
TEACHERS' NOTES:

GET PINOCCHIO HOME SAFELY
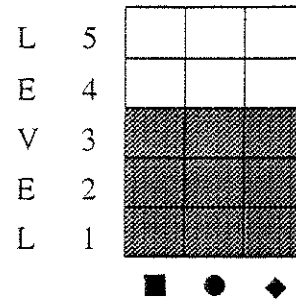
'Get Pinocchio Home Safely' was devised by teachers by adapting one of the optional SATs for 1992 for Year 2 children. The SAT was set in a context of a rabbit having a choice of routes through a burrow from a tree stump to a store of carrots. This classroom activity also addresses Shape, Space and Measures.

■ Making and Monitoring Decisions to Solve Problems

Typical level 1 performance is simply the child using any of the materials and any method to measure one possible route. Level 2 performance entails the child using measuring instruments with reasonable accuracy. You will need to observe children to see how they overcome particular difficulties. For example, a child may decide that they need to be more accurate, and so they repeat their measurements using a 30cm ruler, whereas they had initially used a tape measure. Or children may decide that it is better to use different coloured wool to place accurately along each route, and then measure the length of each piece of wool with a ruler. Examples such as these are typical of performance at level 3.

● Developing Mathematical Language and Communication

Typical level 1 performance is simply the child indicating a possible route. Level 2 performance entails the child talking with the teacher or with other children in some detail about the work they are doing. Prompts from you such as *'Tell me what you have found out'* are helpful. Recording the distances of all four routes, so that it is obvious which distance corresponds to which route, is typical of level 3.

◆ Developing Mathematical Reasoning

Typical level 1 performance involves the child suggesting which of the four routes is the shortest. Level 2 performance entails the child going on to test their prediction. Here, you should closely observe the child to see if their approach to the activity is of a *'What would happen if?'* type. For example, they may explore different routes with the purpose of finding whether one route is shorter or longer than another. The last part of the activity when children are investigating the general statement *'Routes with four turns are longer than routes with three turns'* addresses level 3. If the child considers at least two routes with four turns and two routes with three turns in investigating this general statement, then that is typical of level 3.

INSET PROGRAMME: GET PINOCCHIO HOME SAFELY

USE	Organising the Class for Assessment	Do INSET MODULE C on pages 26 and 27
	Asking Questions	Do INSET MODULE F on pages 43 and 44
	Observing and Capturing Ephemeral Evidence	Do INSET MODULE N on pages 110, 111 and 112
	Involving Children in Self-Assessment	Do INSET MODULE L on pages 84 and 85
REVIEW	Obtaining Evidence from the Product of Work	Do INSET MODULE H on pages 47 and 48
	Improving Assessment Skills	Do INSET MODULE J on pages 64, 65 and 66
	Using Assessment Diagnostically	Do INSET MODULE E on pages 30 and 31

LEVELS 2/3

EXPLORE SHAPES WITH FOUR SQUARES

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'Four Squares', scissors, glue, sticky coloured shapes
or   gummed coloured sheets, A5 size sheets of paper, crayons, pencils.

Time: 30 - 40 minutes.

Organisation: Children working individually.

What to do:

As a range of resources is necessary for this classroom activity, it is unlikely that you will want all children in the class to be working on it at the same time. As it involves cutting, sticking and drawing, it is a good idea to arrange for it to take place in a part of the classroom where work of this type usually takes place.

Give each child a copy of the worksheet 'Four Squares'. Explain to them that they are to find out how many different shapes they can make with four squares. Tell them that they have to follow the rule - *'the squares must touch on whole sides, not just corners'*. The children should draw their shapes on the squares paper on the worksheet.

When children think they have found **all** the different possible shapes, give them scissors and ask them to cut all of these shapes out carefully. Then give the children glue, sticky coloured shapes or gummed coloured sheets, crayons, and A5 size sheets of paper. Ask them to use these materials and all the shapes they have cut out from the worksheet to make a picture on the sheet of paper.

When children have finished making their pictures, you should ask individual children questions about their pictures. In particular, ask questions about some of the four squares shapes they had made.

When they have finished the activity, you could ask some children to show the rest of the class their pictures, and to talk about some of the shapes they have used.

FOUR SQUARES
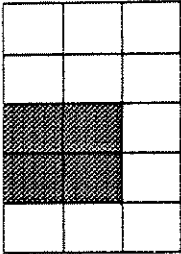
How many different shapes can you make with 4 squares?

RULE - the squares must touch on whole sides, not just corners.

✓   ✗
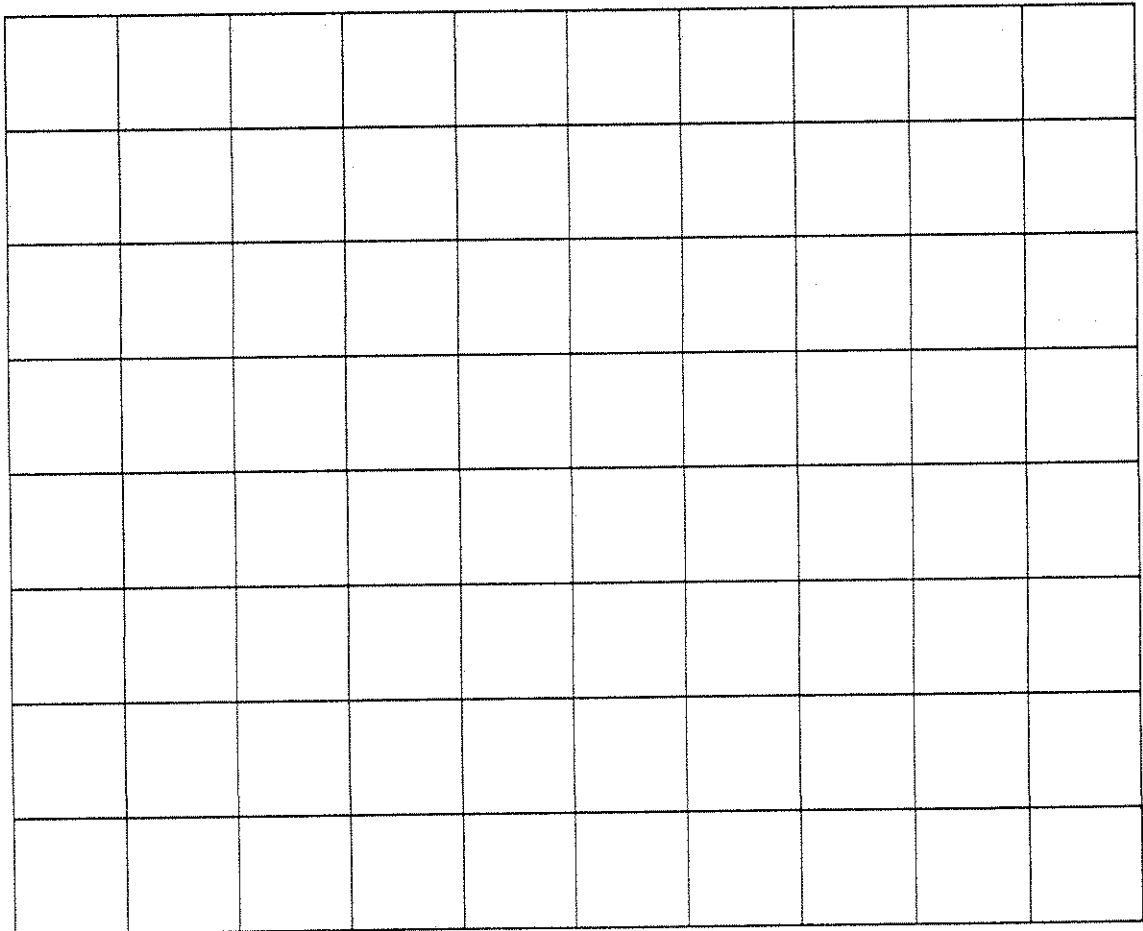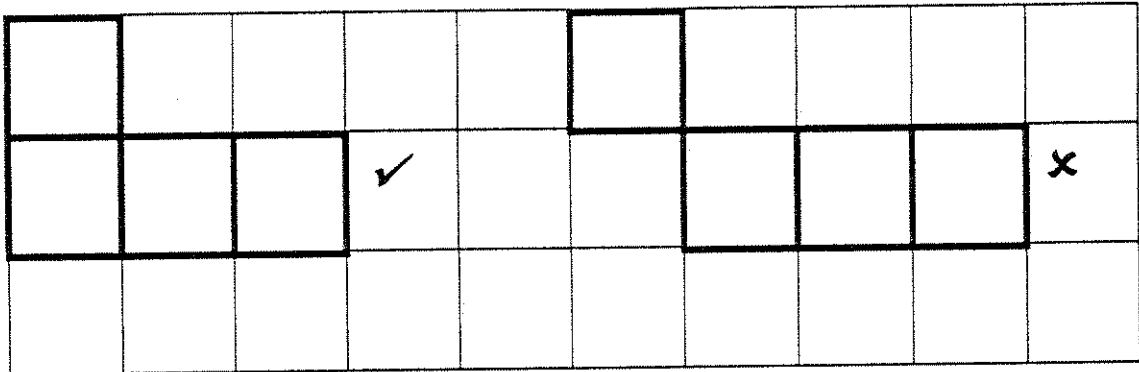
TEACHERS' NOTES:

EXPLORE SHAPES WITH FOUR SQUARES

'Explore Shapes with Four Squares' is a mathematical investigation which also addresses Shape, Space and Measures.

■ Making and Monitoring Decisions to Solve Problems

You should carefully explain the rule '*the squares must touch on whole sides, not just corners*' to the children. Refer just to the diagrams on the worksheet, and leave children to discover the other shapes that are possible following the rule. If a child finds three or four of the possible shapes using the rule correctly then that is typical of level 2. If a child finds all the possible shapes, then that is typical of level 3.

● Developing Mathematical Language and Communication

Some children will decide that shapes like ⊏⊐ and ⊏⊐ are the same as one can be fitted on top of the other when they have been cut out. Also, many children will not recognise shapes as being the same when they are in different orientations. For example, ⊏⊐ is viewed as a different shape from ⊏⊐ .

Children's ideas like these are worth exploring when you interact with them while they are finding the possible shapes, cutting them out, and making their pictures. Children's responses to your questions are likely to show performance typical of level 2 or 3.

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INSET MODULE I

USE - Organising the Class for Assessment

Time Required: About 30 minutes

Introduction

The classroom activity entails a group of children working individually, having access to a range of resources. You and your colleagues will need to decide how many children are to be working on the activity at the same time, the actual composition of each group, where in the classroom the activity is to be based, and any adaptations that may be necessary for particular children (e.g. physically disabled).

Action

Discuss, as a group, the organisation of the class for assessment purposes with respect to the following questions:

*   How many children should be working on the activity at the same time, taking into account the availability of necessary resources?

*   How will you decide which children will be working together? (For example, same ability children, mixed ability, friendship groupings, same gender, etc.)

*   Is there a certain area of the classroom where the activity is most appropriately based? (NB this is particularly relevant to work addressing Making and monitoring decisions to solve problems in which children will need access to resource areas to select various materials.)

*   Are there any adaptations required to the classroom activity, or to the available resources, so that all children in the class can take part?

Follow-on

Use the decisions you have made in this INSET session when organising your class in preparation for the classroom activity.

INSET MODULE J

REVIEW - Improving Assessment Skills

Time Required: About 40 minutes

Introduction

The observation of children is an important teacher assessment skill, and a main way by which to gather evidence about children's process skills. This is particularly so for younger children, who are less likely to reveal their true understanding in written work or solely in their answers to a teacher's questions.

However, there are difficulties in observing children in an effective and systematic way. For instance, there may be constant interruptions from other children resulting in the teacher missing significant actions of children who were the intended focus of observation. Or children may do something unexpected while working on the classroom activity that the teacher had difficulty interpreting. Or the teacher may be so overwhelmed by the abundance of activity in a group of children that significant actions of individuals are not recorded at the time, nor is it easy to establish afterwards who did what.

Action

Give everyone in the group a copy of the self-rating sheet shown on page 66. (NB this page can be photocopied and cut along the dotted line to make two self-rating sheets.)

Ask colleagues to reflect on their observation skills within the classroom activity used with children, and to complete the sheet using the numbers shown above the given statements.

After completing the sheets, ask for their ratings on each statement in turn. Work out an average rating for each statement (for example, if four teachers had rated their observation skills for statement A as 3, 4, 2 and 2, then the average is $11 \div 4 = 2.75$). Identify all those statements that have an average rating of 3 or less.

As a group, brainstorm on those aspects of observation which have proved problematic (i.e. statements showing low average ratings). Some of the points you may wish to discuss are:

- the type of work given to the other children while you were observing a group for assessment purposes.

- the role of any parent helper or teacher assistant in the classroom at the time.

- your interpretation of parts of the programme of study for Using and Applying Mathematics, and what you had expected children to do.

- the composition of the group you observed, and which children and which parts of the programme of study were a particular focus.

- the strategies used by you to record the significant actions of individual children.

Follow-on

As a result of this INSET session, you and your colleagues will have identified common difficulties that are encountered in using observation skills when conducting teacher assessment. You will probably have discussed in the group a number of ways by which these difficulties may be overcome. Next time you use a classroom activity from this pack, you should endeavour to put into practice some of your decisions about making the observation of children more effective for assessment purposes.

You may wish to repeat this INSET module from time to time to check on the development of these observation skills.

SELF-RATING SHEET: OBSERVATION SKILLS

Classroom Activity _____

For each statement fill in the appropriate number in the box.
(5 = Yes, definitely, 4 = To a large extent, 3= To some extent,
2 = Only to a small extent, 1 = Not at all)

A. I was able to observe children at the right time. ☐

B. I was able to make observations without interruptions from
    other children. ☐

C. I managed to observe the children I had intended to. ☐

D. I was able to say from my observations whether children's
    work counted as evidence of performance. ☐

E. I was able to record details of significant actions of individual
    children I had observed. ☐

--------✂--

SELF-RATING SHEET: OBSERVATION SKILLS

Classroom Activity _____

For each statement fill in the appropriate number in the box.
(5 = Yes, definitely, 4 = To a large extent, 3= To some extent,
2 = Only to a small extent, 1 = Not at all)

A. I was able to observe children at the right time. ☐

B. I was able to make observations without interruptions from
    other children. ☐

C. I managed to observe the children I had intended to. ☐

D. I was able to say from my observations whether children's
    work counted as evidence of performance. ☐

E. I was able to record details of significant actions of individual
    children I had observed. ☐

DISCOVER THE POSSIBLE NUMBERS

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'Numbers Cards', sets of number cards, rulers, pencils.

Time: 30 - 40 minutes.

Organisation: Group of four or six children, working in pairs.

What to do:

Before beginning the activity, you should make a copy of the number cards sheet on paper or thin card. Cut the number cards from your copy to make two sets, with each set having the numbers 1 to 9.

Take a set of number cards and show them to the children. Turn the cards upside down, mix them up on the table, and ask each pair of children to take three of the cards at random. You may have to explain that the line under each digit shows which way up it is.

Give a copy of the worksheet 'Number Cards' to each child. Explain to the children that they have to work out how many different numbers they can make with their cards. Encourage children to find all the one-digit and two-digit numbers that are possible, as well as all the three-digit numbers. The children should work in pairs to find the numbers, but each child should individually record the numbers found. Encourage them to talk about the numbers they are making, looking at high and low numbers, and differences between them.

When all the pairs have decided that they have found all the different numbers that are possible, collect the cards back, and repeat the activity. This time emphasise to the children that they should present their results (i.e. the different numbers that they make with their new cards) in a clear way. Suggest to them that they might draw up a table of results. The children can use the reverse side of the worksheet for this.

Before children begin this part of the activity, ask them if they will get more, fewer, or the same number of different numbers this time. Ask them to explain their answers.

NUMBER CARDS

□□□

Look at your three cards

How many different numbers can you make with your cards?

Write down all the different numbers you can make.

NUMBER CARDS

□□□

Look at your three cards

How many different numbers can you make with your cards?

Write down all the different numbers you can make.

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$\underline{3}$	$\underline{2}$	$\underline{1}$	$\underline{3}$	$\underline{2}$	$\underline{1}$
$\underline{6}$	$\underline{5}$	$\underline{4}$	$\underline{6}$	$\underline{5}$	$\underline{4}$
$\underline{9}$	$\underline{8}$	$\underline{7}$	$\underline{9}$	$\underline{8}$	$\underline{7}$

This sheet may be copied onto paper or thin card to make two sets of cards.

TEACHERS' NOTES:

DISCOVER THE POSSIBLE NUMBERS

```
L  5  ┌──┬──┬──┐
      │  │  │  │
E  4  ├──┼──┼──┤
      │  │  │  │
V  3  ├──┼──┼──┤
      │  │▓▓│▓▓│
E  2  ├──┼──┼──┤
      │  │  │▓▓│
L  1  └──┴──┴──┘
       ■  ●  ◆
```
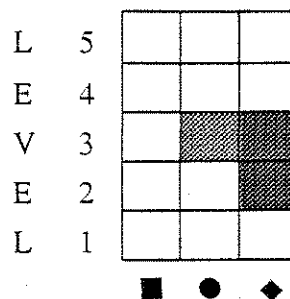
'Discover the Possible Numbers' is a mathematical investigation, requiring children to explain their thinking. This classroom activity also addresses Number.

● Developing Mathematical Language and Communication

Most of your assessment will be during the second part of the activity when children are using a second set of three cards. It is at this stage that you should emphasise to children that they should present their results in a clear, organised way. Children's work which is beginning to show signs of organisation is likely to be judged by you as being typical of level 3.

◆ Developing Mathematical Reasoning

While children are working, you will find it informative to observe them in their pairs, and to listen carefully to what they say. It is very likely that some of their comments will show that they are asking themselves and each other *'What would happen if?'* type questions. Children's work is likely to show performance at level 2 or 3.

INSET PROGRAMME: DISCOVER THE POSSIBLE NUMBERS

USE	Organising the Class for Assessment	Do INSET MODULE C on pages 26 and 27
	Asking Questions	Do INSET MODULE F on pages 43 and 44
	Observing and Capturing Ephemeral Evidence	Do INSET MODULE D on pages 28 and 29
	Involving Children in Self-Assessment	Do INSET MODULE L on pages 84 and 85
REVIEW	Obtaining Evidence from the Product of Work	Do INSET MODULE H on pages 47 and 48
	Improving Assessment Skills	Do INSET MODULE R on pages 138, 139 and 140
	Using Assessment Diagnostically	Do INSET MODULE E on pages 30 and 31

LET'S PREDICT

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'Falling Matchsticks', sheets of A3 size paper, used matchsticks about 4cm long, rulers, pencils.

Time: 45 - 60 minutes.

Organisation: Children working in pairs.

What to do:

Before starting the activity you should prepare some A3 size sheets of paper. Draw on each sheet five parallel lines 6cm apart, as shown in the diagram below.
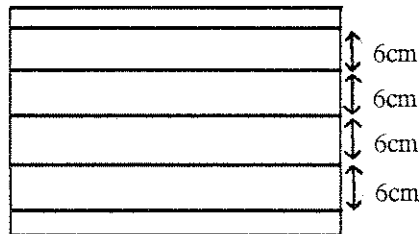
Give each pair of children one of these sheets, 10 matchsticks, and a copy of the worksheet 'Falling Matchsticks'.

Explain to the children how to carry out the experiment following the instructions on the worksheet. You might suggest to them that they take it in turns to let the matchsticks fall, while the other one records the results on the worksheet.

When each pair has finished, ask them to carry out a second experiment. For this, they should turn the A3 sheet over and draw on it a set of lines that are a **different** distance apart. You may have to help some children draw their lines. You should ask the children whether they think more or fewer matchsticks will fall crossing one of the lines than did so in their first experiment. Again children should record their results as they work.

For some pairs of children, give them another sheet of A3 size paper, and ask them to carry out further experiments involving lines other distances apart.

FALLING MATCHSTICKS

1. Place the sheet of paper on the floor.

2. Hold the 10 matchsticks in your hand at head height directly over the sheet, close your eyes, and drop the matchsticks onto the sheet.

3. Count how many of the matchsticks have fallen to cross the lines on the sheet.
   Write down this number.

4. Do this as many times as you think necessary.

RESULTS

TEACHERS' NOTES:

LET'S PREDICT

'Let's Predict' is based on a problem, posed by Buffon in 1777, concerning a plane area ruled with parallel lines, distance d apart, onto which a needle of length l ($l < d$) is randomly dropped. The problem was to calculate the probability that the needle will fall crossing one of the lines. The answer, given correctly by Buffon, is $2l/\pi d$. As such, the problem is interesting mathematically at much higher levels. At these lower levels it is the experimental context and recording of results that is the focus for the children. This classroom activity also addresses Number and Handling Data.

● **Developing Mathematical Language and Communication**

While carrying out the first experiment, some children will be unsure when they have obtained a sufficient number of results. Suggest that they should have obtained at least 20 results. Typical level 3 performance involves some organisation in the recording of their results and coherent discussion about the mathematical aspects of the activity.

◆ **Developing Mathematical Reasoning**

This is largely addressed when children are discussing and making preparations for their second experiment. You should ask the children why they have drawn the lines the distance apart they have, and what they think will happen. Many children are likely to be judged by you as performing at level 2. Those who go on to carry out further experiments can be assessed to see if they are performing at level 3. Here, you will need to find out, through questioning and observation, whether children have a general statement in mind that they are investigating.

INSET PROGRAMME: LET'S PREDICT

USE	Organising the Class for Assessment	Do INSET MODULE K on page 83
	Asking Questions	Do INSET MODULE F on pages 43 and 44
	Observing and Capturing Ephemeral Evidence	Do INSET MODULE N on pages 110, 111 and 112
	Involving Children in Self-Assessment	Do INSET MODULE L on pages 84 and 85
REVIEW	Obtaining Evidence from the Product of Work	Do INSET MODULE H on pages 47 and 48
	Improving Assessment Skills	Do INSET MODULE J on pages 64, 65 and 66
	Using Assessment Diagnostically	Do INSET MODULE O on pages 113 and 114

LEVELS 2/3/4

EQUAL AREAS TO IDENTIFY

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'The Farmer's Land', squares paper (two sizes), rulers, scissors, calculators, pencils.

Time: 30 - 40 minutes.

Organisation: Children working in pairs.

What to do:

Give each pair of children a copy of the worksheet 'The Farmer's Land' and have a supply of the other equipment available for them to use.

Tell them that they can use either, or both, of the two sizes of squares paper, rulers, scissors and calculators, if they wish, to solve the problems. You may need to explain to some children that the pieces each plot is to be divided into should have the same area and be the same shape.

Give those children who have successfully divided all three plots, the additional task of working out for which numbers of pieces it is possible to divide the third plot into, so that each piece has the same area and shape. Again tell them they can use any of the available equipment.

THE FARMER'S LAND

Mr. Jenkins is a farmer. He has three plots of land.
For each plot, he wants to divide it into a number
of equal pieces with the same area <u>and</u> shape.
Work out how Mr. Jenkins could do this.
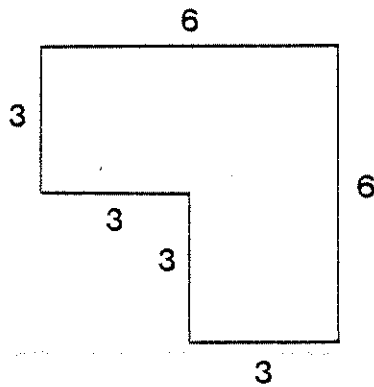
into 3
equal
pieces
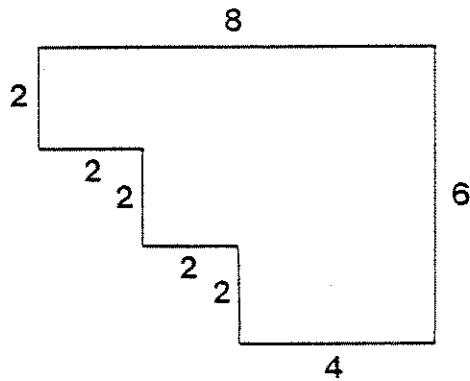
into 3
equal
pieces
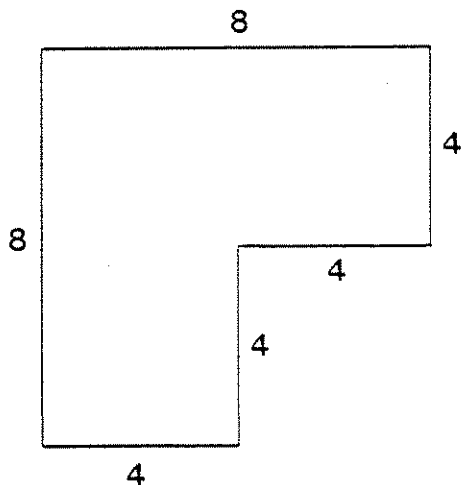
into 4
equal
pieces

80
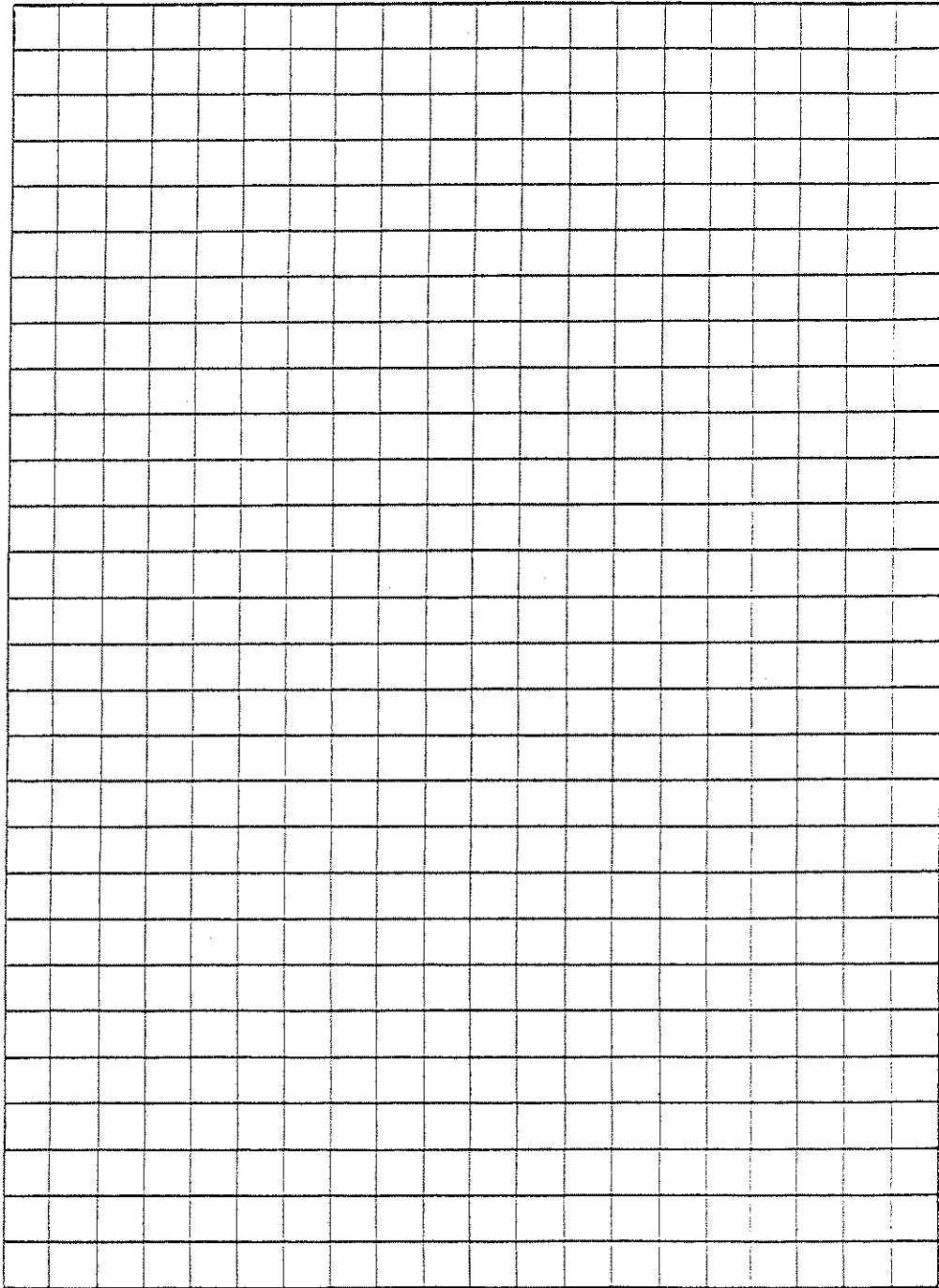
TEACHERS' NOTES:

EQUAL AREAS TO IDENTIFY

L 5

E 4

V 3

E 2

L 1

■ ● ◆
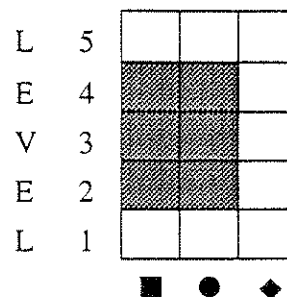
'Equal Areas to Identify' is a problem-solving activity that also addresses Shape, Space and Measures.

■ Making and Monitoring Decisions to Solve Problems

Showing the first plot divided into three squares is typical of level 2. For the second plot of land, many children are likely to encounter difficulties. Some may choose to use squares paper, or to carry out calculations. You should observe children closely to see if they are performing at level 3. Dividing the third plot of land into four equal pieces is a challenging task. It is a good idea to refrain from giving children too much help at this stage, other than to remind them of the strategies they used in dividing the first two plots. If a child successfully completes the task, then this is typical of level 4.

● Developing Mathematical Language and Forms of Communication

Typical level 2 performance entails children talking appropriately about *'shapes'*, *'area'*, *'sides'*, etc. when attempting to solve the problems. For level 3 performance it is necessary for children to show a clear understanding of the tasks, and what is meant by *'same area and shape'*.

You may decide to give some children the additional task of working out for which numbers of pieces it is possible to divide the third plot into, so that each piece has the same area and shape. It may be necessary to prompt children by asking *'Can you divide it into two equal pieces?'*, *'What about three?'* Typical level 4 performance entails children producing diagrams of the plot divided correctly into several different numbers of equal pieces.

INSET MODULE K

USE - Organising the Class for Assessment

Time Required: About 30 minutes

Introduction

Children should be organised into pairs for the classroom activity. It is not necessary for the teacher to be present constantly with a single pair for assessment to be carried out.

After the first part of the classroom activity has been explained to the children, the teacher can move from one pair to another, assessing their process skills through observation and by asking questions. However, if the whole class is involved in the activity at the same time, it is wise to avoid trying to assess more than just a few children.

Action

Discuss, as a group, the organisation of the class for assessment with respect to the following questions:

* What proportion of the class should be involved in the classroom activity at the same time for sufficient evidence to be obtained on the majority of them?

* How does the activity fit in with the other work planned for the class? (content of other work, its intended duration and resourcing are all relevant)

* How will you organise the class over a period of time so that all, or most of, the children have the opportunity to work on the activity?

Follow-on

What you have discussed in this INSET session can be fed into your teaching and lesson plans. This will lead to your assessment of children on the programme of study for Using and Applying Mathematics becoming more systematic.

INSET MODULE L

USE - Involving Children in Self-Assessment

Time Required: About 40 minutes

Introduction

For the purpose of involving children in self-assessment, some teachers have written performance statements to be used with children.

These performance statements can be used in different ways. For instance, they can serve as questions by the teacher to stimulate discussion with the child, so enabling the child to reflect on their understanding and skills. More formally, the performance statements that are focus of a classroom activity can be presented on a sheet for the child to make a written response.

Some teachers use an approach where children are given '*I can ...*' statements at the end of a term or school year. Children tick the statements which they believe describe their usual performance. For example, '*I can choose the equipment I need for a practical problem, and I know what method will work*' is a performance statement for level 2 of Using and Applying Mathematics.

Another helpful approach is to be clear yourself of the assessment objectives of the classroom activity, and to tell these to the children at the start. For example, '*This activity will help you to think about shape and area, and I want to see how well you can record your findings*'.

As well as helping the child to identify strengths and weaknesses, these approaches can provide the teacher with information to supplement their teacher assessment. As children get used to this way of working they will gradually become better at monitoring their own work and at setting their own objectives.

Action

Write on the board or flipchart the following:

What equipment did you use? Why did you choose it?
How do you know you found a correct solution?   LEVEL 2

What difficulties did you have?
How did you overcome them?   LEVEL 3

Tell the group that these two sets of questions, focusing on level 2 and level 3 of Using and Applying Mathematics respectively, could be given on a sheet to individual children, immediately after they had worked on a classroom activity. The children are to write a few sentences in response to the questions.

Discuss, as a group, the advantages of using a sheet comprising a number of questions like these, as a way of involving children in self-assessment. (NB colleagues may wish to improve on the questions.)

Choose two or three other parts of the programme of study for Using and Applying Mathematics that are a main focus of the classroom activity you intend using.

In pairs, or small groups, spend about 10 minutes writing questions, focused on the chosen parts of the programme of study, that could be given to children for their self-assessment.

Collect these questions and write them on the board or flipchart.

As a whole group, refine the questions for use with children, and prepare a self-assessment sheet to be used with the classroom activity.

Follow-on

Immediately after using the classroom activity, give each child a copy of the self-assessment sheet you have prepared, and ask them to fill it in. Later, you should meet again with colleagues to review the completed sheets, and to see how effective they have been in providing information to supplement your teacher assessment.

INSET MODULE M

REVIEW - Obtaining Evidence from the Product of Work

Time Required: About 40 minutes

Introduction

All the classroom activities in this resource pack have a worksheet, or other means, by which children are able to show the product of their work. The product of children's work is another form of evidence that can be used by teachers to make judgements about whether performance has been shown at particular levels.

The product of children's work is particularly informative with regard to levels 3 and 4 of Using and Applying Mathematics. Children's diagrams, the presentation of their results in a written form, and their use of mathematical symbols and terms are all of consideration at these levels. You should refer to the relevant level parts of the programme of study so as to become familiar with these and to consider what is to count as evidence within the classroom activity.

Action

You and your colleagues should bring to the INSET session the completed worksheets from the classroom activity. Also bring any record of individual children's performance on the activity as a whole that was made at the time, or shortly afterwards. (NB this record may be brief notes or may be of a more formal nature.)

As a group, spend 15 to 20 minutes going through the set of completed worksheets (or a selection of them). Use your professional judgement of the worksheets, referring to any record of individual children's performance that was made, to decide collectively whether each one shows evidence of performance at:

- level 3
- level 4
- insufficient evidence to make a judgement

Put each worksheet in one of three piles according to your group decision. Try not to spend too much time on individual worksheets.

Discuss as a group:

*   Which worksheets were difficult to classify as either level 3 or 4? Why was this the case?

*   Are you able to be more explicit about what is to count as evidence at these levels? Furthermore, are you able to define the boundary line between a level 3 and level 4 worksheet?

Follow-on

As an outcome of the INSET session you should be clearer about the distinction between work at level 3 and that at level 4. Also you may have identified some children's work that can be kept as evidence. In cases where a child has shown significant progress the worksheet can replace earlier material in any individual portfolio. It is a good idea to date the worksheet and to annotate your comments about the level of performance that has been shown.

MAKE AN ESTIMATE AND SEE IF IT'S CLOSE

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'Make an Estimate', sets of three different objects each weighing between 40g and 100g (e.g. a ball, a book, a small potato), a variety of non-standard units for measuring weight (e.g. conkers, marbles, multilink cubes), balance scales, calculators, pencils.

Time: 40 - 50 minutes.

Organisation: Groups of three children.

What to do:

Give each group of children a copy of the worksheet 'Make an Estimate', three different objects, and a variety of non-standard units. Explain to children that it is essential that they work together as a team in their groups, and reach agreement on their answers. It is a good idea to suggest to children that each member of a group draws one of the objects in the appropriate box, as agreed by the group. This helps to involve all three children in each group in the work.

Ask the children to decide among themselves which is the lightest and which is the heaviest of the three objects they have been given. The children should draw pictures of the three objects in the appropriate boxes on the worksheet.

Guide children to make an estimate of the weight of each object by asking them first to choose from the non-standard units they have been given, and then to use these units. Ask the children to write down their estimate of the weight of each object on the worksheet. These amounts should include the non-standard unit that they used.

At this stage, give each group a set of balance scales, and ask them to work out the actual weight of each object. Tell the children that they should record the weights of the objects on the worksheet in a clear way.

After they have completed this part of the activity you should ask children how the actual weights compared with their estimates. Ask children to use their estimates and the actual weights to work out which was their best estimate and which as their worst. They could use the reverse side of the worksheet to do their calculations. Ask them to explain how they decided which was the best and which the worst.

To complete the activity, you should ask for a report back to the class from a representative of each group. This provides an opportunity for children to comment on other groups' results and conclusions.

MAKE AN ESTIMATE

Which object is the lightest?

Which object is the heaviest?

Which object is in the middle?

LIGHTEST		HEAVIEST

We think the lightest object weighs about

We think the heaviest object weighs about

We think the object in the middle weighs about

NOW FIND THE ACTUAL WEIGHT OF EACH OBJECT

TEACHERS' NOTES:

MAKE AN ESTIMATE AND SEE IF IT'S CLOSE
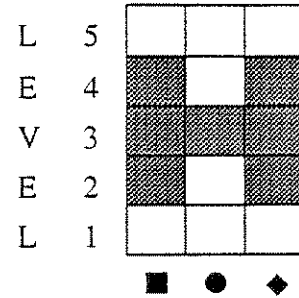
'Make an Estimate and See If It's Close' is a practical activity that also addresses Number and Shape, Space and Measures.

■ Making and Monitoring Decisions to Solve Problems

There are several difficulties children are likely to encounter when finding the actual weight of each object. For example, they may not be able to find an exact number of the non-standard units to balance the object, or the non-standard units may be of different sizes and weights. Trying to balance the scales precisely by using different combinations of non-standard units of the same type is typical of level 3. Typical level 4 performance entails children recognising and recording that the weights may not be an exact number of units, such as by indicating halves.

● Developing Mathematical Language and Forms of Communication

This is addressed by children completing the worksheet, as well as by them explaining their findings. Typical level 3 performance entails children presenting their results in such a way that it is clear which objects and which non-standard units are being referred to, and which weight corresponds to which object.

◆ Developing Mathematical Reasoning

The final part of the activity entails children using their results to work out which was their best estimate and which was their worst. Questions from you such as *'How close do you have to be for it to be a good estimate?'* can help them explain their reasoning.

Working out the absolute difference between their estimate and the actual weight of each object is typical of level 2. Children who are beginning to take into account that the three objects weigh different amounts in making a decision about the closeness of their estimates are showing performance at level 3.

Typical level 4 performance entails children understanding that a large difference between their estimate and the actual weight of the heaviest object does not necessarily make it a worse estimate than a smaller difference between their estimate and the actual weight of the lightest object.

INSET PROGRAMME: MAKE AN ESTIMATE AND SEE IF IT'S CLOSE

USE	Organising the Class for Assessment	Do INSET MODULE C on pages 26 and 27
	Asking Questions	Do INSET MODULE Q on pages 136 and 137
	Observing and Capturing Ephemeral Evidence	Do INSET MODULE N on pages 110, 111 and 112
	Involving Children in Self-Assessment	Do INSET MODULE L on pages 84 and 85
REVIEW	Obtaining Evidence from the Product of Work	Do INSET MODULE M on pages 86 and 87
	Improving Assessment Skills	Do INSET MODULE J on pages 64, 65 and 66
	Using Assessment Diagnostically	Do INSET MODULE O on pages 113 and 114

SEARCH FOR THE BURIED TREASURE

INSTRUCTIONS FOR CLASSROOM USE

Resources: 'Buried Treasure' maps, copies of 'Location of Treasure' paper and 'Extra Clues' paper, pencils.

Time: 30 - 50 minutes.

Organisation: Groups of four children, working in pairs.

What to do:

Give each pair of children a 'Buried Treasure' map, and explain to them that it is a map of an island where a pirate has buried some treasure. Also, give each pair a copy of the 'Location of Treasure' paper. Explain that this says how many chains East, West, North or South you must go to find the treasure, but there is some information missing. Ask children to use this to find where the treasure might be buried.

When both pairs in the group have finished this stage of the activity, give each pair a copy of the 'Extra Clues' paper. Tell children that this is another piece of paper that has been found, and that they should use it to find the exact location of the treasure.

As a further stage to the activity, you could ask children to find another location on the map where the treasure could be buried, and to write directions from the flagpole, or another starting point, to this location. Some children may wish to write directions with missing information, and to provide extra clues, and then to use these materials with others.

BURIED TREASURE MAP

1 chain

N

mountain

pool

flagpole

quick
sand

pool

pool

wreck

pool

pool

pool

wreck

LOCATION OF TREASURE PAPER

Start from the flagpole and go

3 chains East then 7 chains North

then 1 chain East then 3 chains North

then 5 chains East then 4 chains South

then 1 chain West then 6 chains South

then 2 chains West then 5 chains South

then 3 chains then 5 chains South

then 2 chains West then 1 chain

and you will find the treasure

LOCATION OF TREASURE PAPER

Start from the flagpole and go

3 chains East then 7 chains North

then 1 chain East then 3 chains North

then 5 chains East then 4 chains South

then 1 chain West then 6 chains South

then 2 chains West then 5 chains South

then 3 chains then 5 chains South

then 2 chains West then 1 chain

and you will find the treasure

EXTRA CLUES PAPER

The bird that flies straight from wreck to wreck

will pass right over the treasure chest

The pirate who digs up treasure

will end up with wet feet

EXTRA CLUES PAPER

The bird that flies straight from wreck to wreck

will pass right over the treasure chest

The pirate who digs up treasure

will end up with wet feet

TEACHERS' NOTES:

SEARCH FOR THE BURIED TREASURE

■ ● ◆

'Search for the Buried Treasure' is based on an extended task taken from the Problems and Patterns tests of the Assessment of Performance Unit survey of 11 year old pupils' performance in mathematics in 1987. This classroom activity also addresses Shape, Space and Measures.

■ Making and Monitoring Decisions to Solve Problems

Typical level 2 performance entails the child using the compass direction and chain distance shown on the map to follow the given directions. Children who have inferred that the pieces of missing information are first, either East or West, and second, either North or South are performing at level 3.

● Developing Mathematical Language and Forms of Communication

Talking about directions and distances when working out the route is typical of level 2. Children who have indicated clearly on the map the various stages of the route, and shown the four possible locations of the treasure, before the 'Extra Clues' paper is used, have shown performance at level 3. Typical level 4 performance entails the child drawing correctly the entire route, and finding the exact location of the buried treasure.

◆ Developing Mathematical Reasoning

Children who are talking about the possibility of going in different directions at those points where information is missing are showing performance at level 2. In assessing performance at higher levels, you should ask children to explain why there are four possible locations for the buried treasure, before the 'Extra Clues' paper was found. You will need to judge if children's responses are typical of level 3 or level 4 performance.

INSET PROGRAMME: SEARCH FOR THE BURIED TREASURE

USE	Organising the Class for Assessment	Do INSET MODULE K on page 83
	Asking Questions	Do INSET MODULE F on pages 43 and 44
	Observing and Capturing Ephemeral Evidence	Do INSET MODULE D on pages 28 and 29
	Involving Children in Self-Assessment	Do INSET MODULE G on pages 45 and 46
REVIEW	Obtaining Evidence from the Product of Work	No INSET module suggested, as there is no product of children's work from which to obtain evidence
	Improving Assessment Skills	Do INSET MODULE R on pages 138, 139 and 140
	Using Assessment Diagnostically	Do INSET MODULE O on pages 113 and 114

DEVISE A MATHS GAME

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheet 'Our Maths Game', spinners, dice, counters, rough paper, pencils.

Time: 45 - 60 minutes.

Organisation: Children working in pairs, and then in groups of four.

What to do:

Give each pair of children a copy of the worksheet 'Our Maths Game', one spinner showing numbers, two dice, about 20 counters, rough paper and pencils.

Explain to the children that they are to make up an interesting mathematics game, using some, or all, of the equipment they have been given. Tell them that the game should be simple to play, and that there should be a winner after about five minutes of playing. Also, emphasise the idea of fairness by talking about any player having the same chance of winning as any other player. You may need to remind children that they should keep the games fairly simple, so they are easy for other children to play.

The children can use the rough paper to write down details of their game as they develop it, and also any results from playing. When each pair has decided on the final version of their game, they should write down the rules of the game on the worksheet.

After children have devised their maths games and written down their rules, put pairs of children together to form groups of four. Each group can then play both the games that have been devised by the four of them. This helps to involve children in the evaluation of their own and others' games.

OUR MATHS GAME

Make up an interesting maths game that can be played by 2 to 4 players.

The game should be simple to play, and there should be a winner after about 5 minutes of playing.

The game should be fair, so that all players have an equal chance of winning.

Write down the rules of your game below.

RULES

TEACHERS' NOTES:

DEVISE A MATHS GAME

L	5			
E	4			
V	3			
E	2			
L	1			

■ ● ◆

'Devise a Maths Game' also addresses Number and Data Handling. This classroom activity leads to a variety of different games, ranging from the very simple to highly complex ones with numerous rule.

■ Making and Monitoring Decisions to Solve Problems

You will need to observe children closely while they are developing their games. Much of their work will be concerned with making decisions, overcoming difficulties, and obtaining information to solve problems. Children's work on this aspect of the activity is likely to show performance ranging from level 2 to 4.

◆ Developing Mathematical Reasoning

The activity has a great deal of scope for asking *'What would happen if?'* questions. Here, your questions can focus on the effect of making a small change to one of the rules of the game. You may also choose to give children a general statement to investigate relating to their game. For example, you could ask whether the player who has the first go is the one most likely to win.

Typical level 4 performance entails children giving a good explanation of how their game meets the requirements of being simple to play, producing a winner after about five minutes playing, and being fair, as outlined on the worksheet.

INSET PROGRAMME: DEVISE A MATHS GAME

USE	Organising the Class for Assessment	Do INSET MODULE K on page 83
	Asking Questions	Do INSET MODULE F on pages 43 and 44
	Observing and Capturing Ephemeral Evidence	Do INSET MODULE N on pages 110, 111 and 112
	Involving Children in Self-Assessment	Do INSET MODULE L on pages 84 and 85
REVIEW	Obtaining Evidence from the Product of Work	Do INSET MODULE M on pages 86 and 87
	Improving Assessment Skills	Do INSET MODULE J on pages 64, 65 and 66
	Using Assessment Diagnostically	Do INSET MODULE O on pages 113 and 114

LEVELS 3/4

CAN YOU MAKE THIS WEIGHT?

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'Making Weights', balance scales, weights of 20g, 50g and 100g, Plasticine.

Time: 40 - 50 minutes.

Organisation: Children working in pairs.

What to do:

Give each pair of children a copy of the worksheet 'Making Weights', balance scales, a 20g weight, a 50g weight, a 100g weight, and about 300g of Plasticine.

Explain to children that they are to use the equipment to make Plasticine weights of the amounts shown on the worksheet. Ask them, for each of the Plasticine weights they have been able to make, to write brief notes about what they did, or to draw a suitable picture, in the appropriate box on the worksheet.

For those children who have made all, or most, of the weights, you should ask them to consider whether it is possible to make any Plasticine weight that has a value that ends in 5; that is 5g, 15g, 25g, etc.

MAKING WEIGHTS

Can you make balls of Plasticine that weigh this much? If so, how?

150g

25g

30g

75g

80g

125g

65g

TEACHERS' NOTES:

CAN YOU MAKE THIS WEIGHT?

'Can You Make This Weight?' is a practical activity that also addresses Number and Shape, Space and Measures.

■ **Making and Monitoring Decisions to Solve Problems**

Many children will find it difficult to work out how to make a Plasticine weight of 25g. Here, it will be necessary for you to guide them to a correct solution. First ask them to make a 50g weight. Then ask them to use this amount to make two balls of Plasticine, each of weight 25g. You may have to demonstrate that the 50g piece is first divided by eye into two roughly equal pieces, and then by placing a piece on each side of the balance they are gradually evened up to equal each other.

For making the 30g weight, you may have to prompt children that weights can be placed on both sides of the balance scales. For some pairs of children, you may have to demonstrate that the 50g weight is placed on one side of the balance, and the 20g weight and the Plasticine ball are placed on the other side. Alternatively, a 30g weight can be made by first making two 20g weights, halving one of them to make a 10g weight, and then combining the 10g weight with the remaining 20g weight.

After giving children some initial help, it is best to leave them to make their own decisions about how the remaining weights could be made. Typical level 3 performance entails children making four or five of the weights shown on the worksheet with just a reasonable amount of prompting. Those children who are able to make six or seven of the weights are showing performance at level 4.

● **Developing Mathematical Language and Forms of Communication**

Much of children's work on this aspect of the activity relates to their completed worksheets. You will probably judge many children as performing at level 3. Typical level 4 performance involves children presenting clear, organised work which uses symbols or diagrams, or both.

◆ **Developing Mathematical Reasoning**

The final part of the activity, when children are considering whether it is possible to make any weight that has a value ending in 5, addresses children's mathematical reasoning. You should ask children probing questions about the values of the weights that they believe it is possible to make, and how these are made. Some children may have made a generalisation based on their work. A useful way of focusing children on this is to say *'Tell me something important that you have found out in this work'*. Typical level 4 performance entails children searching for a pattern in a reasonably systematic way.

INSET MODULE N

USE - Observing and Capturing Ephemeral Evidence

Time Required: About 1 hour

Introduction

The planned observation of children while they are working can produce a considerable amount of evidence of their process skills. Over a period of time, systematic observations can form a picture of each child's performance across the three subsections of Using and Applying Mathematics. However, evidence from observation is ephemeral; that is it is not readily retainable like the product of a child's work. Therefore, teachers need to capture some of this valuable evidence, and then relate it to specific parts of the programme of study such as *'check their results and consider whether they are reasonable'*, *'use diagrams, graphs and simple algebraic symbols'* and *'explain their reasoning'*.

One means of capturing ephemeral evidence is through the use of an observation sheet. On page 112, there is an example of an observation sheet, which can be used with any classroom activity. This sheet contains spaces for the date, the name of the class, and the specific parts of the programme of study addressed by the classroom activity. All this information can be filled in by the teacher before the classroom activity is used with children. The main part of the observation sheet is where relevant comments about children's process skills are to be made by the teacher, alongside the name of the child in each case.

Action

Make a copy of the observation sheet shown on page 112, and a copy of the appropriate programme of study from page 2 or 3, for everyone in the group.

Discuss, as a group, how the observation sheet could be used in capturing ephemeral evidence, with respect to the following questions:

* Is the use of an observation sheet like this an appropriate means by which to capture ephemeral evidence?

*   If it is appropriate, how might it be used by you with your children?

*   If it is not appropriate, what other means of capturing ephemeral evidence might be used?

If the group has decided collectively that there is a more appropriate way of capturing ephemeral evidence than by using an observation sheet, then they should spend the rest of the session making plans for capturing evidence in the classroom through that way. Otherwise, continue with the INSET session below.

As a group, make alterations to the observation sheet so that you can use it in your classroom when you give children the classroom activity. The following questions may be helpful in considering alterations:

*   Which specific parts of the programme of study, addressed by the classroom activity to be used, should be included on the observation sheet?

*   What sorts of comments do colleagues envisage themselves making on children's process skills with regard to the classroom activity?

*   Does the observation sheet need more structure, such as by including expected performance by children matched to specific parts of the programme of study?

*   How would the completed observation sheet link in with individual children's records of attainment?

Follow-on

You should use the observation sheet you have designed in this INSET session with the classroom activity you intend using with children. It is best to use it by focusing on just a few children. Afterwards, you should meet again with colleagues to discuss how successful the observation sheet was in capturing ephemeral evidence, and how it might be improved for subsequent use.

If, in the INSET session, you worked on a different means of capturing ephemeral evidence, then you should try this out in the classroom, and later meet with colleagues to evaluate its success.

OBSERVATION SHEET

| Date ------------------------ | Activity --- |
| Class ----------------------- | Parts of the Programme of Study For Using and Applying Mathematics --- --- --- |

<u>Child</u>	<u>Evidence</u>

INSET MODULE O

REVIEW - Using Assessment Diagnostically

Time Required: About 40 minutes

Introduction

On the basis of the teacher assessment carried out, it may be the case that some children have not shown evidence at the level that was expected. If this is so for a significant number of children who worked on the classroom activity then this INSET module is particularly worth doing with your colleagues.

With regard to Using and Applying Mathematics there can be a variety of reasons for performance at a lower level than expected. This may include individual children working in groups where there is little cooperation between the group members, the way the classroom activity was introduced to the children, and whether or not children were sufficiently motivated to engage with the activity.

One of the chief causes of children not demonstrating expected evidence of attainment within the programme of study for Using and Applying Mathematics is to do with the actual mathematical content of the activity. This content may be about such mathematics topics as use of a calculator, rotation of shapes, angles, probability, or decimals, to name a few.

In conducting teacher assessment in Using and Applying Mathematics, it is a good idea to arrange for children to have experience of the mathematical content of the classroom activity that is one level higher than the mathematical processes involved. For instance, if the classroom activity is mainly focused on level 3 then it is worth ensuring that the mathematical content has been taught to level 4. This will, to a large extent, help to avoid the situation where children's difficulties with the mathematical content of the activity obscures their process skills.

Action

Have available sufficient copies of the classroom activity, including the Teachers' Notes, for colleagues to refer to during the session. You will also find it useful to have available a copy of your scheme of work for mathematics.

Discuss, as a group, the extent to which children performed at a lower level on the activity in Using and Applying Mathematics than was expected.

The following questions can be used to focus the discussion:

* Were any of the difficulties that children experienced to do with the actual mathematical content of the activity (e.g. use of calculator, rotation of shapes, probability)?

* Where does this content appear within your scheme of work for mathematics?

* In general, to what level is this content taught on those appearances in the scheme?

As a group, you should agree to make any changes to the scheme of work with regard to the timing of certain aspects of the content under consideration or the classroom activity, or both. Furthermore, in your teaching and lesson plans you may decide to teach certain aspects of the content at a higher level than had been taught previously at these times.

Follow-on

Use the group decisions you have made in this INSET session to make changes to your scheme of work, and teaching and lesson plans. If, on the classroom activity, a significant number of children did not show evidence at the levels addressed, then you could decide to use an activity which addresses a lower range of levels. For instance, you might decide to use a classroom activity from LEVELS 2/3/4 if you had previously used one from LEVELS 3/4/5.

INVESTIGATE IF RECTANGLES
CAN BE MADE

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'Rectangles', squares paper, scissors, pencils.

Time: 40 - 50 minutes.

Organisation: Children working in pairs.

What to do:

Give each pair of children a copy of the worksheet 'Rectangles', a sheet of squares paper, and a pair of scissors. Explain to the children that they should cut out several of each of the two types of shape shown on the worksheet from the squares paper.

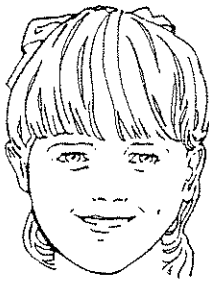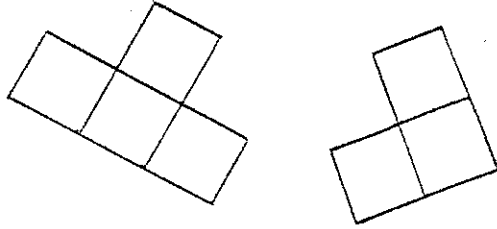Tell children that with these shapes, they should investigate whether or not Susan is right concerning the statement she has made.

Ask children to write down their findings on the worksheet. These findings can be in the form of drawings, possibly with numbers alongside.

RECTANGLES

Susan is investigating whether she can make rectangles from different numbers of pieces like these:

Is Susan right?

TEACHERS' NOTES:

INVESTIGATE IF RECTANGLES CAN BE MADE
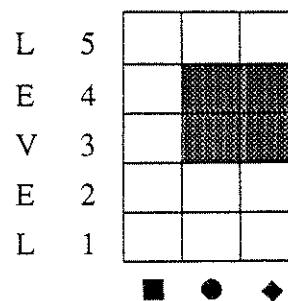
'Investigate If Rectangles Can be Made' is a problem-solving activity that also addresses Number and Shape, Space and Measures.

● Developing Mathematical Language and Forms of Communication

Those children who have correctly interpreted Susan's statement have shown performance at level 3. The key words in this statement are *'even'*, *'odd'* and *'rectangle'*. You will find it helpful to look at children's findings written on the worksheet, including any drawings they have made. You will probably have to prompt some pairs of children that it is not sufficient for them just to consider one combination of the two types of shape in verifying or denying Susan's statement.

Typical level 3 performance entails children trying out two appropriate combinations of the shapes (e.g. 2 L-shaped pieces and 3 T-shaped pieces; 4 L-shaped pieces and 5 T-shaped pieces). Typical level 4 performance entails children showing that they understand it is necessary to consider several combinations of the two types of shape.

◆ Developing Mathematical Reasoning

You should ask children to say whether they believe Susan is right or wrong and to give a reason, making reference to their findings. Those who believe Susan is right, and can give a good explanation of why, have shown performance at level 4. These children will probably have made several rectangles of different sizes, and their explanations will contain references to how these rectangles are related to each other.

INSET PROGRAMME: INVESTIGATE IF RECTANGLES CAN BE MADE		
USE	Organising the Class for Assessment	Do INSET MODULE K on page 83
	Asking Questions	Do INSET MODULE F on pages 43 and 44
	Observing and Capturing Ephemeral Evidence	Do INSET MODULE N on pages 110, 111 and 112
	Involving Children in Self-Assessment	Do INSET MODULE L on pages 84 and 85
REVIEW	Obtaining Evidence from the Product of Work	Do INSET MODULE M on pages 86 and 87
	Improving Assessment Skills	Do INSET MODULE R on pages 138, 139 and 140
	Using Assessment Diagnostically	Do INSET MODULE O on pages 113 and 114

GENERATE NUMBER CHAINS, AND INVESTIGATE

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'Number Chains', rough paper, sheets of plain A3 paper, pencils.

Time: 60 - 75 minutes.

Organisation: Groups of three to five children.

What to do:

Use the board to explain to the children how to generate a number chain following the information and the rule on the worksheet 'Number Chains'. Make sure they are clear about first and last digits, and how successive numbers in the chain are generated.

Then give each group a copy of the worksheet 'Number Chains', rough paper, pencils, and a single sheet of plain A3 paper. Ask them to investigate the number chains generated from the rule. They should do this on rough paper by each member of the group generating a chain from a different starting number.

When all members of the group have finished they should look at each other's number chains to see how they compare to their own. Encourage children together to look for any general pattern emerging from their work, and to write down any interesting chains, along with any important findings, on the A3 sheet.

Next, the groups should go on to investigate the number chains that are generated using the rule when multiplying by 3, 4 or 5. Again they should first use rough paper, and then together look for general patterns and write down any interesting chains, along with important findings, on the A3 sheet.

After an appropriate amount of time has been spent on the activity, ask for a short report back to the whole class from a representative of each group about what they did and what they found out. The A3 sheets can be attached to the board, or information copied from the sheet onto the board. At this stage, it is useful to ask children probing questions about what they have noticed about the number chains.

NUMBER CHAINS

1. *Start with a number between 1 and 9, and write this as a two-digit number. For example, 7 = 07*

   07 is the first number in the chain.

   RULE - Multiply the last digit of the number by 2 and add the first digit of the number to the result

   ---

   $$07 \rightarrow 7 \times 2 \rightarrow 14 \rightarrow 14 + 0 \rightarrow 14$$

   14 is the second number in the chain.

   Apply the RULE again

   $$14 \rightarrow 4 \times 2 \rightarrow 8 \rightarrow 8 + 1 \rightarrow 9 \rightarrow 09$$

   09 is the third number in the chain.

   Keep on applying the RULE, and see what happens

   ---

2. *Try different starting numbers between 1 and 9, and see what happens.*

3. *Change the RULE, so that you multiply by 3, 4 or 5 to generate chains, and see what happens.*

TEACHERS' NOTES:

GENERATE NUMBER CHAINS, AND INVESTIGATE

L   5

E   4

V   3

E   2

L   1

■   ●   ◆

'Generate Number Chains, and Investigate' also addresses Number. This classroom activity aims to encourage children to take responsibility for organising and extending their work.

● Developing Mathematical Language and Forms of Communication

Those children who have correctly interpreted the information given on the worksheet have shown performance at level 3. In addition, you should consider the A3 sheet showing children's chains and important findings, as well as the report made by group representatives at the end of the activity. In considering the work on the A3 sheet, you will need to determine what each child has contributed to the overall product. Typical level 4 performance entails the use of appropriate symbols or diagrams.

◆ Developing Mathematical Reasoning

Children should be encouraged to investigate a suitable general statement during the activity. This may be one they have themselves made or one you have given them. The statement, for example, could be about the result of starting from different numbers or the distribution of odd and even numbers throughout the chains.

Towards the end of the activity, children have to multiply by 3, 4 or 5 to generate chains. Typical level 4 performance entails children making a generalisation about the chains. Prompts from you such as *'What is special about the chains when you multiply by this number?'* and *'How is the x3 chain different from the x2 chain?'* are helpful.

INSET PROGRAMME: GENERATE NUMBER CHAINS, AND INVESTIGATE

USE	Organising the Class for Assessment	Do INSET MODULE P on pages 134 and 135
	Asking Questions	Do INSET MODULE Q on pages 136 and 137
	Observing and Capturing Ephemeral Evidence	Do INSET MODULE D on pages 28 and 29
	Involving Children in Self-Assessment	Do INSET MODULE G on pages 45 and 46
REVIEW	Obtaining Evidence from the Product of Work	Do INSET MODULE H on pages 47 and 48 (NB the product to consider will be the A3 sheets showing children's number chains and findings)
	Improving Assessment Skills	Do INSET MODULE J on pages 64, 65 and 66
	Using Assessment Diagnostically	Do INSET MODULE O on pages 113 and 114

HOW DOES THE SEQUENCE CONTINUE?

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'Triangles', coloured crayons.

Time: 30 - 40 minutes.

Organisation: Children working individually.

What to do:

Give each child a copy of the worksheet 'Triangles', and several different coloured crayons. Explain to them how to make the first two layers in the pattern, and ask them to continue it following the rule of *'touching along a side'*. Make sure children understand the rule, and that they can see that the first two numbers in the sequence are 2 and 4 If children place the first two triangles in the middle of the triangles sheet, then there will be enough space for eight layers of triangles.

You should ask individual children while they are working what they have discovered so far about the sequence of numbers, and what they think the next number will be.

When children have finished you should ask them to tell you about what they have noticed about the sequence of numbers. Ask the children to write down a rule for getting the sequence, and the next few numbers in it.

TRIANGLES

1. In the middle of the triangles sheet below, colour in two triangles that touch along a side.
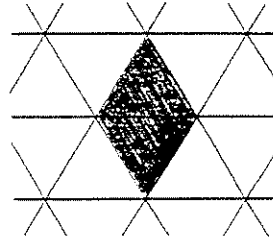
2. Colour in all the triangles that touch along a side of the triangles you have already coloured in.
Use a different colour for this.
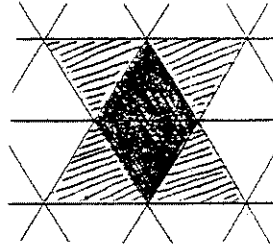
3. Continue the pattern, following the rule of 'touching along a side'.
Use a different colour each time.

4. Count the number of triangles in each layer of the pattern.
Try to work out how the sequence continues.
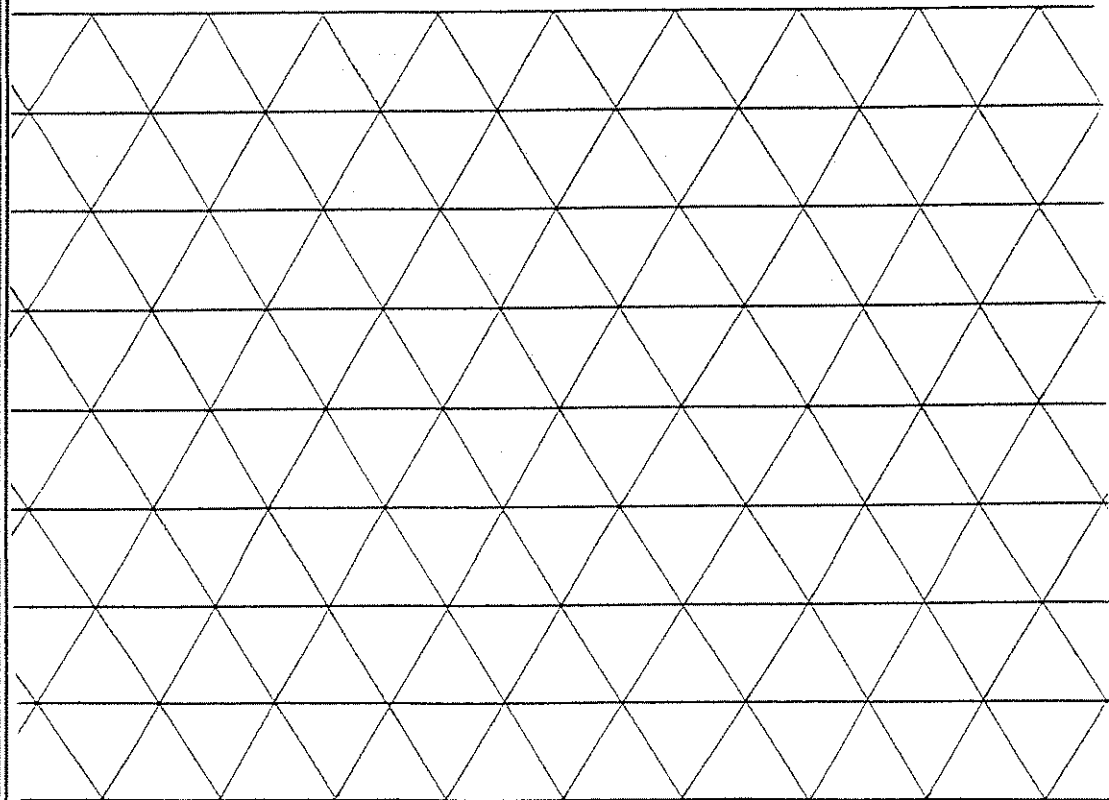
TEACHERS' NOTES:

HOW DOES THE SEQUENCE CONTINUE?

L	5				
E	4			▓	
V	3			▓	
E	2				
L	1				

■ ● ◆
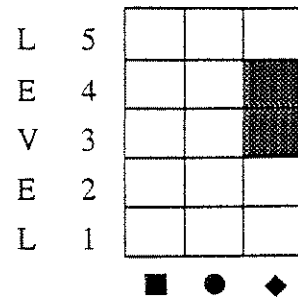
'How Does the Sequence Continue?' is concerned with the development of children's mathematical reasoning. This classroom activity also addresses Number.

◆ Developing Mathematical Reasoning

During the activity, you should ask individual children to predict the next number in the sequence. Many children will be surprised when the number produced is different from their prediction. Here, there will be a good opportunity for you to explore their reasoning.

While children are working they will naturally be making general statements about the number sequence. Typical level 3 performance involves children understanding that some of the numbers go up in twos.

At the end of the activity, you should ask children to look at the number sequence produced, and ask them what they notice about the numbers. Finally, ask them to write down a rule for getting the sequence. Typical level 4 performance involves children giving a rule, in words or symbols, that would produce the sequence, and them being able to work out the next few numbers.

INSET PROGRAMME: HOW DOES THE SEQUENCE CONTINUE?

USE	Organising the Class for Assessment	Do INSET MODULE I on page 63
	Asking Questions	Do INSET MODULE F on pages 43 and 44
	Observing and Capturing Ephemeral Evidence	Do INSET MODULE D on pages 28 and 29
	Involving Children in Self-Assessment	Do INSET MODULE L on pages 84 and 85
REVIEW	Obtaining Evidence from the Product of Work	Do INSET MODULE M on pages 86 and 87
	Improving Assessment Skills	Do INSET MODULE R on pages 138, 139 and 140
	Using Assessment Diagnostically	Do INSET MODULE E on pages 30 and 31

LEVELS 3/4/5

TEST THE 'LEAVES FORMULA'

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'Leaves', five leaves from different trees or plants involving a variety of shapes (e.g. ivy, oak, horse-chestnut, poplar, dock), 30cm rulers, transparent cm squares grids (if available), cm squares graph paper, calculators, rough paper, A4 size plain paper, pencils.

Time: 90 - 120 minutes.

Organisation: Groups of three to five children.

What to do:

Give each group of children a copy of the worksheet 'Leaves', and five leaves taken from different trees or plants, covering a variety of shapes.

First, ask children to identify the trees or plants from which the leaves have been taken. They could do this by referring to books in the classroom or in the library.

Then ask the groups to go through the four remaining parts of the activity on the worksheet. When they have reached part 3, give each group 30cm rulers, a transparent cm squares grid (if available), a sheet of cm squares graph paper, calculators, rough paper and pencils. Also give each group one sheet of plain A4 size paper, and tell them that this is for recording their group results in a clear way.

At the end of the activity, ask for a short report back to the class from a representative of each group about what they did and found out.

LEAVES

1. Look at the leaves you have been given.
    Find out what trees or plants they are from.

2. Which leaf has the largest area?
    Which leaf has the smallest area?

3. Now work out the area of each leaf using some
    of the equipment you have been given.

4. Scientists use the formula

    $$Area = 2 \times length \times breadth \div 3$$

    to work out the area of leaves.

length

breadth
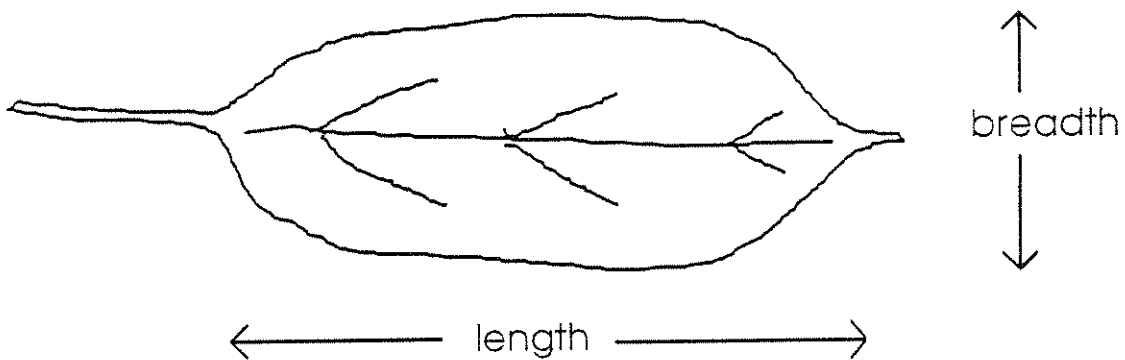
    Use the formula to work out the area of each leaf.

5. How do your results using the formula compare
    with your first results?

TEACHERS' NOTES:

TEST THE 'LEAVES FORMULA'

L	5			
E	4			
V	3			
E	2			
L	1			

■ ● ◆

'Test the 'Leaves Formula'' is a practical activity which also addresses Number and Shape, Space and Measures.

■ Making and Monitoring Decisions to Solve Problems

There will be a number of occasions during the activity when children will encounter difficulties. How children overcome these will provide evidence relating to level 3. Typical level 4 performance entails the child using the available equipment to work out the areas of the leaves and applying the formula correctly.

You should judge whether children have worked out the areas of the leaves with reasonable accuracy, and decided to check results, to see if they are performing at level 5.

● Developing Mathematical Language and Forms of Communication

You should assess children's presentation of their results to see if they are showing evidence at level 3. These results could be presented either on the plain A4 size paper or as an oral presentation to the class at the end of the activity. Typical performance at level 4 entails children using appropriate symbols or diagrams in their work, either on rough paper or in their final results.

Your judgement of whether children have shown performance at level 5 should be based on their entire work, including the presentation to the whole class. Throughout the activity, children will have used skills in a variety of forms: practical, oral, written, calculator. How they present an overall picture of their work, referring to these different forms, will provide evidence.

◆ Developing Mathematical Reasoning

You should observe children to see if they make any generalisations relating to the two sets of results, so providing evidence at level 4. You may need to prompt some groups of children with questions like, *'The scientists think the formula works very well for some shaped leaves, but not so well for other shaped leaves; what do you think?'* Typical level 5 performance entails children testing whether the formula gives better results for some shaped leaves compared to others, and explaining a relationship between the shape of a leaf and the accuracy of the formula.

INSET MODULE P

USE - Organising the Class for Assessment

Time Required: About 30 minutes

Introduction

The classroom activity entails children working in small groups. Teachers will need to decide on the composition of the groups, so that children generally perform at their best, and teacher assessment is conducted effectively. It is also important to bear in mind that the activity is quite demanding, and so it might only be suitable for some children in the class.

There should be a high level of interaction between the teacher and the groups of children for assessment purposes. In order for this to occur, the teacher may decide that perhaps only two or three groups are to work on the activity while the rest of the class are engaged on other work that does not involve much supervision from the teacher. It may be possible to arrange for a parent helper or teacher assistant to work with the rest of the class so that the teacher can focus on those working on the classroom activity.

Action

Discuss the organisation of the class for assessment purposes with respect to the following questions:

* About how many children in the class would you expect to perform well on the classroom activity, taking into account the demands of the activity? Should it just be these children who are given the activity, or should others be given it as well?

* How many groups of children should be working on the activity at the same time, considering the need to conduct teacher assessment effectively?

* How will you decide which children will be working together? (For example, same ability children, friendship groupings, same gender, etc.) Are there individual children in the groups who should be the focus for assessment?

*   Which of the parts of the programme of study addressed by the activity do you think it is best to concentrate on when assessing children in their groups? (NB the parts that you regard as particularly relevant will affect when and how you interact with children.)

Follow-on

Use the decisions you have made in this INSET session when organising your class in preparation for the classroom activity, and in conducting teacher assessment.

INSET MODULE Q

USE - Asking Questions

Time Required: About 30 minutes

Introduction

The classroom activity involves children using a range of skills. During the activity, the teacher should have asked children about aspects of their work on several occasions. The activity is completed by asking a representative from each group to report back to the class about what they did and found out.

Reporting back provides an opportunity for the children to comment on other groups' results and conclusions. It also provides a further opportunity for the teacher to ask questions which explore children's skills and understanding. Effective questions should enable children to give a more lucid explanation of their work. However, questions at this time should be used sparingly so as not to interrupt the flow of children's presentations.

Action

Have available sufficient copies of the Instructions for Classroom Use page of the classroom activity, the Teachers' Notes page, and any worksheet, for everyone in the group.

Discuss, as a group, the spoken presentation to be made to the class at the end of the activity by individual children. The following questions can be used to focus the discussion:

* What parts of the classroom activity do you want children to concentrate on when making their presentations, so that you are able to assess their process skills?

* What specific questions could you ask children to draw out information about their process skills and understanding with regard to the crucial parts of the activity? (Make a list of these questions on the board or flipchart.)

* What strategies could you use to encourage children to discuss the work of others, and to ask questions of each other in a positive way?

Follow-on

As an outcome of the INSET session, you should have clearer ideas about what to assess when individual children are making a spoken presentation to the class at the end of the activity. You may also have ideas about how to draw out information on children's process skills and understanding in crucial areas they have been working on.

INSET MODULE R

REVIEW - Improving Assessment Skills

Time Required: About 40 minutes

Introduction

One of the most important skills of teacher assessment is that of questioning children about their understanding. All the classroom activities in this pack emphasise interaction between the teacher and children as being crucial, and a chief means by which evidence is obtained.

However, there are difficulties in questioning children in a suitable way for assessment purposes. For instance, a teacher may ask fairly closed questions to which children give very short responses, revealing little about a child's process skills and understanding. Other questions, in effect, may be telling a child what to do, when the intention was to guide them with the work or to diagnose any misconceptions. Difficulties with questioning might be encountered because the management of the class is such that the teacher is unable to talk to children about their work at appropriate times. Or a child may give unexpected responses to a teacher's questions, that are difficult to interpret in relation to parts of the programme of study.

Action

Give everyone in the group a copy of the self-rating sheet shown on page 140. (NB this page can be photocopied and cut along the dotted line to make two self-rating sheets.)

Ask colleagues to reflect on their questioning skills within the classroom activity used with children, and to complete the sheet using the numbers shown above the given statements.

After completing the sheets, ask for their ratings on each statement in turn. Work out an average rating for each statement (For example, if five teachers had rated their questioning skills for statement A as 2, 3, 4, 2, 2 then the average is 13 ÷ 5 = 2.6). Identify all those statements that have an average rating of 3 or less.

As a group, brainstorm on those aspects of questioning that have proved problematic (i.e. statements showing low average ratings).

Some of the points you may wish to discuss are:

- the type of work given to the other children while you were interacting with a group for assessment purposes;

- your interpretation of parts of the programme of study, and the responses you had expected from children to your questions;

- the sort of questions you asked, and how effective these were at revealing evidence of performance;

- the composition of the groups, and which children and which parts of the programme of study were a particular focus for your questioning;

- the strategies used by you to record details of the process skills used by individual children and their understanding as revealed by your questions.

Follow-on

As a result of this INSET session, you and your colleagues will have identified common difficulties that are encountered when questioning children about their process skills and understanding. You will probably have discussed in the group a number of ways by which these difficulties can be overcome. Next time you use a classroom activity from this pack, you should endeavour to put into practice some of your decisions about making the questioning of children more effective for assessment purposes.

You may wish to repeat this INSET module from time to time to check on the development of these questioning skills.

SELF-RATING SHEET: QUESTIONING SKILLS

Classroom Activity _____

For each statement fill in the appropriate number in the box.
(5 = Yes, definitely, 4 = To a large extent, 3= To some extent,
2 = Only to a small extent, 1 = Not at all)

A. I was able to question children about their work at appropriate times. ☐

B. I guided children with my questioning, rather than told them what to do. ☐

C. I managed to ask questions of the children I had intended to focus on. ☐

D. I was able to say as a result of my questioning whether children's work
counted as evidence of performance. ☐

E. I was able to record details of the process skills used by individual
children, as revealed by my questioning. ☐

----✂--

SELF-RATING SHEET: QUESTIONING SKILLS

Classroom Activity _____

For each statement fill in the appropriate number in the box.
(5 = Yes, definitely, 4 = To a large extent, 3= To some extent,
2 = Only to a small extent, 1 = Not at all)

A. I was able to question children about their work at appropriate times. ☐

B. I guided children with my questioning, rather than told them what to do. ☐

C. I managed to ask questions of the children I had intended to focus on. ☐

D. I was able to say as a result of my questioning whether children's work
counted as evidence of performance. ☐

E. I was able to record details of the process skills used by individual
children, as revealed by my questioning. ☐

EXAMINE THE NEWSPAPERS

INSTRUCTIONS FOR CLASSROOM USE

Resources: Copies of articles about the same piece of news from six daily newspapers (include both tabloid and broadsheet newspapers), calculators, pencils.

Time: 75 - 90 minutes.

Organisation: Groups of three to five children.

What to do:

Give each group of children copies of articles about the same piece of news taken from six daily newspapers. It is helpful to have copies of the newspapers available in the classroom so that children can see how the newspapers differ from each other.

Tell children that the newspaper articles contain sentences that vary in length, and that these sentences can be classified as short, medium or long. Then give the groups these questions to answer:

'Which article has the most long sentences?'
'Which article has the most short sentences?'

When each group has finished answering these questions, you should point out that the articles are of different lengths and contain different numbers of sentences. Tell children that they should take this into account in answering the following question:

'For each newspaper, if the editor said that the article had to be 20 sentences long, about how many words would this be?'

When all the groups have finished, ask for a short report back to the class from a representative of each group about what they did and found out.

TEACHERS' NOTES:

EXAMINE THE NEWSPAPERS

L	5	▨	□	▨
E	4	▨	▨	▨
V	3	▨	▨	□
E	2			
L	1			

■　●　◆

'Examine the Newspapers' is a problem-solving activity in which children can plan and organise their work. This classroom activity also addresses Number and Data Handling.

■ Making and Monitoring Decisions to Solve Problems

Typical level 3 performance entails children working out appropriate classifications of short, medium and long sentences. Some children will work on how many words are in each sentence, while others will look at the number of letters. For level 4 performance, children should apply their classifications correctly to analyse the articles.

In deciding whether children have shown performance at level 5, you should see how they work on finding how many words would be in each article if it was 20 sentences long. Typical level 5 performance involves children calculating a reasonable estimate for the number of words in each article.

● Developing Mathematical Language and Forms of Communication

Assessment can be made of children's presentations of their results to decide whether they have shown typical performance at level 3 or 4.

◆ Developing Mathematical Reasoning

During the presentations to the class, you should explore children's understanding of any generalisations they have made. This is so you can judge whether children have shown typical performance at level 4 or 5. It is useful at this stage to ask questions like *'From what you have found out, which type of newspaper has longer sentences?'*

INSET PROGRAMME: EXAMINE THE NEWSPAPERS

USE	Organising the Class for Assessment	Do INSET MODULE P on pages 134 and 135
	Asking Questions	Do INSET MODULE Q on pages 136 and 137
	Observing and Capturing Ephemeral Evidence	Do INSET MODULE N on pages 110, 111 and 112
	Involving Children in Self-Assessment	Do INSET MODULE G on pages 45 and 46
REVIEW	Obtaining Evidence from the Product of Work	No INSET module suggested, as there is no product of children's work from which to obtain evidence
	Improving Assessment Skills	Do INSET MODULE R on pages 138, 139 and 140
	Using Assessment Diagnostically	Do INSET MODULE O on pages 113 and 114

CONSTRUCT THE BEST BOX

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'The Best Box', copies of the net of a box, scissors, glue (or double-sided sticky tape), A4 size sheets of card, 30cm rulers, pencils, rough paper, calculators.

Time: 100 - 120 minutes.

Organisation: Groups of three or four children.

What to do:

Give each group of children a copy of the worksheet 'The Best Box', and some glue (or double-sided sticky tape). Give each child in the group a copy of the net of a box, scissors, A4 size sheets of card, rough paper, a ruler and a pencil.

Explain to the children how to make the box from the copy of the net they have each been given, by following the instructions on the worksheet. (NB instead of using sheets of card, you may prefer to use sheets of cm squares graph paper.)

When all the children have made the box, you should encourage them in each group to discuss why its capacity is 120 cubic centimetres.

Ask children to consider how they could make other boxes that also have a capacity of 120 cubic centimetres. Suggest to the children that a good way of working in their groups is for each of them to make a different box. They should first draw the net of the box on rough paper before copying it onto card.

When each group has finished making boxes, you should ask them to decide which of their boxes the manufacturer might regard as the best, and for what reasons.

To complete the activity, ask for a short report back to the class from a representative of each group.

THE BEST BOX

A manufacturer wants to make a closed rectangular box for packaging herbs that has a capacity of 120 cubic centimetres.

You can make one box that has a capacity of 120 cubic centimetres from the sheet you have been given.

1. *Copy the net of the box carefully onto a piece of card using a ruler and a pencil.*

2. *Cut out the net with scissors.*

3. *Score gently along all the solid lines, and fold the net into the shape of the box.*

4. *Put glue (or double-sided sticky tape) on all the flaps, and stick the edges together to make the box. (Note: it is easiest to stick down the longest flap first.)*

   Can you see why the capacity of the box is 120 cubic centimetres?

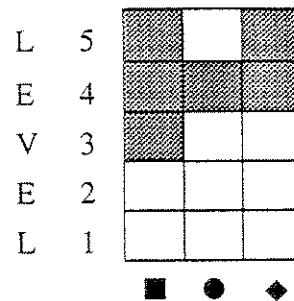   *Now make some other boxes from card that also have a capacity of 120 cubic centimetres.*

   Which of your boxes do you think the manufacturer will think is the best? Why?

NET OF A BOX
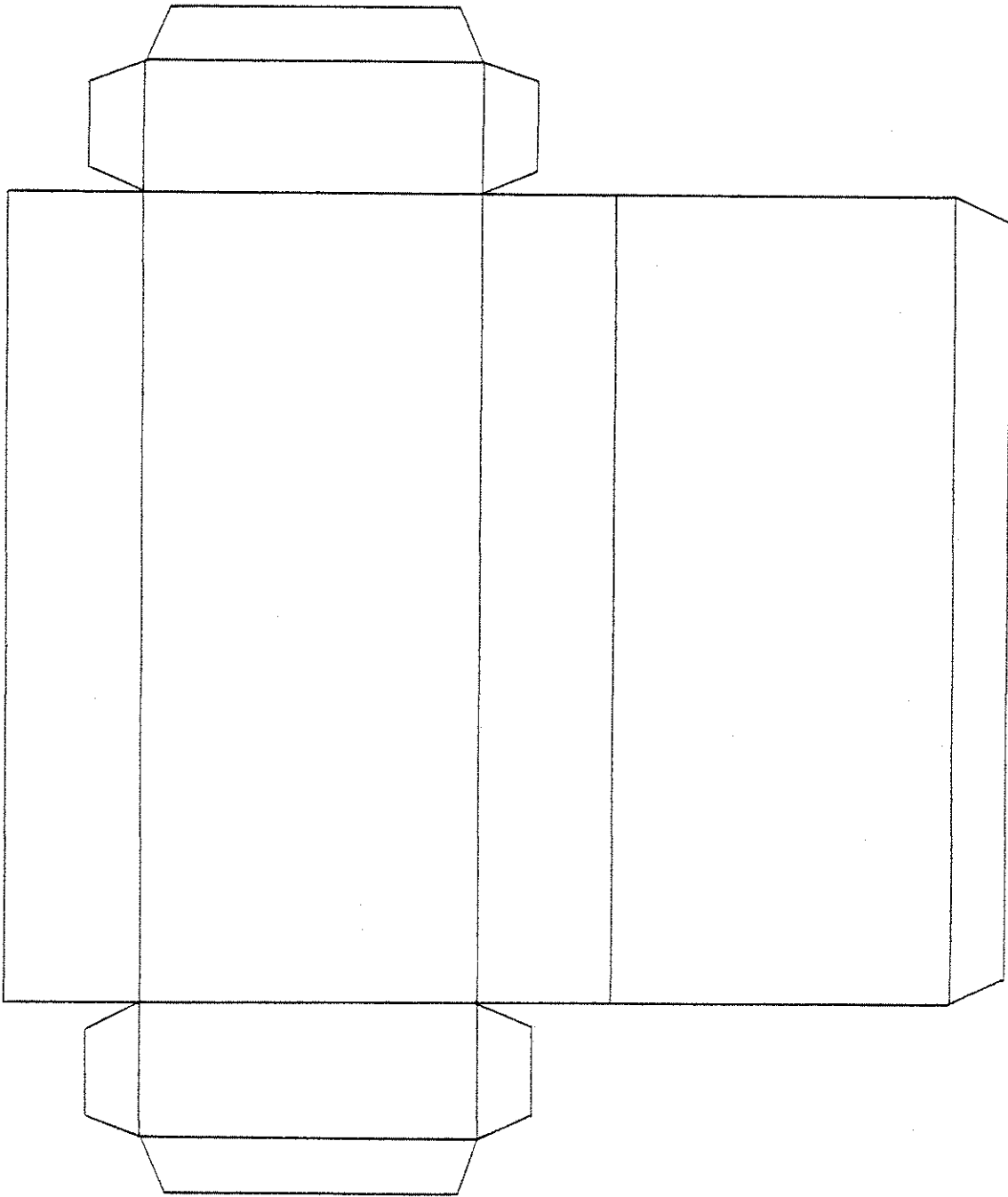
TEACHERS' NOTES:

CONSTRUCT THE BEST BOX

L 5

E 4

V 3

E 2

L 1

■ ● ◆

'Construct the Best Box' is a practical activity that also addresses Number and Shape, Space and Measures.

■ Making and Monitoring Decisions to Solve Problems

Throughout the activity, children will be using a variety of skills, including those of calculating, visualising, measuring and constructing. It is likely they will encounter difficulties in applying these skills on occasions. How children overcome these difficulties will provide evidence relating to level 3.

Typical level 4 performance entails children recognising that they have to find the dimensions of some boxes with capacity 120 cubic centimetres, and working out some correct sets of dimensions. Your judgement of whether children have shown performance at level 5 will be on their entire work throughout the activity, including how they have divided tasks amongst themselves.

● Developing Mathematical Language and Forms of Communication

When children are reporting back to the class, you could collect details on the board of all the different boxes made in the class. These details might be the three dimensions of each box (e.g. 2 x 4 x 15), or the base area and the height (e.g. Base area 8 square centimetres, Height 15cm). At this stage you could assess children's language and communication in relation to typical level 4 performance by asking which box they think is best from the manufacturer's view. Children's responses may include references to the amount of card used in making the box, its stability, the accessibility to its contents, and the amount of space for advertising and information.

◆ Developing Mathematical Reasoning

While children are making different boxes, you should probe their understanding as to why the dimensions of any box give a capacity of 120 cubic centimetres. Then ask how the dimensions of one box are related to the dimensions of another; for instance, 3 x 4 x 10 compared to 6 x 4 x 5. Typical level 4 performance is shown by a child explaining along the lines that multiplying together two of the three numbers in one set gives the same result as multiplying together two of the three numbers in another set (i.e. 3 x 10 = 6 x 5). Typical level 5 performance involves a progression in understanding in that if you halve the length, double the breadth, and leave the height unchanged, then the capacity always remains the same.

INSET PROGRAMME: CONSTRUCT THE BEST BOX

USE	Organising the Class for Assessment	Do INSET MODULE P on pages 134 and 135
	Asking Questions	Do INSET MODULE Q on pages 136 and 137
	Observing and Capturing Ephemeral Evidence	Do INSET MODULE N on pages 110, 111 and 112
	Involving Children in Self-Assessment	Do INSET MODULE L on pages 84 and 85
REVIEW	Obtaining Evidence from the Product of Work	Do INSET MODULE H on pages 47 and 48 (NB the product to consider will be the boxes children have constructed)
	Improving Assessment Skills	Do INSET MODULE J on pages 64, 65 and 66
	Using Assessment Diagnostically	Do INSET MODULE O on pages 113 and 114

PATTERNS TO CREATE AND EXPLAIN

INSTRUCTIONS FOR CLASSROOM USE

Resources: Worksheets 'Squares Within Squares', cm squares paper, calculators, 30cm rulers, pencils.

Time: 50 - 70 minutes.

**Organisation:**   Children working individually.

What to do:

Give each child a copy of the worksheet 'Squares Within Squares', a sheet of cm squares paper, a ruler and a pencil.

Ask the children to follow the instructions on the worksheet to create a succession of squares nested inside each other. Children may use calculators, if they wish, to work out the areas, and to explore the number pattern.

Ask the children to look at the number pattern generated by the areas produced, and to say what they notice about it. Those who recognise that it is a halving pattern should be asked to explain why it follows this pattern.

Then give those children who were successful with the first part of the activity another sheet of cm squares paper. Ask them to draw an isosceles triangle that has a base of 24cm and a height of 12cm.

150
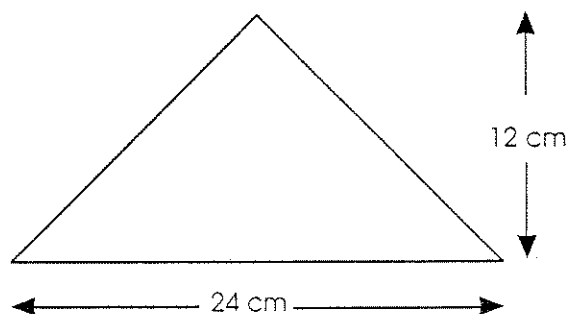
Ask them to draw triangles within triangles in a similar way to how they created a nest of squares.

Again, ask children to focus on the number pattern that is generated by the areas produced, and to say what they notice about it. Those who recognise that each term is one quarter of the previous term should be asked to explain why it follows this pattern.

SQUARES WITHIN SQUARES

Draw a square with sides 16cm.
What is the area of the square?

Then draw another square within the first
square. To do this, mark the point at the
middle of each of the four sides, then join
these middle points together with straight
lines to make a square.
What is the area of the new square?

Then draw another square in the same
way. And so on.

What number pattern do you get for the
areas?

TEACHERS' NOTES:

PATTERNS TO CREATE AND EXPLAIN

'Patterns to Create and Explain' is focused mainly on the development of children's reasoning. This classroom activity also addresses Number and Shape, Space and Measures.

■ Making and Monitoring Decisions to Solve Problems

Some of the main difficulties that children have with the activity are in drawing accurate squares nested inside each other, and in working out the area of each square. How they overcome their difficulties will provide you with evidence relating to level 3.

Typical level 4 performance entails children applying a suitable method for working out the areas of the squares to generate the number pattern. How they work out the areas of the squares with sides that cut diagonally across the squares paper will be particularly informative.

You will probably only want to give some children the task of investigating the number pattern generated by drawing triangles within triangles. You should judge whether children can draw nested triangles with accuracy, and whether they can work out the numbers in the pattern, to see if they are performing at level 5.

● Developing Mathematical Language and Forms of Communication

To assess whether children have shown evidence at level 3, you should see if they understand some of the mathematical terms on the worksheet. You will find that you will have to help some children who have misinterpreted the worksheet instructions with the drawing of the first two squares. If children produce an accurate drawing of several nested squares with little help from you then they have shown evidence at level 4.

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◆ Developing Mathematical Reasoning

While children are working on the squares pattern, you should ask them to predict the next number in the pattern. If necessary, you should prompt children to use a calculator. Typical level 4 performance entails children recognising that it is a halving pattern.

To assess whether children are performing at level 5, you should encourage them to explore the number pattern they are generating from the areas of the triangles. At this stage, it is helpful for children to use a calculator. After drawing the first two triangles, giving areas 144 and 36, ask children to make a prediction about how the pattern is likely to continue. Typical level 5 performance entails children correctly working out the next two numbers in the pattern, and checking that they are right.

INSET PROGRAMME: PATTERNS TO CREATE AND EXPLAIN

USE	Organising the Class for Assessment	Do INSET MODULE I on page 63
	Asking Questions	Do INSET MODULE F on pages 43 and 44
	Observing and Capturing Ephemeral Evidence	Do INSET MODULE D on pages 28 and 29
	Involving Children in Self-Assessment	Do INSET MODULE L on pages 84 and 85
REVIEW	Obtaining Evidence from the Product of Work	Do INSET MODULE H on pages 47 and 48
	Improving Assessment Skills	Do INSET MODULE R on pages 138, 139 and 140
	Using Assessment Diagnostically	Do INSET MODULE E on pages 30 and 31

nfer

Assess and Progress

This resource pack for teachers of key stages 1 and 2 is based on the programme of study Using and Applying Mathematics and its corresponding attainment target. This is the area of National Curriculum mathematics which many teachers have found problematic, both as regards suitable material to use in the classroom and in carrying out everyday assessment.

Assess and Progress responds to these difficulties by providing a range of classroom activities for children, supported by INSET modules which teachers can use to develop their assessment skills. By overseeing the children's classroom activities and working on the INSET modules with colleagues, teachers familiarise themselves with Using and Applying Mathematics and gain the confidence to decide what counts as evidence of performance at each level of a key stage.

The materials in **Assess and Progress** are the fruits of collaboration between teachers of key stages 1 and 2 from several schools and the project team at the National Foundation for Educational Research. The pack has been specially written to relate to the Order in mathematics in the National Curriculum that came into effect in August 1995.

The author, a Senior Research Officer at the NFER, has in recent years worked on a number of mathematics education projects involving the development of classroom materials in co-operation with teachers.

£10