LCP Raising the Standard

LCP ArtyMaths

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Introduction

General

ArtyMaths is an innovative approach that uses visual and kinaesthetic methods to teach maths. These have been shown to motivate the majority of children in mixed-ability group activities. The approach accommodates a variety of learning styles for acquiring mathematical knowledge, and succeeds in generating mathematical vocabulary.

All the activities can be used either as they stand or after modification to suit a different age or ability range. Most of the activities can be easily simplified or extended in terms of the resources and preparation needed and the objectives covered, and ideas for adaptation are provided with each activity.

There are two main aims behind *ArtyMaths*:

- to teach NNS objectives through activities of a generally 'arty' type which children will find 'different' and, most importantly, fun;
- to create a stimulating numeracy environment both in the classroom and around the school.

ArtyMaths activities are half-day workshops, and they exploit various elements from the realm of arts and crafts to secure important numeracy objectives. All these activities have been run successfully in a number of schools across West Yorkshire.

Traditionally, displays in maths areas might consist of a selection of graphs, some charts depicting mathematical symbols, a few lists of key vocabulary, and the odd poster exhibiting fractions and shapes. *ArtyMaths*, on the other hand, always involves some form of drawing, painting, collage or pattern work, and can completely transform the image of maths throughout the school.

Work on paper is replaced in *ArtyMaths* by problems that are physically constructed and can be physically solved. The result (see **Monster problems** and **Translation designs**) is often an eye-catching display that serves as a physical reminder of the mental processes that were involved.

A key feature of *ArtyMaths* is the improvement of children's estimation skills, and a heightening of their sense of proportion, through practical trial-and-error investigations (see **Proportion collages, Weight collages** and **Creative halves**).

Learning is reinforced by resource sheets for the children to complete, and by suggested extensions for the more able. This adaptability of the activities to different age or ability groups is well illustrated by the fact that **Rotational patterns**, **Monster problems** and **Translation designs** have been used successfully right across Key Stage 2, while **Shrinking Sheila** and **Weight collages** have been employed not only across KS2 but also across KS1.

Note that the activity sheets and evaluation sheets have no year-group labels. This enables older children to be assigned an activity that was designed for younger children, without the risk of their feeling ashamed or in some way stigmatised.

All these activities are not only fun to do, but also highly instructive, regardless of the child's age. They are fun because of their kinaesthetic nature, and they are instructive because of their systematic approach. For example, a Year 6 child can surely benefit, just as much as a Year 4 child, from making a translation design, and references to age ranges in the teacher's notes are determined purely by the age-based objectives and vocabulary that the lesson happens to emphasise. This is never meant to imply that there is anything in the activity itself that necessarily disqualifies older or younger children from enjoying it (albeit perhaps in a simplified or more advanced version), and therefore learning from it.

Group work approach

A well known aspect of workshop activities is that they allow children to apply their various strengths (sometimes unsuspected), whether academic, practical or creative. This makes workshops particularly suited to mixed-ability groups, which cannot be said for all numeracy lessons. The activities are designed to allow each child input, and thus to have a personal interest in solving the problem. Even the least practical children will acquire skills through the repetition that is required by an activity, and the continual use and demonstration of appropriate vocabulary gradually improves the understanding of less able children.

In particular, it has been noted by many teachers and assistants, often to their great surprise, that children with special educational needs (re behaviour or numeracy or both) will sometimes become deeply involved in *ArtyMaths* activities, and go on to achieve a high level of understanding.

Introduction continued

What makes *ArtyMaths* fun and 'different' for children is to a large extent the visual 'Wow!' factor, which incidentally makes them ideal materials for inclusion in whole-school maths days or maths weeks (see page 9, **An ArtyMaths day**). What's more, since *ArtyMaths* places such a strong emphasis on group work and collaboration, the work on display can be counted as that of the class as a whole.

Assessment

Given this emphasis in *ArtyMaths* on group work, the assessment of individual attainment needs to be based on the degree to which a child has participated and contributed towards the completion of an activity.

Below is an example of how Level descriptors can be meaningfully used to assess a child's performance in group activities (for *Average,* read Level 3 for a Year 3/4 activity and Level 4 for a Year 5/6 activity):

Below average

Can participate in an activity, but has difficulty in recalling and applying appropriate vocabulary and remembering NNS objectives. Struggles to understand what is meant by – and to follow a systematic approach towards – the outcome of an activity.

Average

Can understand key vocabulary and use it appropriately, in accordance with NNS objectives. For example, 'As I rotated the pentagon template to make my pattern, it matched five times' (see **Rotational patterns**), or 'Two is the only prime number that's even, because any other even number can be divided by at least one number besides itself and one' (see **Colour-and-shape hundred squares**).

Can also grasp and then follow the systematic approach required for a given activity, for example (see **Translation designs**, Year 4), can implement the process of using one-part, two-part and finally three-part templates to find all possible triangles during an investigation of composite shapes, or (see **Rotational symmetry designs**, Years 5/6) can set out the painted squares in the correct order, thus showing an awareness of parallel and perpendicular lines.

Above average

Can exploit a particular activity to improve their grasp of NNS objectives. For example (see **Shrinking Sheila**, Year 3), having participated in the construction of a Shrinking Sheila adventure, can calculate how many whole Sheilas would be equivalent to the Sheila halves, quarters and eighths that were used, or (see **Colour-and-shape hundred squares**, Years 5/6) can create number sequences after devising and investigating formulas.

Throughout the book, NNS Key objectives are highlighted in bold for easy cross-referencing with the strategy. We have also included a table listing all the NNS objectives covered. This can be found on pages 11 and 12.

Evaluation sheet

Each unit comes with an **Evaluation sheet**. These can indicate how much a child has grasped, and will help consolidate what has been learnt. The evaluation sheets make no mention of the year(s) for which the activity was designed.

Teacher's evaluation sheet

Evaluations of group activities must take into account a number of factors. Of importance is not only whether the activity was completed successfully, but also whether the group cooperated, whether appropriate vocabulary was generated, and whether individuals performed to their best ability and were sufficiently challenged. The value of assessing group activities is in the information gained on ways to achieve better cohesion within the class, and with that, a more positive learning environment.

On the CD

The *ArtyMaths* CD is not just a copy of the file enabling schools to customise. It includes additional referenced copies of the photographs and figures in separate folders, so that these can be projected as required.

Teacher's evaluation sheet

■ **Activity:** _____

Was the session successful? Yes / No

How could it have been improved?

.....

.....

Did most children understand the activity and the NNS objectives? Yes / No

If there were problem areas, what were they?

.....

.....

Did any of the children perform below expectations? Yes / No

If so, why?

.....

.....

Did any of the children perform above expectations? Yes / No

If so, how?

.....

.....

Did the activity stimulate appropriate vocabulary? Yes / No

If not, what terminology did the children struggle with?

.....

.....

Did the children work well together? Yes / No

If not, what could have been improved?

.....

.....

An ArtyMaths day

Morning

Year 3	Year 4	Year 5	Year 6

Approximate timings (minutes)

Shrinking Sheila	Monster problems	Colour-and-shape hundred squares	Rotational symmetry designs
Intro/Demo 30	Intro/Demo 30	Intro/Demo 10–15	Intro/Demo 30
Activity 60–75	Activity 45–60	Activity 70–105	Activity 60–90
Plenary 20–25	Plenary 30	Plenary 15	Plenary 30
TOTAL 110–130	**TOTAL 105–120**	**TOTAL 95–135**	**TOTAL 120-150**

Main areas investigated

Equivalence of fractions	Problems to do with proportion	Number sequences	Rotational symmetry
		Properties of numbers	Percentages & ratios

ArtyMaths involved

Storytelling	Collage	Patterns	Designs
Templates	Cutting & sticking	Colour & shape	Mixing colours
Folding		Cutting & sticking	Painting
Cutting & sticking			

An ArtyMaths day

Afternoon

Year 3	Year 4	Year 5	Year 6

Approximate timings (minutes)

Rotational patterns	Proportion collages	Weight collages	Body angles
Intro/Demo 30	Intro/Demo 20–30	Intro/Demo 30	Intro/Demo 30
Activity 45–60	Activity 60–90	Activity 75–105	Activity 90
Plenary 15	Plenary 20	Plenary 20	Plenary 15
TOTAL 90–105	**TOTAL 100–140**	**TOTAL 125–155**	**TOTAL 135**

Main areas investigated

Direction & rotation	Justification of estimates	Quantity & weight estimates	Classification of angles
Right angles	Multiplication by ten	Problems involving mass	Scale

ArtyMaths involved

Patterns	Collage	Collage	Figure-drawing
Water colours	Templates	Cutting & sticking	
Oil pastels	Cutting & sticking		

NB In practical terms, although two ArtyMaths activities in one day is possible, schools generally prefer to do just one large practical activity per day, and spread the activities over an entire maths week. This simplifies the allocation and preparation of resources, and allows for greater time flexibility. Of course, there are many other maths-related activities that a school can include in a maths week, such as quizzes, visits and outdoor maths trails.

NNS objectives

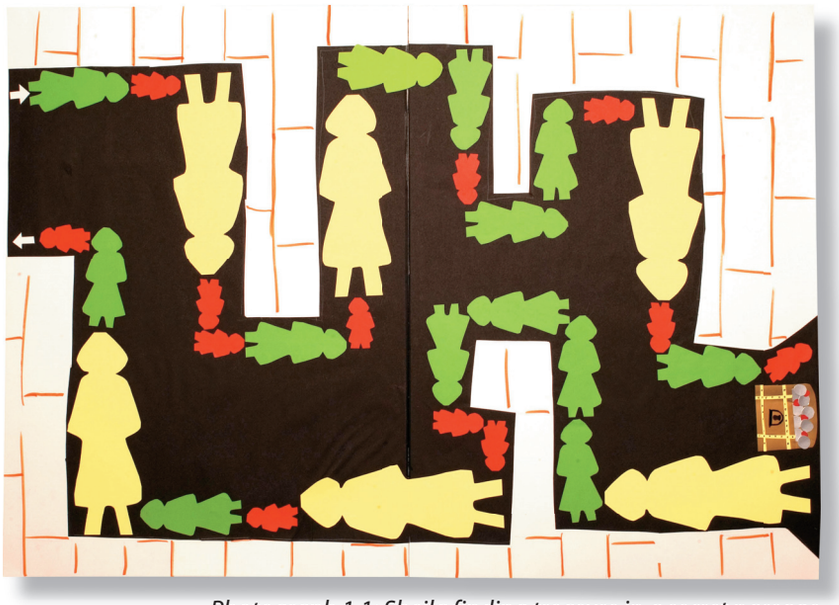
Lesson	Objectives covered
Shrinking Sheila (Year 3)	Y3 ■ **Recognise and find unit fractions.** ■ Recognise equivalent fractions. ■ Compare fractions.
Rotational patterns (Year 3)	Y3 ■ Make and describe shapes and patterns. ■ **Identify right angles** in 2-D shapes. ■ Compare angles with a right angle.
Proportion collages (Year 4)	Y4 ■ **Choose number operations to solve problems in 'real life'.** ■ Use the vocabulary of estimation and approximation.
Monster problems (Years 3 and 4)	Y3&4 ■ **Know by heart the 2, 3, 4 and 5 times tables.** ■ **Solve problems** in 'real life'. ■ Begin to use ideas of simple proportion, for example, 'one for every…'
Translation designs (Years 4, 5 and 6)	Y4 ■ Solve mathematical problems or puzzles. ■ Explain patterns. Y5&6 ■ **Recognise perpendicular and parallel lines.** ■ Recognise where a shape will be after one or more translations.
Colour-and-shape hundred squares (Years 5 and 6)	Y5 ■ Know squares of numbers. ■ Recognise multiples of 6, 7, 8 and 9 up to the 10th multiple. Y5&6 ■ Recognise and extend number sequences. Y6 ■ Explain methods and reasoning orally and in writing. ■ Recognise prime numbers. ■ Solve mathematical problems or puzzles, recognise and explain patterns and relationships, generalise and predict. Suggest extensions asking 'What if…?'
Weight collages (Years 5 and 6)	Y5&6 ■ Use, read and write metric units, including their abbreviations, and relationships between them. ■ Convert larger to smaller units. ■ Choose and use appropriate number operations to solve problems.

NNS objectives continued

Lesson	Objectives covered
Cube structures (Year 5)	Y5 ■ Make shapes with increasing accuracy. ■ Visualise 3-D shapes from 2-D drawings.
Rotational symmetry designs (Years 5 and 6)	Y5 ■ **Relate fractions to division.** Y5&6 ■ **Find simple percentages of small whole-number quantities.** ■ **Solve simple problems involving ratio and proportion.** ■ **Recognise perpendicular and parallel lines.** ■ Recognise where a shape will be after rotation.
Rectangles and triangles (Years 5 and 6)	Y5 ■ Classify triangles. ■ **Use the formula for the area of a rectangle.** Y6 ■ **Find simple percentages of small whole-number quantities.** ■ **Calculate the perimeter and area of simple compound shapes.**
Body angles (Years 5 and 6)	Y5 ■ Identify, estimate and order acute and obtuse angles. ■ Measure and draw lines to the nearest millimetre. ■ Solve simple problems using ideas of ratio and proportion. Y6 ■ **Use a protractor to measure angles to the nearest degree.** ■ Calculate angles in a triangle or around a point.
Creative halves (Years 5 and 6)	Y5&6 ■ Use the vocabulary of estimation and approximation.

Shrinking Sheila

Investigating equivalence of fractions



Photograph 1.1: Sheila finding treasure in a secret passage

Photograph 1.2: Sheila rescuing a rabbit from a fox's den

The photographs above show adventure problems being solved by Shrinking Sheila, using various combinations of her halves, quarters and eighths. She uses her variable size to solve practical problems when daringly rescuing somebody or retrieving something. These problems arise from the geometry of the route to be travelled. For safety's sake, she needs to stick very closely to the surface she is moving along, or up, or down, or around. So she sends her smaller selves – halves, quarters, and eighths – who can fit into smaller nooks and hollows than she could, in a continuous chain. The *Whole* Sheila stays well away from these perilous adventures!

Aims

- Explore the relationships between halves, quarters and eighths through a story format, and thus help children visualise, through practical investigation, the equivalence of fractions.

NNS objectives (Year 3)

- **Recognise and find unit fractions.**
- Recognise equivalent fractions.
- Compare fractions.

Related objectives

An important overall objective is to make it clear that an eighth, like a quarter, is a smaller fraction than a half, even though it has a larger denominator. A common misconception at this age is thus addressed. This activity has in fact been understood by Year 2 children, as an introduction to equivalence of fractions.

Shrinking Sheila

Learning outcomes

At the end of the session, the majority of the children should have:

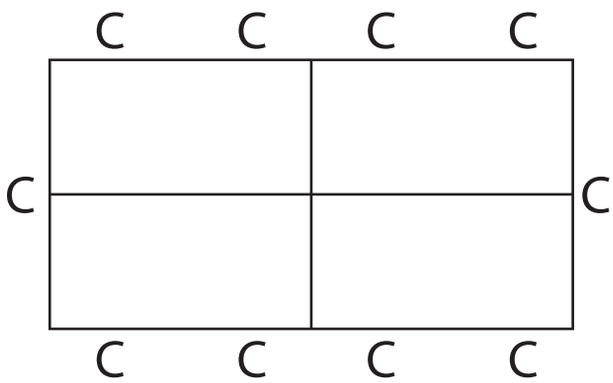
- understood what is meant by the word 'equivalent';
- acquired a sound grasp of the relationships between halves, quarters and eighths.

Key vocabulary

- equivalent: of the same value

Organisation

Two table lengths will be needed for the bases, and the ideal is a group of ten children (c) around four tables:



There should be at least two adults present.

Advance preparation

Resource sheets

Shrinking Sheilas (page 21)
Sheila there and back (page 22)
Match the Sheilas (page 23)
Shrinking Sheila evaluation sheet (page 24)

Preparation for telling the Shrinking Sheila story

You will need fractions of Sheila cut out from coloured paper or (preferably) card: two Sheila Halves (yellow), four Sheila Quarters (green) and eight Sheila Eighths (red). The following procedure is recommended:

- Print out or photocopy **Shrinking Sheilas** (page 21).
- Stick the sheet on to cardboard.
- Label the figures with a 'T' (for template) in the proper colour.
- Cut the figures out of the cardboard.
- Use these cardboard figures as templates.

You will also need a single Whole Sheila of twice A4 length (60 cm). This does not need to be a realistic figure, and in fact it is better for her to be a simple outline (like her fractions), cut out from black sugar paper. However, if you want to add a bit of realism (since she represents the 'original' Sheila), you can use a lighter colour of paper, and draw on to it her face, hair, clothes, shoes and so on.

Of course, each time we halve Sheila's height we also halve her width, in order to preserve proportions, so in fact we *quarter* her area. These mathematical ideas are not covered in Years 3 and 4, but be prepared for some children to express surprise at how much smaller Sheila gets each time her height is halved.

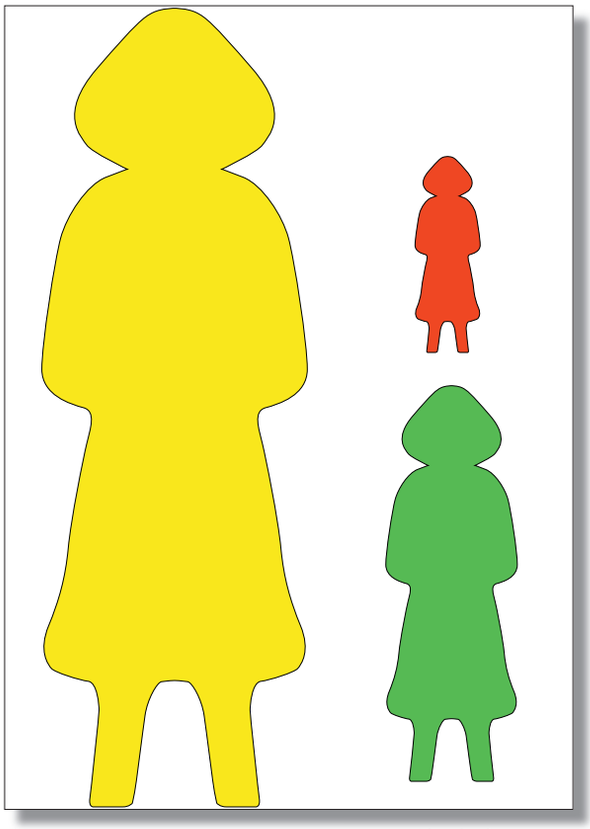


Figure 1.1: Sheila fractions

Shrinking Sheila

Photograph 1.3: Sheila rescuing a boy down a pothole

Preparation for demonstrating how Shrinking Sheila can solve problems

At the end of the story, Sheila takes part in her first adventure by saving a boy stuck down a pothole.

You will need to draw the route on the board. It can be a very simple drawing (the hole minus the Sheilas in Photograph 1.3), but you need to observe the following points:

- The irregularities along the path (e.g. in the sides of a pothole) must be completely fillable either by a half, quarter or eighth of a Sheila, or by any combination of these, including several of the same fraction.
- No part of the route should be narrower than about 25 cm, otherwise the 'homeward-bound' Sheila fractions will not be able to squeeze past those who are 'outward-bound'.
- The pothole should be no more than about 70 to 85 cm deep, and you will need an even mix of Sheila fractions, sufficient to reach the boy and bring him back to the top of the hole.
- To make things more realistic, you could have a small cut-out figure to represent the boy in the hole, and you could keep moving him up the Sheila chain once he has been reached and his rescue is under way.

Preparation for demonstrating how to make Sheila fractions

- Yellow, green and red A4 paper or thin card.
- Sheila templates as specified.

Preparation of children's resources

For making Sheila fractions and sending them on a Sheila adventure, per group of up to ten children:

- an adventure drawing as long as two tables (an extended version of the adventure you demonstrated with, or a different one if you prefer);
- four or five colour-coded card templates of each Sheila fraction;
- 10 to 12 sheets of yellow A4 paper or thin card, and the same number of red and green sheets;
- a pencil and a pair of scissors for each child;
- a reasonable amount of Blu-Tack;
- a single copy of **Sheila there and back** (page 22) for the group to record and compare how many of each Sheila fraction it took to get there and back on each adventure.

Shrinking Sheila

Preparation for Plenary

- Copy of **Match the Sheilas** (page 23) for each child to decide on fraction equivalences.
- Copy of the **Sheila equivalence table** (Photograph 1.4).

Teacher demonstration (30 minutes)

Begin by introducing the Whole Sheila and telling the story of how all the smaller Sheilas came into being. Her first adventure could be made to fit in with current topics (they could scale a pyramid or storm a castle), but for present purposes, let's assume that Sheila lives near a dangerous pothole. Of course, an academically-minded Sheila might find the maths of fractions engrossing enough in itself, and some teachers might prefer to focus purely on that, but the purpose of *ArtyMaths* is to capitalise on children's love of adventures.

Once you've introduced her, stick the Whole Sheila on the board, then begin:

There was once a girl called Sheila who was always unhappy, because she was so much taller than all the other children in her class. In fact, she was almost twice as tall as the next tallest girl! The other children would tease her and call her names. And each night she would cry herself to sleep.

One night, as she was crying herself to sleep, her fairy godmother appeared. 'Oh Fairy Godmother!' said Sheila. 'Please, please make me shorter.'

'As you wish,' said the fairy godmother. 'I'll make you half as tall as you are now,' and with a swish of her wand and a shower of stars she cast a spell, and Sheila became only half as tall.

Place a Half Sheila alongside the Whole Sheila. The children are always surprised at how much smaller the Half Sheila seems than they expected, so you might want to explain that the fairy godmother had to make her half as wide as well as half as tall, otherwise she'd be too wide!

But instead of saying thank you, Sheila looked in the mirror and groaned. 'That's not short enough, Fairy Godmother. I'm still far too tall, and I'm all yellow! Please make me half as tall again!'

'Oh Sheila!' said the fairy godmother. 'If I halve your height again, you'll be ever so short!'

But Sheila insisted, and so with a swish of her wand and a shower of stars her fairy godmother cast a spell, and Sheila became half as tall again.

Place a Sheila Quarter alongside the Sheila Half.

But once again Sheila looked in the mirror and groaned. 'I'm still too tall, and this time I'm all green!' And once again she insisted that her fairy godmother should make her half as tall again. But this time, she became really, really short!

Place a Sheila Eighth alongside the Sheila Quarter.

Sheila looked in the mirror again, and this time she shouted for joy, 'Yes, now I'm really short, so no one can ever call me tall again. I must say, though, it's a shame I've turned all red!'

The next day she went to school feeling much happier. But guess what? The children teased her now because she was so short!

One girl called out, 'Hey, Sheila! What happened? Did you get shrunk in the wash?'

And another girl, who had dropped her rubber on the floor, asked Sheila to pick it up for her, 'since you're so much nearer to it than I am'.

That night, as Sheila lay in her bed, crying herself to sleep once more, her fairy godmother appeared again.

'Oh Fairy Godmother, you were right!' said Sheila. 'I'm too short. Please make me tall again,' she pleaded.

'Oh Sheila, I knew this would happen,' the fairy godmother replied. 'But I'm afraid I'm not very good at undoing spells, and I'm not sure I know how to return you to your old height, although I can try.'

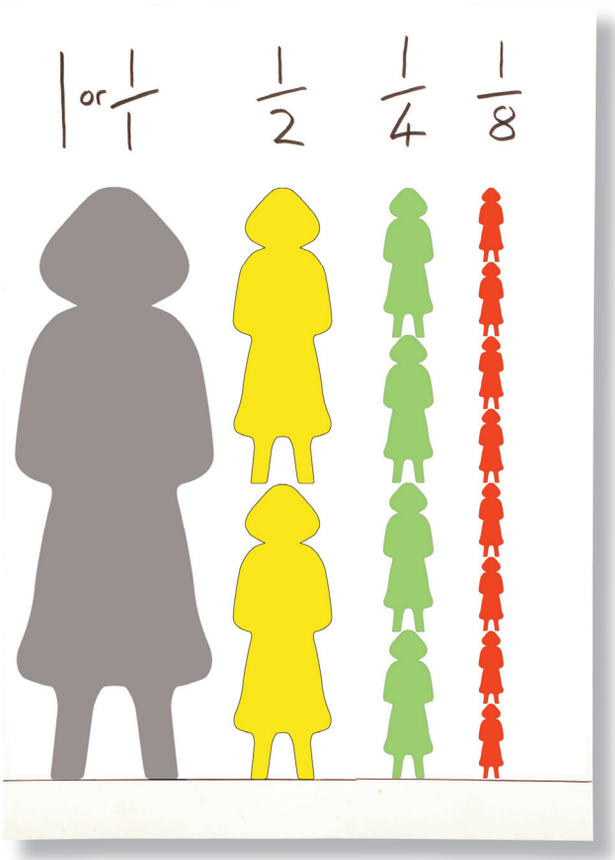
So the fairy godmother thought long and hard, and then with a swish of her wand and a shower of stars she cast another spell. However, what happened next was not exactly what Sheila had hoped for.

First, seven more little Sheila Eighths appeared, each one looking just like Sheila was now.

Now place all the Sheila Eighths one on top of the other to make a Whole Sheila, before you carry on.

Then came three more Sheila Quarters, just like the one she'd already been, and another Sheila Half.

Shrinking Sheila



Photograph 1.4: Sheila equivalence table

'Oh well,' said Sheila. 'At least, in a funny sort of way, I can make myself just as tall as I was before.'

Pause the story at this point and go over the equivalence relationships between the Sheilas, for example, 'How many Sheila Eighths (the red Sheilas) are as tall as a Sheila Half (a yellow Sheila)?'

But then the Sheilas just kept on appearing. 'Oh dear,' said the fairy godmother. 'I thought this might happen!'

Have a few spare Sheilas ready at this point to demonstrate how the fairy godmother has lost control.

The next morning, all the different Sheilas set off to school, and of course this time Sheila was teased because there were so many of her, and she was three different colours!

'Hey, Sheilas! I hope you're not having school dinners, because if you are, there won't be any left for us!' was the sort of comment they had to put up with all day. And to make matters worse, there was only one chair for Sheila, so they all had to climb on top of each other, like a circus act.

After school, at three o'clock, all the unhappy Sheilas trudged off home. Then about ten minutes later, as they were going past a local danger spot known as the Devil's Hole, they heard the voice of a man calling for help. Quickly they made their way across to him and saw that he was lying on the ground and peering over the edge of the hole into the darkness.

'Oh, Sheilas,' said the man. 'You must help me. My son was chasing after a rabbit and has fallen down the hole!'

'But what can we do?' said the Sheilas.

Then the Sheilas remembered how they had all joined up to fit on one chair at school.

'Wait a minute', said the Sheilas. 'We have an idea.'

And with that, they crawled to the edge of the hole and looked down. 'Right,' they said. 'If we all join together we can make a Sheila chain, but in case we go tumbling down the hole ourselves, we must use our different sizes to fit snugly against the side as we climb down, and then back up again, with the boy.'

Using Blu-Tack, stick your pothole route on the board, then begin sticking on the Sheilas, so that they face down the hole, one after the other. Be sure to consult the children as to which Sheilas would best fit into the spaces where the side of the hole keeps changing direction as you go on down. The fit does not need to be exact to the millimetre.

Once the Sheilas reached the bottom and rescued the little boy, they made their way up the other side, head first now, of course.

On this return leg, you should stress possible variations allowed by equivalence, so that, for example, if a space is just big enough for a Half Sheila, you should ask the class which smaller Sheilas could fit in her place. This leads naturally to the explanation that if different combinations of Sheilas can fit in the same space, this must mean that the different combinations are equivalent (or 'equal') in size. Show them the two words, and point out how they both begin with the same three letters. Then complete the story:

The man could hardly believe his eyes when the Sheilas emerged from the dark hole with his little son safe and sound. Word of the Sheilas' brave deed soon spread far and wide, and they quickly became superheroes. They were called upon day and night to perform ever more daring deeds. And now any one of you can learn to make Sheilas, and have them perform equally daring deeds for you!

Shrinking Sheila

How to make Sheilas more quickly with folded A4 sheets

Hold up a piece of yellow A4 paper (or card) with a template for a Sheila Half. Explain that you are going to draw round the template and cut out the shape. Then ask the class how many Sheila Halves they think you can make out of one piece of A4 paper (see Figure 1.2, below).

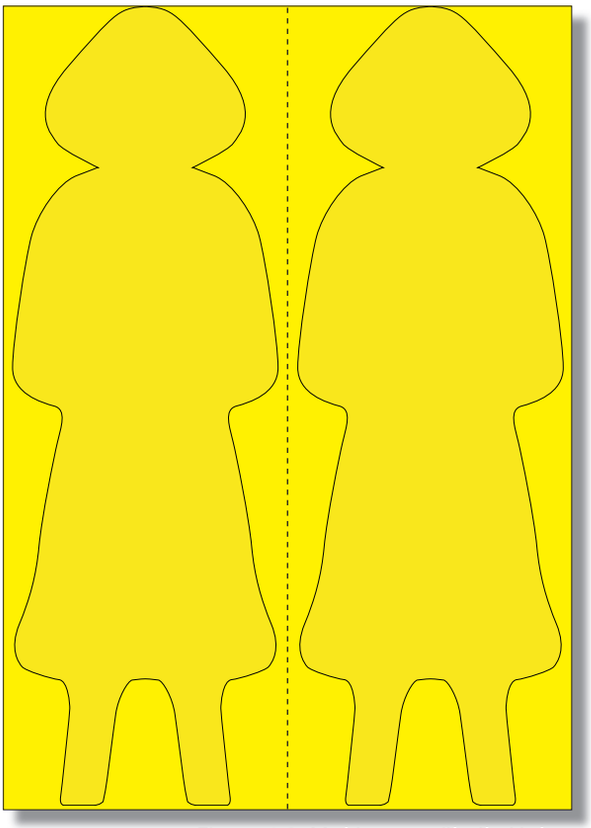


Figure 1.2: Making two Sheila Halves

Often, children will answer 'one', in which case you have to stress that the objective is to make as many Sheilas as possible out of one sheet, and you could ask a child to demonstrate how they could make two.

Next, hold up a piece of green A4 paper with a template for a Sheila Quarter.

Then ask the class how many Sheila Quarters they think you can make out of one piece of A4 paper (see Figure 1.3).

Make sure the children understand that the paper must now be folded widthways rather than lengthways, then show them where to place the template on the paper before they draw round it with a pencil.

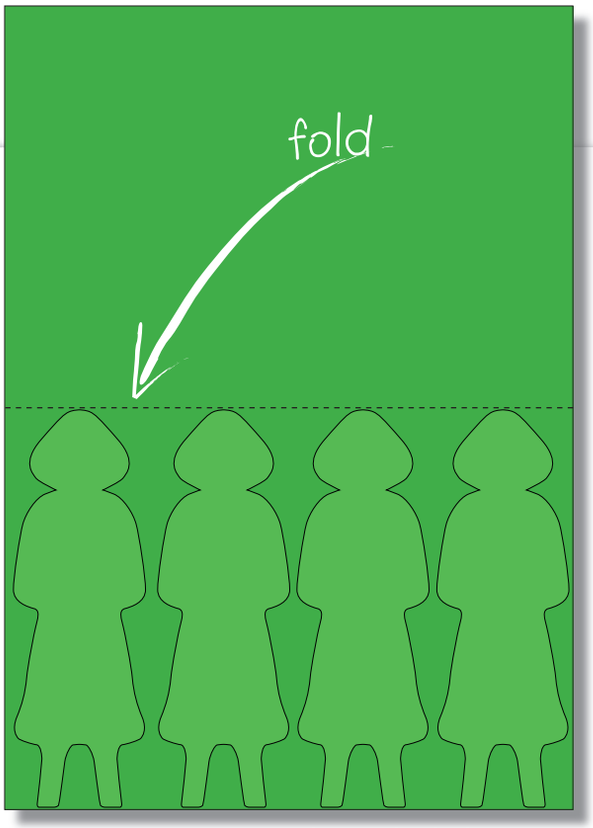


Figure 1.3: Making eight Sheila Quarters

Now hold up a piece of red A4 paper with the template for a Sheila Eighth.

Then, ask how many Sheila Eighths they think you can make out of one piece of A4 paper (see Figure 1.4 below).

Have a child demonstrate how the paper will need folding in half and then half again (remembering the sequence of the fairy godmother's spells) before applying the template.

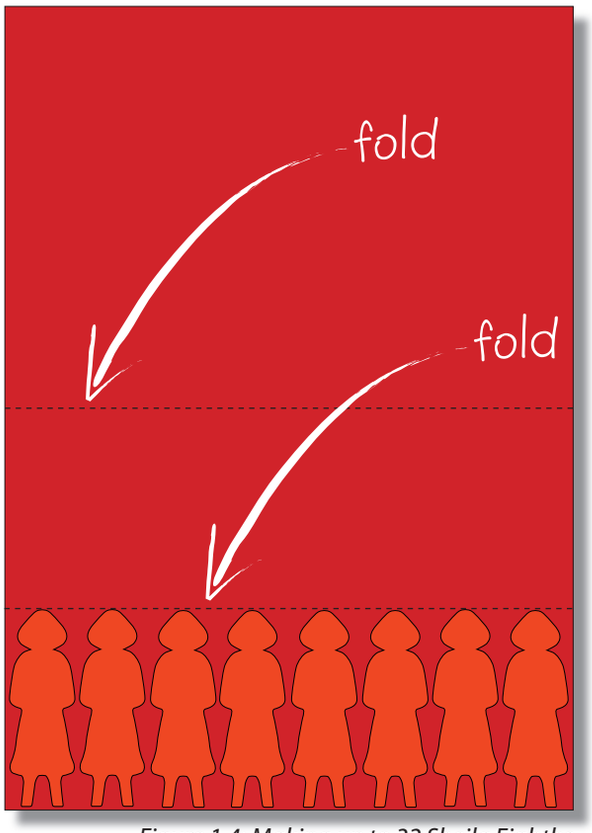


Figure 1.4: Making up to 32 Sheila Eighths

Shrinking Sheila

The children will need to be reminded that by cutting out the Sheilas from folded paper they are always making more than one Sheila at a time. The Sheila Eighths will be very small, so children may not be able to make as many as 32 Sheila Eighths.

Children's activity (1–1¼ hours)

Making Sheilas (25–30 minutes) and completing the adventures

Show each group the Sheila adventure that you want them to complete. If it is a different one from the one you demonstrated with, you'll need to explain the plot (e.g. rabbit to be rescued, treasure to be found), and if you give a different adventure to each of several groups, then of course you'll need time to explain all the plots.

Tell them that for the first part of the activity, they are going to make as many Shrinking Sheilas as possible, to put in a pile at the centre of the table. Remind them quickly how to make the folds, and ask them to make at least one set of each Sheila size.

Once enough Sheilas have been made (30 minutes should easily suffice for an adventure the length of about two tables) the groups can begin placing the Sheilas the way you did in the demonstration. It is important that no Sheilas are stuck down until the group have agreed that the appropriate Sheilas have been used.

Show the children **Sheila there and back** (page 22), and explain that once their Sheilas have been stuck down they can then record the numbers of Sheila Halves, Quarters and Eighths that they used to reach the goal and to return. This resource sheet will be referred to again in the plenary.

Difficulties

Groups will be more likely to make the Sheilas at a similar rate if there is a mix of ability (academic and practical). Some children may have difficulty in folding accurately and will need adult guidance until they get the hang of it. The groups will also need to be checked to ensure that they are positioning the Sheilas sensibly before sticking them down. Less able children should be helped in the use of the correct vocabulary (Sheila Quarter and so on) as they decide which Sheilas should go where, whilst more able children should be investigating possible equivalents.

The teacher and other adults can help to generate vocabulary, and to encourage investigation, by asking questions such as the following:

- Is there enough room for a Sheila Half, or should we use something else (e.g. a combination of different fractions)?
- What would be the best size of Sheila to use here?
- If we didn't have a Sheila Quarter, could we use other Sheilas that are equivalent instead?
- What's the smallest number of Sheilas we could use here?

Whether you say 'Sheila Half' or 'Half Sheila', 'Sheila Quarter' or 'Quarter Sheila', is of course immaterial, but 'Eighth Sheila' is ambiguous, so 'Sheila Eighth' is to be preferred.

Plenary (20–25 minutes)

1. Sheila there and back (page 22)

Get each group in turn to hold up their completed Sheila adventure for the rest of the class to appreciate.

Have each group read out **Sheila there and back** (page 22), then you can choose examples of pupils' work where equivalence is well illustrated, and you can make such generalisations as these:

- When more halves are used, there are fewer quarters and eighths.
- When more quarters and eighths are used, there are fewer halves.

Continue with children giving specific examples of where different combinations of Sheilas have been used in similar spaces, and of how Sheila Eighths were used where taller Sheilas wouldn't fit.

Shrinking Sheila

2. Match the Sheilas (page 23)

Ask each child to circle which of the three answers is right in questions such as the following:

Two Sheila Quarters are	taller than equal to shorter than	one Sheila half
Three Sheila Quarters are	taller than equal to shorter than	one Sheila half

Ideally, have the children complete the sheet while you look over their shoulders with the **Sheila equivalence table** (Photograph 1.4) ready to show them if necessary. Have the children read out the questions, and check that they understand the expressions used: taller than, equal to, shorter than. For each question, have a child illustrate the correct option with reference to the table.

Adaptations

Simplifying the activities

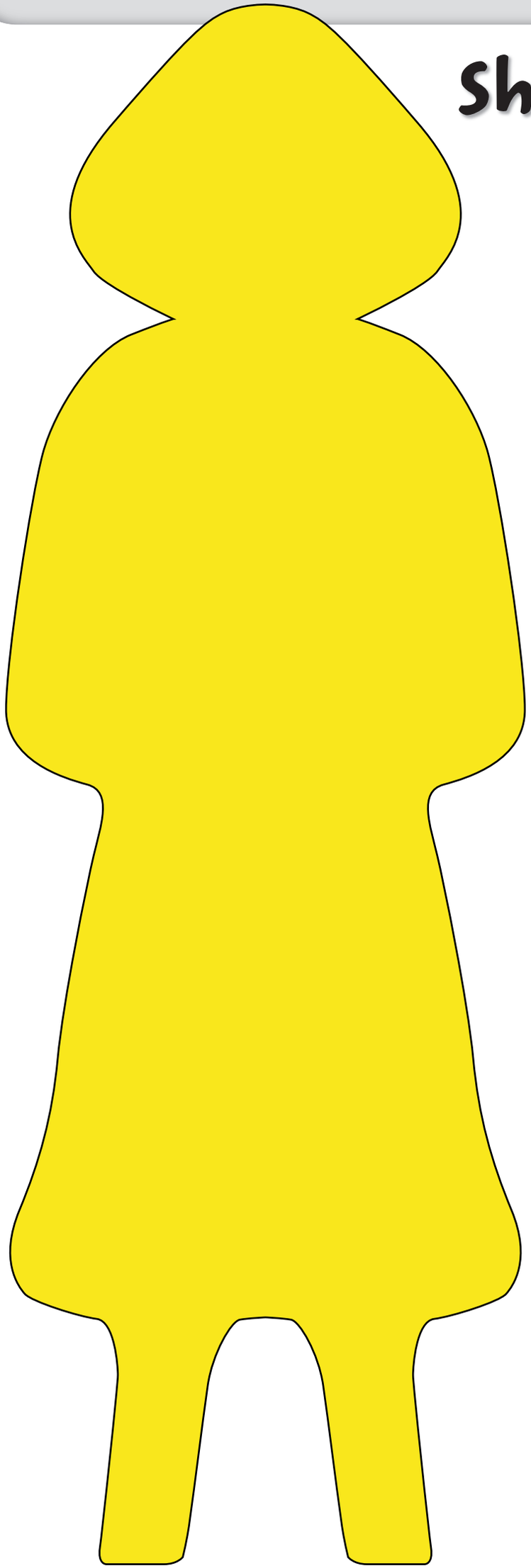
Sheilas can be used even outside the adventure context. For example, the children could be asked to find out how many Sheilas it would take to go and open the window or water the plants.

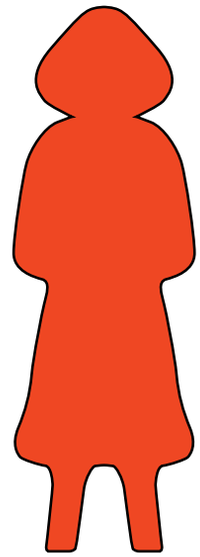
Sheilas could be compared to the heights of children, for example, 'Peter is the same height as seven Sheila Halves or fourteen Sheila Quarters or twenty-eight Sheila Eighths'.

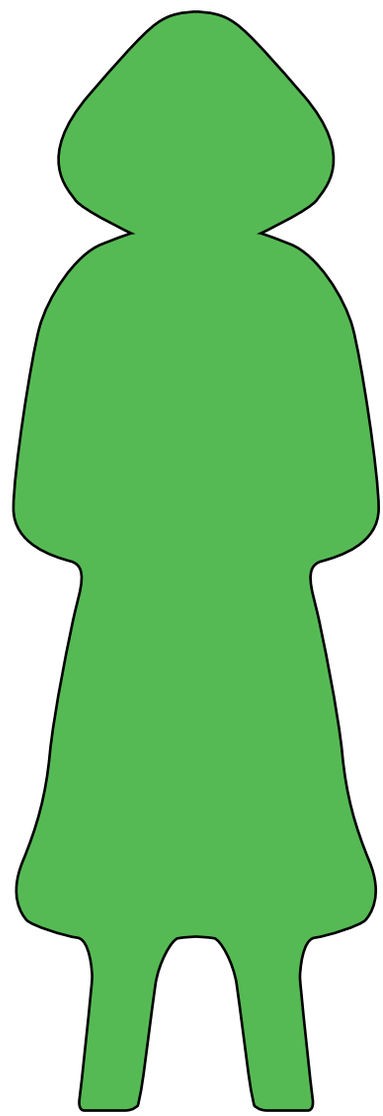
Stretching more able children

More able children can calculate how many Whole Sheilas those used in an adventure were equivalent to, and the answers of course will not always be whole numbers.

Shrinking Sheilas







name:

Sheila there and back

Getting there	Getting back
We used _____ **YELLOW** Sheila Halves	We used _____ **YELLOW** Sheila Halves
We used _____ **GREEN** Sheila Quarters	We used _____ **GREEN** Sheila Quarters
We used _____ **RED** Sheila Eighths	We used _____ **RED** Sheila Eighths
Altogether, we used _____ Sheilas	Altogether, we used _____ Sheilas

name:

Match the Sheilas

A	Two Sheila Quarters are	taller than equal to shorter than	one Sheila Half
B	Three Sheila Quarters are	taller than equal to shorter than	one Sheila Half
C	Two Sheila Eighths are	taller than equal to shorter than	one Sheila Quarter
D	One Sheila Eighth is	taller than equal to shorter than	one Sheila Quarter
E	One Sheila Half is	taller than equal to shorter than	one Sheila Eighth
F	One Sheila Half is	taller than equal to shorter than	five Sheila Quarters

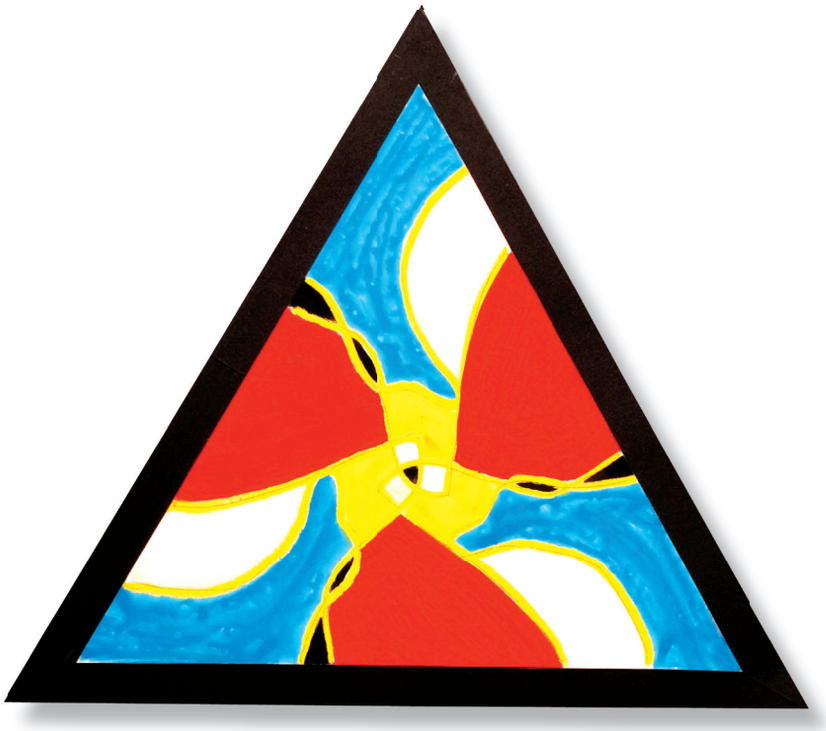
name:

Shrinking Sheila evaluation sheet

I know that a half is a bigger fraction than a quarter.		
I know that an eighth is a smaller fraction than a quarter.		
I know that two Sheila Quarters are the same height as one Sheila Half.		
I know that if two fractions are equal in size they are called equivalent.		
I know that three Sheila Eighths are not equivalent to one Sheila Half.		
I know that two Sheila Quarters and one Sheila Half are equivalent to a Whole Sheila.		

Rotational patterns

Creating rotational patterns from 2-D shapes



Photograph 2.1: Triangular pattern

This simple investigative activity produces beautiful patterns.

Aims

- Extend children's understanding of regular 2-D shapes and related vocabulary through making patterns.
- Relate their work to the rotation of shapes in whole, half and quarter turns.
- Enable children to think creatively about the interaction of colours when creating simple rotational patterns.

NNS objectives (Year 3)

- Make and describe shapes and patterns.
- **Identify right angles** in 2-D shapes.
- Compare angles with a right angle.

Related objectives

Since these patterns have rotational symmetry, the activity would also be suitable for Year 4/5/6 work on the rotation and classification of angles.

Photograph 2.2: Rectangular pattern

Photograph 2.3: Pentagonal pattern

Photograph 2.4: Hexagonal pattern