

Scottish Survey of Literacy and Numeracy (SSLN)

Professional Learning Resource

Pupil performance in
estimating and rounding



Pupil performance in estimating and rounding

Introduction

Analysis of the responses to the estimating and rounding questions in the 2011 SSLN numeracy survey identified the following areas impacted upon learners' performance:

1. Knowledge and understanding of key concepts within other experiences and outcomes in numeracy and mathematics
2. Application of knowledge and understanding from across the numeracy organisers

1. Knowledge and understanding of key concepts within other experiences and outcomes

Learners' responses to estimating and rounding questions were influenced by their understanding of key concepts from other numeracy organisers including fractions, decimal fractions and percentages and number and number processes.

Children and young people were less successful in completing estimation and rounding questions involving:

- Fractions, decimal fractions and percentages: decimal numbers
- Number and number processes: place value
- Number and number processes: larger numbers

Aspects of learning, within the experiences and outcomes, which impacted on learners' performance in estimating and rounding questions have been highlighted throughout this section.

2. Application of knowledge and understanding of numeracy organisers

Within SSLN surveys, learners are required to make connections across their learning. For example, a question involving data and analysis may also include numerical values expressed or displayed as decimal fractions.

When planning for learning, teaching and assessment in numeracy, learners should be provided with many opportunities to apply their knowledge and understanding from across the numeracy organisers. Staff should consider how often their planning for learning identifies connections between numeracy organisers. Making explicit links between associated experiences and outcomes will support learners to make connections and apply their knowledge in different contexts.

Estimation and Rounding - P4 – First Level

The main area impacting on Primary 4 learners' performance in estimation and rounding was their knowledge and understanding of:

- number and number processes experiences and outcomes

Other aspects impacting upon learners' performance at this level included:

- the number of operations and steps involved in a question
- using and understanding appropriate mathematical notation and vocabulary
- learners' ability to check the reasonableness of their answer

Early level	First level
<i>I am developing a sense of size and amount by observing, exploring, using and communicating with others about things in the world around me.</i> <i>MNU 0-01a</i>	<i>I can share ideas with others to develop ways of estimating the answer to a calculation or problem, work out the actual answer, then check my solution by comparing it with the estimate.</i> <i>MNU 1-01a</i>

Rounding

Strength

Rounding to the nearest 10

At Primary 4, learners were able to round two digit numbers to the nearest 10. Learners were also able to round where this occurred within a context or word problem. The example below demonstrates the type of question that three quarters of learners at P4 answered correctly.

Ben counts 48 books on the bookshelf.

Round 48 to the nearest 10.

Answer: _____

Area for improvement

Rounding 3 digit numbers to the nearest 10

Learners at Primary 4 were not as proficient when rounding 3 digit numbers to the nearest 10. Two fifths of respondents failed to provide the correct response to this type of question. Developing an in-depth understanding of the concept of place value will provide learners with a understanding of how numbers are composed. This knowledge will support learners to round appropriately, taking account of the context or question.

A fast food take away uses 428 kg of rice in one month.

Round this number to the nearest 10kg.

Answer: _____ kg

I have investigated how whole numbers are constructed, can understand the importance of zero within the system and can use my knowledge to explain the link between a digit, its place and its value.

MNU 1-02a



Reflective Questions:

- How can the concept of rounding 2 digit numbers be extended to 3 digit numbers and beyond?
- What types of visual representations are used across the school to support understanding of rounding?
- How often are learners asked to round, where consideration of the context determines the answer?
- How confident are learners in their understanding of place value?
- How much time is spent teaching learners how to use non-standard partitioning strategies for calculations? (e.g. Make '344' – standard partitioning would achieve an answer such as $300 + 40 + 4$ non-standard partitioning would achieve an answer such as $170 + 130 + 25 + 15 + 3 + 1$)

Teaching and Learning (T&L) and Career Long Professional Learning (CLPL) resources:

- **T&L** Rounding to the nearest hundred using rounding rules
Mathcoach interactive 3 minute youtube video using number lines to demonstrate how to round to the nearest 100
<http://www.youtube.com/watch?v=bx-XKcgKqzc>
- **T&L** Topmarks interactive whiteboard resources
A variety of interactive tools for exploring place value
First level interactive resources for teaching place value:
<http://www.topmarks.co.uk/Interactive.aspx?cat=11>



Areas for improvement

Using rounding as a strategy for calculating

Learners experienced difficulty when asked to round two-digit numbers to estimate answers to calculations. Less than half of Primary 4 learners were able to accurately apply the strategy of rounding to estimate an appropriate answer.

What is the best way of estimating a total for this addition?

$$11 + 17 + 23 + 48$$

Tick (tick symbol) the best way.

- A $10 + 10 + 20 + 40$
- B $10 + 10 + 20 + 50$
- C $10 + 20 + 20 + 40$
- D $10 + 20 + 20 + 50$

I can use addition, subtraction, multiplication and division when solving problems, making best use of the mental strategies and written skills I have developed. MNU 1-03a

A quarter of learners answered 'A'.

Why do you think this is?

Reflective Questions:

- How often do we ask learners to round to find an approximate answer?
- How much exposure do learners have to the language and vocabulary of estimation and rounding?
- What do learners understand is the difference between rounding and estimation and can they explain how they are different and how they are linked?

Teaching and Learning:

- **T&L** Estimation - rounding numbers. BBC class clip 10251
Contextualised 2 minute video clip involving pirates and rounding to find an approximate answer
<http://www.bbc.co.uk/learningzone/clips/estimation-rounding-numbers/10251.html>
- **T&L** Glowla's Estimation Contraption
Interactive 'against the clock' game encouraging pupils to calculate written algorithms using rounding
<http://pbskids.org/cyberchase/media/games/ballparkestimation/ballparkestimation.html>



Estimating

Strength

Estimating in real life, familiar contexts

Almost all learners were able to estimate the length of time taken to carry out familiar, everyday tasks. They demonstrate a good sense of how long everyday activities take and can estimate a sensible amount of time for these activities. Real life experiences have a positive impact on pupils' ability to estimate.

How long do you think it takes to boil a kettle?

- A. 3 seconds
- B. 3 minutes
- C. 3 hours
- D. 3 days



Reflective questions:

- How are staff planning for rich opportunities for real life application of estimating and rounding?

Area for improvement

Interpreting contextualised, word based tasks

Regular, real life, contextualised opportunities to engage in activities involving mental calculations will encourage learners to identify rounding as a useful strategy to find an approximate answer quickly. The application of rules for estimating and rounding is often determined by the context of the question. Contextualising tasks is vital in supporting learners to consider, and make decisions about, the most efficient strategy to use.

Gran goes to the shop. She has these coins [indicate coins to pupil]

She wants to buy some bananas. What is the largest number of bananas she can buy for her money? Think of a quick way to work out the answer in your head.

[Allow no more than 15 seconds thinking time, then prompt for answer.]

29p



Around one third of Primary 4 learners were able answer this question and articulate how they worked out their answer. When a question involved more than one step, there was a marked drop in learners' performance.



Reflective Questions:

- How much exposure are learners given to real life, relevant, contextualised problems?
- To what extent do learners rely on rote procedures, such as identifying a specific strategy and using it, without going back to check the reasonableness of their answer?
- How reliant are learners on the use of written algorithms and exact answers or have they developed a range of estimation and mental calculation strategies?
- How regularly do we provide learners with opportunities to tackle multistep, mental calculation tasks?
- How efficient are the strategies learners are using to calculate mentally?
- How often do staff plan for and use oral diagnostic assessment?

Teaching and Learning and Career Long Professional Learning resources



- **T&L** Introduction to division with remainders BBC class clip 1807
Short video posing real life problems involving division with remainders
<https://www.bbc.co.uk/programmes/p018brxq>
- **T&L** Division with remainders BBC class clips clip 857
Short video posing a real life problem involving division with remainders
<https://www.bbc.co.uk/programmes/p017y2k7>

- **CLPL/T&L** CPALMS: Those Pesky Remainders

This resource includes lesson plan with teacher resources (including powerpoint and summative assessments) for supporting learners to account for remainders

<https://www.cpalms.org/Public/PreviewResourceLesson/Preview/29139>

Strength

Identifying strategies for estimating quantity

Around three quarters of all learners were able to visually/mentally estimate quantities when they were arranged in standard formats and explain strategies for doing so. Learners' responses indicate that they were counting in 10s. Under a third of learners needed to count the number of items in a row, while the majority of learners chose to either skip count in tens or add up the number of rows and multiply by 10.

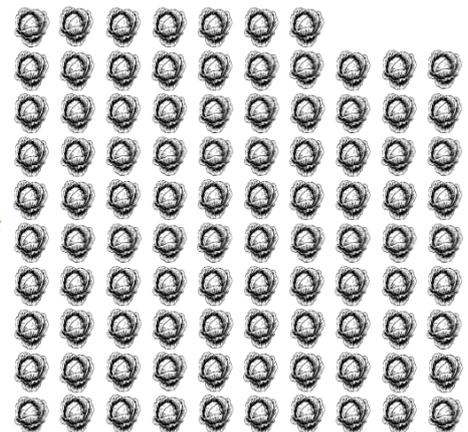
Learners may have been applying their knowledge of pattern and sequence to help them estimate.

I'm going to show you a picture of a farmer's field.

I want you to have a quick look at the picture, then estimate how many cabbages are in the field.

[Show the image of cabbage patch for 3 seconds (count silently to yourself: one elephant, two elephants three elephants), then turn over the page.]

1. About how many cabbages are in the field?



Now I'll give you a longer look at the field of cabbages, so that you can check your estimate. Then you can tell me again how many cabbages are in the field. But please don't try to count every cabbage. Try to think of a quicker way to work it out.

[Show image of field of cabbages, and allow about half a minute.]

2. Now how many cabbages do you think are on the page?
3. How did you work that out?

Area for improvement

Applying strategies for estimating quantity

Less than half of all learners were able to respond to this type of question within a given time frame. Subitising, the ability to see a quantity at a quick glance, is a skill that has been found to form the basis of understanding many other aspects of numeracy and mathematics. This skill can support learners associating numbers with quantities and understanding of the four operations. Subitising is often practiced and developed with early level learners using dominoes or cards with regular number patterns. It is also important to provide learners with experience of non-standard or irregular number patterns to allow flexibility in thinking about number.



Reflective Questions:

- How often are learners asked to estimate quantities when they are presented in visual, non-standard formats?
- What opportunities are provided for learners in the early years to develop their ability to estimate quantities from both concrete and visual representations?
- What strategies, used to teach number and number processes could learners add to their 'tool kit' and apply to other areas of numeracy and mathematics?
- How much importance is placed on getting an approximate answer?
- To what extent is estimating, in early and first level numeracy and mathematics, part of ongoing teaching and learning?

Teaching and Learning (T&L) and Career Long Professional Learning (CLPL) resources:

- **T&L** TES website: subitising powerpoint
<https://www.tes.com/teaching-resource/subitising-updated-version-2-11520986>
(Free registration and login required.)
- **CLPL** LearnZillion: Find the area of a rectangle: using arrays
Short video demonstrating how familiarisation with arrays can be applied to finding the area of a rectangle.
<http://learnzillion.com/lessons/343-find-the-area-of-a-rectangle-using-arrays>
- **CLPL** Teaching channel: visualising number combinations
Short video demonstrating a teacher using subitising to support learners' number development
<https://www.teachingchannel.org/videos/visualizing-number-combinations>



Estimation and Rounding - P7 - Second Level

The main areas impacting on Primary 7 learners' performance in estimation and rounding was their knowledge and understanding of:

- number and number processes
- fractions, decimal fractions and percentages and
- data and analysis

Other aspects impacting upon learners' performance at this level included:

- seeking and identifying strategies and reasoning
- comprehension and interpretation of the question and
- learners' ability to check the reasonableness of their answer

First level	Second level
<p><i>I can share ideas with others to develop ways of estimating the answer to a calculation or problem, work out the actual answer, then check my solution by comparing it with the estimate.</i></p> <p style="text-align: right;"><i>MNU 1-01a</i></p>	<p><i>I can use my knowledge of rounding to routinely estimate the answer to a problem then, after calculating, decide if my answer is reasonable, sharing my solution with others.</i></p> <p style="text-align: right;"><i>MNU 2-01a</i></p>

Rounding

Strength

Rounding decimal fractions involving tenths

Almost all learners at Primary 7 were able to provide the correct response to this type of question.

Which of the following is closest to 40 seconds?

A 40.3

B 39.7

C 39.9

D 40.2

D was the most common incorrect response - why do you think this is?

Rounding

Strength

Using rounding to estimate calculations involving whole numbers and 2 digit decimal fractions.

Three quarters of learners were able to apply their rounding strategies to estimate the answer to calculations involving decimal fractions.

Use estimation to identify the correct answer for 14×3.2

Tick one box

- A 448
- B 44.8
- C 4.48
- D 0.448

I have extended the range of whole numbers I can work with and having explored how decimal fractions are constructed, can explain the link between a digit, its place and its value.

MNU 2-02a

In this example, we might expect learners to estimate the answer through $10 \times 3 = 30$ leading to option B: 44.8; three quarters of Primary 7 learners answered B. In analysing children's responses it is not feasible to determine whether learners calculated the answer, rather than estimating.



Reflective Question:

- How well do learners use their estimation strategies when faced with calculations involving fractions, decimal fractions and percentages?
- How well are we supporting learners to use estimation skills along with more formal written methods?

Application of estimation and rounding strategies in calculations

When learners were asked to estimate the answer to a calculation involving 2 digit by 2 digit multiplication, around a third were able to identify rounding and use it correctly as a strategy to successfully estimate their answers.

Learners' ability to use estimation and rounding to judge the reasonableness of their answer, relies on a fundamental understanding of number; particularly place value. If learners are introduced to written methods for calculations, without a concrete understanding of the number system, they may abandon estimation strategies. Therefore, when introducing learners to formal written methods, it is important to emphasise that approximation, to gain a sense of the accurate answer, is a necessary skill.

**Reflective Questions:**

- When approaching a new, unfamiliar problem, how much time is spent allowing learners to discuss the possible strategies they may use for approaching the task?
- How much time is given to discussing how to use estimation and rounding as a strategy to support calculations?

Teaching and Learning (T&L) and Career Long Professional Learning (CLPL) resources:

- **T&L:** BBC Skillswise Rounding and Estimating
Short video considering the importance of estimation and rounding in real life contexts.
<http://www.bbc.co.uk/skillswise/topic/rounding-and-estimating>
- **T&L:** Countdown numbers game
Interactive whole class mental maths game involving a target number and a list of numbers that can be used to achieve that target. Teachers can choose the answer range according to learners' ability.
<https://nrich.maths.org/6499>
- **CLPL:** Video to demonstrate how area models work
<http://www.khanacademy.org/math/arithmetic/multiplication-division/area-models-multiplication/v/area-model-for-multiplication>



- CLPL:** Ted Talks: Conrad Wolfram: Teaching kids real math with computers
 Explores the importance of estimation in numeracy and mathematics where computers do the calculations for us.
http://www.ted.com/talks/conrad_wolfram_teaching_kids_real_math_with_computers.html

Rounding

Area for improvement

Rounding quantities in context

When Primary 7 learners were faced with large numbers in context, just over half of them were able to answer this question correctly.

Around a quarter of learners did not round to the nearest million, as requested, when answering this question.

The table shows the populations of the countries in the UK in 2011.

Country	Population
Northern Ireland	1 811 600
Wales	3 064 400
Scotland	5 295 900
England	53 762 900

Estimate to the nearest million, the total population of Scotland and Northern Ireland.

Answer: _____ million

Having discussed the variety of ways and range of media used to present data, I can interpret and draw conclusions from the information displayed, recognising that the presentation may be misleading.

MNU 2-20a

It is difficult to establish whether learners’ difficulties in these types of questions was determined by either a lack of familiarity of working with numbers to millions, and a good understanding of place value, or the skill of interpreting questions.



Reflective Question:

- How often do we allow learners the opportunity to work with real figures – for example statistical information from newspaper articles or scale in map work?

Teaching and Learning:

- **T&L** Powerpoint presentation – how to read numbers to millions and identifying place value of digits in millions.

mathjourneys.com/slideshows/placevalue4point1a.pptx

* *in order to gain access to this source, this address must be pasted into the url bar*



Rounding

Strength

Rounding within familiar contexts

Learners are able to take account of the context. They recognise and apply rounding strategies in the context of money. Almost two thirds of respondents could answer this type of question correctly.

Kris buys an MP3 player costing £124.50. He pays for it using £10 notes and receives some change.

How many £10 notes does he need?

Answer: _____ notes

However, in the question below, while just over half of the pupils answered this correctly, around a fifth of pupils failed to round up as the context demanded.

Aneka buys a small tablet costing £85.95. She pays for it using £5 notes and receives some change.

How many £5 notes does she need?

Answer: _____ notes

One quarter of P7 learners answered 15 to this type of question.



Reflective questions:

- How often are learners asked to round, where consideration of the context determines the answer?
- To what extent do learners rely on using rote procedures and /or specific strategies?

Estimating

Strength

Estimating quantities involving 2 digit decimal fractions

When the relationship between two numbers has a straight forward correspondence, where one number is an easily recognised multiple of the other and some direction was provided in the question, learners performed well.

Two thirds of learners were confident in identifying the answer when it involved near doubles in this type of question.

Size of garden by type of plant

	Area (square metres)	Approximate length (metres)
herb	62.4	7.3
cactus	60.7	12.0
rose	57.2	22.6
heather	91.5	17.6
fruit tree	42.6	14.2

I have explored the contexts in which problems involving decimal fractions occur and can solve related problems using a variety of methods.

MNU 2-03b

Compare the length of the rose and cactus gardens.

Fill in the gap:

The rose garden is nearly _____ times as long as the cactus garden.

Estimating

Area for development

Estimating to compare the relative size of different quantities

Under half of P7 learners were able to answer this question correctly. One fifth of learners subtracted to achieve an answer of 15.3, highlighting learners' misinterpretation of the question caused by failing to read and understand contextualised tasks.

Size of garden by type of plant

	Area (square metres)	Approximate length (metres)
herb	62.4	7.3
cactus	60.7	12.0
rose	57.2	22.6
heather	91.5	17.6
fruit tree	42.6	14.2

I have investigated the everyday contexts in which simple fractions, percentages or decimal fractions are used and can carry out the necessary calculations to solve related problems.

MNU 2-07a

Compare the **length** of rose and herb gardens.

Fill in the gap:

The rose garden is over _____ times as long as the herb garden.

Knowledge of fractions, decimal fractions and percentages, including ratio and proportion and data handling may have an impact on learners' responses in this type of question. Interpretation of the question may also have had an impact on performance.

More time spent on tackling a variety of word problems would be beneficial to support learners in developing their skills of comprehension and interpretation in contextualised numeracy tasks.



Reflective Questions:

- To what extent are staff teaching estimation and rounding as a useful strategy for mental calculation?
- How do staff model thought processes and strategies involved in estimation and rounding?

Teaching and Learning and Career Long Professional Learning resources:



- **T&L** Scholastic Study Jams: Maths Problem Solving
Interactive tool to practice rounding skills
<http://studyjams.scholastic.com/studyjams/jams/math/addition-subtraction/estimate-sums-diffs.htm>
- **CLPL** New Zealand Maths Picture Books with Mathematical content
List of mathematical stories, for all stages, to develop learners problem solving and interpretation skills.
<http://www.nzmaths.co.nz/picture-books-mathematical-content>

Estimation and Rounding - S2 - Third Level

The main areas impacting on S2 learners' performance in estimation and rounding was their knowledge and understanding of:

- number and number processes
- fractions, decimal fractions and percentages and
- data and analysis

Other aspects impacting upon learners' performance at this level included:

- learners' resilience to complete more challenging tasks
- comprehension and interpretation of the question
- using and understanding appropriate mathematical notation and vocabulary

Second level	Third level
<i>I can use my knowledge of rounding to routinely estimate the answer to a problem then, after calculating, decide if my answer is reasonable, sharing my solution with others.</i> <i>MNU 2-01a</i>	<i>I can round a number using an appropriate degree of accuracy, having taken into account the context of the problem.</i> <i>MNU 3-01a</i>

Rounding

Strength

Strategies for rounding – rounding to a given degree of accuracy

Learners at S2 were able to round decimal fractions, including rounding within a context.

Round 42.276 to one decimal place

Answer: _____

A classroom has two thermometers.

The digital thermometer shows a temperature of 24.5°C, rounded to the nearest 0.5 °C.

The other thermometer shows 24 °C, rounded to the nearest whole degree.

What could be the actual temperature?

Tick one box.

- A. 24°
- B. 24.2°
- C. 24.3°
- D. 24.5°

Rounding

Area for improvement

Rounding decimal fractions

In order to be able to estimate and round decimal fractions confidently, learners must have a firm grasp of place value. This involves having a good understanding of the relationship between the digits and having the ability to deconstruct a number into its constituent parts. Around two thirds of pupils in S2 were not able to answer estimation and rounding tasks which involved knowledge and understanding of place value.

Which of the following is 69.3428 rounded to the nearest hundredth?

- A 100
- B 70
- C 69.3
- D 69.34
- E 69.343

*One third of S2 learners
answered E*

*Why do you think this
was?*

*I can use my understanding of
numbers less than zero to
solve simple problems in
context.*

MNU 3-04a



Reflective Questions:

- How often do we revisit understanding of place value?
- How often, within our approaches to learning and teaching, do we ask pupils to verbalise their responses in order to assess understanding of decimal fractions?
- What opportunities are provided for learners to explore how decimal fractions are composed?

Teaching and Learning (T&L) and Career Long Professional Learning (CLPL) resources:

- **T&L New Zealand Maths:** Rounding numbers resource
Provides contexts for exploring rounding numbers, taking into consideration place value.
<http://nzmaths.co.nz/resource/rounding-numbers>
- **T&L BBC Bitesize GCSE:** Rounding and Estimating
<http://www.bbc.co.uk/schools/gcsebitesize/maths/number/roundestimaterev1.shtml>



Rounding

Area for improvement

Choosing the appropriate degree of accuracy, having taken into account the context of the problem

Learners' ability to estimate and round numbers in unfamiliar contexts will be influenced by their depth of understanding and experience of using decimal fractions in real life contexts.

How accurate do you think this measurement needs to be?

The Olympic record time for the 100 metre hurdles.

- A to the nearest minute
- B to the nearest second
- C to the nearest tenth of a second
- D to the nearest hundredth of a second



Reflective Questions:

- What level of understanding do learners have of place value and can they apply it accurately and consistently across learning?
- In which subjects do learners have exposure to, and the opportunities to work with, decimal fractions?
- To what extent have learners had the opportunity to work with decimal numbers in real life contexts?

Teaching and Learning and Career Long Professional Learning Resources:

- **T&L TES Teaching Resources** Real Life Calculations with decimals
PDF with a variety of word problems involving decimals from different, real life, relevant contexts. (Learners should be encouraged to estimate their answers first.)
<https://www.tes.com/teaching-resource/real-life-calculations-with-decimals-6315267>
Free registration and login required.
- **T&L Twig On Glow:** Maths – Accuracy and Proof/Measurement – Accuracy and Estimation
Variety of short films and accompanying teaching materials exploring value of estimation and rounding
<http://www.twigonglow.com/mind-map/#411/accuracy-and-estimation/>
- **T&L BBC Class Clips:** How much fuel does an aeroplane need?
Explores the value of using estimation and rounding in the context of passenger airline flights.
 1. Exploring luggage weight:
<https://www.bbc.co.uk/programmes/p00wjb33>
 2. Exploring passenger weight:
<https://www.bbc.co.uk/programmes/p00wjycc>



Applying rounding as a strategy for calculating involving decimal fractions

Approximately one third of learners at S2 were able to apply the strategy of rounding to estimate answers to calculations involving decimal fractions. Where learners did round, approximately one third treated the numbers as whole numbers, opting for 6.0 as their answer, not taking account of place value of decimal fractions.

The value of 0.306×2.16 is approximately:

- A 60
- B 6.0
- C 0.6
- D 0.06
- E 0.006

One third of S2 learners answered 'B' to this type of question

I can solve problems by carrying out calculations with a wide range of fractions, decimal fractions and percentages, using my answers to make comparisons and informed choices for real-life situations.

MNU 3-07a



Reflective Questions:

- What opportunities are learners provided with to consider the purpose and relevance of their learning, prior to new concepts being introduced?
- How often do learners tackle challenging questions and discuss what strategies/prior learning they will need to apply to solve them?
- What opportunities are provided for sharing strategies and discussing the merits and efficiency of chosen strategies?
- How do you encourage learners to use mental strategies to estimate, when they are faced with a calculation, prior to using written or calculator methods?

Teaching and Learning and Career Long Professional learning Resources:

- **T&L Learn Zillion:** Multiply decimals by decimals using an area model
Short video demonstrating a possible method for multiplying decimal numbers - using decimal models – exemplifies the importance of estimating and then 'checks' using a visual strategy.
<http://learnzillion.com/lessons/557-multiply-decimals-by-decimals-using-an-area-model>



Appendix

Performance overview in Estimation and Rounding

From the more detailed analysis of children and young people's performance within **estimation and rounding**, the following strengths and areas for development were identified in the 2011 Scottish Survey of Literacy and Numeracy:

	First level	Second level	Third level
Strengths	<p>Rounding</p> <ul style="list-style-type: none"> Rounding to the nearest 10. <p>Estimating</p> <ul style="list-style-type: none"> Estimating in real life, familiar contexts. Identifying strategies for estimating quantities. 	<p>Rounding</p> <ul style="list-style-type: none"> Rounding decimal fractions involving tenths. Rounding within familiar contexts. <p>Estimating</p> <ul style="list-style-type: none"> Using rounding to estimate calculations involving whole numbers and a 2 digit decimal fraction. Estimating quantities involving 2 digit decimal fractions. 	<p>Rounding</p> <ul style="list-style-type: none"> Strategies for rounding- rounding to a given degree of accuracy.
Areas for improvement	<p>Rounding</p> <ul style="list-style-type: none"> Rounding 3 digit number to the nearest 10. Using rounding as a strategy for calculating. <p>Estimating</p> <ul style="list-style-type: none"> Interpreting contextualised, word based tasks. Applying strategies for estimating quantities. 	<p>Rounding</p> <ul style="list-style-type: none"> Rounding quantities in context. Application of estimation and rounding strategies in calculations. <p>Estimating</p> <ul style="list-style-type: none"> Estimating to compare the relative size of different quantities. 	<p>Rounding</p> <ul style="list-style-type: none"> Rounding decimal fractions which have an extended number of decimal places. Choosing the appropriate degree of accuracy, having taken into account the context of the problem. Applying rounding as a strategy for calculating involving decimal fractions.

Progression issues in **estimation and rounding** identified in the 2011 Scottish Survey of Literacy and Numeracy.

The table below shows the areas for development in estimation and rounding that impacted upon learning at the next level. These are issues that should be taken into consideration when planning for progression.

	First level	Second level	Third level
Areas for improvement	Rounding to the nearest 10 <i>(linked to place value)</i>	Rounding decimal fractions <i>(linked to decimal fractions)</i>	Rounding decimal fractions when understanding of place value is required <i>(linked to decimal fractions)</i>
	Applying rounding as a strategy for calculating <i>(number and number processes)</i>	Application of estimation and rounding strategies in calculations to check the reasonableness of an answer. <i>(number and number processes)</i>	Applying rounding as a strategy for calculations involving decimal fractions <i>(number and number processes)</i>
	Interpretation of contextualised word based tasks involving division.	Interpretation of contextualised, word based tasks involving application of knowledge of number and place value.	Choosing the appropriate degree of accuracy, having taken into account the context of the problem. <i>(number and number processes)</i>
	Ability to articulate thinking using appropriate mathematical vocabulary <i>(using and understanding appropriate mathematical notation and vocabulary)</i>		