UNIVERSITY OF CAMBRIDGE

Camden

Second Lesson Study Workbook

Spring Term 2014

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Names and d.o.b. of teachers in the spring 2014 lesson study group LS Protocol adopted? Y / N	1. Gemma 21/10/64 Yes	2. Emma Yes	3. Edward Yes
Year Group No in class Set? / Mixed Ability Usual teacher 1 / 2 / 3	Year 6 23 Mixed ability but more middle / top ability 2		
Mathematics focus and overall aim and focus for the two research lesson sequence.	We want to learn how to deepen the conceptual understanding our children have of decimal fractions. Difficulties have arisen when children are asked to order decimals (especially when presented with a combination of one, two and three decimal places) and it is felt that this may well be down to the fact that their understanding of what each decimal part actually is or is worth may well be contributing to the difficulty many of the children have. **Our aim, therefore, in the first lesson is to assess what they already know and understand about decimal parts of a whole. Lesson two will be designed around addressing the misconceptions discovered and we will attempt to secure and deepen their understanding of what each of the decimal fractions actually is and help them discover the relationship between each of these decimal parts. In the third lesson, we aim to place the learning within a real life context and hope to see a deeper understanding allowing them to order decimal numbers successfully.** Do the children know how each of the decimal fractions are made? Do the children know why the decimal parts are progressively smaller? Are they able to relate this concept of the different sizes to the **value** of each and in particular, are they secure enough in their understanding to know that 6 hundredths is worth less than 1 tenth (even though there are more of them)? Has the work we have done on the visual representation allowed them to understand why?		
Date and **time** and **accountable learning objective** of RL1	06/02/14 – Planning session 11.00 – 12.30 (Lesson 1 Friday 7th Feb 9.15 – 10.15) To use exploratory partner talk to explain existing and to uncover new understanding about decimal fractions To understand how 1/10, 1/100 and 1/1000 can be made from one whole To recognise 1/10, 1/100 and 1/1000 in relation to the same whole and to be able to say why each part is different in size. To be able to use manipulative base 10 apparatus to 'show' a given decimal number eg: 0.135 (one flat, three rods and 5 tiny cubes) To begin to see that even though there are MORE thousandth, they have less value than fewer hundredths.		

Date and **time** and **accountable learning objective** of RL2	07/02/14 – Planning session 13.30 - 14.30 (Lesson 2 – Monday 10th Feb 9.15-10-15) To be able to use 'base ten' equipment to give a concrete representation of a decimal fraction. To be able to show, then compare the value of two decimal numbers and to say why one is greater in value than the other. To be able to successfully compare two decimal numbers without using any concrete equipment and to explain my reasoning To be able to relate decimal fractions to real life measures
Date and **time** and **accountable learning objective** of RL3	10/02/14 – Planning session 13.30-14.30 (Lesson 3 – Tuesday 11th Feb 9.15-10.15) To be able to apply their understanding of decimal fractions to problem solving involving real life measures.

Lesson Study Overview Table

Research lesson (RL1) planning, observation and discussion sheet

(Spring 2014 | RL 1)

Research lesson (RL) planning, observation and discussion sheet Spring 14 **RL 1**. Date 7/02/14 Time: 9.15 **– 10.15** Decimal Fractions

Teacher: GC Observers: EB and EP

Accountable learning intentions and success criteria To be able to show and explain how 1/10,1/100 and 1/1000 can be made from a given unit (base 10 cube) To make visual representations of given decimal fractions in order to compare the size and hence the value of each part. To understand that one tenth is a larger part of the whole than one hundredth and that one hundredth is a larger part than one thousandth.	Case pupil A: Maryam **Success criterion for this lesson**		Case pupil B: Samiah **Success criterion for this lesson**		Case pupil C : Riaz **Success criterion for this lesson**	
Stage of lesson sequence Describe key elements in the stages of your RL plan.	How you predict case pupil A will respond	*How they are observed to respond*	How you predict case pupil B will respond	*How they are observed to respond*	How you predict case pupil C will respond	*How they are observed to respond*
<u>Opening activity</u> We wanted the children to use 'Exploratory talk' whilst using the base 10 equipment to be able to demonstrate their understanding of the whole, tenths, hundredths (and later, thousandths) (9.25am)	We hoped she would be able to use a partner to help clarify her understanding of how decimal fractions are made from a whole. We hoped that she would not be too confused by the fact that the whole was the grid made up of 100 equal parts (individual cubes)	She was very vocal and eager to participate in the partner talk but was confused by what 1/100 was and what 1/10 was. Abdullah her partner was able to show her why one cube was one 100^{th} of the whole grid.	We hoped to see the true level of Saniha's conceptual understanding as she is someone who is normally very shy. We also hoped that the partner talk used in the first lesson study and more regularly in class would enable S to articulate what she knew.	She took a while to warm up, initially letting baneen take the lead but she was encouraged by confirmation of her own understanding and grew in confidence as a result. She showed quite a good level of understanding of how decimal fractions are made.	We wanted to see if Riaz would engage in explaining his understanding of decimal fractions by using the objects and a talk partner	He struggled initially to engage in the talk as he didn't seem to have a starting point and couldn't find one without a prompt from an adult. There was still some confusion around showing what 1/100 was but Tasnim was able to help with an

						explanation and demonstration.
Activity 2 **Presented with a new whole (base ten large cube) could the children extend their understanding of decimal fractions in relation to this new whole and work out that the small cubes would be thousandths**	We hoped the initial warm up work would help Mariam to break the large cube into tenths and to see that breaking the whole into 100 rods would give 1/100 and that finally, each tiny cube would represent 1/1000. We wanted her to then see the relative sizes of each part.	The new whole confused Maryam and at first she thought the rods were tenths as they had previously been. Through lots of questioning and unpicking, she was able to show that she could see why each part was what it was.	We hoped that Samiha would take a more confident lead in this second activity and that she would quickly establish the decimal parts of the new whole.	Initially confused by the new whole but used her partner well to clarify her thinking. She was then able to demonstrate a good understanding of how each of the parts were derived from the whole.	We hoped Riaz would also use the previous activity to help him explain how the new whole could be divided into tenths, hundredths and thousandths and see the relative value of each.	Again, the talk did not flow automatically but questioning from an adult and help from Tasnim saw him demonstrate how each of the parts of the whole were made.
On the sugar paper grid, U. t h th could children build various decimal fractions using the base 10 objects and use the visual as a way of determining which had the greatest value (by comparing the size of the decimal parts)	We hoped that Maryam would confidently show that 3/10 was greater than 5/100 by representing the fraction with the apparatus or by using a diagram to show which was greater.	She was very good at demonstrating this.	We hoped that Samiha would only need a quick sketch to help her compare two decimal fractions that had a different number of decimal places.	Samiha didn't need to actually use the objects anymore - a quick sketch was fine. She benefitted from having her partner to check in with and was able to show how 13/100 was the same as 1/10 and 3/100	We wanted riaz to be able to use the objects or a quick sketch to show that he knew why one decimal fraction was smaller or larger than another.	He left the objects after a while and once shown, was able to draw a quick sketch to confirm his thinking.

What were they able to do? (What progress have they made and how do you know?)	By the end of the lesson, the children had a picture in their heads off the relative sizes of the decimal fraction parts they were asked to compare. This helped then to see which had the greatest value. Befor the lesson, they were not sure why for example 1/10 was greater than 3/100. Now, they felt confident enough to explain this to us.					
Initial thoughts, ideas, reflections	By having this image in their heads, we hope to move them on to comparing a range of decimal numbers with more confidence and accuracy by understanding the most 'significsnt' digit and why it is actually the most 'Significant'					

Post lesson interview with the pupils

Date: **Time**:

Case pupils present: **Number of other pupils present**:

What did you enjoy most about that lesson?	**S**: Baneen helped me to figure out what the whole was and to see the whole was 100%. *(Although initially Sumaya's partner took the lead by the end Sumaya had strengthened her understanding and was leading the exploratory talk and being more accurate than Baneen).* **R:** I liked it when we are in partners it helps us to think more. We also got equipment to help us. **M:** When someone my own age explains stuff it sometimes gets in my head better. *(Maryam really benefitted from her partner Abdullah explaining certain things to her.)*
What did you learn? (What can you do now that you could not do? What can you do better? How is it better?)	**S:** Before I never knew how to work with fractions, I got confused. I thought that 1/100 was bigger than 1/10 but now I saw it I get it. **R:** I just used to do everything in my head but now I can can see it. It helps me to understand better. **M**: Before we did fractions we used to divide by the denominator and multiply by the numerator but the numbers confused me. Now we have used the equipment I understand it a bit more.
What aspect of the teaching worked best for you?	**S:** You made it simpler for me to understand. **R:** You did actions to help us understand. **M:** The hand gestures helped. When teachers just say words it doesn't get into my head but if I see it I get it.
If the same lesson is being taught to another group what would you change? Why would you change that aspect?	**S:** It would be good to start with the whole and show breaking it up first into a 1/10ths and then 1/100ths. **R:** To get us to teach each other a bit more. **M**: You could get more children to come up and show stuff. You could get children to act our each part.

Please use this template to capture your post research lesson discussion

Post Lesson Discussion record RL 1

Date7/2/14 Time 9.15-10.15

	Case pupil A- Maryam	Case pupil B- Samiha	Case pupil C- Riaz
What progress did each pupil make? Was this enough?	Maryam really benefitted from the use of the manipulatives and the partner talk. In the post lesson discussion she explained that she likes it when someone her own age explains "stuff because it gets in her head". Maryam certainly developed her conceptual understanding through the lesson. She explained that before she didn't understand why thousandths were smaller than hundredths but that she "gets it now".	Samiha was initially confused with the difference in relative size. She struggled to articulate why a tenth is a tenth and a hundredth is a hundredth. However, with the help of her partner and through directed questioning from the teacher her conceptual understanding and confidence grew. She did make progress in this lesson and I think we are clear about Samiha's next steps	The gaps in Riaz's conceptual understanding were evident in the exploratory talk section of the lesson. He needed the guidance from his partner to understand how to divide the whole into tenths, hundredths and thousandths. However, we did notice that through the manipulation of the resources he was more confident in showing decimal fractions at the end of the lesson
What about others in the group of learners they typify?	All learners seemed to benefit from the use of the concrete materials. Through the hands on manipulation of the resources the children were better able to understand the relative size of each of the parts of the whole. In the post lesson feedback from the children all of them seemed to have a more secure understanding of the basics of decimal fractions. In particular the value of each number in a decimal.		
Do we need to revise our assessment of any pupils?	As this was the first lesson in the sequence we planned this as an assessment lesson and I think there were good opportunities to assess the children's understanding in the lesson we planned. Through our probing questions and listening into the children's exploratory talk we were able to assess the children's conceptual understanding. Next lesson we also need to build in some independent activities so we can continue to assess the individual children's understanding.		

How did the teaching being developed help or hinder the pupils' learning? (Maybe a bit of both) What surprises were there? Did we find out anything of note about the way they were learning?	Maryam was very clear in the post lesson discussion about the benefits of using the concrete materials and discussion with her partner. Maryam showed increased confidence by the end of this lesson and we need to build on this next lesson.	Samiha definitely benefitted from the talk and the support of her partner. It was hugely beneficial that the class teacher took the time to think carefully about the mixed ability pairings. We were surprised and pleased to see Samhia showing increasing confidence in her discussions with her partner.	Riaz is normally very confident in the procedural side of maths but it was surprising to see how much he struggled in this lesson. It was interesting to see the gaps in his conceptual understanding of fractional decimals. He certainly benefitted from the use of concrete materials and partner talk.
What aspect(s) of our teaching could be adjusted next time to improve the progress of our case pupils and all pupils	• We could have modelled the exploratory talk more explicitly as some pairs struggled to sustain the conversation themselves. • We will need to recap very explicitly on the new/improved understanding of decimal fractions from the first lesson • We will allow partner talk before asking pupils to demonstrate the understanding using base 10 equipment • We will incorporate the use of diagrammatic representation of decimal fractions and symbolic representation alongside the concrete apparatus during this lesson and hopefully strengthen the visual representation of decimal fractions before moving on to purely symbolic representation • Continue to allow partner talk as all of our focus children have said that they like the opportunity to talk with a partner in maths to help them understand better (either by teaching it to a peer or by having it explained by a peer)		
So what should we try next time?	• Make sure we have a model of the whole that will break up into tenths and a model of the whole that will break up into hundredths. • Get the children to demonstrate the relationship between the tenths, hundredths and thousandths by dividing each of these into ten • Move the children away from the concrete to the visual and finally the symbolic once their understanding is secure but encourage children to use apparatus or diagrams if they feel they need them. • Introduce the decimal parts of length using a meter tape that can be cut up into its decimal parts		

Initials ..... Date .....

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Research lesson (RL2) planning, observation and discussion sheet

(Spring 2014 | RL 2)

Research lesson (RL) planning, observation and discussion sheet Spring 14 **RL 2**. Date 10/02/14 Time: 9.15 – 10.15 Decimal Fractions

Teacher: Ellman Berman Observers: Gail Carlyle and Ellen Pratt

Accountable learning intentions and success criteria To understand the value of each digit in a decimal number (up to 3 decimal places) and to be able to compare two decimal numbers. **Success criterion for this lesson** • I can explain, using concrete objects, how tenths, hundredths and thousandths are made from a whole. • I can use the base 10 equipment to prove that tenths are larger than hundredths • I can use a mental image of the size of each of the decimal parts in order to help me work out which decimal number is larger or smaller • I can use what I have learnt about how decimal fractions are made to understand what the decimal parts in different measures represent eg: if my unit is 1m, 1/10 is 10cm or 0.1m	Case pupil A: Maryam		Case pupil B: Samiah		Case pupil C : Riaz	
Stage of lesson sequence Describe key elements in the stages of your RL plan. (You can add more).	How you predict case pupil A will respond	*How they are observed to respond*	How you predict case pupil B will respond	*How they are observed to respond*	How you predict case pupil C will respond	*How they are observed to respond*
Stage 1 **Introduction – recap on previous learning** We wanted to recap on their new understanding of what **each** of the decimal parts of a whole are – how they are derived and what value they each have. In order to refine the language they use to describe what is happening to the whole, we will allow some partner talk first before calling on our focus children (if they are willing) to come up and offer a clear demonstration to the class. (10 minutes into lesson)	We hoped Maryam would feel confident enough to explain what she learnt in the last lesson after having an opportunity to talk it through with her partner first. We also hoped to see that her conceptual understanding	Maryam was definitely more confident today and actually started the discussion with Abdullah. She was able to explain how the 'flat' was one tenth of the whole because you needed ten of them to make the whole so one part was	We hoped that Samiah would offer to explain her understanding to the whole class or at least with confidence to her partner.	Samiah was very articulate with her partner and after showing a good understanding of what each of the decimal fractions were and how they related to the whole she confidently demonstrated and explained using the base	We hoped Riaz would be able to use the partner talk time and the base 10 equipment to show that the initial confusion he showed during the last lesson had been clarified. We would be looking for him to demonstrate	The progress he had made from the beginning of the last lesson was very clear to see. In recapping his learning to his partner, he took the lead today and used the base ten objects to explain that 'ten tenths (showing flats) made up the whole, a hundred

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	of decimal fractions had grown.	a tenth. She explained how both the hundredth and the thousandth were smaller parts of the whole.		ten apparatus to the whole class.	greater understanding when answering targeted questions in this recapping session.	hundredths (rods) made up a whole and that 1000 tiny parts made a whole' He also offered that thousandths were the smallest part of the whole.
Activity 3 – converting fraction cards into decimal notation (on PV grids) and being able to identify the larger/smaller parts in each representation After having practised making decimal numbers with the base 10 equipment (show me 2 tenths, 4 hundredths and 5 thousandths = 0.245) and having seen both pictorial (drawings of the base 10 apparatus) and symbolic representations (decimal notation) at the same time, we wanted to give the children an opportunity to convert, record and compare decimal numbers from the fractional representation Eg: 2/10 , 4/100 and 3/1000 (0.243) compared to 1/10, 6/100 and 9/1000 (0.169) and to be able to say which has the greater value and why? We then wanted to extend it to see what they understood about the relationship between the parts eg 14/100 , 15/1000 , 123/1000 , 0.14 , 0.015, 0.123 30 minutes into lesson	We hoped Maryam would be able to use the image she had built in her mind or to use a quick sketch if needed in order to do this successfully. We also wanted to see her checking with her partner and being able to offer reasons for her choice of the larger or smaller number.	Maryam showed that she was able to record decimal notation accurately when presented with the easier ones. She was also very confident in stating that even though there were 9/1000 they were not worth as much as 2/10. When it came to the harder representations, she began by writing 14 in the hundredths column (Abdullah pointed out that this was not right and even though he explained, she wasn't with	We hoped Samiah would be able to determine the larger or smaller decimal number without having to draw a picture to help her.	Samiha had no trouble with this part of the lesson. She was able to convert and then record the decimal fractions accurately. When asked why she had recorded one in the tenths, a two in the hundredths and a 3 in the thousandths, she said ' I know that 100 of these thousandths make one of the tenths and that twenty of them make two hundredths so I have written it 0.123. Her understanding of the decimal	We wanted to see if Riaz was able to use the visual and concrete support we had offered up to this point to hang the symbolic representation on to. We also hoped that he would be able to use a quick sketch if he needed to help him 'see' which one was bigger. We hope that his ability to articulate his understanding has grown.	Riaz was confident when recording the easier representations and was able to pick out which had the greater value by explaining that 2/10 was worth more than 1/10. He also found it harder initially to record the more difficult representation of 14/100. He went to the equipment to 'show' it without any prompting but also put all 14 into the hundredths column. He needed help to see how ten of the rods changed into one tenth. When it came to

		him) I prompted her to get the rods out and put them all in the hundredths column. Abdullah was then able to show her how 10 of the hundredths were the same as 0ne tenths and she adjusted her recording. (more work will be needed on this but she is feeling confident and the concrete objects have really helped)		parts and their relationship to one another exceeded where we thought she was.		15/1000 though, he made the exchange himself and recorded it as 0.015.
Activity 4 **Independent work** We will give the children three decimal numbers to compare independently (they will not all look the same – some will have 1 decimal point, others will have two or three.) The base 10 equipment will be available for the children to use should they need to and we will encourage them to draw the decimal number too if it helps them to 'see' the size thus allowing for accurate ordering. **0.9, 0.95, 0.123** 40 minutes into lesson	We were hoping to see Maryam approach this ordering exercise with confidence and to begin to work out which was the most significant decimal digit without necessarily using a drawing or the equipment. We	When presented with the first set of decimal numbers to order, Maryam made the mistake of jumping in very quickly and saying that 0.123 was the largest. She was prompted by Mr Berman to slow down and	We also wanted to see Samiah approach this ordering exercise with confidence and to begin to work out which was the most significant decimal digit to look at in order to successfully order the numbers.		We hoped to see Riaz using the equipment, a quick sketch or visualisation in order to order the numbers he was given. We hoped that he would realise that a two digit decimal number would not automatically be smaller than	**Activity 4** **Independent work** We will give the children three decimal numbers to compare independently (they will not all look the same – some will have 1 decimal point, others will have two or three.) The base 10 equipment will be available for the children to use

	hoped that M would see that if no digit was recorded in any of the columns, that that meant there were no decimal parts there.	reminded of the ways in which she could make a successful comparison. She opted for the equipment and very quickly (before she even needed all 9 flats) realised that 0.123 would actually be the smallest because there was only one tenth. She didn't need any equipment to help her determine that 0.95 was the largest and she was able to say that it was because there were 9/10 **and** 5/100 whereas there were only 9/10 in the other number so 0.95 was the largest.			a three digit decimal number. 0.23 0.146	should they need to and we will encourage them to draw the decimal number too if it helps them to 'see' the size thus allowing for accurate ordering. **0.9, 0.95, 0.123** 40 minutes into lesson
What were they able to do? (What progress have they made and how do you know?)	Our case study children were all successful with the ordering activity and their explanations were quite sound, showing that they knew a lot more about what each part of the decimal number represented.					
Initial thoughts, ideas, reflections	We hope that these two lessons will have deepened their understanding enough to apply making tenths, hundredths and thousandths from a new unit – a metre.					

(Please tailor questions to your RL)

Suggested questions for a post RL2 interview with the pupils

Date 10/02/14 ***Time 11.00*** ***Case pupils present 3*** ***Number of other pupils present 0***

What did you enjoy most about that lesson?	***M**: I enjoyed when we had to stand up and move the digit cards to show what the fractions looked like as decimal numbers. It was clever the way we moved into size order too 'cause that helped us remember the size of each fraction (decimal). I liked it when we had to talk to each other and agree where we should stand.* ***S:** I enjoyed it when I was chosen to get up and show the fractions and I liked explaining it to the class. I felt confident.* ***R:** I liked it when we could use the cubes again to work out the biggest decimals. It helped because in my head it gets confusing and I couldn't do it but when I used the objects again, it came back to me and then I could also draw it. I also liked it when Tasnim didn't get it and I had to work it out to help her.*
What did you learn? (What can you do now that you could not do. What can you do better? How is it better?)	***S** – I learnt that even though 123/1000 seems bigger (than 5/10) it doesn't matter about the amount it matters where it is that tells you it has more value. After I could see that in the first lesson, I didn't need the objects any more – I know what it (each decimal digit) means now.* ***M –** Same as Samiha but when I was struggling to compare the decimal numbers, I found out that I could quickly draw the picture and I could see the tenths were greater than the hundredths. I learnt that in decimals when it is point something I can use the shapes in my head to help me know which one is the biggest.* ***R** – I learnt what each number in the decimal number looks like and that helped me to know which one was the most value. Before when I tried in my head, I didn't know what they were.*
How did you use the strategies to help you?	***M –** The partner talk gives me confidence and it helped when we were comparing the value of the decimals because Abdullah disagreed then I disagreed back and eventually we agreed when we proved it with a drawing.* ***S –** Working with a partner was good because we sometimes got it muddled up. At times I used some self talk like when Baneen thought it was tenths and I talked to myself before I helped her.* ***R –** The concrete objects helped me to understand that 14/1000 is the same as 1/100 and 4/1000. I didn't know that before and Tasnim (her partner) showed me how to do it and to see that 1/100 is bigger than 4/1000.*
What aspect of the teaching worked best for you?	***M –** What helped me best was when you let us use the manipulatives and we figured out how the hundredths is 100 parts of the whole and also part of the tenths. (How many parts of the tenth? Looking up and clearly tapping into a picture of the tens flat and hundredths rods answered 10)* ***S –** Same as Mariam but also the place value charts on the table to change the (decimal) fraction into a decimal number. When I compared 0.9 and 0.24 I knew what 1/10 was so 9 of them was worth a lot. It was more than 2 of them.*

	R – *When you let us come up and make the decimal numbers and then use the pictures to decide which was bigger. I liked coming up and working it out with everyone.*
If the same lesson is being taught to another group what would you change. Why would you change that aspect**?**	***M –*** *I would probably add a few more challenging problems and let the class solve them in a fun way.* ***S –*** *I would give a big quiz at the end – which is the biggest number? – to see who listened, gave the right answers or needed more help. Sometimes I don't show that I don't understand something and I just go along.* ***R –*** *I would make a board game of decimals with cards of numbers to compare and let the children play it.*

Please use this template to capture your post research lesson discussion

Post Lesson Discussion record RL2

Date: **Time**:

	Case pupil A	**Case pupil B**	**Case pupil C**
What progress did each pupil make? Was this enough?	Maryam has made a significant leap in her understanding of what decimal fractions and decimal numbers actually are in relation to the whole and was able to demonstrate this understanding through the use of concrete objects and in her explanations to her partner. There is still work to be done on understanding the relationship between each of the decimal fractions but she is well on her way – "we figured out how the hundredth is 100 parts of the whole and also part of the tenth"	Samiha who is usually very quiet and reserved and whose deeper conceptual understanding is often hard to gauge has grown in confidence and her ability to articulate her understanding has been impressive. She has made very good progress indeed.	Riaz has also made good progress from where he started and especially from last week to this week. It was almost as if he needed to 'sit' with Friday's lesson a bit and work more in the concrete at the beginning of this lesson before we could see him move on.
What about others in the group of learners they typify?	We felt that going back to the concrete and visual representation of decimal fractions and how they are each a different part of the whole has deepened the understanding of the class as a whole and in particular, the children who are generally less confident in their approach to working with fractions and decimals.		
Do we need to revise our assessment of any pupils?			

How did the teaching being developed help or hinder the pupils' learning? (Maybe a bit of both) What surprises were there?	The aim of making the learning more visual and concrete in order to strengthen Mariam's conceptual understanding of decimal fractions and their representation as a decimal number has helped Mariam's learning enormously. She has also benefitted from the availability of a partner for confirmation of her thinking and it was lovely to see her ability to challenge Abdullah and for her to see the value of this way of learning. Note her comment: 'Abdullah disagreed and I disagreed back and eventually we agreed'	By allowing Samiha the opportunity to confirm her understanding of decimal fractions with a partner and through the use of the concrete objects she has grown in confidence. By encouraging and specifically targeting her to come out and explain to the whole class we have seen a confidence previously not shown – this was a great surprise.	Without doubt, Riaz has benefitted from our approaches. He has recognised himself that working with just numbers 'in my head it gets confusing' He has acknowledged how drawing the pictures of the decimal numbers helped him to sort out his confusion. He was also able to articulate the value of working with a partner and how she helped him. What was also great though, was when he realised that she was relying on him (at one point when they were both unsure) and he felt he really had to work it out using self-talk.
Did we find out anything of note about the way they were learning?	Each of our learners (and indeed the rest of the class) used all of the strategies/approaches modelled and provided for them in different ways and to different degrees according to what suited them best. Riaz proved to be very visual – resorting to the concrete and visual representations more than the other two and using his partner to a lesser degree. Mariam benefitted from all three approaches almost equally and Samiha was able to move away more quickly from the concrete once she understood it. The fact that we made all three explicit and available was important to the learning and progress each of them has made so far. It was also good to hear both Riaz and Samiha refer to the 'self-talk' we had worked on with them in our last lesson study.		
What aspect(s) of our teaching could be adjusted next time to improve the progress of our case pupils and all pupils	• Provide a greater challenge for the children who are ready to move on and to really have an opportunity to 'show' just how far they have come in their learning and conceptual understanding of decimal fractions and numbers. • Our approach of making it concrete, visual and interactive is proving successful so we would want to continue with these approaches in order to move the children towards the application of their growing understanding.		

So what should we try next time?	• Provide an opportunity for children to recap and explain learning so far – demonstrating with apparatus or drawings. • Introduce the concept of a different whole (one metre) and allow the children to connect what they have understood about decimal fractions through using the base 10 equipment to this new unit. We will allow the children to cut the whole into tenths, hundredths, thousandths (as best as they can!) and interrogate their understanding. Is it still sound? Can we further develop their understanding of the relationship between each of the parts eg: when I cut the tenths into 10 equal parts, I get hundredths etc. • Place the ordering of a set of decimal numbers – a variety to three decimal places, two decimal places, one decimal place – into a real life context in order to assess their ability to do so accurately based on their greater understanding of the value of each of those parts of the whole.

Initials ..... Date .....

Research lesson (RL3) planning, observation and discussion sheet *(optional)*

(Spring 2014 | RL 3)

Research lesson (RL) planning, observation and discussion sheet Spring 14 **RL 3**. Date 11/02/14 Time: 9.15 **– 10.15** Decimal Fractions

Teacher: Ellen Pratt Observers: Ellman Berman and Gail Carlyle

Accountable learning intentions and success criteria **Accountable learning intentions and success criteria** To be able to order a set of decimal numbers (with differing number of decimal places) into ascending order. **S/C** • **I know which digits in a decimal number have the greatest value so I will start by comparing these.** • **I must also remember to look at the whole numbers first as these have greater value than the decimal parts.** • **If I get stuck, I can visualise or draw a quick picture to help me see the size of each part** • **Once I have finished, I will remember to check my order by comparing the most significant numbers and making sure my ordering is correct.**	Case pupil A - **Maryam**		Case pupil B - **Samiha**		Case pupil C- **Riaz**	
Stage of lesson sequence Describe key elements in the stages of your RL plan. (You can add more).	How you predict case pupil A will respond	*How they are observed to respond*	How you predict case pupil B will respond	*How they are observed to respond*	How you predict case pupil C will respond	*How they are observed to respond*
First Activity – I can use my knowledge of the value of each digit in a set of decimal numbers to place them in ascending order. (In pairs, the children will have been asked to quickly discuss and feedback on S/C for how they would go about ordering a set of decimal numbers – picking out the possible pitfalls and reminding each other of ways of checking and making sure of their choices.) We will observe our case pupils working independently first to order the set of decimal	We expect to see Maryam approach the task with confidence and to take her time to think about using the strategies we have been working on. We hope to see her tapping into	Maryam was successful with this task and her approach was methodical with quite a bit of 'think out loud' as she checked herself. When I asked her why she	We hope to see Samiha's confidence still high and expect her to articulate her reasoning and understanding clearly to her partner if there is any difference in their ordering. We also expect	Samiha and her partner were successful at ordering both sets of decimal numbers and needed the briefest of 'check-in' to confirm that they were successful. When I asked her if she	We expect Riaz to order these numbers accurately and hope that he continues to see the value of drawing the decimal number if he gets stuck.	Riaz appeared confused to begin with but then had a go. Before finishing, he sought the help of his partner who prompted him to use pictures. The T then reminded him to look at the S/C and he went on to check the tenths

numbers they have been given and then watch them as they 'check' in with their partner at the end. (10 mins into lesson)	the visual representation if she gets stuck.	was successful, she said 'At first I was tempted to put the one with three decimal places first as biggest but then I remembered that this was the mistake I used to make. So then I said to myself to look at the tenths first because it has the greatest value and I know that because I remembered the size from the objects. Then I looked at the hundredths and in the end I checked everything' Maryam did not need to 'draw' any of the numbers to help her compare.	her to move on to the second, more challenging set of numbers.	found any of them tricky to order she showed me that 0.4 and 0.25 made her stop and check. She then said: "I remembered to look at the tenths first and I knew that 4/10 was bigger than 2/10 so the 5/100 didn't really count. 0.4 was larger than 0.25"		first. When asked why he did this he said because I remember that they were the biggest part, they were the flat so they are worth more.
Activity 3 – I can divide up my new unit (a metre) into tenths, hundredths, thousandths and talk about the relationship between each part. Can they demonstrate/explain how to make each of the parts and are they able to talk about the	We expect Mariam to be able to say that she would divide the whole metre up into 10 equal parts to make	Mariam was quickly able to fold the tape measure into tenths and said it was because there were ten	We expect that Samiha will be able to cut the tape into tenths, hundredths and thousandths and to be able to say	Samiha confidently identified each part of the metre and lay them one under the other saying "I cut ten	Our expectations for Riaz are the same as for Mariam.	The idea of the metre being the new whole threw Riaz a little to begin with. Instead of thinking about what he would

relationship between each of the parts of the metre eg: 1/10 is the same as 10/100 or if I cut tenths into ten pieces I get hundredths. Do they understand that cm and mm are decimal parts of the whole metre and can they explain what 3.256m means. (20 mins)	tenths, into 100 equal parts to make hundredths and into 1000 equal parts to make thousandths and to demonstrate this. We hope she will be able to see how cm and mm are part of a metre	equal pieces – she noticed that each part was worth 10cm. "I know it is a tenth because if I divided the cube into ten equal parts last time then I have to do the same with the tape measure 'cause this is the whole now. If I want a hundredth, I have to cut it into 100 pieces. Confusion started to creep in when she was asked to say how many cm 1/00 of a m was worth. She reverted to panic mode, and wanted to try to answer from her head. When she was reminded to use the pieces of the tape measure she had in front of her and to look for the answer, she was able to find the	what the value of each part is in cm or mm. We hope that she will be able to explain that 3.256m is the same as 3m + 20cm + 5 cm + 6mm	of these to make tenths, I cut 100 of these to make hundredths and I tried to cut the thousandth but they are really tiny. There will be 1000 of these tiny pieces. When asked to write what 1/10 of a m was worth she wrote 10cm. Later on she was given a measure 3.256 and asked to write what each digit was worth – and she did so accurately.		actually do to the whole in front of him to get tenths, he wrote the multiples of ten out on his whiteboard. His partner then helped him by showing it on the tape measure and by folding it into the ten equal parts – she then very helpfully reminded R about the way we got tenths from the cube – dividing it into ten equal pieces. Once he has made this connection he happily cut his tape measure into tenths and then into hundredths and had a go at cutting off the mm as thousandths. He was able to explain each part in relation to the whole and used the pieces to make the length 0.231 by placing the pieces into the PV grid on the table. He was also able to say when questioned that 2/10 of the m

		hundredth and to say that it was worth 1cm. By looking at the parts she was able to say that 1/10 was worth 10cm and that 1/1000 was worth 1mm				was the same as 20cm etc but only by looking at each of the parts he had in front of hin.
Final stage – I can place the different ski jumper's lengths into ascending order by using what I have learnt about the value of each part of the metre. (35 mins into lesson))	We expect Mariam to set about this task in an organised and confident way. We hope to see her suggesting a sensible starting point for the task and for her to complete it successfully.	Because we had been so focussed on looking at each of the decimal parts of the metre, Mariam started the task by looking at and comparing the tenths and ignored the fact that there were two measures that were obviously the longest and shortest based on the whole metres. When she was reminded to look at these, she was fine. There were two distances she had in the wrong order but she was able to address these	We expect Samiha to lead in the partner talk before the activity and to come up with a good way of starting this task and an explanation of how she will proceed. We then expect her to complete the task and move on to the extension.	Samiha and Baneen were confident about how they would approach this task and even though the spoke about it first, they each used a different system to get through the lengths. Samiha had three columns on her whiteboard. Wrote all the distances in the left hand column one under the other. Excluded the two with different metres by placing them in the far right hand column as being shortest, longest then set about using the middle column as a place to	We hope that Riaz will make good use of the partner talk before starting the task in order to help clarify his thinking and give him a confident starting point.	There was the briefest of partner talk before starting this activity and Riaz was confident to proceed. During the brief whole class feedback on what strategies everyone had used to help them with the first ordering activity, someone had shown how they had used zeros as place holders in order to make all the numbers have three decimal places. In this way it was easy to 'see' that 0.23 could be 0.230 and how it was easier now to compare it to 0.156 and to see that it was bigger because 230/1000 is greater than 156/1000. This was the

		herself when she was checking her work at the end. She didn't use her partner for any checking as he had moved swiftly on to the challenge. However, this did not phase Mariam and she kept plugging away and checking as she went along. She showed good perseverance and the one mistake she had made by the end of the task, she was able to see where she had gone wrong.		compare the rest of the distances that all had the 125m. She knew the tenths were the most significant digit but did have to tease out the trickier ones.		strategy that Riaz used and he was easily able to order the decimal numbers. He was successful in his approach but less confident to explain why it worked.
What were they able to do? (What progress have they made and how do you know?)	Our case pupils were able to order the lengths of the Olympic skiiers successfully and more importantly, were able to use what they learnt about decimal fractions and their relative value to help them check their answers. They were all able to self-correct successfully and with a good understanding of where they went wrong.					
Initial thoughts, ideas, reflections						

(Please tailor questions to your RL)

Suggested questions for RL3 post lesson interview with the pupils

Date: **Time**:

Case pupils present: **Number of other pupils present** :

What did you enjoy most about that lesson?	**M:** I enjoyed ordering the decimals. It felt quite good to finish first and get it right. I kept the picture of the manipulatives in my head and that helped me. I know that the tenths were the biggest *(she corrects herself)* had the greatest value so that helped me. **S:** I enjoyed the challenge at the end because we had to use different numbers and bigger numbers. **R:** I enjoyed the challenge at the end because me and Tasneem worked separately and then checked our answers. I used the 0 as a place holder and that helped me to see the smallest and largest decimal.
What did you learn? (What can you do now that you could not do. What can you do better? How is it better?)	**M:** I got a bit worried when I saw the numbers were bigger but I managed to figure it out. **S:** I learnt how to order the decimals. I used to scatter the decimals everywhere but now I know the size of the tenths and that they are the biggest and most significant. *(This was evident in Sumaya's systematic approach to ordering the decimal numbers.)* **R:** I learnt that the pictures helped me to get the answers and understand it better.
What aspect of the teaching worked best for you?	**M:** It helped me to see the 1 metre tape and to cut it. I didn't really understand length decimals before now I get it. **S:** The challenge of ordering the decimals. I found it easier because I knew the amounts of each part. **R:** It helped when we cut the tape. I knew that one tenth was 10 cm, 1 hundredth was 1cm and 1 thousandth was 1mm.
If the same lesson is being taught to another group what would you change. **Why would you change that aspect?**	**M:** I wouldn't change anything. Maybe more decimals to order. **S:** I think we could do the same but use different things related to length. *(When we questioned Sumaya she seemed to be suggesting a next step for our learning. Such as weight or capacity).* **R:** I would like even harder challenges now I understand it.

Please use this template to capture your post research lesson discussion

Post Lesson Discussion record RL3

Date: **Time**:

	Case pupil A	Case pupil B	Case pupil C
What progress did each pupil make? Was this enough? What about others in the group of learners they typify? Do we need to revise our assessment of any pupils?	We felt that all three of our pupils had made good progress towards showing a deeper conceptual understanding of decimal fractions, their relative sizes and value. They now know that decimal fractions are smaller parts of the whole and that no matter what the whole is (a number or a measure) tenths are made by dividing the unit into ten equal parts etc. Because of this knowledge and the work done around helping them to visualise the sizes of each part, they were able to pick out the most significant digit in the decimal number so that they could order them correctly. They were mindful not to assume that a number with three decimal places was automatically larger than one with only one decimal place. The progress was deemed similar for the rest of the learners in the class		
How did the teaching being developed help or hinder the pupils' learning? (Maybe a bit of both) What surprises were there? Did we find out anything of note about the way they were learning?	For all **Maryam's** willingness to 'talk' and try and explain her understanding, she benefitted from the use of a partner as well as the equipment to actually 'see' what each decimal number looked like before ordering them.	We feel **Samiha** has been quietly confident all along but the approaches we have taken through this series of lessons have allowed her to showcase her understanding and may just be the springboard she needs to allow her to take greater risks with her learning and to really push on with her greater confidence.	**Riaz** allowed himself to engage with the equipment and his partner to deepen his understanding and as a result feels more confident and ready for a challenge.
What aspect(s) of our teaching could be adjusted next time to improve the progress of our case pupils and all pupils	• • •		
So what should we try next time?	• • •		

Initials ..... Date .....

Overall assessment record of pupil progress in Lesson Study 2 Spring 2014

Please summarise the progress of case pupils and other pupils across the three research lessons in relation to the success criteria of the accountable learning objective that you set for them in each of the three research lessons.

Total number of pupils in class:

Pupil(s) Total number of pupils in the class 30	**Met success criteria**	**Exceeded success criteria**	**Fell short of success criteria**
RL1			
Case pupil A - **Maryam**	**Yes**		
Case pupil B - **Samiha**	**Yes**		
Case pupil C - **Riaz**	**Yes**		
Number in class who we predicted..	**15**	**4**	**4**
Number in class who actually..	**17**	**4**	**2**
RL2			
Case pupil A - **Maryam**	**Yes**		
Case pupil B - **Samiha**		**Yes**	
Case pupil C - **Riaz**	**Yes**		
Number in class who we expected to have..	**15**	**6**	**2**
Number in class who actually..	**17**	**4**	**2**
RL3			
Case pupil A - **Maryam**	**Yes**		
Case pupil B - **Samiha**		**Yes**	
Case pupil C - Riaz	**Yes**		
Number in class who we expected to have..	**15**	**6**	**2**
Number in class who actually..	**15**	**7**	**1**

Summary Lesson Study 2: LS Group Reflective Report

1. What were the main things you discovered about how the pupils learned mathematics?

We discovered that when pupils are actively involved in the learning process, true learning takes place. During the first lesson, we gave the pupils the opportunity to explore on their own, with manipulatives first, instead of telling them exactly what to do and when to do it. This allowed them to first try a few things themselves. We (the teachers) acted as guides through this stage of learning, rather than the disseminators of information. This approach allowed the pupils to use the manipulatives as 'thinker toys' rather than just 'answer-getting' devices.

The use exploratory partner talk to explain existing and to uncover new understanding about decimal fractions focused the pupils' attention and motivated them to learn with a problem solving approach, using something they could touch (base ten blocks); this eliminated their frustrations and motivated the pupils to discuss mathematical ideas about decimal fractions and verbalise their mathematical thinking.

In what ways will this change your teaching in the future?

We will ensure that pupils are directly involved in the learning (experiencing it themselves), rather than being mere spectators, so that they learn and retain what is taught.

2. What were the main things you learned about the pupils that you did not know so clearly before?

Some pupils, especially the case pupils, have learnt 'correct' mathematical procedures without really understanding how they work. One major drawback is that if a pupil is able to perform a certain mathematical procedure well, the pupil may resist going back and developing the concept later (evident, initially, with one of the case pupils). We discovered that some pupils were not able to apply the procedures to situations other than the context in which the procedure was learnt. The procedural knowledge (without contextual understanding) led to errors. Pupils' responses when trying to compare decimal fractions revealed a number of misconceptions. However, when prompted to use the visual representations on the board, as well the base ten blocks, the children were able to make connections with the symbolic representations of the fractions.

In what ways will this inform your future practice?

We will ensure that conceptual understanding is secure before procedures are introduced

3. What other things have you learned about teaching or learning not captured in 1 or 2?

Although manipulatives can be wonderful tools for teaching and learning mathematical concepts, we discovered the need to be careful with how they are implemented. If used improperly, they can cause problems. We are aware that the manipulatives themselves are not the mathematics; they are the tools to be used to understand the mathematics. Furthermore, manipulatives by themselves do not teach. The pupils still need to be guided to make the connection from the manipulatives to formal mathematical knowledge illustrated. We learnt that through careful observation of the pupils, as they are working, we can gain an understanding of where the pupils' levels of understanding are and can adjust guidance and teaching from there. We also discovered the need to be aware of the developmental levels of the pupils and choose manipulatives that are developmentally appropriate.

How will this change your teaching in future?

We intend ensuring that pupils use manipulatives for as long as necessary to reach a clear understanding of the conceptual knowledge. This process may take longer for some pupils than for others. Having manipulatives out and accessible for any pupil to use, as needed, may help them gain the confidence necessary to move to the next step in the understanding process. From there, the pupils can switch to using drawings or pictures to represent what is happening mathematically, before making connections with the symbolic notation using numerals and operation symbols.

4. Are there any implications for the mathematics curriculum, assessment or pedagogy?

In every class, many different learning approaches are present. To help pupils learn maths, we need to do it in a way that addresses their varied learning styles, in order to keep them motivated or interested. However, trying to address all of these in one lesson is very difficult and often may not be achieved. Nevertheless, the use of partner exploratory talk, manipulative base 10 apparatus, visual representations and real-life contexts, we managed to cater for the learning styles of the pupils. If pupils just learn to perform computations mechanically or through memorisation, the knowledge is usually stored for only a short, temporary period of time. One way to help pupils make connections is through everyday, real-life contexts. Using real-life contexts that are meaningful to the pupils (the Winter Olympics was the context for our third lesson) will bring meaning to the mathematics at hand.

We suggest that using concrete manipulatives and pictorial representations over a long period of time should allow pupils the opportunity to gain a strong conceptual understanding of the concept being introduced/taught. Teachers can help encourage pupils in this process by making the aim of using manipulatives to help pupils 'think' rather than just get answers . It was evident during our lessons that learning and understanding fractions can be enhanced through the use of manipulatives.

As pupils move to upper KS2, it is important for teaching and learning to include manipulatives and visual representations. Conceptual and procedural knowledge need to be connected in a way that conceptual knowledge guides the 'whys' behind procedures behind procedures, and at times, procedures could help enhance conceptual knowledge.

5. What key learning will you share with colleagues in school and within the project?

Manipulatives can play a role in pupils' construction of meaningful ideas. They should be used before formal symbolic instruction, such as teaching algorithms. Teachers and pupils should avoid using manipulatives as an end - without careful thought - rather than as a means to that end. A manipulative's physical nature does not carry the meaning of a mathematical idea. Manipulatives alone are not sufficient - they must be used in real-life contexts to actively engage pupils' thinking with teacher guidance. The pupils who appeared to struggle with fractional concepts certainly benefitted from using base ten blocks, which helped eliminate some of the common mistakes made due to whole number thinking (some pupils thought of the fraction as being two separate whole numbers rather than one single number).

✓ **Data Return Checklist**

Remember bring this workbook with you on 25 March. It contains many of the things we will need you to bring. Things additional to this are in bold italics below.

- ☐ Your overall focus, teaching group etc – on title page
- ☐ Your RL plans and observation schedules – ***you will need to copy these including those you each jotted down your observations and comments on. If you used a separate lesson plan in addition to the RL planner and observation proforma in this workbook you will need to bring copies of these. It is usual to enlarge them to A3 for practical use.***
- ☐ ***Make sure you complete the grid on page 12 in full so that an assessment is made on the progress of <u>all pupils</u> in the class.***
- ☐ The notes of the post lesson pupil interviews
- ☐ The notes of your post lesson discussions (before you started planning the next one). ***You will need to copy these as with the RL plans/observation proforma***
- ☐ The notes of your end of Lesson Study discussion. ***This may also need copying***
- ☐ ***Any copies of pupils' work or other things that help to illustrate and bring to life key issues, a list of any published resources you used and copies of any you made.***

- Your video files on the memory stick.

Could you please observe the following guidelines when making recordings for the next round of the lesson study programme

Each file should be no bigger than 2000 Mbytes (2GB) in size It would be easier to state this as a particular length in minutes. As a guide it might be better to limit videos to 30mins restarting (part 2) with a fresh recording if the discussion or observation goes on longer.

Recordings that exceed the 2GB limit should be 'cut' into shorter parts and/or be reformatted or compressed using the range of tools available in school. Acceptable file formats - .asf, .avi, .flv, .mov, .m4v, .mp4, .mpg, .rm, .wmv

Please contact Stephen or the CLC if you require further advice.