

Decimals lesson plan

LEVEL: Upper Primary	CONTENT: Number & Algebra	FOCUS: Place value: decimals
In the Classroom		
PURPOSE	<p>Learning Intention</p> <ul style="list-style-type: none"> We are learning to recognise that the place value system can be extended to tenths, hundredths and thousandths and using decimats to help us. <p>Success Criteria</p> <ul style="list-style-type: none"> I can compare decimals and recognise which is larger, smaller or equal. I can use place value to numbers recognise numbers smaller than one. I can recognise that 10 hundredths make one tenth. I can write tenths and hundredths as fractions and decimals and explain my thinking. I can recognise the size of the decimal number in the place value system. I can correctly pronounce decimals as tenths, hundredths, thousandths. 	
WARM UP	<p>Decimal Density</p> <ul style="list-style-type: none"> Give each group of 2-3 students a set of the shaded decimat cards Ask students to order them from smallest fraction shaded to largest fraction shaded Students need to justify their conclusions <p>Decimals Comparison Test</p> <ul style="list-style-type: none"> Give each student the decimals comparison test Give them 2–5 minutes to complete it. 	
INTRODUCTION	<p>This activity provides opportunities for the symbols for fractions and decimals to be connected and highlights the place value of decimals to thousandths. This model has the advantage of showing the proportional relationship between the respective place values (e.g. ten thousandths will make one hundredth, and ten hundredths will make one tenth. It was adapted from an article by Anne Roche called DECIMATS: Helping Students To Make Sense Of Decimal Place Value: https://files.eric.ed.gov/fulltext/EJ891799.pdf</p>	
EXPLICIT TEACHING & LEARNING	<p><u>Materials:</u></p> <ul style="list-style-type: none"> Large decimat per student. Two dice (one standard six-sided die and one containing these fractions, $\frac{1}{10}$, $\frac{1}{100}$, $\frac{1}{1000}$, $\frac{1}{1000}$, $\frac{1}{1000}$) Pencils and paper for recording. <p><u>Instructions:</u></p> <ul style="list-style-type: none"> Player A rolls the two dice and then shades the product of the two numbers displayed. Player A then records 'how much of the decimat is shaded' in the table provided on the handout. This needs to be shown as a fraction and as a decimal. Player B rolls the two dice and continues the game, with each player recording 'how much of the decimat is shaded' after their turn. It is permitted for tenths/hundredths to be further divided into hundredths/thousandths if more hundredths/thousandths are required. For example if a player has shaded all of their hundredths and they then roll four hundredths then the player can 'cut' a tenth into 10 equal pieces (therefore creating hundredths) and shade four of these. If the product of the roll is greater than the remaining unshaded part of the decimat then the player misses a turn. The first player to reach one (by shading their complete decimat) or the player closest to one (by shading more of their decimat) after a certain amount of time has elapsed, is the winner. Each turn must be written and shaded in a different colour to help keep track of each turn and help students check their working. 	

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DISCUSSION/ KEY QUESTIONS	<ul style="list-style-type: none"> • What do you know about unit fractions? • Can you represent fractions in different ways? • What do you know about decimals? • What does each digit in the decimal represent? • Can you explain all of the parts of the decimal? • Can you represent the shaded part of the decimal as a decimal value? • Can you represent these decimal values on a decimal? • Can you show a decimal as a fraction? • Can you show a fraction as a decimal? • How many parts do we break the unit up into to make 0.1, 0.01, 0.001? • Can you place these decimals in ascending/descending order?
DELIBERATIVE PRACTICE	<p>This activity allows students to develop an understanding of decimals and how they connect to fractions and the area model. It enables them to make comparisons between decimals and their sizes and build a greater understanding of what makes a larger decimal and smaller decimal. The decimals provide them with a representational model in order for students to test their conclusions using the area shaded.</p>
REFLECTION	<ul style="list-style-type: none"> • Refer back to the shaded decimal cards • Now that students have been exposed to the correct format of writing decimals to tenths, hundredths and thousandths using the decimals, ask students to correctly write the decimal value under each shaded diagram. • Did the students make any changes to the original order of the shaded decimal cards? If so ask them to explain their reasoning.
RESOURCES	<p><i>DECIMATS: Helping Students To Make Sense Of Decimal Place Value</i> https://files.eric.ed.gov/fulltext/EJ891799.pdf Longer is Larger: Decimals Comparison Test http://www.education.vic.gov.au/Documents/school/teachers/teachingresources/discipline/maths/continuum/dectest13.pdf</p>
Curriculum Connections	
CONTENT	<p>AUSTRALIAN CURRICULUM YEAR 4 – NUMBER AND ALGEBRA Recognise that the place value system can be extended to tenths and hundredths. Make connections between fractions and decimal notation (<u>ACMNA079</u>).</p> <p>Elaborations:</p> <ul style="list-style-type: none"> • using division by 10 to extend the place-value system • using knowledge of fractions to establish equivalences between fractions and decimal notation <p>YEAR 5 – NUMBER AND ALGEBRA Recognise that the place value system can be extended beyond hundredths (<u>ACMNA104</u>).</p> <p>Elaborations:</p> <ul style="list-style-type: none"> • using knowledge of place value and division by 10 to extend the number system to thousandths and beyond • recognising the equivalence of one thousandths and 0.001 • Compare, order and represent decimals (<u>ACMNA105</u>). <p>Elaborations:</p> <ul style="list-style-type: none"> • locating decimals on a number line
WHAT CAME BEFORE	<ul style="list-style-type: none"> • Students require knowledge of fractions and parts of a whole. • They will understand that breaking a unit into ten parts will make tenths and one of these parts can be represented as 1/10.

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	<ul style="list-style-type: none"> Students understand the concept of place value and how it applies to the base 10 system.
WHAT COMES NEXT	<ul style="list-style-type: none"> Students will develop their ability to successfully compare decimals in terms of their numerical value. Add and subtract decimals, with and without digital technologies, and use estimation and rounding to check the reasonableness of answers (ACMNA128). Multiply decimals by whole numbers and perform divisions by non-zero whole numbers where the results are terminating decimals, with and without digital technologies (ACMNA129). Multiply and divide decimals by powers of 10 (ACMNA130). Make connections between equivalent fractions, decimals and percentages (ACMNA131).
VOCABULARY	decimal, decimat, tenths, hundredths, thousandths, decimal place, fraction
WHAT PROFICIENCIES ARE TO BE UTILISED? Understanding Fluency Problem Solving Reasoning Communicating (NSW) Justifying (NSW)	<p>Year 4</p> <p>Understanding includes making connections between representations of numbers, partitioning and combining numbers flexibly, extending place value to decimals, using appropriate language to communicate times and describing properties of symmetrical shapes</p> <p>Fluency includes recalling multiplication tables, communicating sequences of simple fractions, using instruments to measure accurately, creating patterns with shapes and their transformations and collecting and recording data</p> <p>Problem-solving includes formulating, modelling and recording authentic situations involving operations, comparing large numbers with each other, comparing time durations and using properties of numbers to continue patterns</p> <p>Reasoning includes using generalising from number properties and results of calculations, deriving strategies for unfamiliar multiplication and division tasks, comparing angles, communicating information using graphical displays and evaluating the appropriateness of different displays.</p> <p>Year 5</p> <p>Understanding includes making connections between representations of numbers, using fractions to represent probabilities, comparing and ordering fractions and decimals and representing them in various ways, describing transformations and identifying line and rotational symmetry</p> <p>Fluency includes choosing appropriate units of measurement for calculation of perimeter and area, using estimation to check the reasonableness of answers to calculations and using instruments to measure angles</p> <p>Problem-solving includes formulating and solving authentic problems using whole numbers and measurements and creating financial plans</p> <p>reasoning includes investigating strategies to perform calculations efficiently, continuing patterns involving fractions and decimals, interpreting results of chance experiments, posing appropriate questions for data investigations and interpreting data sets.</p>
ASSESSMENT	<p>Decimal comparison test</p> <p>Repeating the decimals comparison test with students will establish whether the concepts taught through the 'Decimats Game' have been understood and can be applied.</p>
Teacher Knowledge	
STORIES AND ANECDOTES	The decimals comparison test is a simple but powerful pre-assessment tool to determine how many students possess the misconception that longer is larger. Quite often, it is surprising to teachers how many students hold this misconception.
METHODS FOR ENGAGEMENT	<ul style="list-style-type: none"> This method of engaging students with decimals can be introduced on its own or after the concept of decimals has been introduced using LAB (Linear Arithmetic Blocks) or decipipes. It is important to explicitly show how the unit or one whole is

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	<p>broken down into their parts using the presentation provided or another method of your choice.</p> <ul style="list-style-type: none"> • This game was designed to be repeated regularly over the course of the unit as it may take time for the students to grasp it fully. It is also important for them to show the decimal in all its parts; as a fraction and as a decimal in order to make the connections between the two representations. As an addition, writing the decimal in words is also just as important. • Also, ensure that the students write the total decimal shaded, as this will also allow them to consolidate the concept as well as lead the way for decimal addition. • Encouraging students to refer to the decimals in terms of their fractional parts. E.g. 0.12 as one tenth and 2 hundredths or 12 hundredths instead of zero point one two.
IMPROVISATION OF MATERIALS	<ul style="list-style-type: none"> • A decimat that has been broken up into tenths only can be given to students who need enabling prompts or are at Level 4. The fractional die will then only contain $\frac{1}{10}$ • A decimat broken up into tenths and hundredths can be given to students who are not quite at the level of understanding required to introduce them to the thousandths unit. The fractional die will then only contain $\frac{1}{10}$ and $\frac{1}{100}$. (These templates are provided with this material on the website.) • As a further addition to the decimals unit, ask the students to order or compare their decimals on a numberline or from smallest to largest.
EASIER AND HARDER QUESTIONS	<p>Easier</p> <ul style="list-style-type: none"> • A decimat that has been broken up into tenths only can be given to students who need enabling prompts or are at Level 4. The fractional die will then only contain $\frac{1}{10}$ • A decimat broken up into tenths and hundredths can be given to students who are not quite at the level of understanding required to introduce them to the thousandths unit. The fractional die will then only contain $\frac{1}{10}$ and $\frac{1}{100}$. <p>Extension</p> <ul style="list-style-type: none"> • As well as being encouraged to break their tenths into further hundredths, their hundredths into further thousandths, students can be prompted to break their thousandths into smaller parts to make ten thousandths. • As the students roll the dice and shade their decimat, students can work out the total parts shaded using decimal addition before counting parts. • Once students have completed their 'game table', ask them to order their decimals from smallest to largest or on a number line. • Give students some ragged decimals to thousandths and ask them to represent them on a decimat and as a fraction or expanded fractional form.
KNOWLEDGE OF MIS-CONCEPTIONS	<ul style="list-style-type: none"> • Young students often think that the size of a decimal number is related to the length of the decimal. • Whole number thinking for decimals: 0.4 is smaller than 0.13 because the number 4 is smaller than the number 13. • Longer is larger: the length of the decimal predicts the size. E.g 0.7 shorter than 0.324 so this means that 0.7 is smaller. • Shorter is larger: 0.4 is larger than 0.87 because sharing something among 4 people will give a larger piece than sharing among 87 people. • Another reason why students think 0.4 is larger than 0.87 is that they think that tenths is a larger fraction than hundredths. • Increasing decimals across a place value. E.g 0.9 and one tenth more makes 0.10 instead of 1.0.

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<p>AN AWARENESS OF THE CURRICULUM FOR DETECTING GAPS IN STUDENT KNOWLEDGE</p>	<ul style="list-style-type: none"> • It is important for students to have a good understanding of fractions in terms of parts of a whole. • It is important for students to learn how to represent decimals as a: <ul style="list-style-type: none"> ○ Number ○ Word ○ Quantity ○ On a number line • Encourage the use of benchmarking when ordering and comparing decimals. • Use different models to represent decimals e.g. finding 0.3 of a circle or a volume.
<p>DID THE LESSON ACHIEVE ITS PURPOSE? (WAS IT SUCCESSFUL?)</p>	<p>The 'Decimats Game' is designed to be played by students repeatedly over the course of the unit in order to consolidate understanding of decimal place value. Throughout the course of the unit, it can be pulled out and repeated as a whole lesson or as a warm-up or cool-down activity. It can also be extended using the extension prompts listed above. Students at the enabling level can slowly be introduced to the complete decimat as they develop confidence with the concept of decimals.</p>