IDL
NUMERACY

Animation and Activity Guide

Contents

Introduction

IDL Numeracy is built using a variety of approaches intended to assist the widest range of learners possible. To that end, each lesson will contain elements of audio/kinaesthetic learning, themes and layout whilst at the same time adhering to a consistent interface and style. Over time, the level of scaffolding and support provided by the program is decreased in place of the learner's growing confidence and familiarity with the threads of learning woven throughout IDL.

'Problem Solver' Animations

In consultation with educational specialists such as Judy Hornigold, we have created a number of helpful animations now included with the numeracy package. Each short animation describes a mathematical aspect such as addition or place value and suggested strategies to assist the learner in answering that problem. They are a reminder as much as an educational tool, drawing upon the learner's experience in the classroom whilst providing visual prompts in an engaging way. These animations can be used within the program and also as a teaching resource for the whole class!

The animations are accessible from every question, each linked to videos related to that specific problem.

Each animation has been given their own brief methodology to explain some of the creative decisions in their design and the theory behind it. We have also included some of the reasoning for the questions in IDL and how they relate to the learner's development as well as these new tools. Amongst the many ideas addressed in these animations is an underlying thread of developing resilience in learners. By providing them with easy-to-access guidance and reminders, they are given tools to take control of their learning and feel more confident in tackling these problems themselves.

Extension Activities

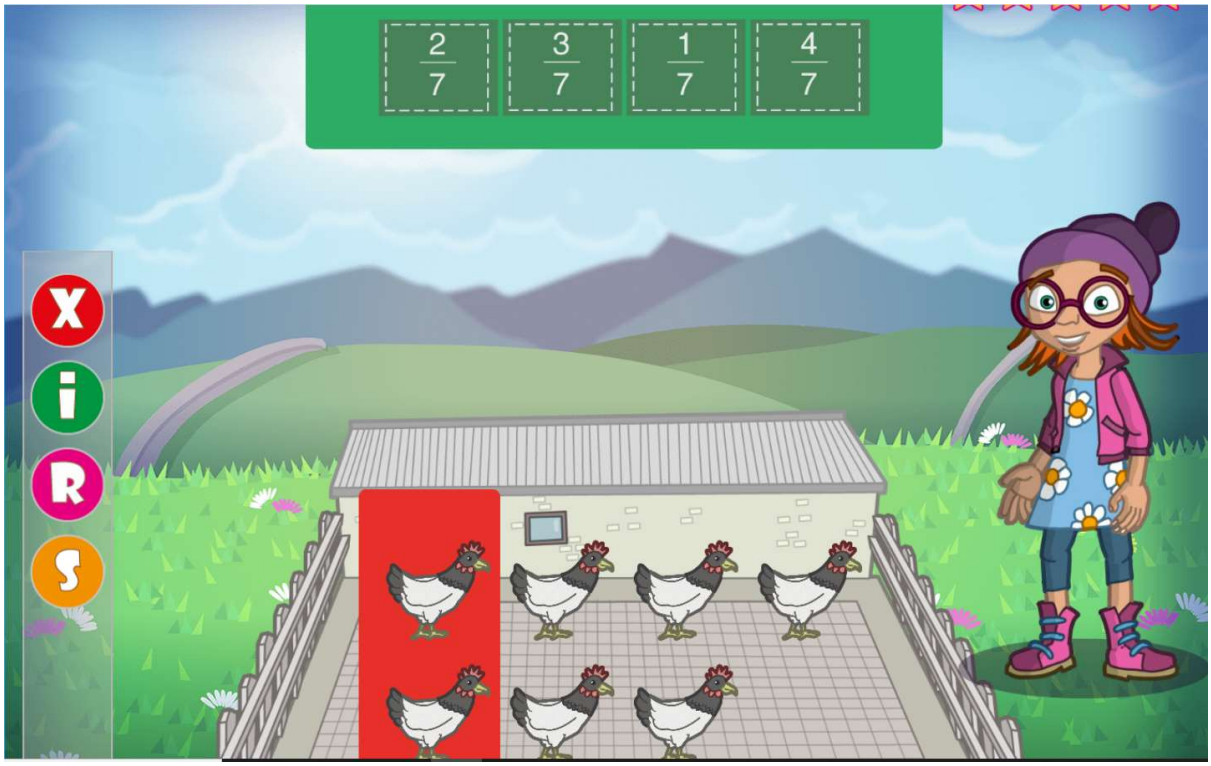
This guide also contains suggestions for activities which can take place alongside the learner's IDL experience with the intention of supporting and expanding on the strategies used there. Whilst none of the activities are explicit replications of the problems they will solve in the program, they have been developed along the same framework to complement them. Their description has been intentionally phrased to be as open to interpretation as possible as to retain a breadth of method. We understand that lower-ability learners will likely have their own difficulties which their teacher/TA are uniquely suited to approach. You are welcome to adapt activities as you see fit or contact us if you have any additions you would like to see!

The activities are intended to be carried out in a small intervention group of 2-3 learners although some of them can certainly be used as inclusive, whole-class tasks. Secondly, they are designed to use as little resource as possible. Whenever physical resources are required, they are either readily available items in a classroom or materials which can be constructed with the learner as part of a larger educational process. With so much to do in teaching maths and often little time, this guide has been designed to give quick, simple access to all levels of learning without additional complications.

Always Developing

IDL is a constantly evolving intervention program, developed in concert with specialists and feedback from users. We already have plans to include more animations covering subjects like measurement and multiplication but we are always eager to hear what you would like to see in future updates. If you have any feedback then please let us know how we can make interventions better.

Fractions



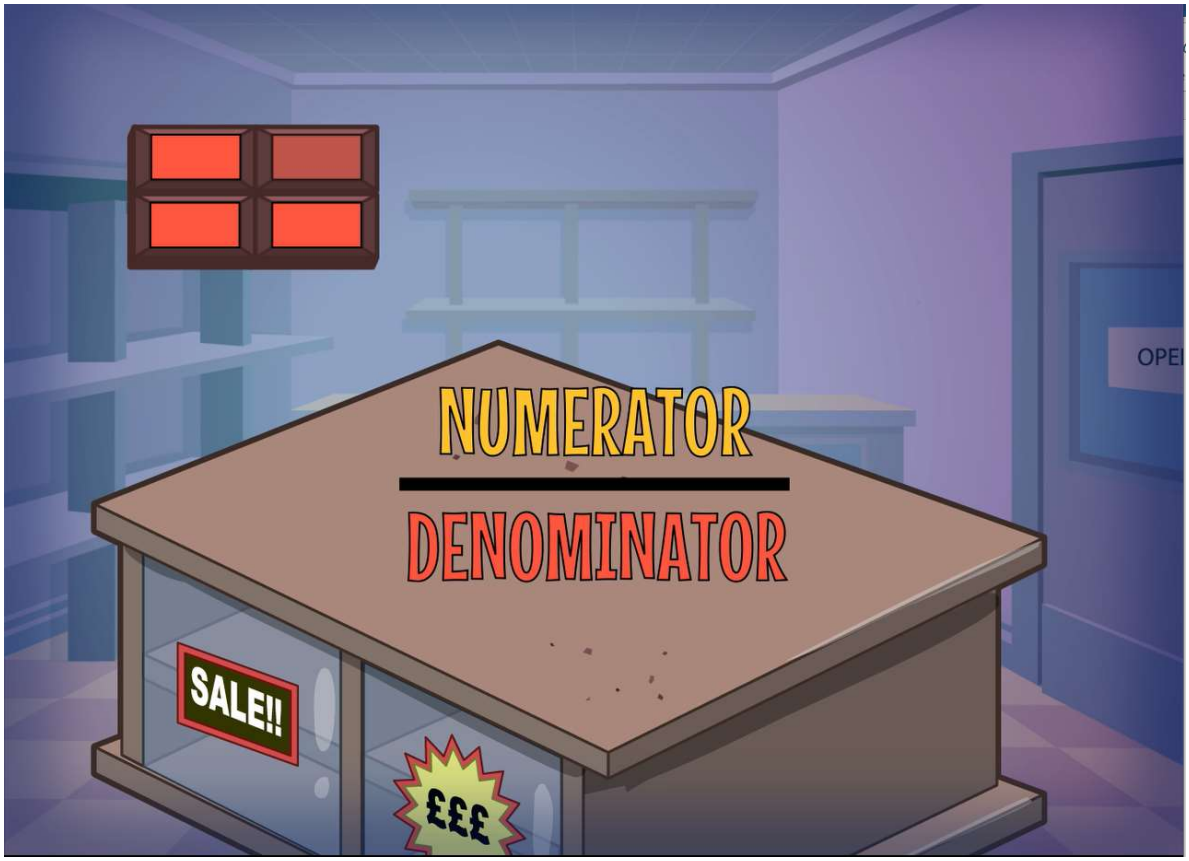
Methodology

In our fraction problems clear, visual representations of the denominator to aid the learner in understanding that a fraction is a portion of a whole. The numerator is highlighted so the learner can easily count them and then the total, deducing the correct answer from the options above. As the lessons grow more complex, the amount of support will be reduced as to prompt a reliance on the learner's comprehension. Other fraction problems may be:

- Click the pieces of chocolate so that 2/3rds of them turn blue.
- Which number is the denominator?
- Put one half of the chocolate pieces on to the counter.

These are all designed to include a strong kinaesthetic element to secure their understanding that each is a part of a whole. This is reinforced across the problems and animations to drive it home and through that, help the learner understand how fractions combine into a whole as well as how to write them down.

Animation



Using the familiar sight of a chocolate bar, the fractions animation explains how a whole can be divided into equally sized parts which are called fractions. Learners see how the chocolate bar can be broken into different shaped pieces but whilst the number and shape of segments can change, they can be brought back together as one whole. The colour of the denominator also matches the total number of segments to further reinforce their connection. Numerous examples of common fractions are included such as quarters, halves and thirds.

Activities

- **Draw a circle on a piece of paper.** Show the learner that this is a whole shape (imagine it as a cake or apple if that helps) and that together you are going to divide that shape into 4 equal pieces. Using a pencil and ruler, allow them to try and figure out where they are going to have to cut it. With less-able children you can let them indicate whilst you model the process, perhaps letting them have a go with the next one once you have finished demonstrating.

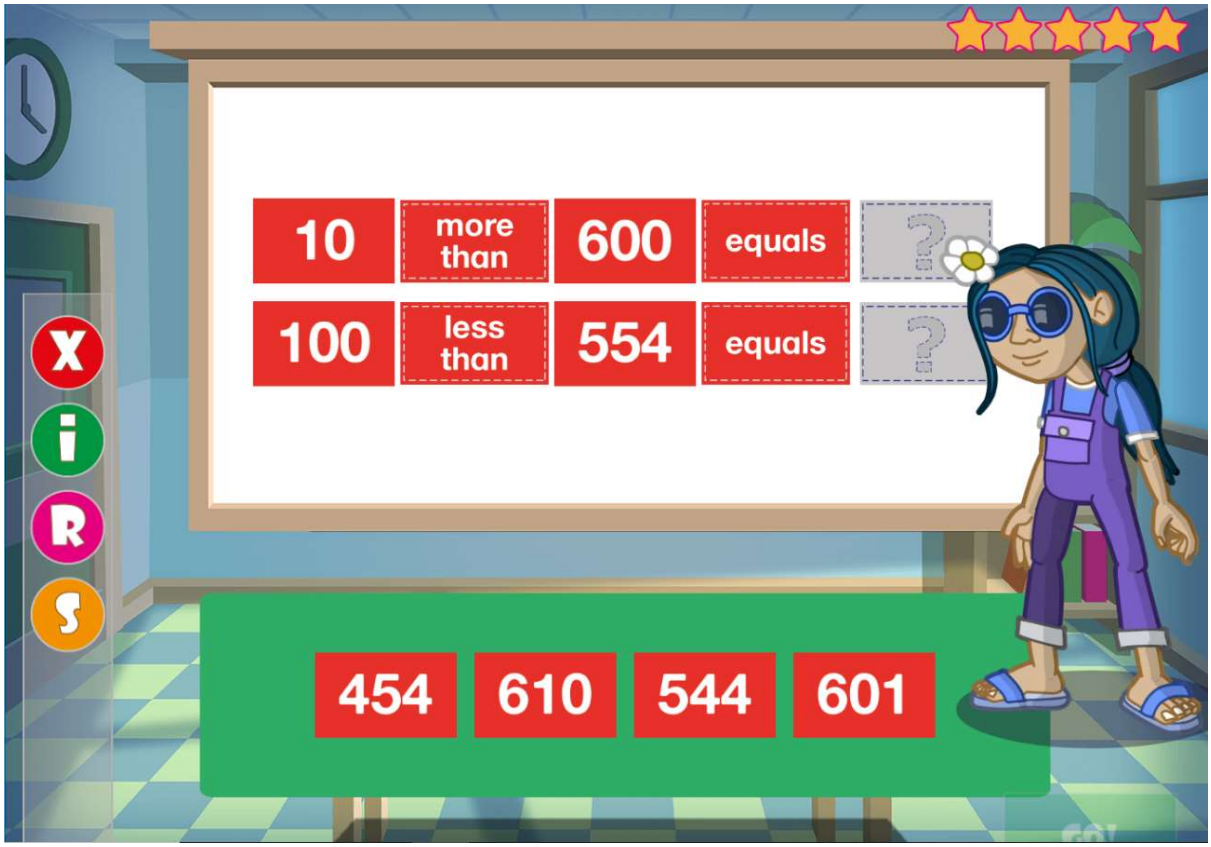
  Once the circle has been cut into 4 equal parts, show them that all together they make '1' before showing them a quarter and a half. Depending upon their understanding you may want to model ¾ or not. Show them that 2 halves are equal to a whole and two quarters are equal to a half. Once all of that has been shown to the learner, ask them to divide their own circle.

As an extension task, you can use a square and have the learner colour in the relevant sections and label the fractions.

- **Ask the learner to draw a picture of a square** then have them divide it into halves and then one half into quarters. Repeat with the picture of an apple or similar to help visualise the idea that an object can be divided into smaller pieces. Have them label the fractions. You could also draw equal sized boxes in their exercise book or graph paper before asking them to colour the fractions you give them.

- **Fraction Snap –** Make two piles of cards, one with the numeric representations of fractions and another with pictorial versions. The objective of the game is to match each fraction with the correct picture, providing the learner will minimal prompting such as reminding them that a quarter is “half of a half”. Whoever gets rid of all their cards first is the winner!

More/Less/Equal

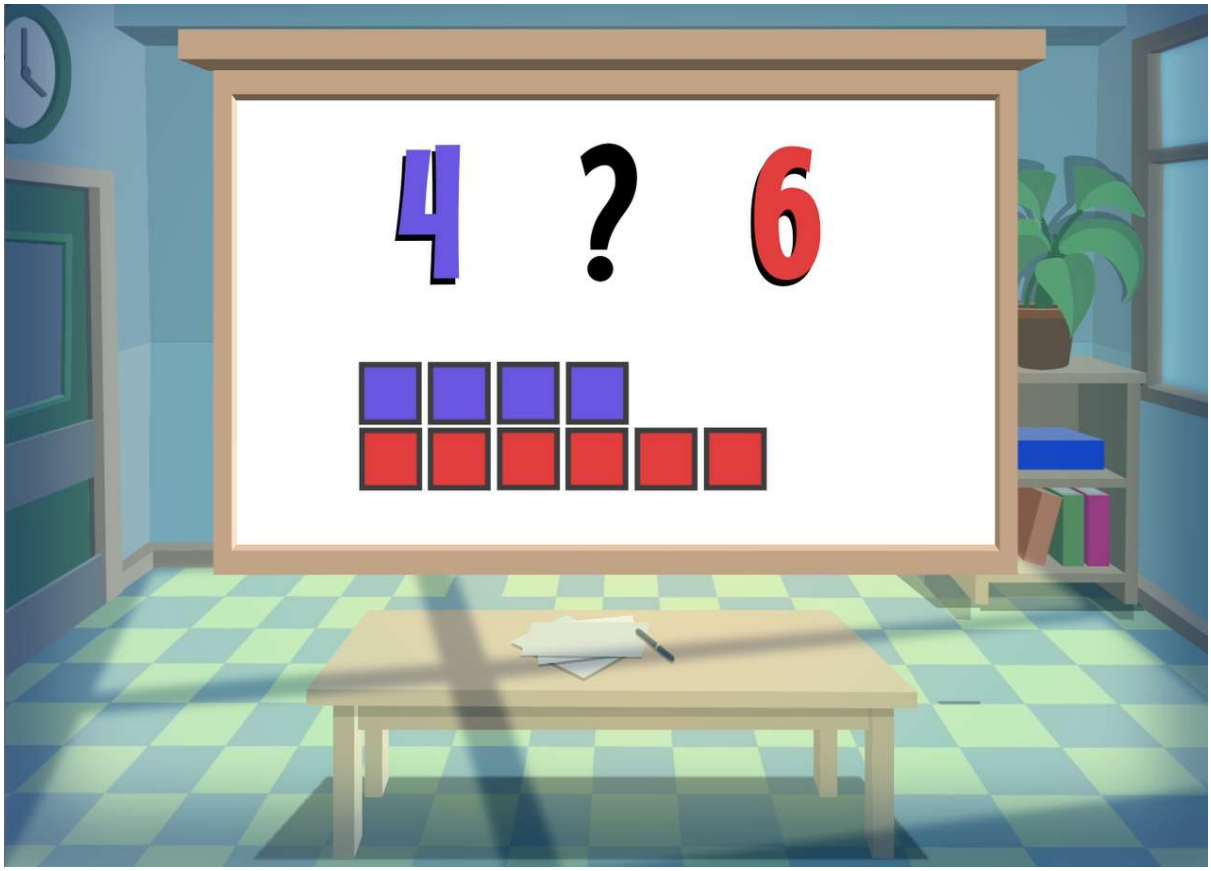


Methodology

In the app, these difference problems are divided between symbolic (<, >) and written form. Problems range between one to four-digit numbers where learners have been gradually introduced to checking units and then tens, hundreds and eventually thousands. As they progress through the modules, the value of the difference between the numbers will grow smaller as to make them more difficult to answer. These problems are often followed by a comprehension exercise involving ordering numbers as to further secure their understanding of place value.

- Which of these four numbers is the largest?
- Which of these four numbers is the smallest?
- Click the larger of the two numbers (one will be in larger font that the other)

Animation



This is the first of two animations about comparing numbers and deals with one-digit numbers. Viewers are shown the symbols for greater than, less than and equal as well as the written form of each. The strategy of using dots to compare two values is modelled in the animation as a simple method for learners to use.

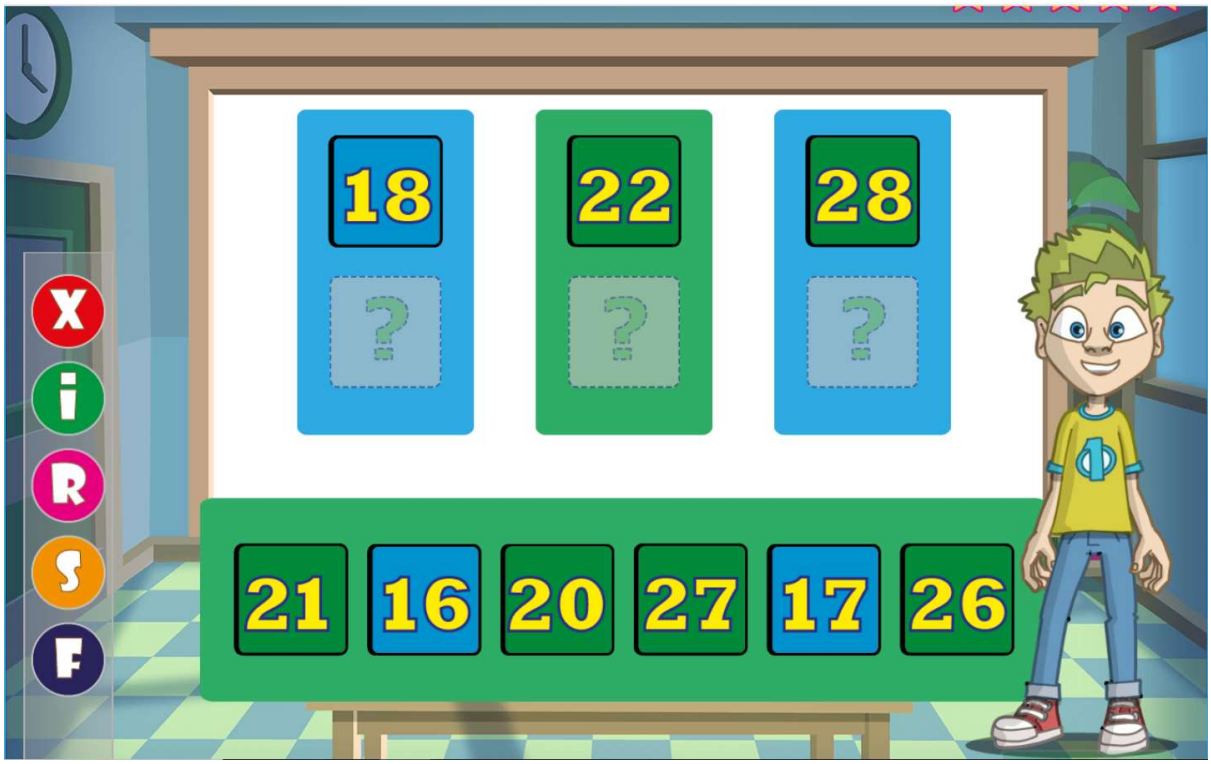
Activities

- **Tokens.** Using beads, tokens or similar small objects, set out a number of sheets of paper with the symbols for <, > and = along with numerical values. The learner then arranges the tokens to solve the problems, be it a number less than, equal to or larger than the one written on the paper.

- **Higher or Lower!** Using a deck of cards, the learner has to identify if the next card is higher or lower than the one you draw. This activity can take place with multiple learners at once, awarding points for not only correct answers but also prompting them to wait their turn as well. Playing cards work well for this as they have the numeric and symbolic versions of the value on each card.

- **Tally System.** Write a list of numbers where learners can see and ask them to find which are the largest and smallest. Count along with the learner as they make dots, circles or tally lines for each value they need to compare. Make sure they are setting them down in a clear manner such as one below the other and once both have been completed, ask them to compare and tell you which is the larger of the two. Whilst this is an inefficient method, it helps to secure the values in their head and eventually will be replaced by recognising the value as obviously being either larger or smaller.

More/Less/Equal – 2 digits



Methodology

The problem from the app pictured above is 'Choose the numbers that are 1 less than the numbers shown here'. To answer they must drag the correct tile into the space below which is intentionally including elements of kinaesthetic learning. The colours of the lettering and tiles are also designed to be clear even to learners with visual processing difficulties. Learners might benefit from the presence of a number line if they are answering this problem unguided and one has been provided on-screen in other problems.

Animation

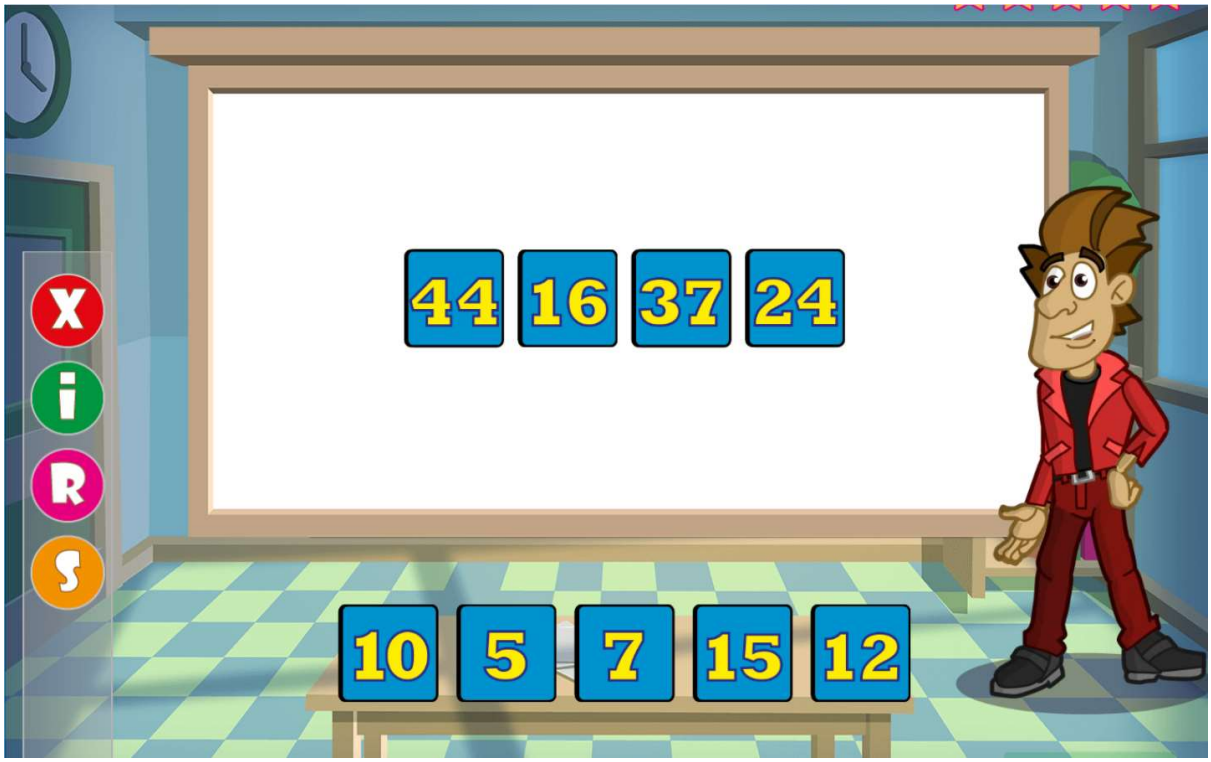
Building on the non-numerical format of the previous video, here learners are reminded of the importance of place value in comparing numbers. By reviewing ones and tens, they are introduced to the strategy of comparing tens first to find the larger value. If both possess the same number of tens, the animation then examines the ones column to find the answer. Multiple examples are provided in the short video as well as using mathematic terminology such as >. The written form of more or less than appear though the symbolic representation (e.g. >) are not expected until Year 2.

Activities

- **Size –** Provide the learner with items of various lengths or labels with sizes written on them (values in cm of two-digit length). They must then order them from smallest to largest, demonstrating understanding of place value and order. If you are using actual items (e.g. straws) this can help how some lengths can be equal to each other. Try having them pick the straws which are of the same length and then order them from shortest to longest. You can record these by taking pictures and sticking them into their books for their own future reference too.

- **Flip and Compare –** Cards with two digit numbers are placed upside-down in front of the learners. Each learner takes it in turn to turn over two cards and indicate which is the higher or lower of the pair (according to TA instructions). If they are able to do so correctly, they keep the card indicated. Whoever has the most cards at the end wins.

Place Value – 1's and 10's



Methodology

The place value question above asks the learner to 'Add together the tens from these numbers' and select the correct number from the bottom. Being able to identify which column is the tens from each number will challenge lower ability learners whilst understanding that each 'ten' is in fact 'one ten' may cause some difficulty. The additional activities suggested below are intended to help secure their learning regarding place value. Problems involving place value will frequently require the learner to correctly identify and manipulate discrete values such as tens or units as to scaffold in preparation for later problems including converting between tens and hundreds.

Animation

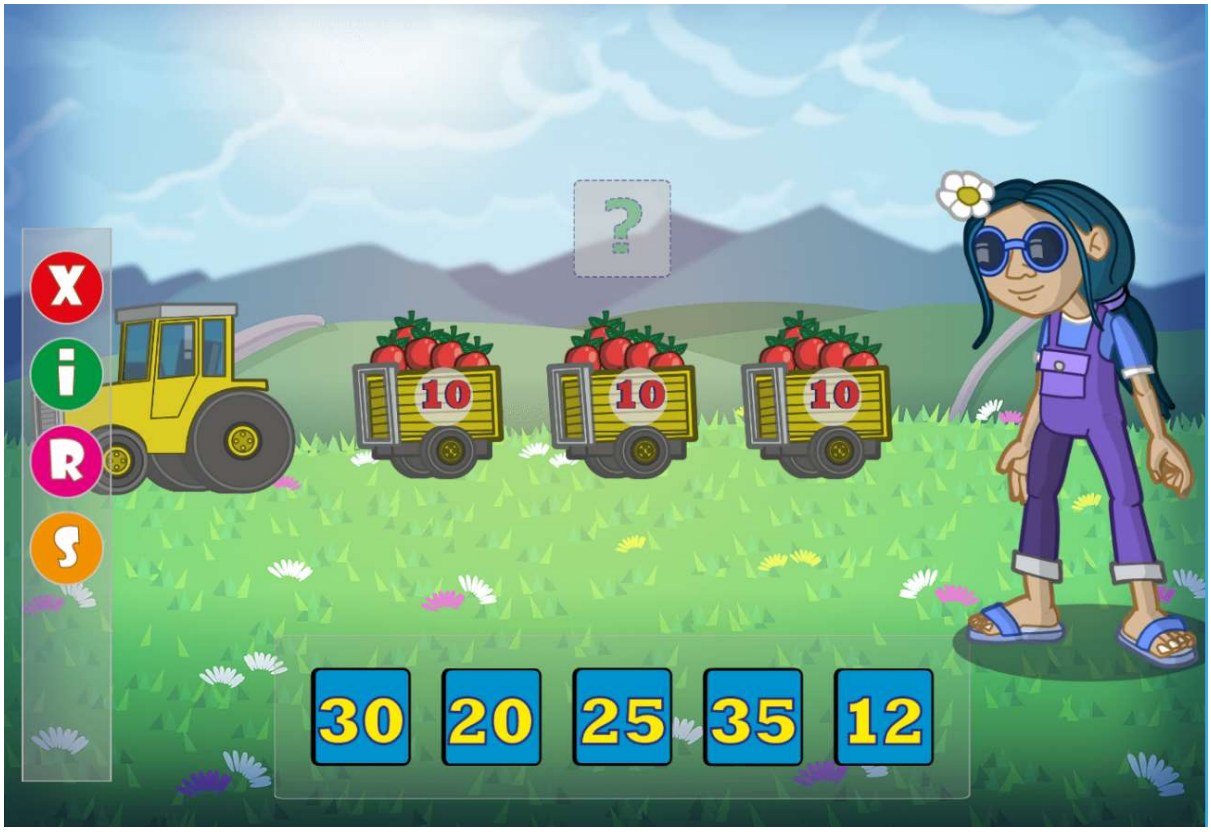
This place value animation focuses mainly on the conversion of ones to tens and how the columns are set out. As the apples are counted out one at a time, the video visually demonstrates the point at which they become one ten. This continues to twenty in order to further support their knowledge of how the ten column operates and lays the ground work for subtraction challenges they will face later in the program. Apples appear throughout IDL as something for them to count and drag which helps the learner understand what it is the question is asking them to do when they appear.

Activities

- **Number Search –** Using a pile of old magazines or newspapers, set the learner a list of numbers for them to find (e.g. a number with five tens). They have to cut the numbers out and glue them next to the question. You could expand on this with getting them to put together entire number sentences or making their own number line with cut-out numbers.

- **Sticky Note Numbers –** Draw out two columns, one for tens and another for units. Using coloured sticky notes compose a number for the learners to identify. For example, two sticky notes in the ten column and one in the units (or ones) would be 21. This is a useful way to identify learners who might be struggling with composition of number. You could label the sticky notes with 10s and 1s if they are struggling.

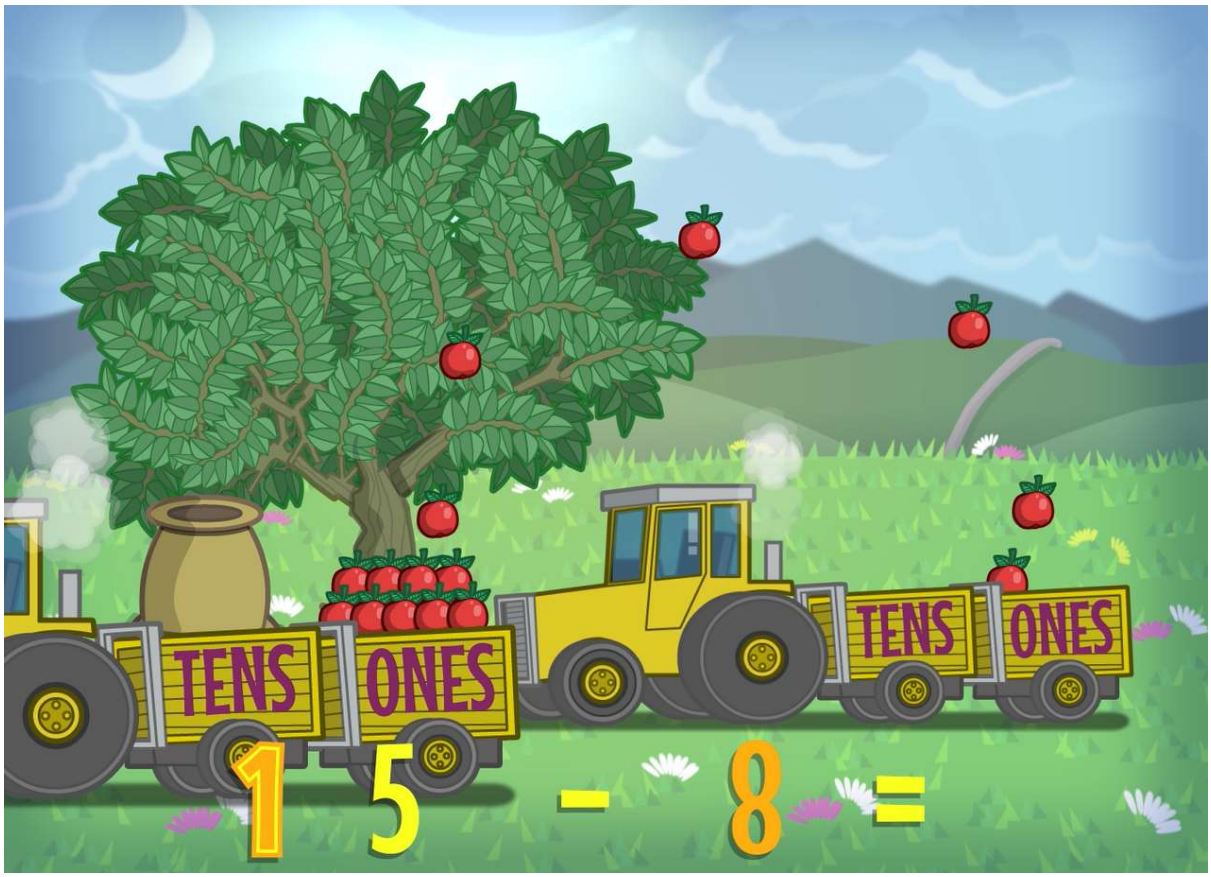
Place Values – Decomposition



Methodology

When confronted by the place value problem above, learners are asked how many apples there in total with three groups of ten. Their knowledge of place value and decomposition is complimented by clear visual representations of three tens. However they choose to answer this problem is up to them with counting up in tens or units, perhaps using external strategies like counting on their fingers or using a ruler/number line. More complex problems involving decomposition occur later with values including non-zero units and asking to add all the tens or units from a range of numbers. As in the animation, apples are a familiar motif reused throughout to help build the learners' confidence and competence in decomposition. Repetition is key when explaining new concepts and the animation carefully breaks down the process of moving between tens and units to fulfil that need.

Animation

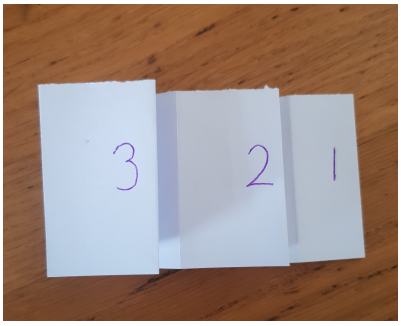


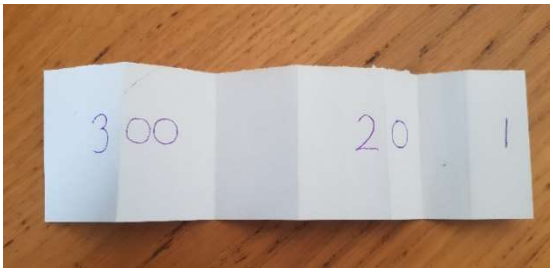
Similar to the previous place value animation, this one continues using the example of apples and bags for ones and tens. By representing the 10 as a collection of 1s, the video works through the process of decomposing a ten through subtraction and moving the apples from the tens trailer to the ones. This demonstration develops towards a number problem as shown in the example below, helping provide context to the picture representation the viewer had just seen. By visualising the numerals as collections of discrete objects, the learner is better able to manipulate and subtract them.

Activities

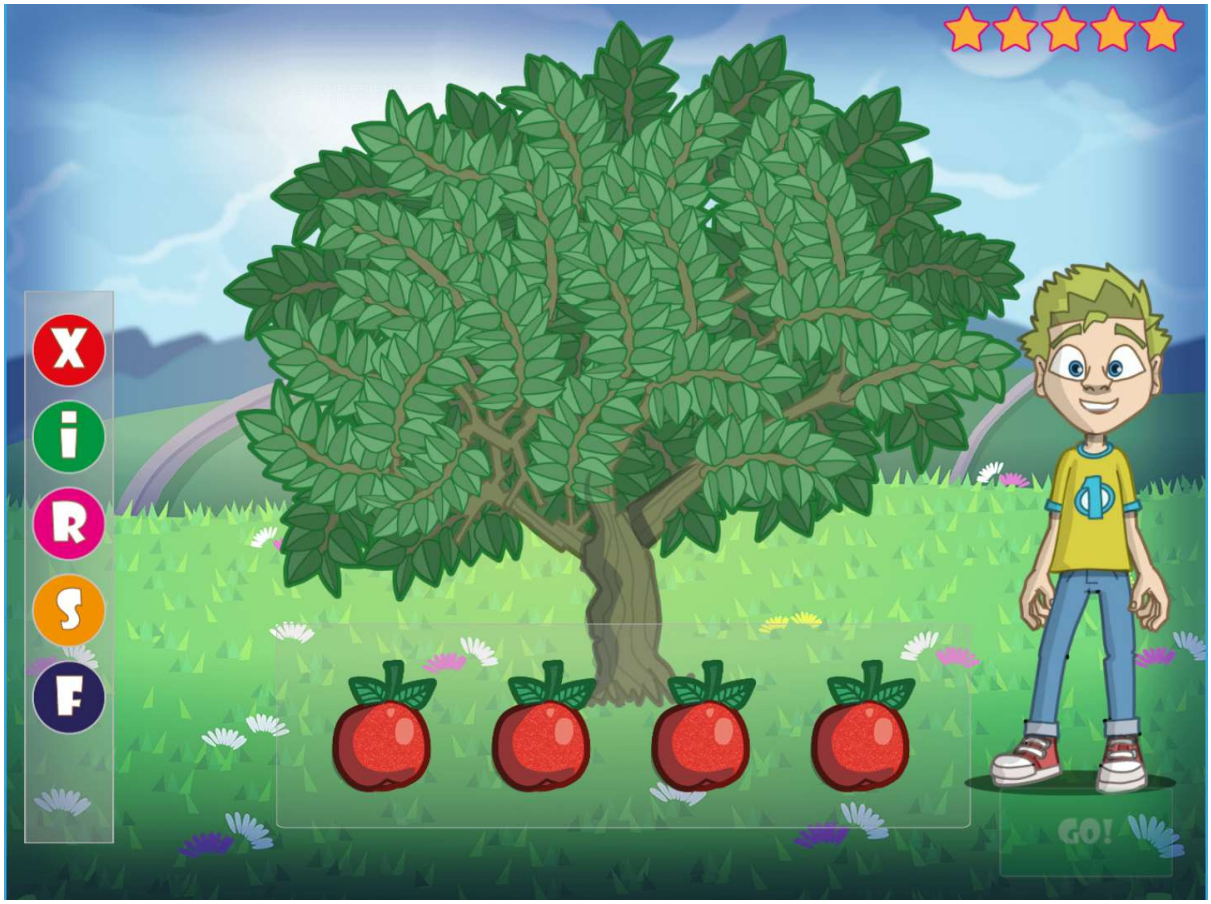
- **Sorting Exercise –** Using a number of tokens or beads, the learner must demonstrate the composition of ten units into one ten. By sorting the tokens into piles of ten they make a mark representing how many tens they now have, perhaps by organising them into separate piles. Once they have arranged the tokens you provide them with, check they understand that ten units are equal to one ten. Extend their learning by quizzing them on how many tokens there are at a glance, testing their ability to understand tens as multiples of units.

- **Expanding Numbers –** Write a three digit number on a long strip of paper folded into a concertina shape, making sure that each digit is on a separate ‘face’ of the paper. When extended there should be space for the rest of the number on the reverse side. Model the process first and then set the learner a task to decompose their own three digit number before explaining how it is composed. Whilst I have used three digits for the example, smaller units will be simpler for learners to grasp and then move onto hundreds and perhaps thousands depending on ability!





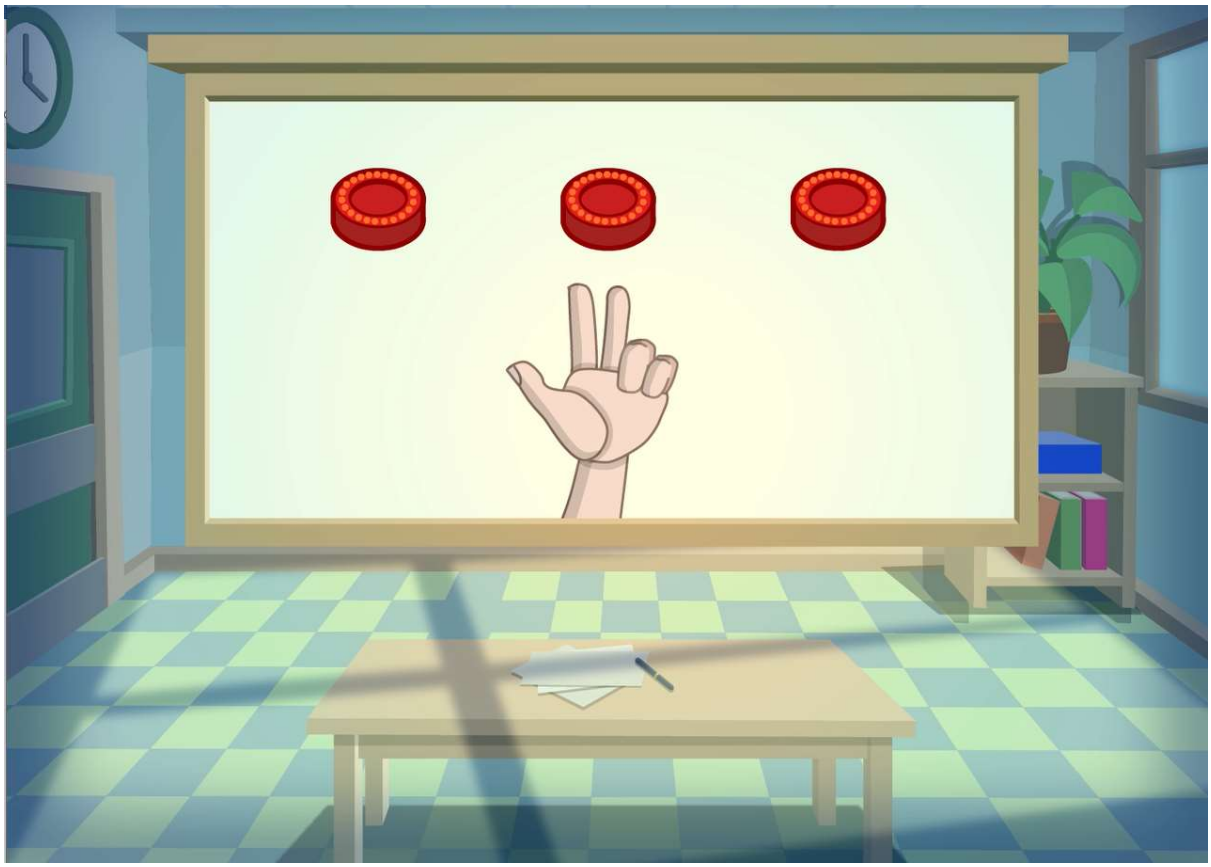
Value of Number



Methodology

This number value problem requires the learner to ‘Place four apples on to the tree’. Since there are only 4 apples available, the learner needs to drag each and every apple to the tree. The purpose of this is to help secure correspondence and value of each apple to the user. For example if the learner is working with a TA they could prompt the learner to count along with each apple they add to the tree. The focus is not just to count the apples on to the tree but understand that each apple is worth 1 unit and by grouping them on the tree, they reach a total of 4. By dragging an apple on to the tree, the learner kinaesthetically attaches value to each and helps them count along to reach the desired number.

Animation



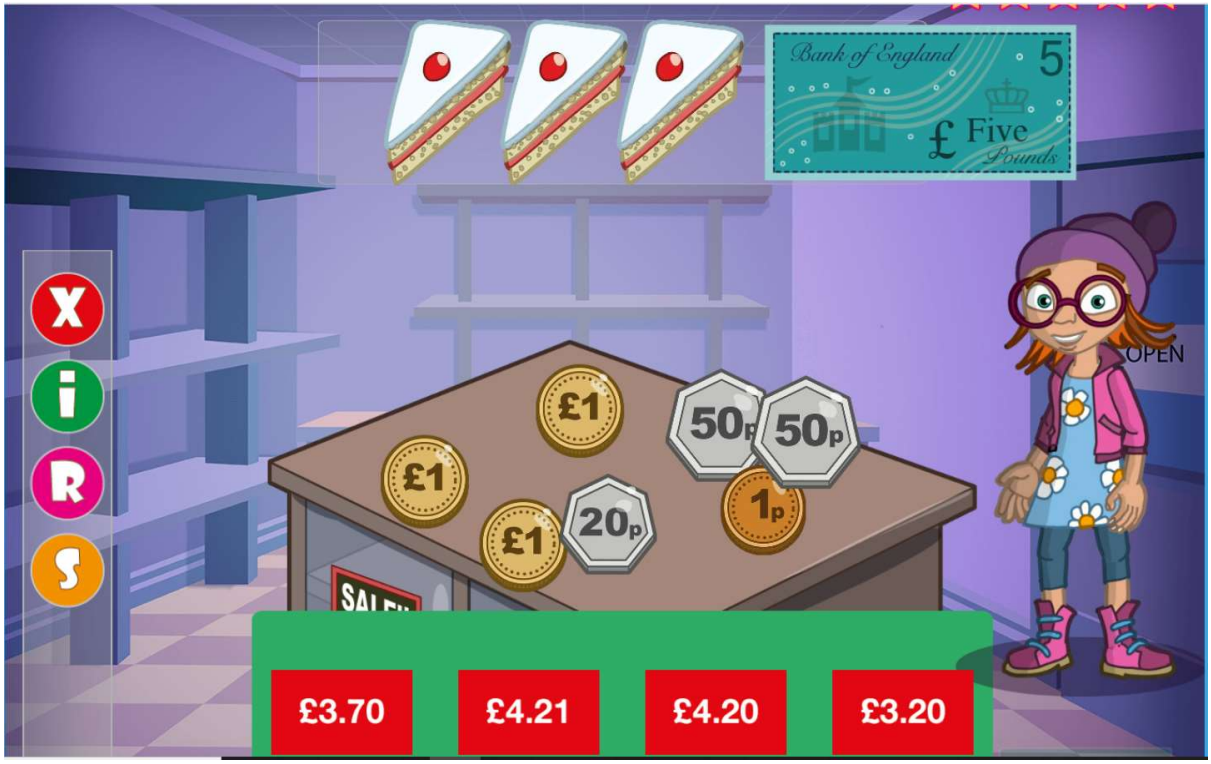
This number value video lays out the fundamentals for counting strategies with mnemonic devices such as clapping or using your fingers to count. These skills are normally developed early on however they may not have been mastered or are otherwise absent. By encouraging the learner to develop their own counting strategies, the intention is to improve their confidence in facing addition problems. The animation goes on to reinforce this by referencing elements of cardinality and if the learner finds it more helpful to imagine the number as an equal amount of items then they should feel free to. By encouraging a non-prescriptive approach the animation and subsequent problems invite the user to explore numeracy and use a strategy which works for them.

Activities

- **High Score Counting –** Using scrunched up balls of paper, balls, bean bags or other safely thrown objects – the learner must successfully toss a set number into a bin or target. As they do so, have the learner say which number this is as they count along. For example, the learner is asked to throw three balls into a basket a short distance away. One at a time they toss the ball and say “One” “Two” “Three!” Afterwards, have them pick the items out of the basket one at a time and count them back to further consolidate their understanding.

- **Go Fetch –** Write a one-digit number on a sheet of paper and affix it somewhere in the classroom. Repeat with different numbers until you have a suitable amount compared to the learners you have. The objective of the game is to take sticky notes from a central location and stick them one at a time to the number on the wall. Each learner has a wall assigned and the first one to reach the correct number of sticky notes wins. The activity can be repeated a number of times with learners swapping number walls.

Number Value – Coins



Methodology

Currency problems like the example here where the learner is asked to pick the correct change from £5 for the slices of cake begin to appear in the third module. Similar problems include calculating the amount spent on different items and using a limited number of coins to fulfil a value. An element of object recognition skills is required with the coins being distinctly modelled after actual currency. The animation focuses on the value of coins by carefully breaking each unit of currency down into the smaller denominations it contains, helping secure the idea that only set amounts can be used to reach that total. The demonstration of how something is bought using specific coins is a direct example of the problems they will be answering within the problem. Learners will sometimes have to drag relevant currency into slots or visually assess the amount present and select the correct total (such as in the example). In most problems they are able to interact with the coins, moving them as they count and enabling them to use their own strategies.

Animation

This animation provides a comprehensive overview of coin value as well as how larger denominations are made from smaller ones. The most common problem encountered by learners in this regard is how there are limits to which values can be used in reaching a larger total (1p, 2p, 5p etc.) and so as in the example above, the video makes it explicit how these smaller amounts can be combined. Though confidence in money problems will only grow through experience and familiarity, the animation will always be accessible to provide a reminder.

Activities

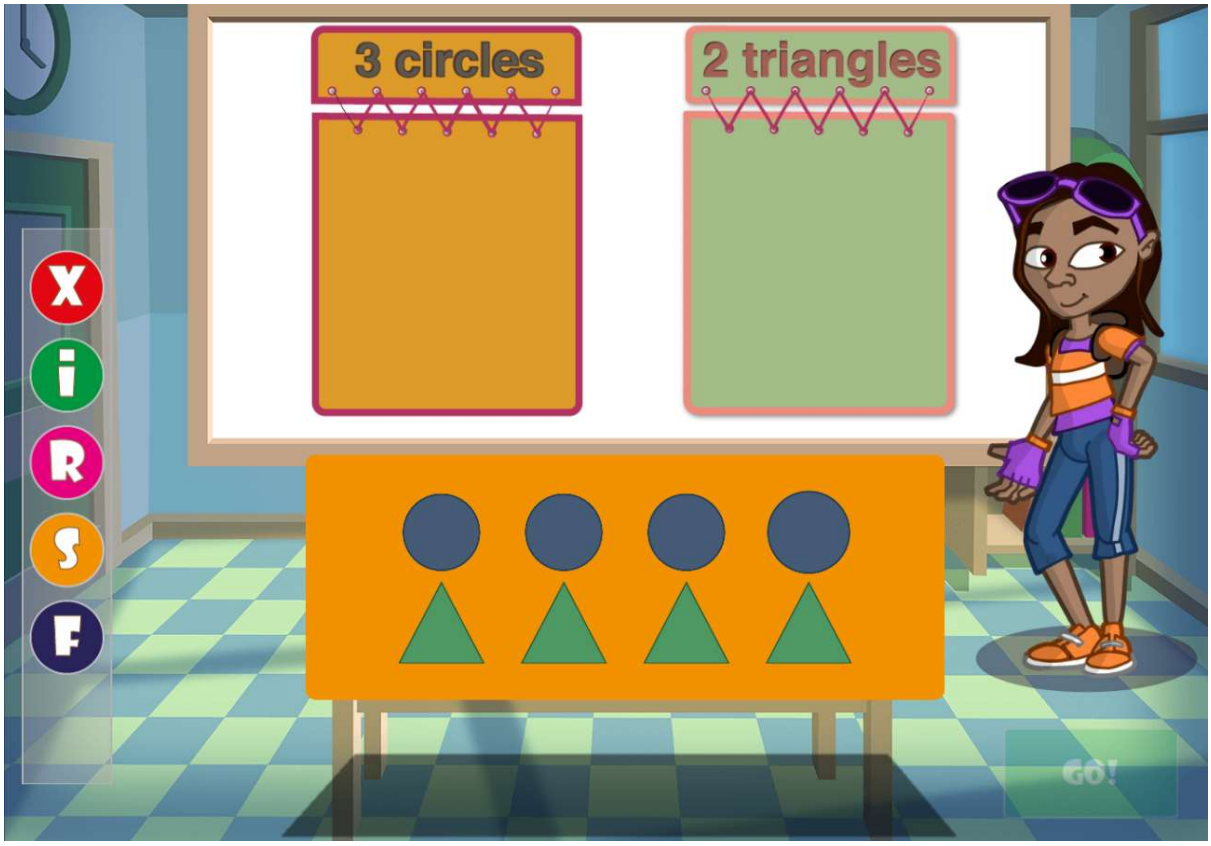
- **Classroom Shop –** Make price labels for items in the classroom (rulers, pencils, board pens, exercise books) requiring different amounts to purchase. Each learner is given an amount of money with which to buy as many things as they can afford. They need to write down what they purchase and how much it costs with more-able learners calculating their change as well.

- **Coin Combinations –** Using price labels similar to the previous task, ask the learner to see how many ways they can pay for the item and which coins they would use. They have to demonstrate understanding of each coin's value and could write their answers in either numeral form (2x 10p) or by drawing the combinations of coins they use.

- **Counting Change –** Have your learners bring in loose change (1p and 2p) over a few weeks then have them sort and count it. This will teach them cardinality between the coins as well

as helping with multiples of 2. In addition, this can also demonstrate number value when they reach 100p then it becomes £1.

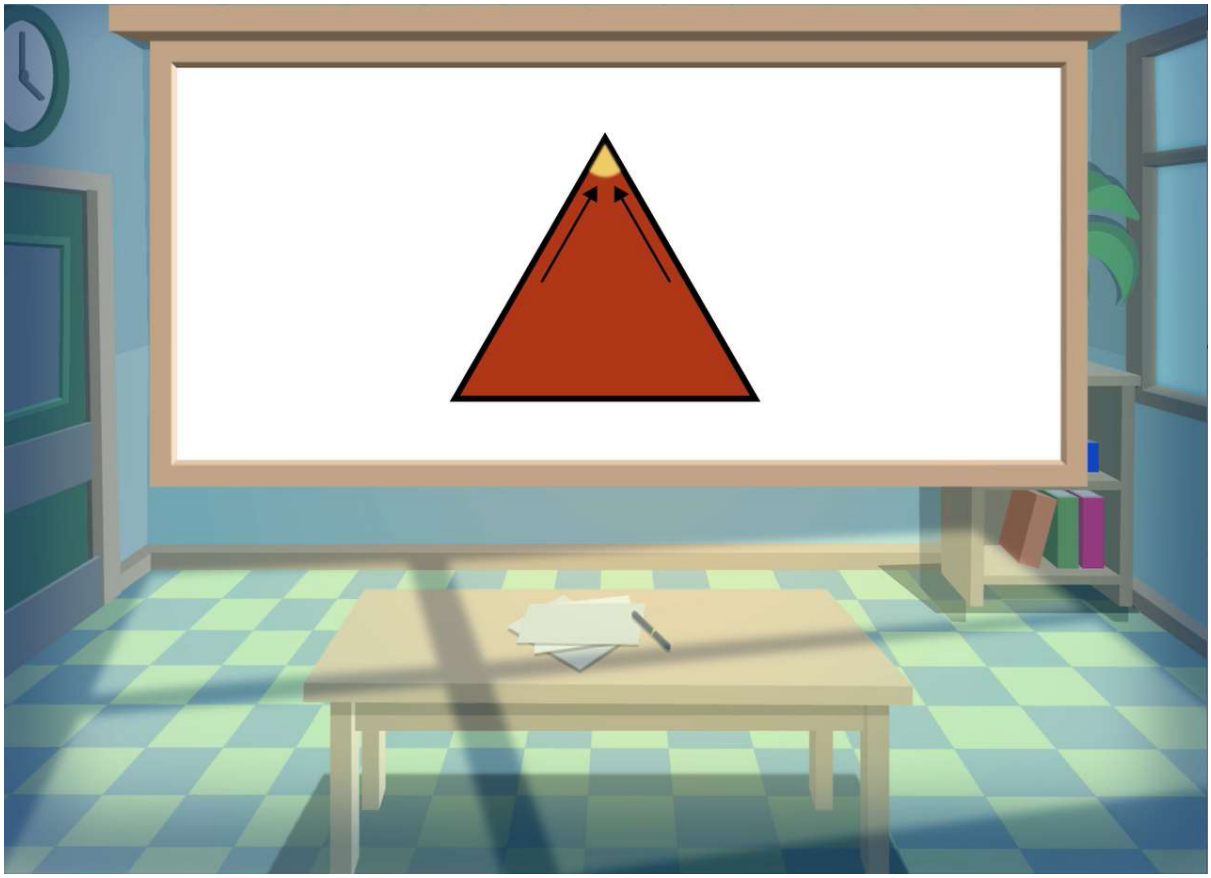
2D shapes



Methodology

Most shape exercises involving exclusively 2D shapes are found in the early stages of the program as simple 3D shapes are rapidly included to provide greater depth of knowledge. Sorting exercises such as the one above contain aspects of number value as much as shape recognition as they must recognise each shape as one of itself as it counts towards a total. Other shapes used in similar problems include rectangles but most of the earlier examples such as above will be very simple shapes.

Animation



In the 2D shape animation, the position of vertices in a variety of shapes is highlighted and explained. Both dimensions of height and width are explained along with visual demonstrations. Each are highlighted to demonstrate exactly what is meant by a vertex whilst faces and other elements of dimension are explicitly modelled along with the correct terminology. The video also directly compares squares and rectangles, providing useful reminders of the differences between the two.

Activities

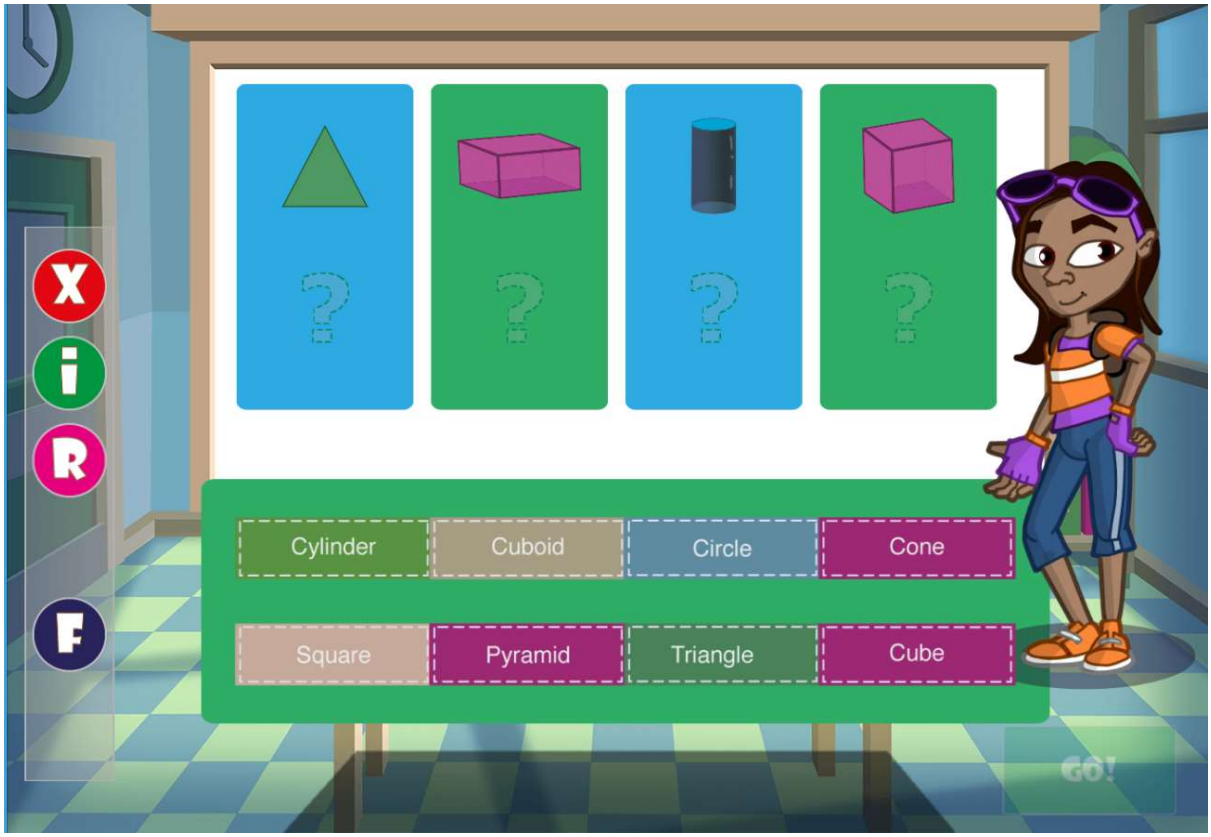
- **Tessellation –** Look at a chessboard (or similar chequered grid) and in particular the patterns. They begin as squares however if you change the colour of one of the squares then that shape becomes a rectangle. Change two and it becomes a larger square! Using coloured squares of card (or graph paper), the learner fills a grid with squares and rectangles. As an extension task you can ask that they make a specific number of squares or rectangles, prompting them to consider elements of tessellation.

- **Shape Identification –** Going around the classroom or school with the learner to explore where geometric shapes occur in things they see every day. Not just the whiteboard as a rectangle but how elements of larger objects are made up from 2D shapes (e.g. a keyboard

might be rectangular but the keys are square). Have the learner record this information in the way they feel most comfortable however a helpful extension task would be to have them record it as a tally chart.

- **Sort it Out –** Label two sorting hoops or areas for shapes with ‘more than three edges’ and ‘less than three edges’ or similar criteria before having small groups of learners sort pictures of 2D shapes into the correct area. As a supervised activity, this provides opportunities to discuss and explore other aspects of the shape such as the number of vertices and how they relate to the number of sides.

3D shapes



Methodology

3D shape problems usually require the learner to label them or drag the correct shape based on how many faces or vertices they have. Clear and colourful visual examples show if the requested shape is a 2D or 3D one. Correct terminology is used throughout with clear examples of cylinders and square-based shapes.

Animation

The 3D shape animation has rotating shapes to help explain the appearance of three-dimensional shapes and how they differ from the 2D ones. In addition, the video puts 3D shapes next to their 2D counterparts, modelling how they form the faces of 3D shapes and how they are important to identifying different kinds of shape such as the square-based pyramid. Building on the previous animation, the third dimension of length is introduced and shown in context of the other two alongside reminders of how each are spelt.

Activities

- **Find the Face –** Building on the animation, show the learner how a 3D shape is made of 2D faces. Begin with a circular cylinder and show how each end is a circle – a 2D shape but the overall cylinder is 3D. Ask them to find other 2D shapes in 3D objects, see if there are some they can identify but not find. One recommended example is a football as a sphere, making sure to explain that whilst it might look like a circle that it is instead a 3D shape.

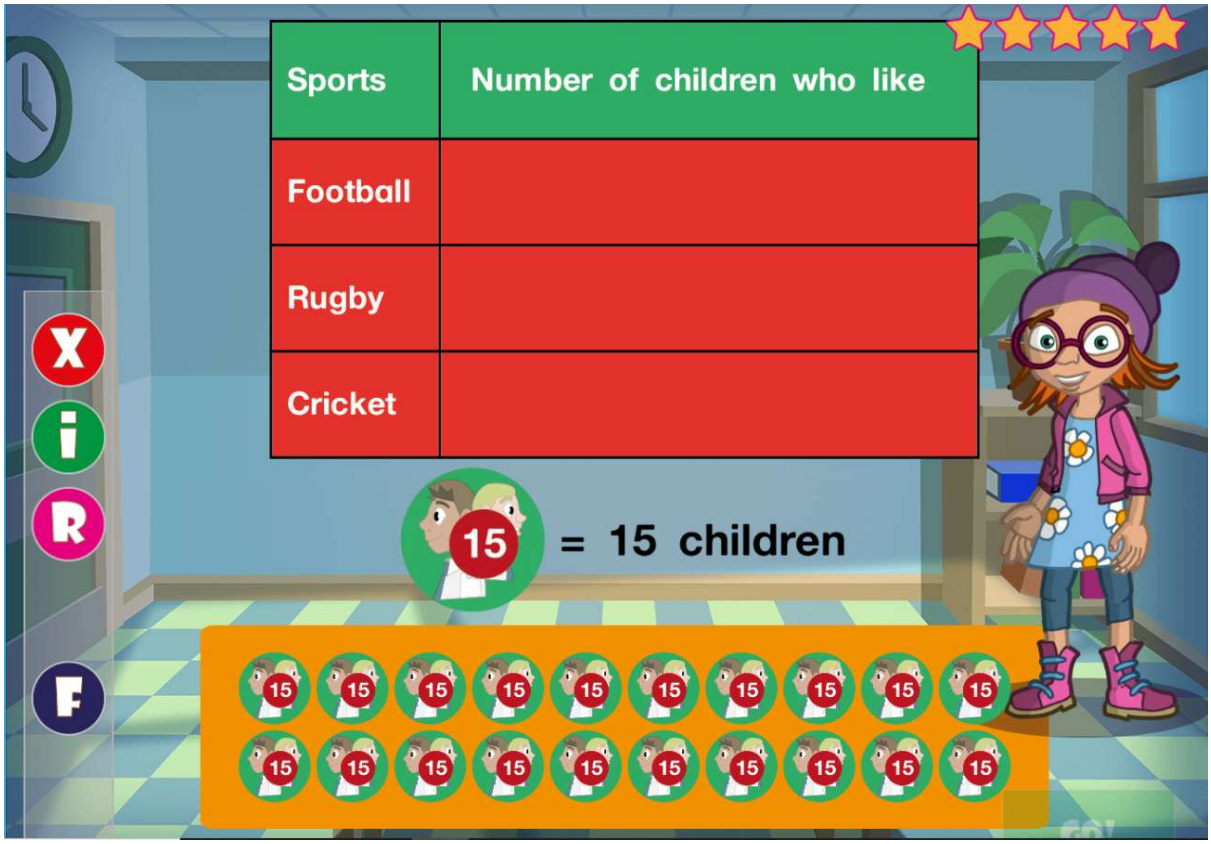
- **The Pointiest Object –** As the animation explains, most 3D shapes will have one or more vertices. Going around the classroom, the learners record items with as many vertices as they can find. The objective is to find the object with the highest number of vertices and

then describe it using the correct terms.

- **Will It Stack? –** Looking at a selection of 3D objects, the learners must predict if they can be put on top of each other without them falling off. Do they notice anything these shapes have in common? They must be able to use the correct mathematic language like face, vertices and edges.

- **Nets –** Learners are provided with a number of nets for different 3D shapes and must identify them from their 2D images. Once that is complete, they can construct them and label each side with a number. These shapes will then serve as dice for later tasks (e.g. pyramid – d4, cube – d6).

Bar Model

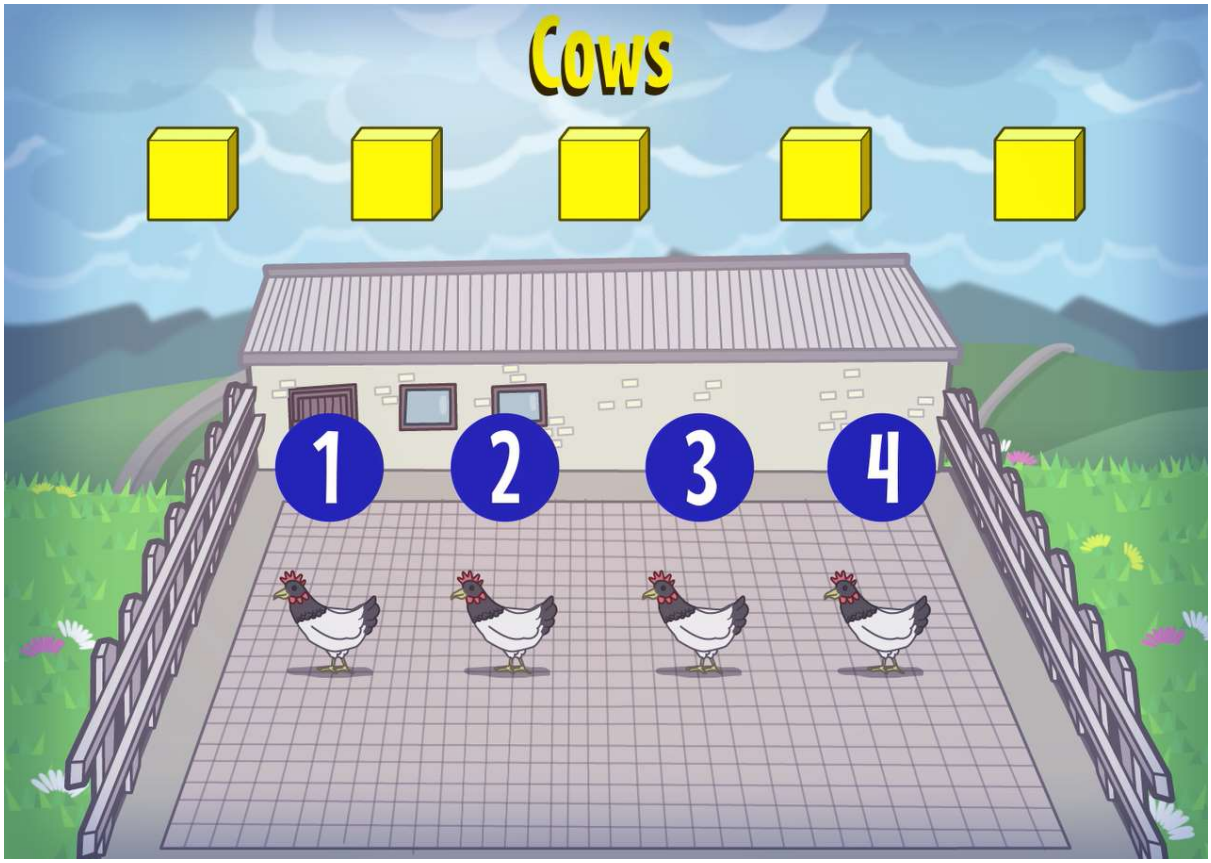


Methodology

Combining number value and comparison, problems around bar models are addressed in a range of problems around how larger pieces are represented by smaller units. By furthering the demonstration beyond cubes and towards practical applications of the strategy such as comparing numbers, the learner sees how maths problems can be solved regardless of what the items involved are.

Unlike physical resources which are limited in a school, the maths problems it addresses can represent as many cubes as necessary. The animation demonstrates the function and layout of a bar model.

Animation



This bar model animation specifically addresses the problems for which this method would be helpful and provides examples of how blocks are used to represent specific objects (in this case, cows and chickens). By approaching values in an object agnostic way, the learner can develop their skills of addition without being confused by the objects being different. Base-10 is a teaching tool employed in many schools with blocks of one, five, tens and hundreds. Whilst it establishes the fundamentals of multiplication, addition and equivalence the layout of the units here has been explicitly designed to mirror that. In so doing it lays the groundwork for later work on fractions and some elements of division.

Activities

- **To Rule(r) Them All –** Have the learners look at their ruler and see if they can divide them into thirds using the measurements along the edges. Hopefully they will already understand that 30cm can be equally divided into three 10cm lengths. Demonstrate that this can be represented by a bar model made up from three smaller bars contributing to a whole. These thirds can be found in other lengths although they will be smaller, provide the learners with some physical representation such as base 10 and model before allowing them to conduct their own investigation. Ask the learner how many other size increments their ruler can be broken down into (2s, 3s, 5s etc.)

- **Bar Labels –** Present the learners with a bar chart containing data but without the labels on either axis. The learner is informed what the value of the largest and the smallest bars are and from there must label the blank gradients on the axis. With guidance and perhaps following on from the previous activity, this will help demonstrate scale and that the values on the axis will increase at the same rate. Suggested data could include ‘Number of boys/girls in the class’ or ‘Number of days we are in school’.

Subtraction

Methodology

The subtraction problem above asks the learner to 'Pop 4 birds and then choose the number that tells us how many are left'. Clicking on a bird will make them disappear and pressing the 'R' button will reset them, giving the learner opportunity to experiment with the values involved. The layout of the birds in a 4/6 pattern is intentional as it will help them identify the remainder more easily by removing all of the birds on the left side of the pole. The learner can either remove the 4 birds and then count the remaining total or alternatively count backwards from 10 as they pop the birds to reach the answer. Whilst the layout of the birds helps separate the two values, the learner should still be taught to recognise the number of birds as a whole value rather than two distinct groups being added together.

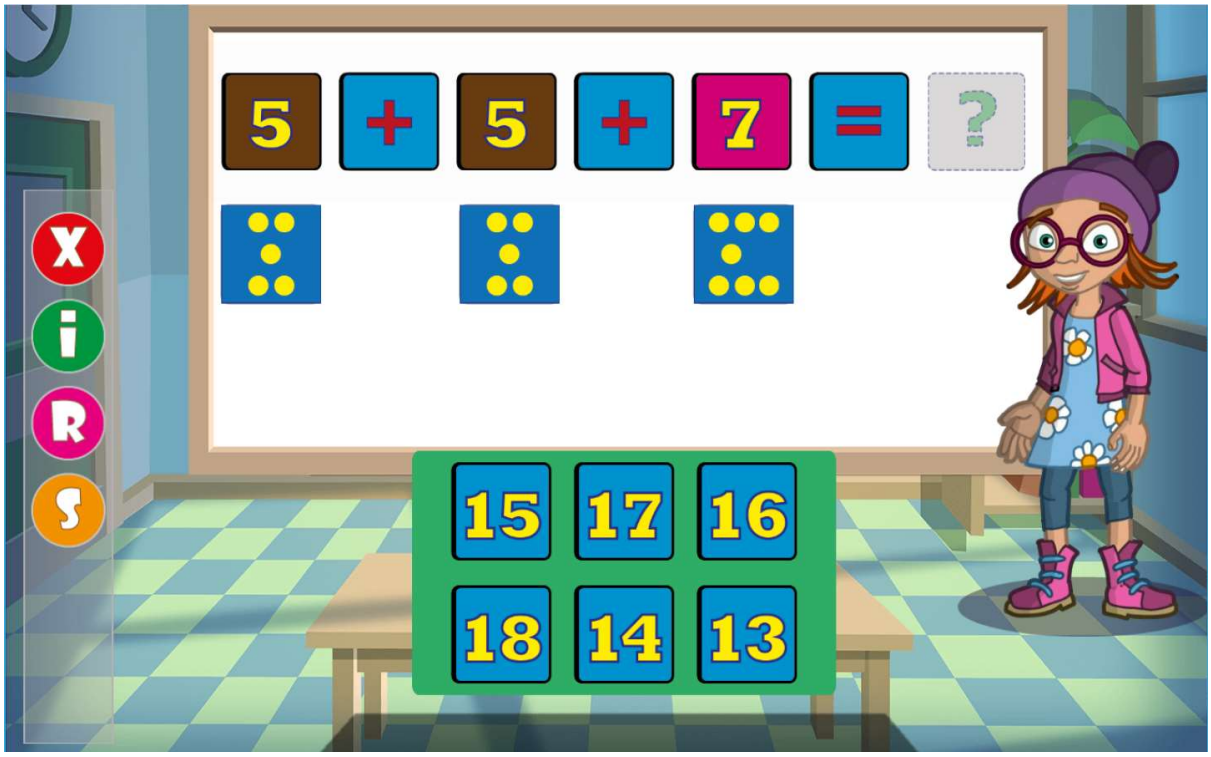
Animation

This subtraction animation uses both numerical and written form problems to develop learners' experience with the word problems they will encounter in exams and later questions in the program. Donuts are used to represent the values being subtracted as many of the questions in the program will have some kind of physical representation to assist them in grouping and subtraction. Different strategies are highlighted in the video to cover a range of abilities including written form, partitioning and subitising.

Activities

- **Take Away Takeaway –** Using empty takeout tubs or whatever small boxes are in the classroom, have the learners figure out how many will be left when you subtract some. Count the total together and then remove some, counting each as you do so before asking them to figure out how many remain. You may want to hide the remaining boxes to prompt them into completing the calculation instead of simply counting the ones which are left!

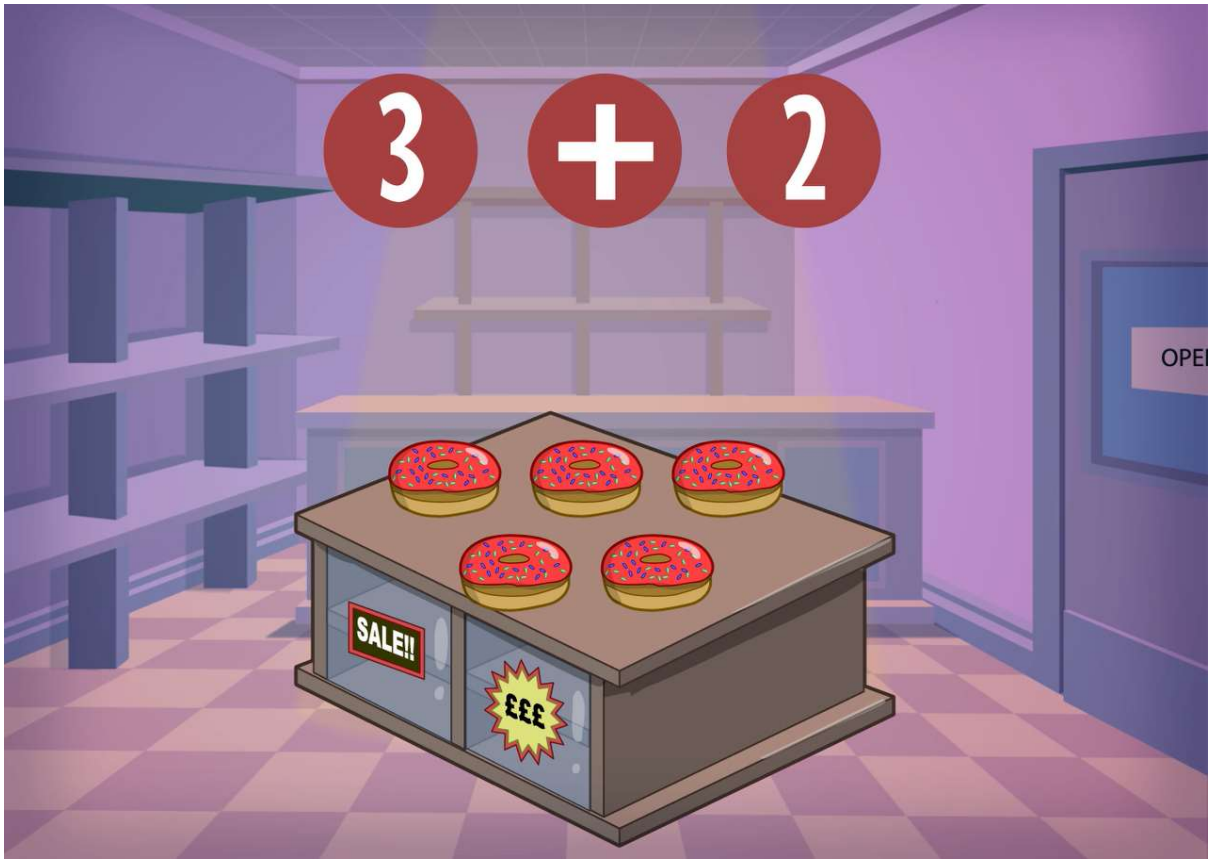
Addition



Methodology

The addition problem above asks the learner to complete the sum. This particular problem appears in module 2 and so has several aspects of scaffolding in place to help understand and solve the sum. Dots subitising for the digits helps learners to count and understand the values involved. Less-able learners can count up the dots to find the total whilst others will be able to follow the numerical problem. Learners will drag the correct answer tile into the space at the end, swapping out incorrect choices in a manner similar to what they could be attempting in class with physical resources which helps embed their learning as well as engaging their interest.

Animation



Addition, one of the fundamental skills of addition, is carefully modelled in this animation using the trusty donut. Viewers are shown how a collection of objects can be counted and then how that number is increased by adding more. Each time the donuts are counted, they are highlighted so that the learner can count along and then the number sentence is laid out for them. The animation also provides the numerical and the written form of the problem to expand the breadth of learning and prepare the viewer for written form problems later in the program.

Activities

- **Pyramid of Numbers –** Begin with asking the learner to write a line of one-digit numbers. There has to be an even number of written values (2, 4, 6 etc.) The learner will then add each pair of values together and write the sum above and in-between each value. For example:

		5		7		5	
	2		3		4		1

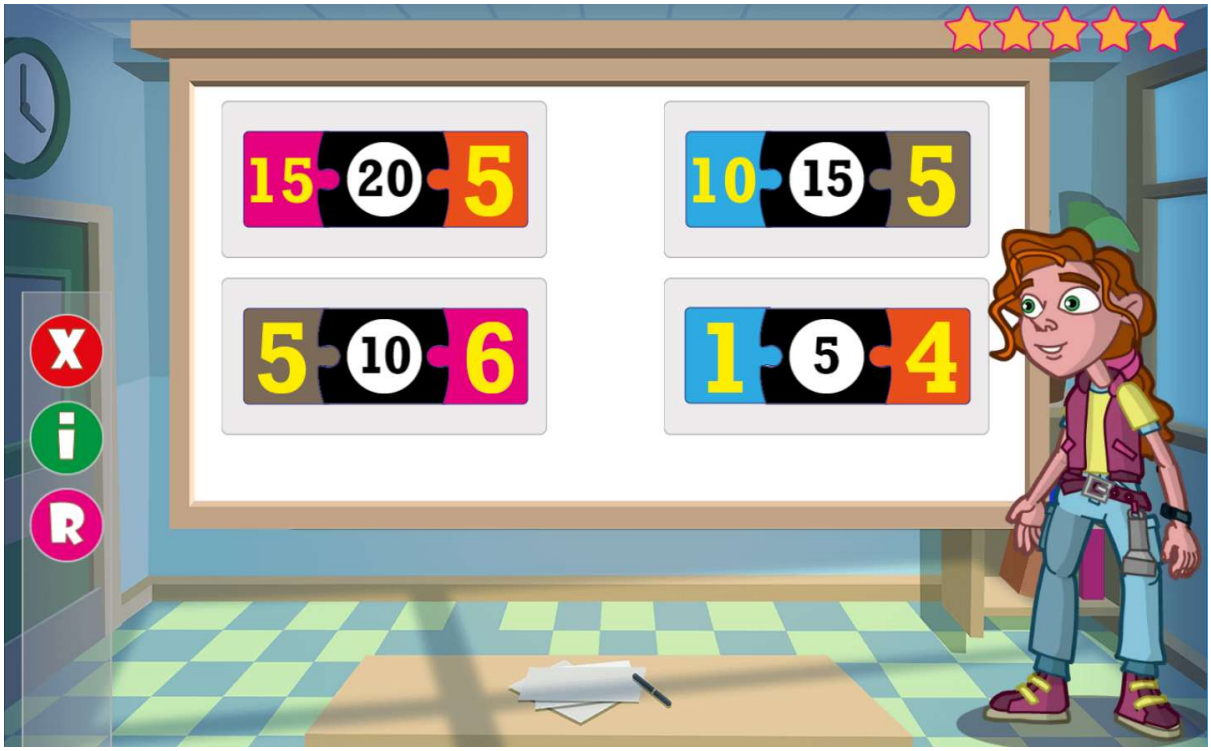
  Depending upon the ability of the learner and time constraints, the exercise can be as long as necessary. Once the second line has been completed, the learner repeats the process on a third line above that until a pyramid is formed. A further extension task could be setting the learners to work independently and see who could make the largest, correct pyramid. This can also be another method of teaching number bonds if they are struggling with those.

- **Kinaesthetic Counting –** Learners are given sheets of paper with a number written on it (place value of 1 to begin with) and given space to move around the classroom. Learners need to form trios of numbers with two learners' numbers adding up to the third. You can extend this task by asking the entire group to form the largest number they can or the

smallest.

- **Adding Tens –** Learners with whiteboards are lined up with a single digit value written on the first board (for example, they chose 9). The next learner in the line has to write a number 10 higher and so on (19). Progress can be measured by the speed they calculate at.

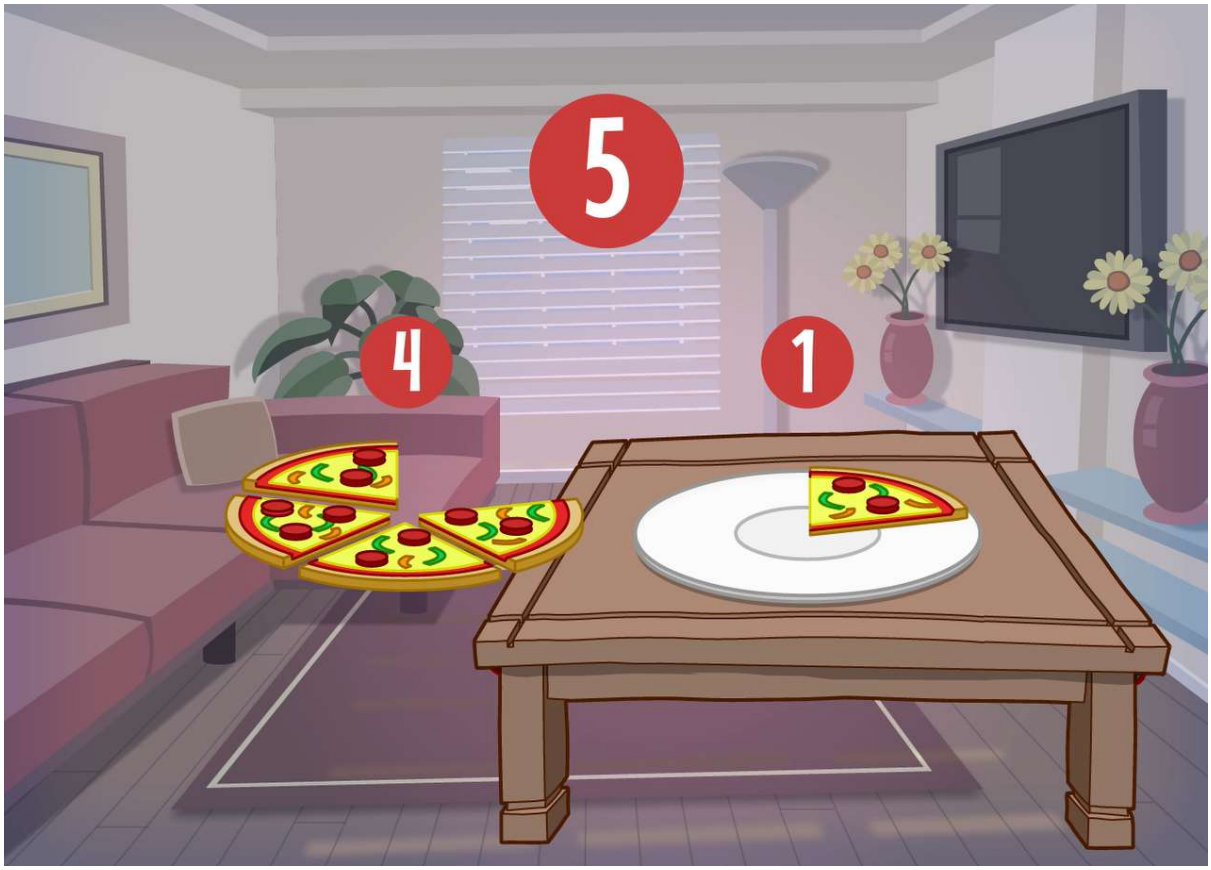
Bonds



Methodology

Number bonds in IDL are represented using this puzzle piece theme to help the learner visualise the idea of two numbers 'completing' the value in the middle. Most require the learner to drag piece tiles from the bottom of the screen for some kinaesthetic ownership and drop them into place to complete the bond. Others (like the example above) require the learner to identify incorrect number bonds by selecting them from a collection of similar bonds. These require the learner to work through the addition problem of each bond and successfully identify the incorrect answers. Learners might achieve this by calculating the answer through addition or subtracting one value from the total.

Animations



Number bonds can be formed any number of ways and the animation addresses this along with how they are commonly laid out. In this case, the number being divided is represented by slices of pizza which is the case in many of the IDL questions too. The video counts the total number of slices in a manner which the learner can follow along with before modelling the different ways in which the slices can be divided. At the end, the written form of how bonds are recorded is shown with different values to secure their understanding.

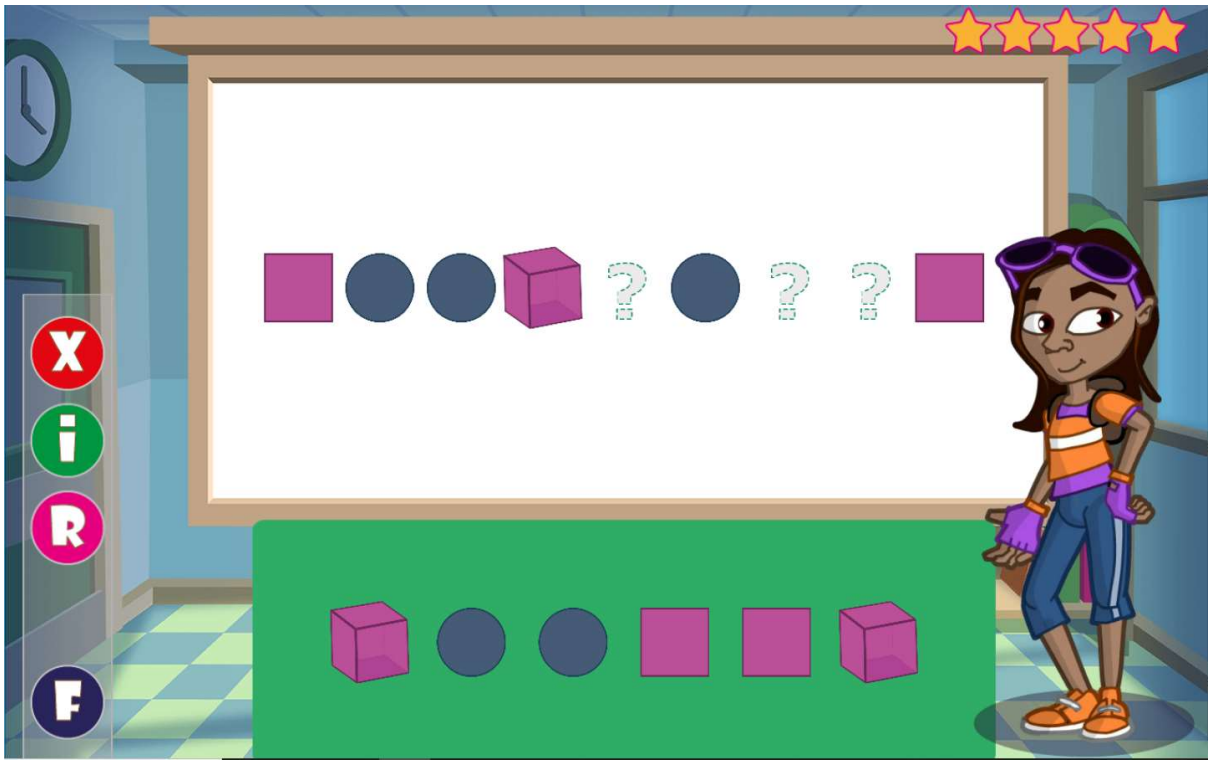
<u>Activities</u>

- **Decomposing Numbers –** Learners are paired off. One chooses a number at random (depending on ability this can be one, two or three digits) and the other must find at least two number bonds to total that number. The learners take turns in suggesting numbers and breaking them down into their number bonds. You might find it helpful to set a target number of numbers or introduce a competitive element with peer teaching and the highest total of bonds winning.

- **Rainbows –** Guide the learner in writing a line of numbers starting at 0 and up to 10. Using different colours they draw arcs connecting the number bonds to ten (e.g. 1-9, 2-8). As long as the numbers are even then the number line can extend as far as the learner's ability!

- **Rearranging Numbers –** Each learner is provided with a short problem (e.g. 7 + 3 = 10) which could be rearranged into multiple problems such as 10 – 7 = 3. Groups can be set to work with a list of such values as an extension task or exercise for lower ability groups. Scraps of paper with these numbers written on can provide guidance for lower ability learners.

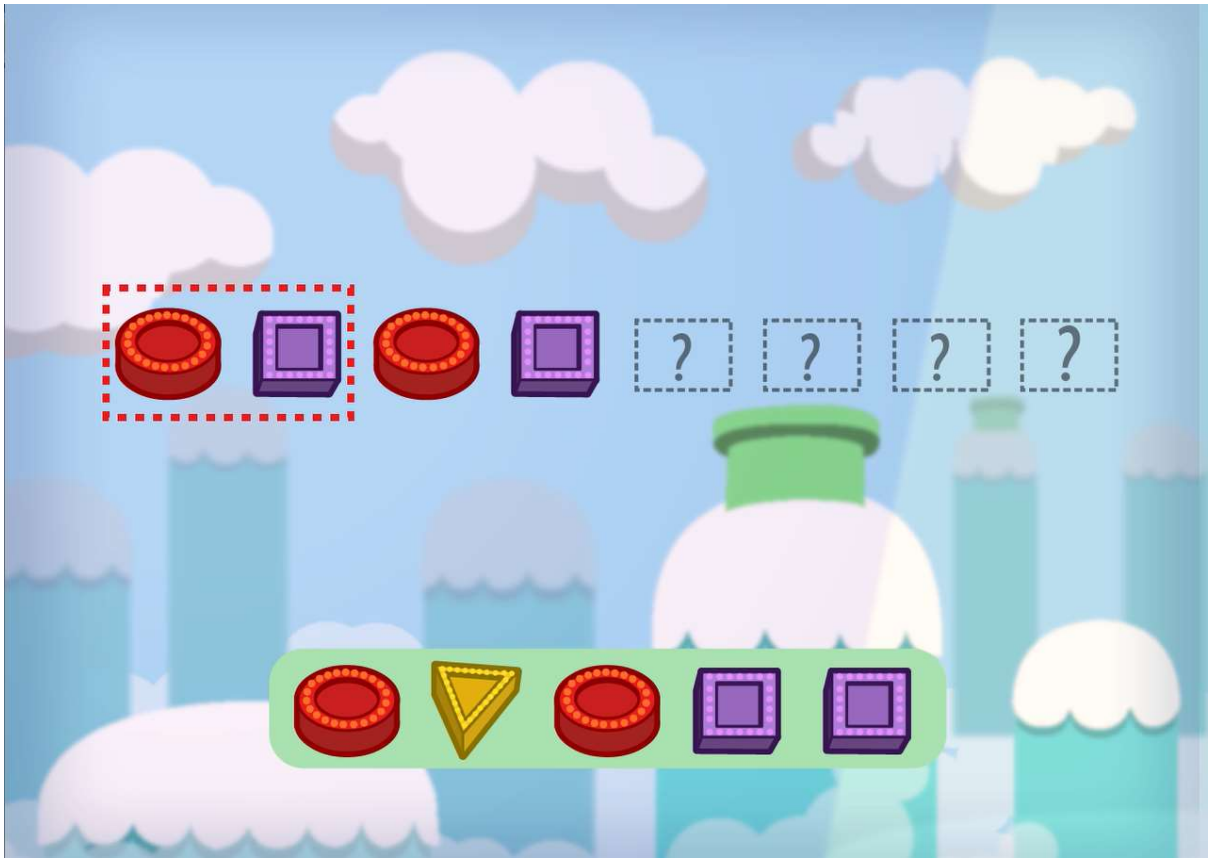
Sequencing Shapes



Methodology

The shape pattern question provided above appears in module 3 and contains a combination of 2D and 3D shapes. Earlier problems are exclusively 2D shapes for simplicity however as they increase in difficulty and the learner's familiarity with 3D shapes increases, so too do shape pattern problems involving both. As in the animation, the range of shapes rarely exceeds three and the learner has the ability to drag and drop shapes along the spaces – reconfiguring them as they see fit and taking ownership of their own experience.

Animation



Starting with a simple pattern of three different shapes, the video walks the learner through different strategies for figuring how the sequence. By breaking it down into small, repeating patterns the animation then explains how by understanding the rule, they can predict what the next shapes are going to be. The inclusion of intentional mistakes and recognising them is important to help the viewer understand how they will spot their own errors later and hopefully correct them.

Activities

- **Grouping Shapes –** Using plastic hoops or sheets of paper, create areas where learners can move representations of shapes based upon their properties. For example, separating shapes with less than six sides or more than six sides. They can use drawings of the shapes or just the names however 3d models would be ideal as they can explore the properties of them.

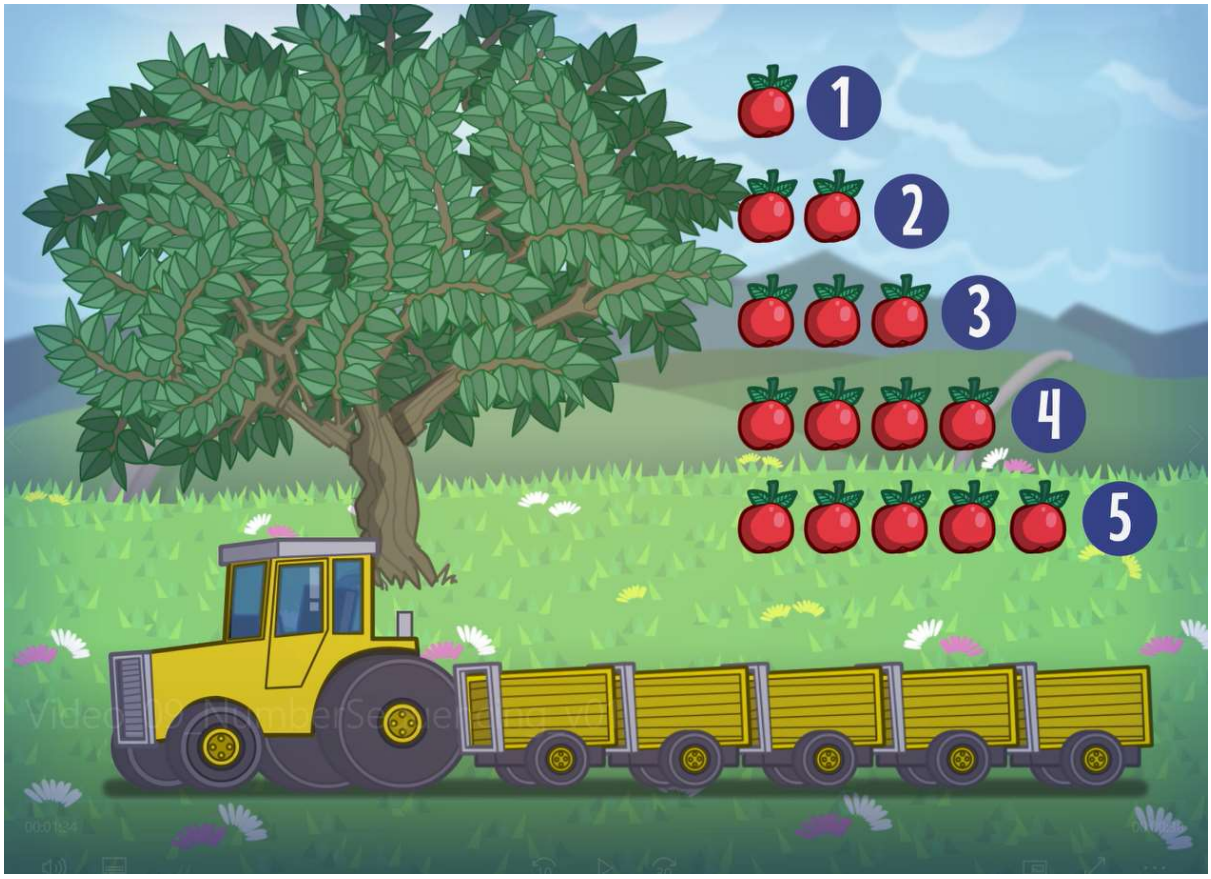
- **Other Directions –** Instead of running left to right, try patterns which run from top to bottom or diagonally for higher ability learners. Many pattern problems differentiate by colour as well as shape so you could try making them all the same colour to slightly increase the difficulty.

Sequencing Numbers

Methodology

Sequencing problems such as the one above make an appearance early in the modules but more sophisticated challenges involving number patterns appear towards the end of the program and will require cross-curricular skills such as addition and subtraction to calculate the rule and subsequent numbers. These problems will ask learners to insert the missing numbers from a pattern or to calculate what the rule is for that particular sequence. Tiles are used to help learners experiment with number sequences, moving them around until they are confident in their answer.

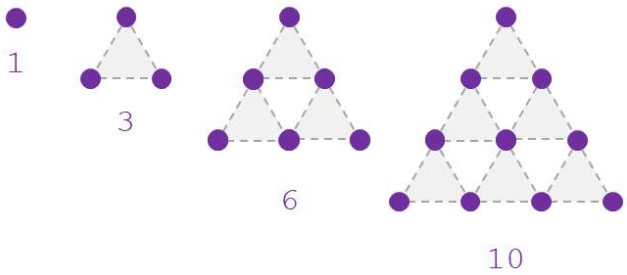
Animation



The number sequencing animation lays out the basic order of numbers from 1-10 using apples however beyond the earliest modules, number sequencing problems will be more complex. Using the same model as classroom teaching, learning to count takes place by rote however the questions within the program require confidence in counting forwards by the same amount consistently to reach the next value.

Activities

- **Smallest to Largest –** Using playing cards, the learner must arrange the numbers from smallest to largest. Different suits can make this somewhat more challenging for lower ability learners so you may wish to ignore that or not, focusing on the Chinn configuration of the symbols for value instead.

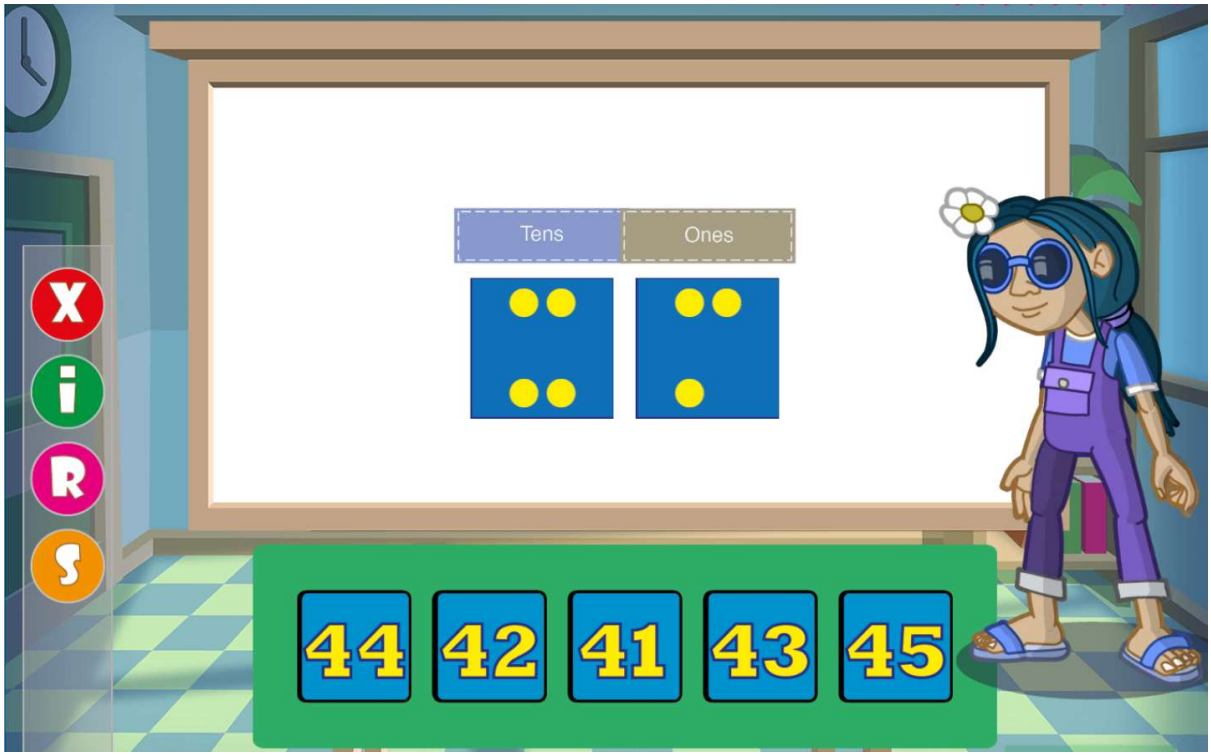


- **Number Shapes –** Many numbers can be represented by equilateral shapes and make a helpful reference for learners struggling with correspondence. This can also help with understanding multiplication. Ask the learners to see how big a shape they can make like the examples above and what they notice about the difference between them.

- **High Roller –** Using dice (perhaps the same ones you made in the 3D Shapes exercise) the learner rolls a number of different die (e.g. a 6 sided and 4 sided dice) before adding the values. Ask the learner which dice will have the highest values on (whichever one has the

most sides) but this is not necessarily the one which rolls the highest. Repeat with differing amounts of dice and continue adding the results, making sure to remind the learner that the value of the number is the important part – not the number of sides. You could extend their learning with asking them to add the total number of sides together to further illustrate the difference between the shape and the number generated.

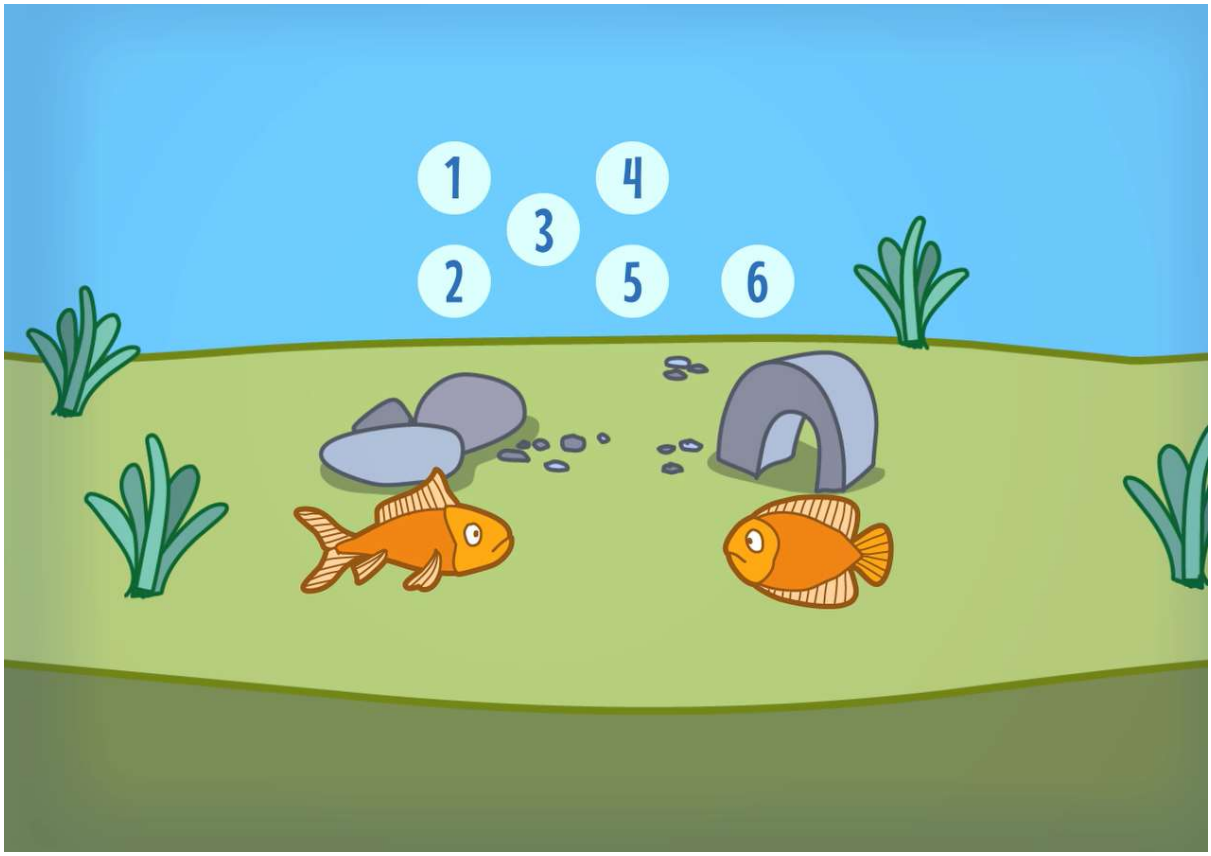
Counting – Subitising



Methodology

Subitising is a useful method for learners in securing knowledge of place value and cardinality. Starting with representations of only units from a young age, this method is extremely important in teaching value however it can have valuable applications later. For example, using subitising to represent place value by 'counting up in tens' it can be better visualised by the learner. Furthermore, problems such as the one above is designed to facilitate familiarity with both the Arabic numeral and the Chinn pattern forms and similar problems will use them interchangeably.

Animation



In this subitising animation, the viewer is show how this strategy is helpful for addition, subtraction and even multiplication. By using dots to represent the numbers, they can be more easily understood, counted and manipulated by a learner. This video provides a walkthrough of how numbers can be turned to dots and vice versa, reminding the learner to use their own strategies in how they approach a problem.

Activities

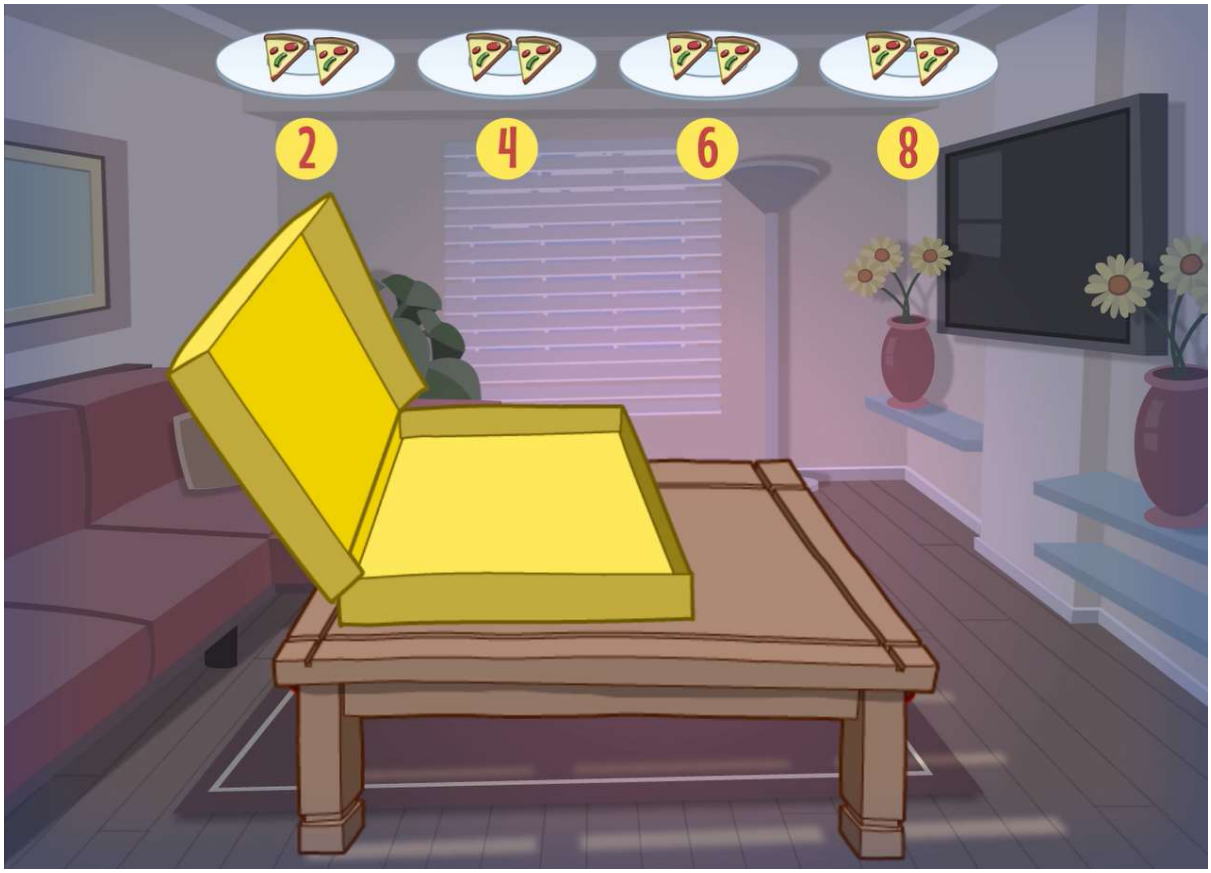
- **Domino Casino –** Players are given a number of dominoes each. Taking it in turns, the players must either 'raise' by putting in domino higher than the last or 'fold' and sit out that round. Either side of the domino can be used as 'tens' or 'units' and whoever has the most or all of the dominoes by the end wins. Obviously the more dominoes one has, the higher the likelihood is that they will be the winner therefore the teacher/TA might choose to limit it to a number of rounds instead and keep the focus on understanding the numbers and not just winning!

Counting – Skip Counting

Methodology

The problem above says ’10 bees each want to land on their own flower. How many flowers are you short?’ The learner is limited to only being able to drag one bee to any given flower meaning the number of bees remaining must be the correct amount. They must understand the correlation between one bee and one flower means that the number of bees remaining must also be the number of flowers required. They then click the correct answer from the tiles below. Lessons like this one will use larger groups and different tokens such as pizza slices or sweets being shared out. By physically moving the relevant tokens, the program replicates the act of interfacing with resources as they would inside the classroom without being limited by the quantities of such being available.

Animation



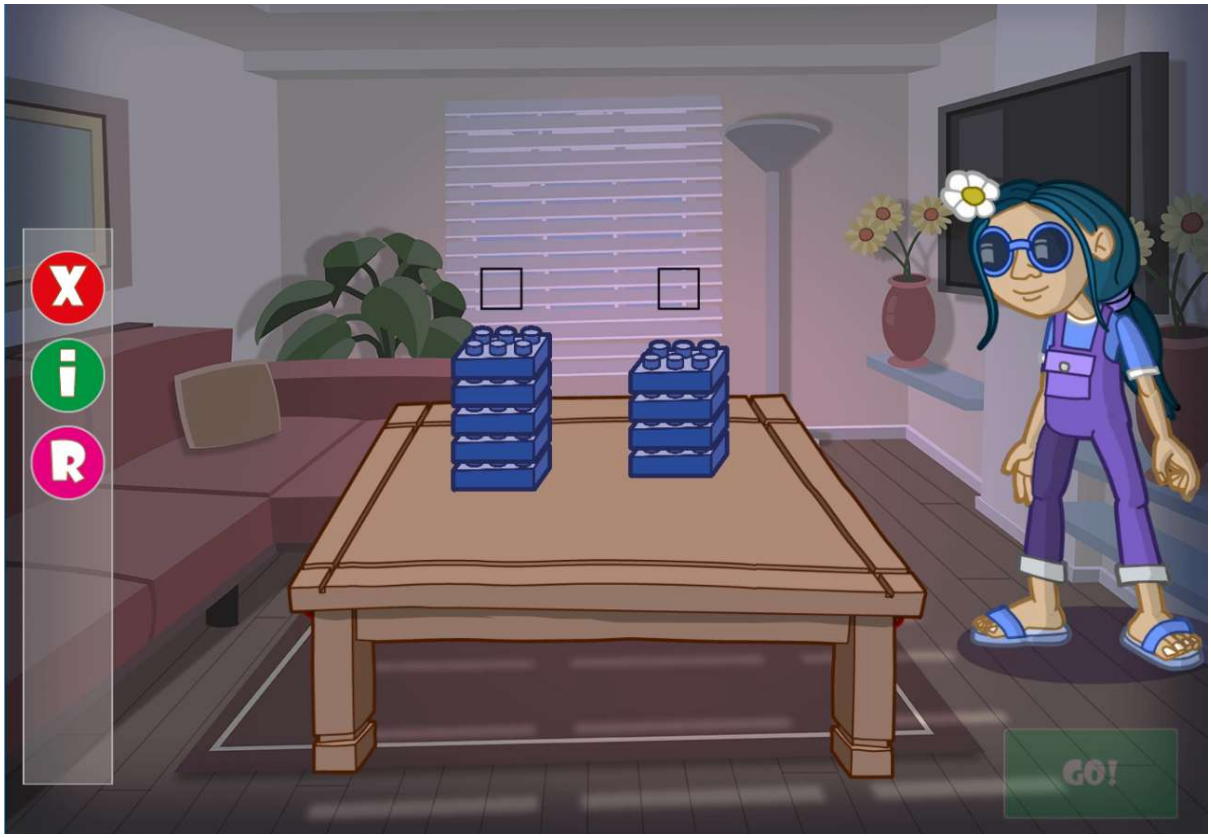
Group or skip counting is an important stepping stone to understanding multiplication as well as solving division problems. The animation models how the same amount can be counted in groups of two and three, using pizza slices. These strategies can later be applied to fractions such as finding quarters or halves of values.

Activities

- **Missing Numbers –** Draw a 6x2 grid on squared paper. Fill some of these squares with numbers whilst leaving some blank with a pattern. This will require some preparation with patterns and rules to facilitate quick marking however should quickly demonstrate how numbers can increase by more than one.

- **Literally Skip Counting –** Drawing a hopscotch grid outside with increments of 2,5,10 etc. Each learner jumps from one number to another whilst saying the name. Afterwards they have to figure out which amount the numbers are increasing (or decreasing depending upon ability) by. This activity works best with smaller groups however it is especially effective with more kinaesthetic learners.

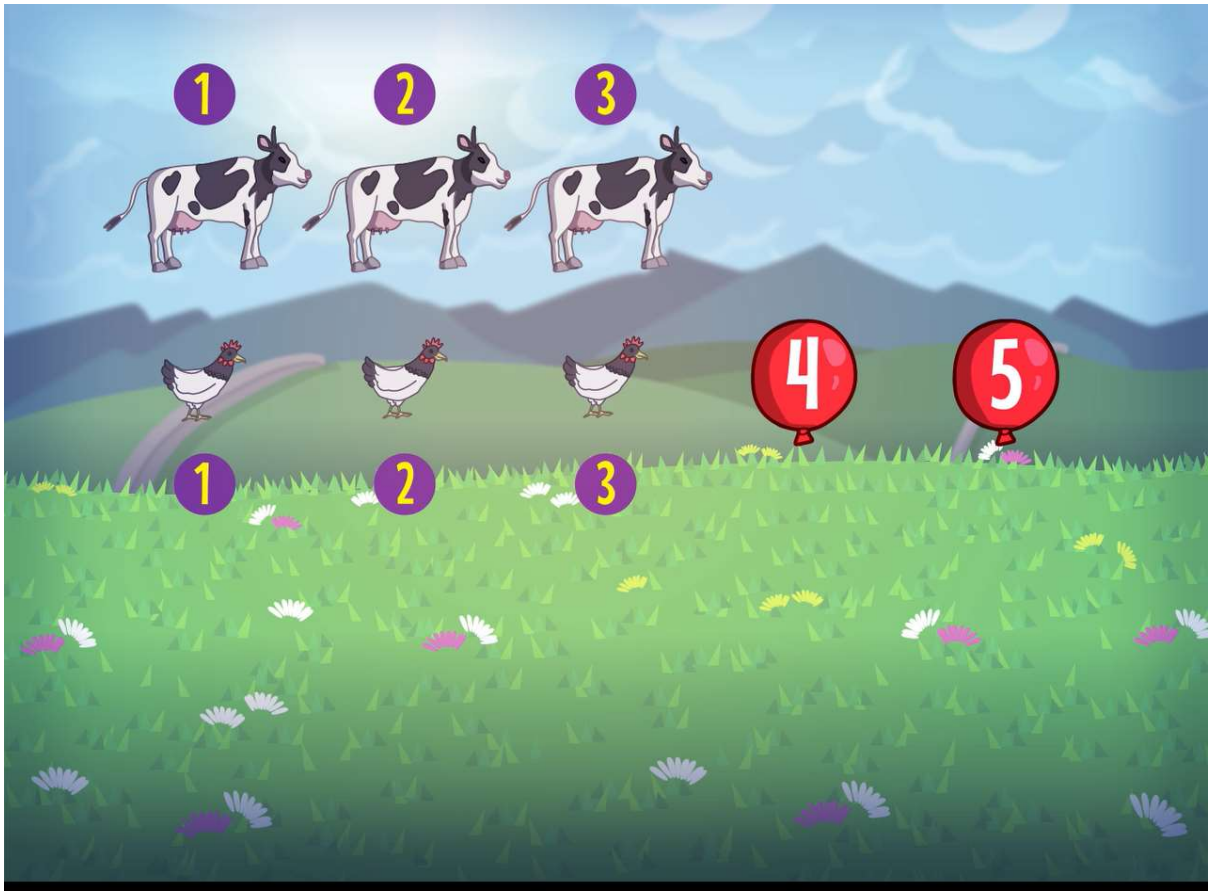
Counting – More/Less



Methodology

The lesson above requires the learner to ‘Tick the pile with the most bricks’ which includes the operative terminology of ‘most’. Other questions use ‘largest’ or ‘more’ in similar problems to further expose the learner to variations on the standard terminology which they will encounter in later questions and written form exams. The smaller pile has been deliberately offset to secure the learner’s visual deduction in that even though they are not level with each other, one pile is obviously smaller than the other and therefore will have fewer bricks. This method is used in similar problems to further embed their visual evaluation skills and reduce the likelihood that they will need to count the bricks.

Animations



In the more/less animation, particular focus is drawn to the irrelevance of the size of any number of objects. Different items are used in the video (cows, chickens and balloons) to explain that it is the number of items which is important, their size does not make the value larger. They are shown different ways of arranging objects such as lining them up to more easily see which is larger or by reducing them to dots to reduce confusion or distraction.

Activities

- **Higher or Lower –** Using large cards with random numbers, the group has to guess if the next card will be higher or lower. Establishing parameters and scale is important for this activity to work, the learners need to know which values the cards are between as to better predict the cards.

- **All the Things! –** Gather a small collection of similar items (counters, books, animals etc.) and compare them to a larger or smaller amount of different objects. The objective is to have the learners improve their visual identification of larger amounts at a glance. Experiment with a greater number of groups, enforcing a time limit or closer amounts of objects to challenge higher ability learners.

- **Build a Number –** The learner is given numbered cards between 1 and 9 to make the smallest or largest number they can. This exercise can be limited to 2 or 3 digit numbers depending on their ability. The TA then produces a similar number from the remaining cards and the learner must deduce if it is a higher or lower number than what they have.

Counting – Cardinality

Methodology

This cardinality lesson asks the learner to ‘Move four sweets into the left jar and three into the right jar’ by clicking and dragging. This exercise teaches the learner to understand cardinality of the groups by totalling the sweets as described. Whilst never referred to as such the purpose of the exercise is to demonstrate cardinality, that is the total value of each group and how it is composed of units.

Animation

This counting animation is intended to model how the number of objects being counted remains the same no matter how they are arranged. In relation to general counting skills as well as other parts of the program such as subitising, the video carefully explains that you can count items in any order – the total remains the same. The donuts are labelled in different ways to further demonstrate this fact and show the learner that they don't have to go about counting a certain way, only one which is accurate and through this helps develop resilience and familiarity with linear counting.

Activities

- **Counting On –** Using cards with numbers on (playing cards or homemade resources) ask the learner to pick a card. Putting it in front of them, they need to state what number comes after that. If they are able to then they can keep the card. This game continues until all cards have been used and the learner with the most cards is the winner. For extension, you can ask the learners to sort their cards from lowest to highest.

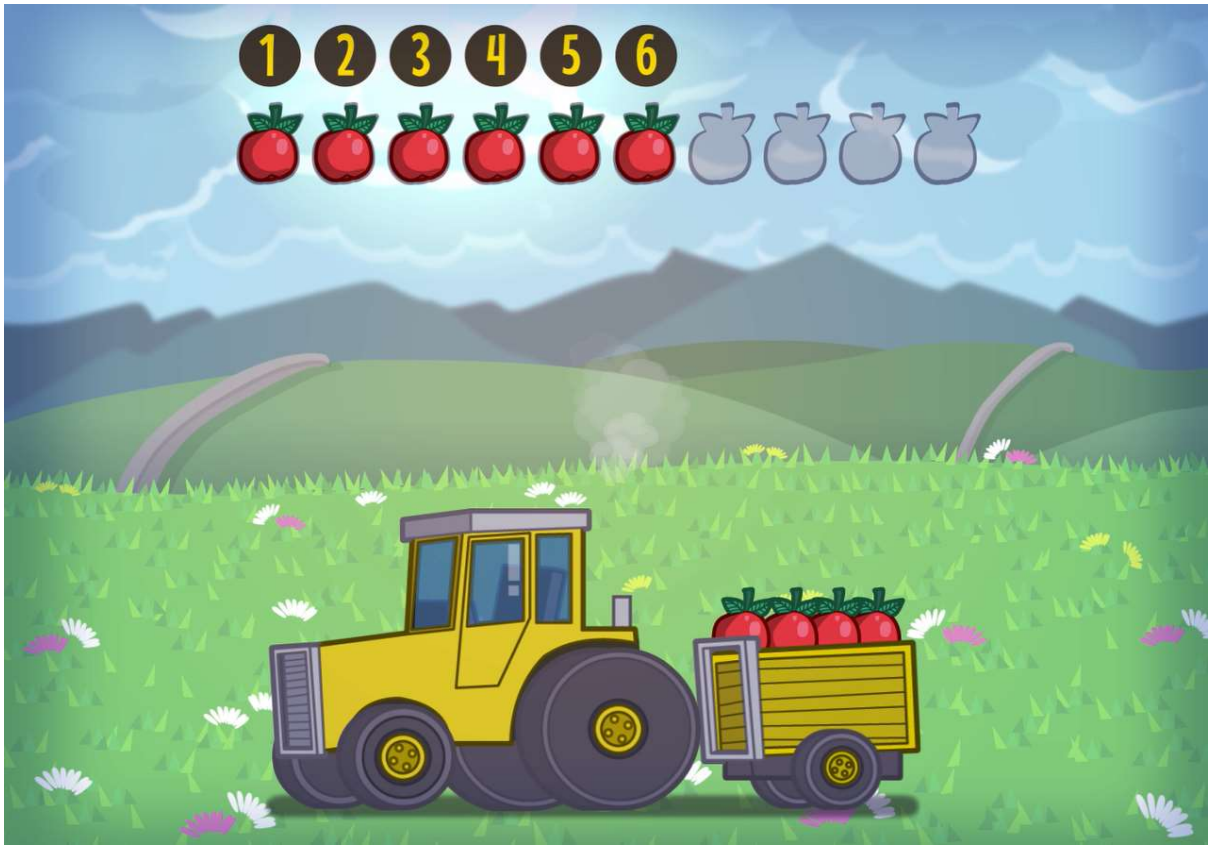
- **Tidying Up –** Collect a number of different objects (pencils, rulers, other things commonly found in classrooms) and put them into a single pile. There needs to be more than one of at least one kind of item e.g. 3 rulers, 1 pencil and 3 pens. The learner must then sort the items into groups of the same item and identify how many of each there are. It might help to count along with the learner as they move the item into the correct group. This exercise helps them understand that whilst each object is worth one of itself, the overall total of a group will be different (a group of three separate pencils is worth 3).

Counting – Correspondence

Methodology

1:1 correspondence is implicit in the teaching of number order and understanding which numerals represent what number. The example problem above asks learners to move the remaining slices into the box and then count how many there are in total. This exercise demonstrates understanding of 1:1 correlation between value and item as well as helping kinaesthetically support lower-ability users by giving them opportunity to move the slices around, group them and interact in meaningful ways to help them count.

Animation



This correspondence animation sets out the basics of counting from one to ten, demonstrating as the apples are taken from the tree and placed into the trailer. Every apple is counted along with its numeral, modelling that it is worth one and contributes to the total amount – even if you mixed all the apples up. Whilst correspondence is not taught explicitly, the animation demonstrates order irrelevance in an accessible and clear method.

Activities

- **Guessing Game –** Pair up the learners. One learner must guess what number the other is trying to tell them without speaking. They are allowed to count on their fingers, use provided physical resources like counters or gesture that it is higher or lower. This exercise doesn't necessarily require a TA and could be a full class activity.

- **Combinations –** Cut out some simple t-shirt and shorts shapes of different colours. Provide the learner with one of each object and ask them to see how many different combinations of clothing they can come up with using them. Ensure they record their combinations as they work in whatever form they are comfortable with (full written form or abbreviations). Once they have discovered as many combinations as they can, explore with the learner if there was a mathematical way they could find that total.