

A world of limited resources

Primary: (ages 7 – 11)

Mathematics

Students are challenged to consider how mathematics can help them understand and address problems faced in a world of limited resources. The learners become immersed in two fictional scenarios that invite them to apply a variety of mathematical disciplines. First, students consider how a generous financial gift to their school could be divided fairly, which requires the use of fractions, percentages and money. The second scenario involves them dividing their playground using skills such as measuring, ratios, and problem solving. Students develop their creative thinking to generate solutions to real-life problems before thinking critically in order to consider the relative merits of different solutions.

Time allocation About 2 lesson periods but could be extended to 4

Subject content Build knowledge of applied fractions, percentages and measuring
Develop problem solving skills related to division
Understand equality and equity within a mathematical framework

Creative and critical thinking This unit has a **creativity** and **critical thinking** focus:

- Generate & play with several approaches to a maths problem
- Consider several perspectives and reflect on chosen approach relative to alternatives
- Explain strengths and limitations of solutions

Other skills Communication, Collaboration

Key words division; fractions; percentages; equality; equity; democracy; resources; immersive; money; measuring; ratios; problem-solving

Products and processes to assess

Students propose and debate solutions to distribute resources equally amongst the school. At the highest levels of achievement, they are able to draw on a good knowledge of maths to generate equitable and accurate solutions with visible workings. They take an active part in discussions, are able to discuss the merits of different solutions, justify their position with good reasoning, and are open to the ideas and feedback of others.

Authors: Paul Collard/CCE and Paul Gorman/Hidden Giants (United Kingdom). This work was developed for the OECD for the CERI project *Fostering and assessing creativity and critical thinking skills*. It is available under the [Creative Commons Attribution-NonCommercial-ShareAlike 3.0 IGO](https://creativecommons.org/licenses/by-nc-sa/3.0/) licence (CC BY-NC-SA 3.0 IGO). © OECD

Teaching and Learning plan

This plan suggests potential steps for implementing the activity. Teachers can introduce as many modifications as they see fit to adapt the activity to their teaching context.

Step	Duration	Teacher and student roles	Subject content	Creativity and critical thinking
1	Lesson period 1	<p>The teacher begins by having a conversation with the class about the purpose of play and how we can learn using fictional scenarios. The teacher explains that over the course of the next 2 lessons they will be invited to learn and play within a story.</p> <p>Show the pupils a letter that has been sent to the school by a mysterious financial donor. The letter contains a cheque worth £200 (or equivalent) and outlines a challenge: if the class is able to divide the money equally and fairly amongst the whole school community they can keep the money. If they can't, the money will be taken away.</p> <p>The mysterious donor wants to see a clear and detailed breakdown of how the money will be divided. It must be presented on one piece of A4 paper.</p> <p>Ask the class to initially work in small groups to develop a solution to the challenge. The small groups will then present their ideas, making sure to cover both the strengths and any limitations of their solution. After they have presented, the whole class must debate and decide on a fair process to choose which solution should be sent back to the mystery donor. The final output of the lesson is a piece of A4 paper with the workings of how to divide the money equally and fairly.</p> <p>The process could also take place over two lesson periods with time in between to encourage thinking and research. In either case, the teacher may choose to close each period with a discussion prompting students to reflect on what they have learned, the steps they took, and how they used creative and critical thinking to solve the problem.</p> <p>Key questions:</p> <ol style="list-style-type: none"> 1. How many people are in our school community? 2. Do people in our community deserve more of a share than others, i.e. should teachers get less? Why do you think this? How do we show this in a fraction? 3. How can percentages help convey our opinion? 4. How can we use maths to share a large sum of money equally amongst a lot of people? 5. How do we show our workings to ensure people understand our decision? 6. How can decimals help us divide a large sum of money? 	<p>Building knowledge of the application of percentages, fractions and division</p> <p>Building awareness of equality and equity</p> <p>Identifying and carrying out mathematical calculations and showing workings</p> <p>Presenting their maths solution to the class</p>	<p>Generating and playing with several approaches to solve the maths problem</p> <p>Making connections between mathematical concepts such as fractions and concepts such as equality and equity</p> <p>Considering several perspectives on approaching a maths problem</p> <p>Identifying and questioning assumptions about equality and equity</p> <p>Envisioning how to solve a meaningful maths problem in a personally novel way</p> <p>Explaining both strengths and limitations of their proposed solution</p> <p>Reflecting on steps taken to pose and solve a maths problem</p>

<p>2</p>	<p>Lesson period 2</p>	<p>Remind the class of purpose of play and how we learn within a fictional scenario. Reflect on the benefits of the first scenario involving money.</p> <p>Ideally the Head Teacher would tell the class of a new Government education initiative that comes from research from Scotland. The research suggests children learn better if they play within their own year group which means ensuring the playground is divided into areas that the classes use at break times. There will be fences built to ensure the pupils don't stray into other classes areas. After delivering this information the Head Teacher will tell them to research the idea and come back with possible solutions to divide the playground. They will return in a number of days to see clear workings that show the classes solution.</p> <p>If the Head Teacher is unavailable a letter could be used with instructions from the Government with a date on when the research must be sent back.</p> <p>Ask the class to initially work in small groups to develop a solution to the challenge. The small groups will then present their ideas. After they have presented, the whole class must debate and decide on a fair process to choose which solution should be given to the Head Teacher/Government. The final output of the lesson is a piece of A4 paper with the workings of how to divide the playground.</p> <p>The teacher may again choose to close with a discussion prompting students to reflect on what they have learned, the steps they took, and how they have used creative and critical thinking to solve a maths problem.</p> <p>Key Questions:</p> <ol style="list-style-type: none"> 1. How do you find a fraction to show how the playground can be shared equally? 2. What percentage of the playground should go to different age groups? 3. Do we need to measure the playground? Do we need to measure/count the students? 4. Do some groups deserve a large proportion of the space – how do you show that using percentages, i.e. do smaller children need a larger space to run around? 5. What are the different calculations needed to show your thinking – how do you record your process mathematically? 	<p>Working on making process of thinking visible using key mathematical vocabulary</p> <p>Identifying and carrying out appropriate calculations at each stage of the challenge</p> <p>Building awareness of space, distance, measurement</p> <p>Using mathematical terminology to support opinion</p> <p>Applying mathematics in an everyday context</p>	<p>Generating and playing with several approaches to solve the maths problem</p> <p>Making connections between mathematical concepts such as fractions and concepts such as equality and equity</p> <p>Considering several perspectives on approaching a maths problem</p> <p>Identifying and questioning assumptions about equality and equity</p> <p>Envisioning how to solve a meaningful maths problem in a personally novel way</p> <p>Explaining both strengths and limitations of their proposed solution</p> <p>Reflecting on steps taken to pose and solve a maths problem</p>
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Resources and examples for inspiration

Web and print

- N/A

Other

- A fictional letter outlining a financial gift to the school from a mystery donor
- Paper and pencils to show workings

Opportunities to adapt, extend, and enrich

- This activity could be expanded to build further links to subjects such as health and well-being, citizenship, or economics. For example, the teacher could deliberately distribute resources unequally and then discuss different ways of rectifying this (for example, in a similar manner to the activities described here <https://www.theguardian.com/teacher-network/2015/jan/28/teach-students-equality-smarties>)

Creativity and critical thinking rubric for mathematics

- Mapping of the different steps of the lesson plan against the OECD rubric to identify the creative and/or critical thinking skills the different parts of the lesson aim to develop

	CREATIVITY Coming up with new ideas and solutions	Steps	CRITICAL THINKING Questioning and evaluating ideas and solutions	Steps
INQUIRING	Make connections to other maths concepts or to ideas from other disciplines	1,2	Identify and question assumptions and generally accepted ways to pose or solve a maths problem	1,2
IMAGINING	Generate and play with several approaches to pose or solve a maths problem	1,2	Consider several perspectives on approaching a maths problem	1,2
DOING	Pose and envision how to solve meaningfully a maths problem in a personally novel way	1,2	Explain both strengths and limitations of different ways of posing or solving a math problem based on logical and possibly other criteria	1,2
REFLECTING	Reflect on steps taken to pose and solve a maths problem	1,2	Reflect on the chosen maths approach and solution relative to possible alternatives	1,2