

Lesson Plan

Title: "Playing Math with Alice in Wonderland"

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Curriculum links: Mathematics, Literature.

Gender Equality Charter Mark category/subcategories: Attitudes and Relationships
(Language and communication)

Learning outcomes:

- To understand the social construction of gender roles (stereotypes, social rules and norms, gender as a historical matter interwoven at the intersections with other social identities such as social class through the use of symbols based on mathematical language.
- To reflect on gender adherence and think of ways of breaking gender stereotypes.

Gender equality concepts: Discuss gender roles and stereotypes as a social construction in an interdisciplinary framework using the story of "Alice's Adventures in Wonderland"

Key vocabulary: size, grow, shrink, count, re/present, how much more, how much less, nothingness, infinity, probability, risk.

Age group: 9-12 years old (primary school)

Lesson Plan Development

Starter Activity	Time	Resources needed
Step 1. Read the story of "Alice's Adventures in Wonderland" by Lewis Carroll (see note i) For the very young children, we recommend reading a shortened overview of the book, "The Nursery Alice", written by Lewis Carroll (see note ii)	20 mins	Books: "Alice's Adventures in Wonderland" or/and "The Nursery Alice" by Lewis Carroll.
Step 2. Discuss the story of "Alice's Adventures in Wonderland" with children, in a circle type discussion. <ul style="list-style-type: none"> • Who is the human, animal, non-human heroes/heroines in the story? • What part of the story did children like or dislike most and why? 	15mins	
Step 3. Ask children to draw the main characters. Or, draw the part of the story children liked most and can share with others.	15 mins	A4 paper sheets crayons

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Express feelings or thoughts in the circle or tapestry.		
Step 4. You might also give them pictures of significant events in the story and ask them to place them in order, working in groups of 4.	20 mins	Printed pictures of the story.

Main activities

Activity 1: Playing with sizes	Time	Resources needed
<p>Step 1. Read with children <i>Chapter 1: Down the rabbit hole</i> ("Alice's Adventures in Wonderland") or <i>Chapter 2: How Alice grew tall</i> (Nursery Alice) You could ask children the following:</p> <ul style="list-style-type: none"> • What does Alice do in this story? • When and how did she shrink in size? When and how did she grow up? • Could children draw the idea of shrinking and growing? How do they imagine that? (children can exhibit their drawings to the class). • Could children find objects in the classroom that change shape and size? 	30 mins	"Alice's Adventures in Wonderland" or/and "The Nursery Alice", by Lewis Carroll.
<p>Step 2: Encourage children to form pairs or groups of 4. Students can move in the classroom and find materials to use. You can encourage them to play with play-dough and/or with elastic bands (in different sizes), creating different shapes or lines. Discuss in groups the following:</p> <ul style="list-style-type: none"> • How big or small can you make your materials? • Think of ways to express and show to your friends, the largest or the smallest transformation of an object? <p>One could stimulate student's thinking by encouraging them to use different materials and by providing instructions, such as:</p> <ul style="list-style-type: none"> • How far can you expand your elastic bands through the use of geoboards? • Count the largest or the smallest number of pins each elastic band can cover in your geoboard, comparing the bigger and smaller in that space. • Talk with students about using a ruler to measure the size of their play dough. 	30 mins	<p>Play-dough, Elastic bands (in different sizes and colors)</p> <p>Geoboards Pencils, Markers, Erasers, A4 paper sheets, Ruler, Ropes.</p>
Activity 2. Infinity		
Step 1. Based on the previous task on sizes, you can stretch children's imagination to think about	10 min	

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<p>the concept of infinity. You may ask them to think of the tasks they did in activity 1.</p> <ul style="list-style-type: none"> For example, how could you call something that goes down to something that is very, very small, or up to something that is very, very big or very far away? Do you have a word for it? You could ask children to think of other ways to consider infinity (e.g. grains of sand, stars in sky). 		
<p>Step 2. In a circle, read the section based on Chapter 2 <i>How Alice grew tall</i> (from the book "Nursery Alice" -see note iii) and ask children to express what they think or to draw what has impressed them.</p>	15 min	Quote from Chapter 2. How Alice grew tall (" <i>Nursery Alice</i> ") <i>papers, crayons</i>
<p>Step 2. Then, move into discussing with children:</p> <ul style="list-style-type: none"> What was the problem that Alice has to face? What do you think that Alice has decided to do? Would you drink it, if you, were in her place? What thoughts come to your mind? 	10 min	
<p>Step 3. Continue with the part of the story where Alice tasted the drink and began to shrink until she could pass through the door:</p> <ul style="list-style-type: none"> Did Alice forget something? (<i>The door key was left at the table! Now, the door is locked and Alice cannot enter.</i>) Can you find other ways for Alice to get through the locked door? <p>You could encourage children's thinking to find solutions to the problem and break the rules. They can talk or draw their thoughts.</p>	15 mins	Key or door models papers, crayons, pencils, materials for kids to create models
<p>Step 4. In chapter 2, Alice wonders, if she can shrink forever, getting smaller and smaller, or if she'll eventually reach the point of nothingness. Explore Alice's thoughts with children, introducing them to the notion of becoming smaller, becoming bigger until you might arrive at the concept of <i>infinity</i>. Encourage their thinking and problem solving with questions, such as:</p> <ul style="list-style-type: none"> How small does Alice need to be, in order to get under the door and go out into the beautiful garden with beautiful flowers and cool fountains? Can you tell or show me, how much you have to shrink? If Alice had the last drop of that magic drink, could she continue to shrink forever or will she stop? 	10 mins	Ruler, Elastic bands, Play dough, Ropes.

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Activity 3: Playing with Probability		
<p>Step 1. Queen's Rules. Read the chapter 8: <i>The queen's croquet -ground</i> (Alice's Adventures in Wonderland) and discuss with children the queen's rules and her relations with others.</p> <p>The Queen, a figure difficult to please, introduces her signature phrase "Off with his head!" which she utters at the slightest provocation. As we can see, the Queen of Hearts holds the most powerful political position in the book and even her husband, the King, fears her and he doesn't share his opinions or contradict hers. Also, the Playing Cards- gardeners are submissive to the Queen and fear that they be punished after the mistake with the roses.</p> <p>But, in this chapter we see how Alice disobey the Queen's rules, and stay fearless and confident in front of her, supporting her views. Read with children the three quotes (see note iv) from this chapter, forming a new basis for discussion with students. You may ask them:</p> <ul style="list-style-type: none"> • How does the Queen react to being contradicted? • How does Alice react to the Queen? What does she say? • What would you do, if you were Alice? 	25 mins	<p>Parts of the story with pictures so that children reflect and discuss</p> <p>Paper to write down the rules</p> <p>Paper, pencils and crayons for children to draw, sketch or write.</p>
<p>Step 2. The red seed Extending the story of the Queen of Hearts and the gardeners' "mistake" with the rose tree, you can play a math game about "probability" with children. You can read a story (see note v) as a stimulus for that activity.</p>	15 mins	You may need to create some models so that to liven up the story.
<p>Step 3. Is all a matter of luck? Encourage students to help Alice find the red seeds by playing the game, one by one. The goal is to find the red seed in every stage of the game.</p> <p>1st game (very easy level): In a box there are 3 red seeds. Ask children to close their eyes....</p> <ul style="list-style-type: none"> • "Now, close your eyes and pull a seed out of the box. What color seed can it be?" • "Is it certain that the seed will be red? why did you think that? " • "Could it be any other color? why do you think that? " 	40 mins	2 transparent or black boxes, 3 red seeds (red paper balls), 2 white seeds (white paper balls)

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<p>Discuss with children this case: <i>Since all 3 seeds are red, the probability of getting a red seed is 3 out of 3. So, the probability is 100%. This means that we will always draw a red seed and there is no risk of losing or hope of gaining?</i></p> <p>2nd game: In a box we have three seeds (2 red and 1 white) and we ask again children to close their eyes.</p> <ul style="list-style-type: none"> "Now, close your eyes and pull out a seed. Do you think it's easier to get a red or white seed? How did you think about it?" <p><i>Discuss with children. What is now our probability to get red seeds? Do they realize that now, the probability gets smaller?</i></p> <p>3rd game: In a box there are 1 white and 2 red seeds. In another transparent box there is 1 white and 1 red seed. You may ask children:</p> <ul style="list-style-type: none"> "You want to pull out a red seed. Which box would you choose to get the red seed more easily? How did you work that out?" <p><i>And now, what is happening to the probability? Is it getting bigger or smaller?</i></p> <p>4th game: You could extend the game in a totally different situation (similar to gambling). In a box there are 3 white seeds. Ask children to draw one red. What is happening? You may discuss the game with them and ask to think who does these sorts of things? You may continue playing the game by letting children create their own probability problems, using, as they wish, other colors or materials.</p>		
<p>Expand learning on gender issues</p>		
<ul style="list-style-type: none"> Discuss with children how Alice relates with the Queen. Could they express their views on these two female characters in the story? Ask children to think how Alice worked out the problems she faced. What do they learn from her? 	<p>40 min</p>	<p>Papers, crayons and other material for children to draw, sketch or write thoughts, ideas or emotions.</p>

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c. Reflection / Evaluation

Decide with children to perform a scene or write a screenplay based on the novel of *Alice in Wonderland*. They can alter the story line, or add new heroes and heroines that challenge the end of the story. You can also introduce children to and play their preferred scene of the novel, based on the techniques and aims of "the theatre of the oppressed". You can find more information here:

<https://organizingforpower.files.wordpress.com/2009/03/games-theater-of-oppressed.pdf>

d. Suggested follow-up activities

Play the game of possibilities with other children in your school and create many more challenging Maths games with them.

NOTES:

Note i: *Alice's Adventures in Wonderland*

Lewis, C. (1865). *Alice's Adventures in Wonderland*. Macmillan and Co. London.

Free online distribution by Book Virtual Corporation (2000), in EN:

https://www.adobe.com/be_en/active-use/pdf/Alice_in_Wonderland.pdf

Note ii: *The Nursery Alice*

Lewis, C. (1889). *Nursery Alice*. Macmillan and Co. London. Free online distribution by the Project Gutenberg (2017), in EN: <https://www.gutenberg.org/files/55040/55040-h/55040-h.htm>

Note iii: "Paradoxes", based on 'Chapter 2. How Alice grew tall' IN Lewis, C. (1889). *Nursery Alice*. Macmillan and Co. London. Free online distribution by the Project Gutenberg (2017), in EN: <https://www.gutenberg.org/files/55040/55040-h/55040-h.htm> (p.5).

Many paradoxical things happen in Alice in the Wonderland. After Alice had tumbled down the rabbit-hole, and had run a long long way underground, all of a sudden, she found herself in a great hall, with doors all round it. But all the doors were locked: so, you see, poor Alice couldn't get out of the hall: and that made her very sad. However, after a little while, she came to a little table, all made of glass, with three legs (There are two of the legs in the picture, and just the beginning of the other leg, do you see?), and on the table was a little key: and she went round the hall, and tried if she could unlock any of the doors with it.

Poor Alice! The key wouldn't unlock any of the doors. But at last she came upon a tiny little door: and oh, how glad she was, when she found the key would fit it! So, she unlocked the tiny little door, and she stooped down and looked through it, and what do you think she saw? Oh, such a beautiful garden! And she did so long to go into it! But the door was far too small. She couldn't squeeze herself through, any more than you could squeeze yourself into a mouse-hole! So, poor little Alice locked up the door, and took the key back to the table again: and this time she found quite a new thing on it (now look at the picture again), and what do you think it was? It was a little bottle, with a label tied to it, with the words "DRINK ME" on the label. ()

Note iv: The 3 quotes from 'Chapter 8: The queen's croquet -ground' in C. Lewis (1865). *Alice's Adventures in Wonderland*. Macmillan and Co. London.

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Free distribution by Book Virtual Corporation (2000), in english:

https://www.adobe.com/be_en/active-use/pdf/Alice_in_Wonderland.pdf (p. 112-129)

Quote 1. (ibid. p.116-118)

-And who are these? said the Queen,
pointing to the three gardeners who were lying ground the rose-tree; for you see, as
they were lying on their faces, and the pattern on their backs was the same as the rest
of the pack, she could not tell whether they were gardeners, or soldiers, or courtiers,
or three of her own children.

-How should I know? said Alice, surprised at her own courage.

-It's no business of mine. The Queen turned crimson with fury, and, after glaring at
her for a moment like a wild beast, began screaming,

-Off with her head! Off"

-Nonsense! said Alice, very loudly and decidedly, and the Queen was silent.

The King laid his hand upon her arm, and timidly said.

-Consider, my dear: she is only a child!

The Queen turned angrily away from him, and said to the Knave:

-Turn them over !

The Knave did so, very carefully, with one foot.

-Get up! said the Queen in a shrill, loud voice, and the three gardeners instantly
jumped up, and began bowing to the King, the Queen, the royal children, and
everybody else.

-Leave off that! screamed the Queen, "You make me giddy."

Quote 2. (ibid. p.118-119)

(...) And then, turning to the rose-tree, she went on,

-What have you been doing here?

- May it please your Majesty, said Two, in a very humble tone, going down on one
knee as he spoke -we were trying—

-I see! said the Queen, who had mean-while been examining the roses.

- Off with their heads! and the procession moved on, three of the soldiers remaining
behind to execute the unfortunate gardeners, who ran to Alice for protection.

Quote 3. (ibid. p.119)

-“You shan't be beheaded!” said Alice, and she put them into a large flower-pot that
stood near. The three soldiers wandered about for a minute or two, looking for them,
and then quietly marched off after the others.

-Are their heads off? shouted the Queen.

-Their heads are gone, if it pleases your Majesty! the soldiers shouted

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-That's right! shouted the Queen.

Note v: Making connections across

Alice leaves the party and enters the garden, where she comes upon three living Playing- Cards painting the white roses on a red rose tree, because the Queen of Hearts hates white roses. Alice thought this a very curious thing, and she went nearer to watch and ask them: "Would you tell me please," said Alice, "why you are painting those roses?"

Playing cards said nothing, but after a while, one of them looked at Alice and replied:

"Why, the fact is, you see, Miss, this here ought to have been a red rose-tree, and we put a white one in by mistake, and if the Queen was to find it out, we should all have our heads cut off, you know..." The other two Playing-Cards desperately shouted to her: IT WAS NOT A MISTAKE, IT WAS A MATTER OF LUCK.

"What do you mean with that?", said Alice.

When Playing-Cards meet the "royal florist" of Queen's garden and ask him for red rose seeds, the florist invited them to play a game. He promised to give the red seeds they wanted, if and only if they could find them in his lucky boxes.

Then Alice wanted to play with "luck" and help Playing-Cards! Ah... We know very well how much she likes to take risks and test her abilities fearless of making mistakes!

So, she found the royal florist, ready to play the game and bring the red rose seed back to the Playing-Cards.

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