UNIT 7

Playing with Dough

What is the best recipe for playdough?

Materials

- Playdough (a piece for each student)
- Salt, flour, cream of tartar, cooking oil, food colouring (see Resource sheet 1)
- Measuring jugs, cups and spoons, mixing bowls, wooden spoons, blunt-edged knives
- Airtight containers for storage

Curriculum Links

- English – Procedural genre (recipe)
- Science – Testing

Mathematical Focus

- Number and Algebra – Fractional understandings of volume
- Measurement and Geometry – Money; standard measures of volume – cup, tablespoon
- Statistics and Probability – Data collection and organisation

Resource Sheets

- Resource sheet 1: Playdough Recipes
- Resource sheet 2: Recipe Genre
- Resource sheet 3: Recording Sheet
- Resource sheet 4: Cost Sheet – Example
- Resource sheet 5: Cost Sheet

Support Website

www.curriculumpress.edu.au/maths

All of the resource sheets are available on the support website to download as PDF files. Those that you might customise are also available as editable Word documents.

WHAT HAPPENS?

Students use measurement and the procedural genre (recipes), and are introduced informally to scientific testing when they follow a recipe to make playdough, then determine their own criteria by which to rank the playdough to determine the 'best'.

Students will:

- Handle playdough and consider what they think are important qualities of playdough. (Discover)
- Be introduced to the idea that there are multiple types of playdough and recipes to make their own. (Devise)
- Plan how to determine which is the 'best' playdough, and therefore the best playdough recipe. (Devise)
- Make their playdough and carry out the judging. (Develop)
- Explain what they thought, justify their answers and come to consensus about which is the 'best' playdough. (Defend)

This is SO hands-on!

TEACHER NOTES:

Students enjoy the kinaesthetic nature of this unit and the opportunity to get 'messy' and play. This appeals to young learners and enables the development of a wide range of mathematical concepts from a number of strands. In making the dough themselves, students develop an ownership of the outcome and in turn become 'experts' in playdough!

EXPLORE AND DESCRIBE PROPERTIES OF PLAYDOUGH

Provide each student with a piece of playdough and let them play with it freely for ten or so minutes. After they have had the opportunity to mould, build and so on, ask the class what they can tell you about playdough.

DEVELOP VOCABULARY AND CONTEXT

Students may mention colour and what they can make from it, how it feels and how it can be worked. Encourage all ideas and discussion, particularly that the playdough can be squished, squeezed, rolled, moulded, kneaded, re-moulded, pressed, shaped, sculpted, carved, mashed, flattened, dented, built etc.

This is a key step as it begins to provide the students with the language that they will need later to enable them to communicate their understandings.

List the students' ideas and words on poster paper for display. Encourage students to add words to the poster throughout the investigation.

Pack away the playdough in front of the children, explaining that playdough needs to be kept in an airtight container to stop it drying out and becoming hard and unpleasant to work with.

PLANNING PLAYDOUGH INVESTIGATION

Introduce the question to the students in such a way as to ensure their 'assistance'. What is the best recipe for playdough? Explain to students that the playdough they were using was one that you made (or bought from the shops). Let the students know that playdough is fairly easy to make but that there are many different recipes for it and you have often wondered which one is the best.

Show the students the recipes that you have and explain that these are only a few of the many available (Resource sheet 1 provides several, or an internet search for 'playdough recipes' will net hundreds. Please note the health and safety considerations on Resource sheet 1).

Ask the students if they think they would be willing to help you to try some of these recipes out.

MAKE A PLAN

Engage the students in a discussion about how they could find out which playdough recipe is best. The following prompt ideas will help to draw out understandings and develop a plan:

- Look at all these recipes! How do we find out which one is the best?
  (Elicit that they will need to be made and tested – there is no real way to know if the playdough is any good without making the recipe.)
- How much dough do we need to make?
  (Enough for each group to have one test sample of each recipe.)
- How many of these recipes should we try?
  (This is entirely up to the teacher and the time and assistance available. Approximately five recipes would provide enough options that the students should be able to separate the better dough recipes from the others, but not so many that students will become confused by having to deal with too much information. This will also allow each group to produce one recipe.)

Mathematical Focus

Geometry – there are many geometrical concepts that could be visited incidentally in this investigation

Encourage children to build different shapes with their playdough so that geometrical vocabulary and concepts are kinaesthetically explored. As an example, ask the students to make a shape like a can.

PROMPTS FOR A CYLINDER INCLUDE:

- Do we know anything else that is shaped like this? (Jars, barrel sharpeners, etc.)
- What shape is the top? (A circle.) What about the base? (Also a circle.)
- Do you think it would roll, stack, and fit together without any spaces?

Many 3D shapes (spheres, pyramids, prisms, cones) could be modelled with discussion about their characteristics, straight and curved edges, faces, vertices and bases.

This is an opportune time to analyse the generic structure of a recipe (procedural genre). Resource sheet 2 provides a sample that could be used for discussion. It is necessary to read the recipe through with students and help them with unfamiliar words. Get students to act out the actions as they are read: it's fun, helps them to remember the words, makes the meaning clearer and provides evidence that they understand the actions.

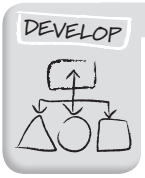
- Who is going to make the dough?
  (Students will 'own' the experiment if they are able to take part in making the dough themselves. The opportunity for practical measurement experience is also invaluable. The adults working with the children need to emphasise the language of measurement while working with students.)
- How will we know which is the best playdough?

  (It is important that students think ahead about the qualities that are important in playdough. They may amend this later, but need to develop ideas at this point. The poster paper listing ideas and words from the Devise phase will act as a stimulus. Allow students to come up with any ideas they have, even if not measurable or useful. They will discover for themselves what works, later.)

FORMALISE THE PLAN

Compile a sequence of steps for experimentation:

> Playdough Experiment
>
> 1. Make five different playdough recipes.
> 2. Test each playdough.
> 3. Decide which one is best.
> 4. Explain why it is the best.



MAKE PLAYDOUGH AND JUDGE WHICH IS BEST

In five different groups, have students make playdough according to the recipes. As each batch of playdough is made, store it according to the directions to ensure quality is not lost.

TIP

If no instructions are provided, generally playdough that is made with heat can be kept in an airtight container or zip-lock bags, while no-heat playdough requires refrigeration as well as airtight storage.

Colour each batch of playdough differently and use a matching colour code on the recipe to provide a visual link for students.

PREPARE TO JUDGE THE PLAYDOUGH

As a whole class, discuss how students are going to decide which playdough is the best. What are they going to consider? What is important with playdough? (Is colour important?)

TIP

Students need to identify that colour is not important, as this factor can be changed by the person making the dough.

Assessment Idea

Focused observation:

- Observe whether students can begin to consider what evidence will be required and the criteria for assessment of their playdough trials. This demonstrates an ability to envision the investigation ahead which is very difficult for students to do.

When students are asked to determine whether something is the 'best', they have difficulty letting go of ownership of their own contribution. The students often argue that their playdough is the best because they want theirs to 'win'. It is helpful to focus the activity as a whole class goal ('As a class we are going to work together to find the best playdough recipe'), even if each group makes their own playdough to test.

To further encourage whole class ownership of the problem, place all the playdough in a neutral place for testing – rather than at a child's or group's desk area.

Colour the playdough different colours so that the teacher and students can refer to the playdough by colour 'the blue playdough' rather than 'David and Elliot's playdough'.

Mathematical Focus

Number – making playdough and following the recipe is an ideal opportunity to introduce, reinforce or develop understandings of:

- whole-part-whole
- half as two parts
- half as equal parts

Some features students might consider:

- Texture: Not lumpy and no hard 'bits' in it.
- Stickiness: Playdough should not be sticky, even when used repeatedly.
- Firmness: Playdough should be easy to roll out or model, but not so soft that it doesn't hold its shape well.
- Cost: See details provided below. (Optional.)

TIP

Cost calculations are optional and dependent upon the developmental stage of students.

Attributes such as stickiness, texture and firmness can be easily measured on a rating scale. Depending on the attributes selected, either copy Resource sheet 3 (one for each group) or prepare a sheet that enables students to record their responses. For example:

Blue Playdough			
Stickiness	Too sticky	Too dry	Just right
Lumpiness	Too lumpy		Just right
Firmness	Too hard	Too soft	Just right

ASSESS THE COST (OPTIONAL)

This optional activity assesses the cost for preparing each different sort of playdough. Students would need to be provided with a unit cost for key ingredients:

Item	Amount	Cost
plain flour	1 cup	60 cents
salt	1 cup	80 cents
cream of tartar	1 tablespoon	40 cents

The figures provided are done so in amounts that will enable students to double and halve costs with relative ease; they are not meant to reflect real costs, which could have students working with numbers beyond their ability.

Display or project Resource sheet 4 as an example. Point out clearly how the students took the amounts from the recipe and wrote them into the chart. Show students that this group used drawings of coins to calculate the total – but they can use drawings, numbers, calculators, manipulatives or play money to help them – whatever they wish except that they must show how they got the answer. Provide copies of Resource sheet 3 for the students to use as worksheets.

JUDGING THE PLAYDOUGH

Set up five 'stations' for judging the playdough. At each station, have the playdough sample along with a set of measuring cups, cost sheets (if used) and playdough tools.

Provide each of the student groups with a copy of Resource sheet 3. They rotate through the five stations, judging the attributes on the rating scale. As this happens, ensure that groups work out how much playdough each recipe

Assessment Ideas

Task analysis:
Recording sheet – observe the method that students use to calculate the total cost of their playdough.

- Do their calculations show that they understand the actions required to get the correct answer (such as doubling or adding together twice the cost of 1 cup of flour to get a costing for 2 cups of flour)?
- Are students able to choose a method that helps them add up the coins? Are they able to add coins using their chosen method?
- Do they recognise that 250 cents is also $2.50?

Assessment Idea

Focused observation:
Listen and keep anecdotal notes as the students discuss their ideas.

- Are they able to express ideas with logical justification? ('This dough is too soft because it doesn't stay in the shape I put it in')
- Are they able to express ideas using comparisons? ('This dough is stickier than...[another batch] but not as sticky as...' or; 'This dough is the lumpiest.')
- Do students consider others' ideas and, where appropriate, provide evidence to defend their own opinions? ('I still think that this dough is the lumpiest because when you spread it out, you can see bigger lumps than in that dough.')

Assessment Ideas

Focused observation:
Continue to observe (as detailed above), and include whether students:

- are able to express ideas with logical justification
- are able to express ideas using comparison
- consider others' ideas and, where appropriate, provide evidence to defend their own.

made, using the measuring cups. It is sufficient for students to give approximate measures, for example, 'a bit more than 3 cups'.

TIPS

These informal measures indicate whether or not a student has grasped the concept of part cups and is able to use informal mathematical language to explain quantities.

Working through the sheet as a group enables students to discuss their ideas extensively. This is very useful for developing understanding and vocabulary, as well as for formative assessment.

DECISION TIME

Encourage the students to come to an agreement with their groups about the best playdough recipe. Arguments may follow and this is healthy so long as respect for others, logic and reasoning are maintained. Students record their group decision and reasoning on the bottom of their data-gathering form.

REACH CONSENSUS ON THE 'BEST' PLAYDOUGH

Each group shares their findings with the class, presenting which playdough they believe is the best and explaining why it is better than the others. Students may ask questions but must maintain the respect necessary to share successfully.

At the end of the student presentations, engage students in a whole class discussion, noting the results.

- Did all the students agree?
- Why might their opinions have differed?
  (Why did this group rate the purple playdough as good for lack of lumpiness and this group here rate the same playdough as hard and dry?)
- Can we reach a whole class agreement?

PLAYING WITH DOUGH

INACTION!

A SAMPLE RESPONSE

Who is in your group?

Daniel Jenna Danielle Matthew

Playdough 1: Blue

Stickiness 

Lumpiness 

Firmness 

How much does it cost to make? $2.50

How much does it make? 3 cups

Playdough 2: Red

Stickiness 

Lumpiness 

Firmness 

How much does it cost to make? $3.00

How much does it make? 3 cups

Playdough 3: Green

Stickiness 

Lumpiness 

Firmness 

How much does it cost to make? $1.70

How much does it make? 3 cups

Playdough 4: Yellow

Stickiness 

Lumpiness 

Firmness 

How much does it cost to make? $4.40

How much does it make? 3 cups and about a half

Playdough 5: Purple

Stickiness 

Lumpiness 

Firmness 

How much does it cost to make? $3.70

How much does it make? 3 cups and a little bit more

Questions:

Which is the best playdough? The green playdough

Why do you think so? The green playdough was the best. It wasn't sticky at all. It was very smooth and had no lumps or hard bits. It was a bit too firm. It was harder to roll out than the yellow one. The yellow one was the best but it was really expensive to make. We thought that the teacher should make the green one.

TEACHER NOTES:

This is quite a sophisticated response, as it demonstrates reasoning and use of logical comparison. Look for evidence that the students have been able to justify their decision on grounds that are not emotive (my friend made it) or irrelevant (I like the container it is in).

TO EXTEND:

- Consider additional attributes such as how long each playdough mix remains usable.

TO SIMPLIFY:

- Reduce the number of attributes used to evaluate the playdough to just one.
- Reduce the number of recipes students evaluate.
- Focus on the rating scales only, without consideration of the quantity made.

ALTERNATIVE INQUIRIES:

This inquiry could be replicated with almost any baked, consumer or classroom item, such as:

- What is the best ANZAC biscuit recipe (cost and taste test)?
- What brand of glue sticks are the best (test their capacity to hold items, cost)?

Playdough Recipes

Safety notes

Three playdough recipes that don't require heat have been provided below (however, the playdough they produce often isn't as good as those recipes that do require heat).

Consideration must also be given to allergies/intolerances, particularly as young children often try to eat the playdough.

When colouring playdough, using a different colour for each type will make it easier to record responses.

No-Heat Playdough 1

INGREDIENTS

2 cups plain flour
1 cup salt
1 tablespoon vegetable oil
1 cup water
food colouring (a few drops of desired colour)

METHOD

- Put flour and salt into a mixing bowl and mix together.
- Form a well in the centre and add the remaining ingredients.
- Mix everything together with a blunt knife.
- Empty dough onto a placemat or other flat surface and knead until it comes together and forms a soft dough.
- Add extra flour if the dough is sticky.
- Store in an airtight container in the refrigerator.

No-Heat Playdough 2

INGREDIENTS

1 ½ cups plain flour
1 ½ cups salt
2 tablespoons vegetable oil
1 ½ cups water (approximately)
food colouring (a few drops of desired colour)

METHOD

- Put flour and salt into a mixing bowl and mix together.
- Form a well in the centre and add the remaining ingredients.
- Mix everything together with a blunt knife.
- Empty dough onto a placemat or other flat surface and knead until it comes together and forms a soft dough.
- Add extra flour if the dough is sticky.
- Store in an airtight container in the refrigerator.

No-Heat Playdough 3

INGREDIENTS

1 ½ cups plain flour
1 ½ cups salt
1 tablespoon vegetable oil
water
food colouring (a few drops of desired colour)

METHOD

- Put flour, salt and oil into a mixing bowl and mix together.
- Begin adding water, a little at a time, mixing the dough between additions.
- Empty dough onto a floured placemat or other flat surface and knead until it comes together and forms a soft dough.
- Add extra flour if the dough is sticky, or extra water if too dry.
- Store in an airtight container in the refrigerator.

PLAYING WITH DOUGH

Recipe Genre

No-Heat Playdough 1

INGREDIENTS

2 cups plain flour
1 cup salt
1 tablespoon vegetable oil
1 cup water
food colouring (a few drops of desired colour)

METHOD

- Put flour and salt into a mixing bowl and mix together.
- Make a well in the centre and add the remaining ingredients.
- Mix everything together with a blunt knife.
- Empty dough onto a placemat or other flat surface and knead until it comes together and forms a soft dough.
- Add extra flour if the dough is sticky.
- Store in an airtight container in the refrigerator.

Ingredients list

Tells us what is needed and how much of each item is needed.

Title

Tells what the recipe is for.

Method

Tells us what we need to do in the order that we need to do it. These steps are sometimes numbered.

Method

Each step usually starts with an action word which tells us to do something.

Recording Sheet

Who is in your group? .....

Playdough 1 – .....

Stickiness 
Lumpiness 
Firmness 

How much does it cost to make?

.....

How much does the recipe make?

.....

Playdough 2 – .....

Stickiness 
Lumpiness 
Firmness 

How much does it cost to make?

.....

How much does the recipe make?

.....

Playdough 3 – .....

Stickiness 
Lumpiness 
Firmness 

How much does it cost to make?

.....

How much does the recipe make?

.....

Playdough 4 – .....

Stickiness 
Lumpiness 
Firmness 

How much does it cost to make?

.....

How much does the recipe make?

.....

Playdough 5 – .....

Stickiness 
Lumpiness 
Firmness 

How much does it cost to make?

.....

How much does the recipe make?

.....

Questions:

1. Which playdough is the best?

.....

2. Why do you think so?

.....

.....

.....

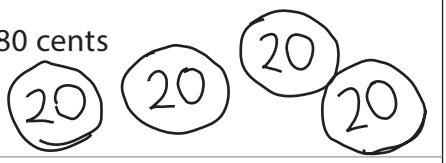
.....

Cost Sheet – Example

➔ Who is in your group? Matthew, Daniel, Jenna, Danielle

➔ Which playdough recipe is this costing for? Green Playdough

Cost of ingredients		
Item	Amount	Cost
plain flour	1 cup	60 cents
water	1 cup	0 cents
salt	1 cup	80 cents
vegetable oil	1 tablespoon	40 cents
food colouring	5 drops	10 cents

How much does your recipe cost?		
Item	How much do you need?	How much will it cost?
plain flour	2 cups	120 cents 
water	1 cup	0 cents
salt	1 cup	80 cents 
vegetable oil	2 tablespoons	80 cents
food colouring	A few drops	10 cents

➔ How much will it cost altogether? 290 cents which is $2.90

Cost Sheet

➔ Who is in your group? .....

➔ Which playdough recipe is this costing for? .....

Cost of ingredients		
Item	Amount	Cost
plain flour	1 cup	60 cents
water	any amount	0 cents
salt	1 cup	80 cents
vegetable oil	1 tablespoon	40 cents
food colouring	5 drops	10 cents

How much does your recipe cost?		
Item	How much do you need?	How much will it cost?
plain flour		
water		
salt		
vegetable oil		
food colouring		

➔ How much will it cost altogether? .....