Potato Olympics

- Overview
- Lesson Plan
- Classroom Contributions

Maths300 is a living site. This lesson will be enriched through further teacher development in classrooms across the world. You are invited to contribute to that process by submitting:
  variations ... extensions ... inspirations ... photos ... student work

Please email material to: Doug.Williams@curriculum.edu.au
Potato Olympics

Overview

Each MATHS300 lesson serves two purposes. On the one hand it is a professional development experience offering opportunity to try something new, hopefully in conjunction with your staff, in the knowledge that the notes record the successful experiences of your colleagues elsewhere. On the other hand it is a well trialed lesson plan which provides clear information about ‘what to do in maths tomorrow’.

Years: K - 8    Time: 2 - 10 lessons

Summary:

Who would believe that students could build a personal relationship with a potato? Well in this lesson they do! As a result of developing their potato into a character the students prepare it for entry into specially designed potato olympic events. They have to measure their potato in various ways and produce measurements that will allow the efforts of their potato athletes to be compared. All this measurement produces data which needs to be displayed, analysed and reported.

The integrated cross-curriculum opportunities for language, art, science and health lessons are almost endless. And you don’t even have to wait for an Olympic year to use this lesson. The Spudville Athletic Carnival is an annual event.

This lesson links well with Lesson 11, This Goes With This.

Resources required:

- one clean, washed potato for each student - ensure that there is a wide range of sizes across the class
- measuring equipment for length, mass and capacity
- felt markers for drawing on the potatoes
- 100 bead ring as for This Goes With This, or a circle of card marked into 100 divisions.
- a ball of knitting wool/yarn

Content Outcomes/Links To Curriculum Documents

- measurement of length, mass, time and displacement of water
- collection & display of data
- analysis of data - range, mode, median, mean
Lesson Stages

1. Develop potato characters.
2. Introduce characters to each other and develop stories about the meetings - group work.
3. Write and present a literary piece based on the stories - group work.
4. Measure vital statistics of the potato and prepare a profile of the potato athlete.
5. Design a potato olympic event and gather statistics on the performances of a range of potato athletes - group work.
6. Analyse, display and write reports about the the data.

Issues or Discussion Points

- Frequently mathematics is only included in a token way in integrated studies. However, classroom examples in these lesson notes illustrate many exciting and valuable cross-curriculum learning opportunities. Is it possible to construct more integrated units which begin with mathematics and reach out to other disciplines?
- Imagine the lesson began by providing a set of measurements someone else had made of a bag of potatoes. It would be much easier to organise that than to bother with these 'concrete' materials, to organise the measuring equipment and to put up with the noise and movement associated with collecting the first hand data. What effects would it have on the quality of the lesson to leave these things out? In which other lessons have we made a choice to leave out 'things' on the basis of convenience rather than for educational reasons?

Straw Vote

After teaching the lesson, please rate each of the following features (out of 10) as to its contribution to the overall quality of the learning experience. This exercise will provide a basis for staff discussion of curriculum development.

<table>
<thead>
<tr>
<th>Feature</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Having a personal potato</td>
<td></td>
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<tr>
<td>2. Group work</td>
<td></td>
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<tr>
<td>3. Cross-curriculum aspects</td>
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<td>4. Opportunity for toolbox lessons in statistical skills</td>
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<td>5. Physical involvement in data representation</td>
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<td>6. Mixed ability - suits many grade levels</td>
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<tr>
<td>7. Contextually developed curriculum</td>
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<tr>
<td>8. Using real data to illustrate the Working Mathematically process</td>
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Acknowledgements: This lesson was first published in *The Classroom Connection*, Volume 8, Number 3, July - September 2000 and is used here with permission. *The Classroom Connection* is published by Research Publications, which can be contacted on respub@access.net.au.
Thanks also go to Ruth Court and Caroline Miller who provided photographs and other material from their classrooms.

**Features**

*Personal potatoes:* are the key to the students' involvement. These are easy and cheap for any teacher to organise. Beginning with such an unexpected activity as drawing on the potatoes immediately gives the lesson a play/fun aspect. For the children, 'owning' the potato has the same feel as playing with their own model car or Barbie doll. The lesson capitalises on this interest and leads on to extensive and important mathematical and language experiences.

See [Classroom Contributions](#) for one teacher's summary of her full day's work on Potato Olympics.

*Cross-curriculum:* This lesson is rich with opportunities to use and develop skills and concepts from other disciplines. Examples are given. The wholeness this brings to the lesson appears to be very satisfying for both teachers and students.

*Group work:* is vital to parts of this lesson.

- The language work benefits from the ideas and discussion generated between pairs.
- The design and technology work can become chaotic without group-based activity to reduce demands on space and classroom resources.
- Just like the 'real' Olympics, the whole potato Olympic day cannot work without team commitment and co-operation.

When reflecting on the lesson with students the development of social skills is supported by reviewing the part group work has played.

*Acting out the data:* Since the potatoes which are the source of the measurement data are in one to one correspondence with the students, the students can represent their potato in data displays. They:

- begin as unordered data,
- arrange themselves from smallest to biggest,
- rearrange into grouped data to make a bar graph or histogram, and
- follow the leader to turn the histogram into a circle graph and a pie chart.

Physical involvement like this has been shown to keep the learning in memory longer. It helps to create brain pictures of the mathematics. As a result, teachers find they can call on previous experiences with comments like "Remember when we ..." and use these images to introduce or explain new situations.

Further, the process of collecting and organising data, looking for patterns and connections in it, and building hypotheses based on these has a direct connection with the process of **Working Mathematically**.

*Toolbox lessons:* in statistics can readily follow this lesson.
Yesterday we learned to average our potato masses. Today is a toolbox lesson designed to practice that skill because it is very important in maths. So, turn to page .. of your book and let's have look at the exercises there.

Working this way emphasises the link mathematicians express between mathematical content and the process of Working Mathematically. The learning and application of content is in the service of process, and the process is being called on to solve a problem.

The image of a toolbox lesson to service Working Mathematically has really worked with my Year 8s. I am simply not asked any more "Whattawegotta learn this for Miss?"

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Lesson Plan

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Lesson Notes

**Your Photo Opportunity:**
Maths300 is frequently updated with contributions which help others 'see' the lesson. You are invited to send your electronic photos of this lesson to Doug.Williams@curriculum.edu.au for possible inclusion.
We will need written permission from the parent of any child who could be identified.

This little cutie is showing us her potato. She has made it into a character by using markers to highlight its eyes and other features.

With older children the activity can be introduced like this:

Potatoes have eyes ... And eyes are the windows of the soul ... And soul is expressed through character, so your potato has character. Take a good look at your potato and as its character starts to reveal itself, pick up a marker and draw in its features.

Using clean, washed potatoes is sensible and it is important to hand select a wide range of potato sizes for your class.

Now your potatoes are beginning to show their character, so get to know yours. Ask its name and inquire about its family history, schooling, favourite sport, best friend, the church it goes to and anything else that might develop in your conversation. Don't forget to tell your potato a little about yourself too.

Students record notes about their potato character - bullet points are sufficient.

Introduce your potato to the potato next to you and begin a conversation. Remember, a good host/hostess will provide enough information during an introduction to encourage the potatoes to begin a conversation.

Encourage the potatoes to form groups, get to know each other and make up a story that involves them all.
There are many directions to go with the language arts once the students have developed a relationship with their potato. To get things rolling ask students to work in groups of 2/3 to prepare a 'literary piece' about their potatoes which could be:

- a story
- song
- poem
- comic strip
- news report
- play ...

Then students perform and present to each other and begin building a potato community. Here are examples from two sets of young writers.

**Don't Stop**

Don't stop - never give up
Bank robbing is the life for me
Don't stop - never give up
Couch Potato watching TV
Don't stop - never give up
Designing special clothes.

Let the world see what we have got
Dream of a life for you and me
Bring it all back to us.

**Spud & Spunky**

Spud and Spunky met in a vegie patch. They were best spuddies. One day they were big enough to be mashed. They were worried because they had seen some of their friends go to be mashed but they didn't know what was involved. They didn't know because no-one ever came back to tell them about it. They hoped that they could stay together and that it would be fun. They had asked their parents about it but they didn't know either. They hoped it would be an adventure they would enjoy!

**LET THE GAMES BEGIN**

Now it's time to organise Potato Olympics, or the Annual Spud Sports Festival, depending on the year. Here the activity breaks into two parts, Olympic Events and Athlete Dossiers, which come together later.

**Olympic Events**

Each of our potatoes is hoping to be in the Potato Olympics, so we have to do things to help them. Potatoes can't run, but they can roll down a ramp. Potatoes can’t swim, but they can dive or displace water. Potatoes can’t pole vault, but they can high jump ...

... if they happen to be on the end of a metre ruler which is balanced over a fulcrum at the same time as a foot comes down on the other end of the stick.
Now think about what your potatoes can do. We need each pair to design, test and build a Potato Olympic event. You can use anything in the room to help, but you must find some way of measuring or scoring the results of your event, just like in the Olympics.

A small amount of pandemonium will follow, but that will soon subside into purposeful design and technology activities. The aim here is to provide sufficient time for each pair to create and test their event so that when you take over the multi-purpose room in a few days for Potato Round Robin, every pair will have an event from which they can gather data for every potato in the class.

**Athlete Dossiers**

Each potato has to provide the sports commentators with a dossier of information containing:

- an identifying photo (or drawing or potato print)
- vital statistics, especially mass, but also including items such as girth and height and amount of water displaced
- personal best scores in their own event
- a few paragraphs of possibly interesting personal drivel which the commentators can use to fill time before, during and after the events.

**Getting To The Maths**

Before the big Round Robin day, use the data the students have collected about their potato masses to model what can be done with the data they will obtain by measurement in their event.

1. Invite the students at random to come to the board and record their potato mass. This provides the unordered data. A questioning sequence like:

   What does this data tell us about the masses of potatoes in our class?  
   Is there anything we can do with this data which might give us more information?

will soon lead to a suggestion that the data be ordered:

   Where would you like to start?

*Note:* Some teachers use post-it notes and ask the students to record their mass in bold black marker before sticking the post-it to the whiteboard. Then, at the re-ordering stage, the students are asked to come and shift their post-it into order.

2. Once ordered, more information can be discovered about the distribution of potato masses:

- The range of masses in this class is the difference between the smallest and largest.
- The mode of the distribution is the most frequently occurring data point. (There may be more than one mode.)
- The median can be found by counting up from the least to the data point which is halfway. (What will you do if there are two 'halfways'.)
- The average can be found using the rule everyone knows. But what does that statistic mean???
Average

Average is the communist statistic. If we share everything the group has (ie: the total mass of potatoes) equally between all the members of the group, then average tells what each member would receive. In this case that is the number of grams of potato available to each student in the class.

It's a bit like mashing the potatoes and working out how much to dish out to each of us.

- Why do children learn that average means *add 'em all up and divide by how many there are*? Surely it's better to understand and apply this first principles approach rather than a parroted rule?
- It is also important to realise that not all data can be averaged. What would it mean to average the numbers on the football jumpers of your favourite team? Or to average the room numbers in a hotel. These latter sets of data are only nominal, ie: they are essentially being used to name something. The potato data *can* be averaged because the scale for measuring mass has a meaningful zero *and* equal steps along the scale indicate equal changes in the mass. That is, the difference in mass between a 100 and a 150 gram potato has the same meaning as the difference between a 200 and a 250 gram potato.
  
  This sophistication may become important in the students' Olympic events.

Displaying Data

There are a number of options for display which can be explored at this point. You might like to use either of the following, or others, so that the students can make choices when it comes to displaying their own results.

S*tem and Leaf*

Draw up a vertical column which starts at 5 and grows to about 20. These numbers represent the tens part of the potato mass range (50 to 200 grams in this case), but you don't have to tell the students that. They will find out.

Now I want you to come up in order and tell me your potato mass. Watch carefully what I tell the first few students to do, because I think you will be able to work out where to put your number before you even come up here.

Explain to the first few about how and where to place the units part of their potato mass. You can just walk quietly away and they will teach the others. The finished display will look something like this.

- Check where the previously explored statistics would appear on this display.
- Also, you can adapt any text book questions from any chapter on graphs to invent practice exercises based on this more personal data.
Further, given that our students are learning to 'work like mathematicians', and that mathematicians need to become increasingly proficient at using a range of tools, it is quite valid to bring some textbook exercises into class at some future time and introduce them with a comment like:

Today is a toolbox lesson. When we did our Potato Olympics, we made lots of stem and leaf graphs. Today we are going to practise the skills we learned about making these and getting information from them.

**Bar Graphs**

Another way to organise the data is to display it in class intervals from, say, 50-74, 75-99, 100-124 grams, and so on. This produces a bar graph or histogram, and it is worth noting that in order to do so, each data point loses its 'personal' importance in favour of the group 'image'.

It is important to realise that this potato data is continuous (unlike, for example, data about the children's favourite pets). So the correct representation of data such as this:

<table>
<thead>
<tr>
<th>Potato Masses (grouped)</th>
<th>Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>51 - 100</td>
<td>5</td>
</tr>
<tr>
<td>101 - 150</td>
<td>4</td>
</tr>
<tr>
<td>151 - 200</td>
<td>5</td>
</tr>
<tr>
<td>201 - 250</td>
<td>2</td>
</tr>
<tr>
<td>251 - 300</td>
<td>2</td>
</tr>
<tr>
<td>301 - 350</td>
<td>1</td>
</tr>
</tbody>
</table>

is along a scale which is continuous, ie: a histogram such as this:
Rather than as a bar graph like this:

![Bar graph](image.png)

**People Graphs**

It helps students to better understand the display and interrogation of data if they are personally involved as data points.

- Ask the students to remember their potato's mass and follow you to the netball court. Ask them to stand anywhere.

  Now you are the same as the unordered list of potato masses that we made on the board. I want you to become ordered data with the smallest mass starting here.

  More minor pandemonium can be expected, but at least you are outside this time.

- Prepare class interval cards in advance to match the previous board display and ask the ordered data to become the grouped data.

  As long as you are in the correct family, does it matter where you stand?

Discuss the sophistication of representing continuous data as a histogram, and shuffle the columns together to make a histogram. However, it is also important to realise that as people graphs, it is more difficult to 'see' what is going on when everyone is 'on top' of each other.

- Also in advance of moving outside, tie enough 2 metre lengths of yarn to your key ring to match the number of class intervals. While children are in the histogram arrangement give an instruction like:

  Now I want you to follow the leader, starting from the smallest family, so that we make a circle. Before we start, the front person in each family needs to pick up the name card.

- Form the students into a circle. Ask them to sit. Place your key ring in the centre of the circle and use the lengths of yarn to link the centre to the first person in each category. Adjust the hand they use to hold the string so that they are actually within the sector representing their group. Place the cards in the sectors to name them.
Now you have made a circle graph, which is another way of displaying data.

- At this point, if you happen to be standing outside wearing a 100 bead necklace, and let's face it, you have to get it out there somehow, take it off and place it so that the key ring is also the centre of the circle made by the beads.

  (You can see a 100 bead necklace in action in Lesson 11, This Goes With This. Also, in the Lesson 11 Classroom Contributions, you will find a different wonderful way to construct percentages from a strip graph.)

Now you can count up the number of beads which fall in each sector and get a fairly accurate result for the percentage of potato masses in each category.

- Check these with a calculator by dividing the number of bodies in each sector by the total number of bodies in the circle. Here is the way one child from Kingston Primary School represented the class making their pie chart.

Spreadsheet Representation

So that the students can have as broad an opportunity as possible to show off the data they will gather at the Potato Olympic events, you could take this opportunity to use a program like Excel and display the data as:

- an unordered list: just enter in any order
- an ordered list: copy the unordered list and use the Sort function to order it
- any number of graphs: by selecting the data, choosing Insert Chart, and using the wizard to choose the appropriate form
For example, using the same data as for the histogram above, the corresponding pie chart is:

![Pie Chart](image)

Using a spreadsheet graph gallery requires choosing between many representations, some of which may look good but may provide confusing or incorrect information when representing particular data. This is a good opportunity to encourage discerning selection from among the myriad of available choices.

**Reporting on the Olympics**

The students have now designed a Potato Olympic event, collected data from it, and, as a class, explored various ways to display and analyse this data. To complete the unit ask each pair (or individual) to write a report which includes:

- A description (text and pictures) of the atmosphere on Games Day.
- A summary of the results of their own event which includes the statistics of the outstanding achievements compared to the overall results.

**Lots More**

The potato theme can be extended in many other directions. Potato batteries and potato soup being just two. See *Potatis Matematik*, The Classroom Connection, Vol.4 No.2, April - June 1996 for more. If the school is prepared to plan this experience with team work and dedication, just as an Olympic Team would, the rewards will be gold medals in learning.

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Please email material to the address below. If it is included it will be acknowledged. You can review current contributions in the Classroom Contributions folder for this lesson.
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Potato Olympics

Classroom Contributions

We are grateful to the teachers, schools and students listed below for:

i. taking time to use this lesson
ii. taking time to add to community knowledge of its educational value by sharing additional information

Luther College, Croydon, Australia

Year 7
Ian Edwards

And what made you think this lesson was for primary students? Ian Edwards, has donated the 16 page Investigation Guide he prepared for his Year 7 students. Trialed first in 2006 and refined in 2007, this unit is now well developed. An incredible preparation effort, incredible generosity in offering it to Maths300 and, we believe, incredible engagement leading to high level outcomes for the students.

Get into The Spudlete project (a PDF file) and explore literacy and craft in secondary mathematics, masses of measurement, stacks of statistics and heaps of hypothesising. Truly, you won't believe your eyes - spuds/potatoes/eyes, get it?

Kingston Primary School, Australia

Grade 5/6
Ruth Court

Massed Potatoes

There was a buzz of excitement in the class when I produced a bag full of something. I removed one of the bag's contents and held it up. "It's just a potato," said Brad.

I replied, "This is not just a potato! It's a special potato. I'm going to give you all a potato and you're going to draw in its features and give it a name."

Each child was given a potato and a permanent marker - permanent because in the later water experiments the drawing won't wash off. They then proceeded to put in the features on their potatoes and name them.

While they were doing this they were asked to think about their potato's story. When the potato was suitably recognisable from the other potatoes, each child was asked to pair up with someone and introduce their potatoes to each other. They then had to compose the story of their meeting and tell it to the class in any form they wished. This all took a bit over an hour. This was a good place to stop (Recess time).
After recess, I told the children that their potatoes were going to perform in the Potato Olympics and they needed to find what events their potatoes were particularly good at. They were told that they must find the mass of their potatoes and they could find any statistics relevant to their potato. The children had many measurement tools at their fingertips. They had scales, tape measure, stop watches, calculators, counters, metre rulers, T squares, Unifix cubes, Dienes Blocks etc. The children immediately took this on board and the classroom was a hive of activity.

The language and variety of measuring activities was exciting. They were talking mathematically in a most natural manner. We found that we had expert high jumpers, wrestlers, bowlers, balancers, swimmers, (they even had bathing caps made for them), hurdlers, obstacle performers, divers etc. This activity could have gone on indefinitely. Every child was focussed and involved. When they packed up (reluctantly) each child wrote their potato's mass on the board.

The children were then asked to make a poster about their potato's coming performance at the Olympics. They were asked to make it as a persuasive poster to encourage people to come and see them. Then came lunch.

After lunch the children were given a bit more time to finish their posters. We then focussed on the masses the children had recorded on the board. We talked about what sense we could make of the numbers. Someone suggested we average them. Then followed a discussion as to what an average was and how it would help us to make sense of the information.

Someone else said we could order them, so as a class we ordered them. I then asked them what that told us and we discussed how we could show lightest to heaviest etc. Then we decided to group them. We talked about the number of groups we could make and finally decided on 3 groups. We grouped them as follows:
- 80-159 grams
- 169-220 grams
- 221-350 grams.

I then asked the children to order themselves from smallest mass to greatest. This they did well. They then sorted themselves in 3 rows in the above groups. They showed that they had made a people column graph which they understood immediately. We then walked outside in our groups in one long line keeping the order. When on the oval we made our straight line into a circle with the leaders holding their number range on card. I then stood in the centre of the pie and threw a piece of wool to each leader.

Nick called out, "We're making a pie graph, aren't we?"

He was right. We had in fact made a pie graph.

I took a circle of 100 beads and asked the children how many I had. Eventually we came up with 100. I then put the beads around the centre of the circle and we counted the number of beads in the largest segment of the circle. We counted 54 beads. I asked the children how we could say that another way. Someone said 54 out of 100. Another said 54/100. Eventually someone said 54%.

When we came inside Nick entered the data into Excel and then produced a column graph and a pie graph. We found out that the largest segment was in fact 52% and not 54% which was pretty close.
These activities took a day which was probably one of the reasons it worked so well. We didn’t have children who had been away arriving half way through the activity; we didn’t have children away. Continuity of activities was an important part of this unit of work.

**Fregon School, South Australia**

**Staff**

*Fregon is in the far outback north-west corner of South Australia. The staff came to Alice Springs (a mere six hours drive - four of that across dirt) for a professional development session led by Matt Skoss. Their photos below indicate that the bush air, and the candy on the tables, is a great stimulant to creativity.*
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