Compost Calculations: Algebra and Measurement in Action

Written by Annelies Judson, published August 2025 **This is a printer-friendly simplified version*
www.nzaee.org.nz/spotlight/compost-calculations-algebra-measurement-action

Getting Started: Support and Resources

National programmes such as **Enviroschools**, **Para Kore** and **Garden to Table** all have experienced educators who work with schools to support composting and gardening. You can also search our **Providers catalogue** or use the **Aotearoa Composters Network** to find organisations in your local area. The Love Food Hate Waste website has pages for beginners to **Worm Farms**, **Bokashi Bins** and **Compost Bins**, which are a good place to start for basic knowledge. Zero Waste Zero Carbon has online modules for schools about setting up **Bokashi Bins** using biochar, with links to climate change and soil science in the module about carbon sinking.

Curriculum Links: Mathematics - Algebra and Measurement

Algebra strand is linked here: Phase 1 (Yrs 0-3) Phase 2 (Yrs 4-6) Phase 3 (Yrs 7-8)
Measurement strand is here: Phase 1 (Yrs 0-3) Phase 2 (Yrs 4-6) Phase 3 (Yrs 7-8)

Algebra is divided into two parts: Equations & Relationships, and Algorithmic Thinking. Measurement is also divided into two parts: Measuring, and Perimeter, Area & Volume. All of these areas of algebra and measurement are incorporated into the activities on the following pages, but not all learning outcomes are covered. We also encourage you to integrate other learning areas with your mathematics learning, such as science, technology, social sciences, health, English and the arts.

Stories and Related Resources

Te Kauwhata Community Compost Hub is an inspiring case study written by Paul Murray from Para Kore, who has supported Te Kauwhata Primary School in the Waikato to develop an effective hot composting system, in collaboration with the CarbonCycle company.

Enviro Rangers Take Action for Compost - Reefton Area School, story from Enviroschools with a range of examples that highlight students investigating, trialing and carrying out actions to improve their systems for collecting organic waste and composting.

Earth Dreamers, for ākonga in Years 7 - 8 and linked to Te Ao Tangata | Social Sciences curriculum, with an inquiry focus that can easily be adapted for younger or older ākonga. We highly recommend this resource, based around mātauranga Māori and our local Aotearoa context.

The Future of Growing Kai by Arihia Latham, School Journal 2023 (Level 2) provides an opportunity to support literacy within this learning context.

Trees, Seas, and Soil, Connected 2020 (Level 3) includes information about soil as a carbon sink.

Worms are Wonderful by Giselle Clarkson, School Journal 2024 (Level 3).

Kiwi Kai online tool is designed for year 5–8 students, introducing them to sustainability issues encountered in farming and food growing.

Exploring Biodiversity through Statistics Investigations (NZAEE collection)

Measuring the Mighty: Maths Adventures in Kauri Education (NZAEE collection)

ACTIVITY IDEAS

Planning and Design: Which bin is right for us?

Compost and worm bins have different sizes, shapes and capacities. Students could compare either existing bins on site, or online listings if you are intending to buy or construct new bins. This inquiry links really well to the technology learning area, with opportunities to review the suitability and design of existing products, or students could design and build their own bins to suit the needs of your key audience and the space available. Incorporate the arts by adding some creative flair to your bins or build literacy skills by creating advertisements for their new designs.

Measurement

- Estimate and then measure the following features of existing bins, using standard or non-standard measurements:
  - **Size (height, width, depth**)
  - **Capacity (volume)** Hint: number of bags of compost is a good non-standard measurement option here!
  - **Area** that the bins take up
- Discuss whether different **shapes** of bin would have different **volumes**, and how you could tell which is the biggest/smallest
- Estimate and record the **temperature** in different parts of the bins e.g. middle, at the side, different times of day, or in different weather.
- Consider the different **lengths (perimeter)** of fencing you would need around the bins depending on the placement of the bins *e.g. Would having the bins in a long line need more or less fencing than in a square? What about other shapes? What if they were in two places? How much fencing might that require?*

Algebra

- **Use equations** to calculate:
  - How much **area** the school will need if you want to purchase 1/2/5/10 more bins
  - How much compost or worm tea you would want for your school gardens, and how many bins you would need to supply this. *e.g. if one bin will provide 50L of compost per year, how much will 2/3/5/10 bins provide?*
  - The **cost** for purchasing more bins, based on different combinations of bins *e.g. if a worm farm costs $100 and a compost bin $250, how much will 2 worm farms and 3 compost bins cost?*
  - The **volume** of worm tea over different time intervals, or the **volume** of soil in the different bins, based on a sample of worm tea/soil
- **Create a graph** to show the optimum layout for the bins based on the **perimeter** of the area they are in (this Worms at Work resource has an activity about perimeter)
- **Provide instructions** for how to carry out the measurement tasks and ask students to follow them. Get students to help with constructing any new bins using the instructions provided.

Circular Systems: Using compost in our school garden

Your compost and worm bins provide an opportunity to create a circular system, with resources staying within your school and being reused in your school gardens or donated to the community. This links nicely with the social sciences and health learning areas, where students can relate their learning and actions to concepts of equity, community, hauora and the sustainable use of resources.

Link this learning to science by spending some time learning about decomposition, to make sure your compost is working well and not getting too smelly! Garden to Table's resource **There's a Party in the Compost Bin!** provides a simple overview about how to get the correct ratios in your system and how to use the compost you produce. Zero Waste Zero Carbon has an online module about **resource recovery stations**, to help set up effective systems for separating food waste to use in your compost.

Measurement

- Carry out a **waste audit** of the school's organic waste: this can include food waste, but also things like paper towels, cardboard, leaf litter. Record the **weight** (**mass**) and/or **volume** of the different types of waste.
- Calculate the amount of **time** (labour) required for emptying bins and managing the compost bins.
- For a new bin, measure the **weight (mass)** of what you put in (including worms if it's a worm bin!), and then over **time**, measure the **weight (mass)** of what is in the bin.
- Write explanations for the school about **how much** can be put into each bin per **day/week**.
- Collect the liquid and or solid products from the bins over a period of **time** and calculate and compare the **volume** produced (in litres or cubic cm depending on the type).
- Take a sample of soil from a bin and **weigh** it. Use this to estimate the weight of the soil in the whole bin, and then in all the bins you have.
- Measure the dimensions of your school garden beds and calculate the **volume** of soil (in cubic centimetres or metres) needed to fill them, or how much compost you would need to top them up.

Algebra

- Investigate which types of bins are best for which type of organic matter, and the capacity for each bin to break down this waste. Use this information to **calculate** how many bins you would require to take care of all of the school's organic waste.
- **Calculate** and **graph** the cost for different types of waste solutions for the school e.g. commercial waste removal, purchase of compost bins etc.
- Graph the relationship between the **weight (mass)** of what is in the bin and the **weight (mass)** of what has been put in the bin. *Note: this will require quite a lot of data collection as you will need to keep track of how much is being put in a particular bin each day/week.*
- Create **a flow chart** for the school to show which items go in which bin.
- **Use equations** to calculate
  - How much compost or worm tea you would want for your school gardens, and how many bins you would need to supply this *e.g. if one bin will provide 50L of compost per year, how much will 2/3/5/10 bins provide?*
  - The **volume** of worm tea over different time intervals, or the **volume** of soil in the different bins, based on a sample of worm tea/soil
- **Use ratios** from the Love Food Hate Waste 101 pages for Worm Farms, Bokashi Bins and Compost Bins to **calculate** and/or **graph**:
  - How much liquid fertiliser you can make with the worm tea or bokashi liquid from 1//5/10 bins
  - How much liquid fertiliser you would need for your school gardens for different purposes
  - How much fertiliser you could make with the worm castings from your worm bins *e.g. this Worms at Work resource includes lessons about ratios and castings*
  - Amount of brown and green waste required for different types and numbers of bins
  - How many bins you would need for the brown/green waste your school produces

Investigating Closely: Who lives in the bins?

Once you have a functioning compost or worm system set up you can get outside and explore them more closely. A wide range of insects, fungi and micro-organisms live inside compost bins, providing the vital service of decomposition. Insects provide a great context for measurement and algebra, and statistical surveys can also assess biodiversity - see our Statistics and Biodiversity collection.

The Science Learning Hub has a range of useful information about earthworms, including lesson plans for teachers and a page about the types of earthworms found in Aotearoa. For older students we recommend checking out the citizen science project The Great Kiwi Earthworm Survey which takes place from June - September each year.

Link this inquiry to the arts and English by encouraging students to write and illustrate stories, poetry or comic strips from the perspective of a compost resident - whether that's an earthworm, fungus or colony of bacteria. Take inspiration from Giselle Clarkson's book The Observologist or read her article in the School Journal (2024) Worms are Wonderful.

Measurement

- Using standard or non-standard measures, **estimate** and then **measure** the **length** of different creatures in the bins. *Note: Worms are a great option as they often come in various sizes and are easy to collect, but if you are able to capture other creatures in special insect jars, these often have measurements on them to help students work out the size of whatever is inside. This Worms and More resource can help students practice measurement skills in the classroom before attempting them on live creatures!*
- Collect a sample of worms and weigh (find the **mass**) of the worms.
- Collect data about the creatures in the bins on different **days** and at different **times** of day and record this in a chart.

Algebra

- Using a sample of worms, create a table to calculate the **mass** of the worms in all the bins, or extend this to how many worms there might be in a garden/in the school field.
  Information about worms, including about biomass, is available in this story on Te Ara.
- Take a small sample of soil from a compost bin and count the number of different organisms present. Do this with larger and larger samples. **Graph** and look for a **relationship** between the size of the sample and the number of different organisms present.
- Research the different types of worms in Aotearoa and create a **flow chart** (dichotomous key) to help identify worms. *There is an example of a dichotomous key from AgResearch here.*