

PATAKA Project Report

A Hastings Intermediate School / Neighbourhood Engineer (IPENZ) Technology Project



The KAT (Kids Accelerate Technology) Team in our school gardens

Introduction

The Team

We are the Hastings Intermediate K.A.T (Kids Accelerate Technology) team. The team consists of Mr Simon Reveley, our engineer, a selected group of year 7 and 8 students (11 to 13 year olds), and our teacher Mrs Heather Bell.

Our names are:

Sue Mun Huang, Sharn Graham, Arohia Kershaw, Samantha Marsh, Alisha Ngarotata, Shaun Chubin, Cameron Crawford, Nathan Curran, Daniel Mason and Brett Wilkins. We also got help from Alec Olsen, a local farmer whose property our school uses for environmental education camps. Parents and family members helped out in the construction.

We were chosen because we showed an interest and skill in technology, either this year or last year. A couple of people dropped out of the K.A.T team because their interest was not as strong as the remaining members. The ones named above are the ones who stuck with it.

The Reasons

We have a large organic garden at our school which is looked after by our biotechnology students and supplies our food technology programme with fresh vegetables all year round. The garden is a feature of our school and it is well known in our community (and throughout NZ), even though it has only been running for just over a year. Our teachers are trying to get us to appreciate fresh food so we know how to feed ourselves without eating takeaways all the time. We have had lots of support from organic organisations locally to help us get the garden established and have held cooking classes for the local community based on the gardens, so it is a real community project.

This year our garden was overloaded with vegetables that we couldn't store in our shed. Some of them had started to rot so we were preserving the remaining lot of vegetables by bottling, freezing or dehydrating. We wanted to be able to use things like potatoes and pumpkin throughout the year in their natural state so these methods didn't help our food technology programme. Our project therefore was to design a method of storing vegetables safely for up to six months so they were still edible at the end of that time.

We were also here to learn how qualified engineers solve problems in the real world. Simon Reveley, a process engineer from Heinz Watties, helped us with our project. He taught us what was necessary to store vegetables, and from him we learnt about controlling temperature naturally. Our final idea was based on the Maori pataka, which was successfully used by traditional Maori people to store vegetables like the ones we wanted to keep, many years ago. However we have modified it to bring in our knowledge of natural temperature control methods.

Method

Identifying the problem

The first task we did was to define the problem, and our own objectives. Mrs Bell walked us around the gardens and then showed us the shed with the pumpkins, potatoes and onions in it. She showed us the rot that was beginning to happen to the pumpkins to make us aware of the problem she had and how it affected us in our food technology programme. As we were busy dehydrating, freezing or bottling garden produce in the food technology programme, we understood why there was a problem. Other students would not be able to go and get fresh produce like we could unless we could store the food safely.

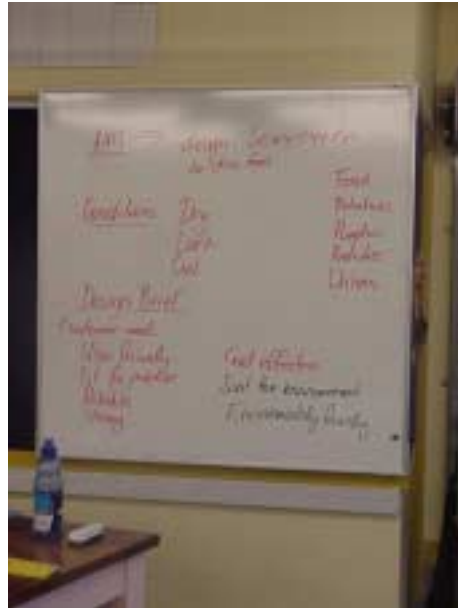


Sharn and Samantha in the tool shed with a pumpkin showing signs of rot

Developing a brief

We then went through the issues in our discussions and brain-stormed our individual ideas. The objectives we came up with were as follows:

1. To design and possibly build a structure that would store the excess food from our organic gardens.
2. The structure needed to be cost effective, culturally and environmentally appropriate, user friendly and fit for purpose, words we had all used before in our technology classes.



Identifying the requirements

We developed a list of specifications that would meet our needs (see Table 1). Cost effective for us meant no on-going payments such as power bills, and a relatively small structural cost. Cultural and environmental appropriateness meant the building would fit with the environment created in our school gardens and suit the culture of our school. User friendly meant it would open and shut easily, be easy to access, easy to use and get into and out of. Fit for purpose meant it had to be strong and keep food fresh for as long as possible. Once we had identified these principles, we had to learn how we could make them happen.

Gathering the knowledge

Simon Reveley, our neighbourhood engineer, is a process engineer at Heinz Watties. He talked to us about the advantages of height above ground, insulation and using nature to keep things cool such as natural shade from trees. We found out that the body uses evaporation to cool itself so it was a possible way for us to keep the building cool too. Things got hard at this point and a couple of people dropped out because they couldn't cope, but the rest of us kept going.



Sharing our initial ideas

After a wave of knowledge from Simon, we began thinking about what sort of things we could use to store the vegetables. Firstly we worked on how to keep the temperature as constant as we could, using what we had learnt about evaporation. Sue Mun had already thought about some ideas using bowl shaped structures surrounded by water. We drew up several other ideas showing how we thought we could make this building keep the food cool effectively, and discarded some as they were impractical (such as using a big sponge to hold water). We felt that the easiest way for evaporation to happen was by putting water on the roof in some way. Some of us wanted to have water running on the roof, others thought a soil roof would work better as it would hold the water. We went from that idea to a sod roof, as we could see the soil would wash off if it wasn't held in place somehow. Both water and damp sods would evaporate moisture during the day and therefore cool the air below, so we experimented with ideas and measured the air temperature below.

Our experiment results were not significant, probably because we didn't test a large enough area of material. We were probably getting inaccurate measurements as the black containers would have attracted heat. It could have been better if the experiment was in the shade. We also should have tested the air temperature for a comparison. But the results did show that the air temperature stayed relatively constant under both of them, and they both evaporated water, as shown by the weight difference. We discussed the outcomes and decided that for practical reasons we would cover the roof with sods as we could contain it better than water.



Testing the potential roofing materials

From Alec (our farmer) we learnt the causes and effects of the winter and summer sun angles. We searched through library books and online for history on what the Maori and other cultures used

for food storage, and we found the Maori pataka. It seemed to be a suitable choice for us too so we decided to adapt that idea to our purpose. It had height above ground for air flow, was dark and was definitely culturally acceptable. It must have worked for the purpose we needed too. With the objectives and knowledge learnt, we went on to designing our food storage unit.

Developing the plans

After that decision was made, we planned how we would achieve the other specifications. We brainstormed ideas that we thought could be useful and made a chart to make sure we had everything covered. We worked in groups and all drew our ideas about how we would prevent vermin and pests getting in, how we would make it look acceptable, how we would get into and out of the building, etc.

Technology Principles	Specifications	Possible Solutions
User friendly	Opens and shuts easily Easily accessible Easy to place food Easy to get into and out of	Door handle, latch, hinges Placed in spot that can be accessed easily Shelves, decent size to get into, storage boxes or crates Steps, ladder, large door
Efficient	Able to work without too much energy input Easy to maintain Simple is good. KISS method (keep it simple stupid) Cost effective Low operational inputs	Above ground to create air flow, grass roof, under a tree Large roof overhang to prevent sun getting into the building Pole construction Plywood or corrugated iron construction Water roof, auto timer?
Strength and durability	Last for 10 years at least Not fall apart or collapse when used	Build it right the first time, paint it, look after it Get plans checked by professionals
Vermin proof	Keeps out dogs, cats, birds, rats, ants	Bands around poles, traps, baits, prevent access by blocking holes
Visually appealing	Blend in with the environment Looks good Pleasing shape Fits in the gardens Belongs to the culture of the school	Paint it earth colours (brown/green) to blend in, mural, Maori designs
Fitness for purpose • Keeps food fresh	Keeps food cool, dry, dark. Has soft surfaces to place food on to prevent damage to food	Closed in, no need for windows, sod roof to make it transpire or evaporate Carpet or foam underlay the shelves

Table 1 - Brainstorm of specifications and solutions

We got into groups and spent a couple of weeks thinking of how we could represent our ideas and best meet the needs of the project. We had to revisit the specifications several times and keep reminding ourselves of what we said we wanted, but eventually we developed our plans. After we had drawn our ideas, we presented them to the group. We all tended to agree that although Cameron and Nathan's ideas looked good, it would be a combination of everyone's ideas that would be necessary. Mrs Bell suggested that Alec could have a look at our plans and draw up something suitable from them. We agreed.



Presenting our ideas

Consultation

Mrs Bell discussed the grass roof idea with a builder she knew and he told her that a pitched roof would need to be designed by a structural engineer and have really strong trusses as it would need to hold a lot of weight. He suggested that we think about a flat roof with a small slope (minimum of 8 degrees) instead. She brought the idea back to us and we agreed that it didn't really matter whether the building had a traditional pataka-type appearance or not, as long as it worked. Alec drew up plans based on a flat roof and Simon checked these with a structural engineer to make sure they were OK. We then rang the Hastings District Council to see if we needed a building permit. Once they found out that we were working with an engineer, they were happy. All we needed to do was send in a site plan and show that the pataka was not going to be closer than two metres from a building or boundary, and ask for a dispensation.

Fundraising

Alec and Mrs Bell priced the materials needed to build the pataka. We knew that our principal supported our ideas, but that there was not a lot of money available to build it. We had to go and ask him whether we could go ahead, so two of us and Mrs Bell went to see him, although she needed to be encouraged as she knew we were asking for more than was available. However he said he would support it as long as we did some of the fund raising ourselves, so we decided to do a 'sausage and pikelet meal deal' at the end of the term. We all got the morning off school and made pikelets furiously, there never seemed to be enough. Then the sausages were cooked and the pupils all queued up waiting. It was very successful and we raised about \$130 towards the materials. We are planning to do something else next term.

Construction

Site preparation

Alec purchased the materials for us and brought them to school in the last week of term. We identified where the structure should go to meet the needs of our design, the sun needed to get to the roof to cause evaporation, but it also needed to be shaded from the worst heat, so we placed it near a large tree. We unloaded the trailer and learnt how to measure where the poles would go so the structure would be square. Then we dug the holes and rammed them in.



Working out where the poles would go



Ramming in the poles

Holiday Jobs

We decided that we really wanted to get the building done, so we met in the holidays with some parents to get it started. We met twice during the second week of the holidays and even had the principal helping us as well as several other teachers who were keen to be involved. Some of us also brought along our brothers, sisters and cousins to help.



Checking the levels



Marking the levels



Drilling the holes



Hammering the floor joists



Pre-nailing the joists



Nailing the floor



Drilling the roof supports



Mr Ellis with the 'skill saw kid'



Checking the plans



Placing the rafters



A well-earned meal and a chance to share more ideas

We still need to have another day to put walls and insulation on, and to install all the little features that we had in our plans, like vermin proofing and steps. Although we haven't finished building it yet, we are well on the way and it should be done within the next few weeks, as soon as the weather clears up again.

Outcomes of the project

Benefits to us

We have worked since April on this project and have really enjoyed it, although there were times when all the knowledge almost seemed to be too much to handle. We had to learn how to present our ideas so other people could understand them, and to justify why we thought the way we did. Mrs Bell was constantly making us explain ourselves clearly and refer back to our specifications. We worked with students we normally don't have much to do with as they are in different syndicates, so we've made new friends. We had to talk to people we don't normally have much contact with, such as professional engineers, and had to persuade Mr Ellis, our principal, to finance our project. We had to try to work within a budget, and raise funds when we didn't manage that. We had to give up our own time during the holidays and all of us that were here at the time found that was lots of fun. We learnt how to safely use a whole lot of tools that we hadn't used before, and work together as a team. Some of us persuaded our parents, brothers and cousins to help too. It was great the way everyone supported us on those days.

Wider benefits

The project has created an opportunity for us to bring people to our school that wouldn't normally have anything to do with schools. They've seen what we can (and can't) do. We have learnt some things about how local businesses operate, and how people such as engineers and farmers go about solving problems in their work, and they have learnt a lot about us too.

We know that the pataka will be finished soon. It is four poles in the ground with a roof and a floor at present, but we are planning another working bee in the coming holidays. We will always be able to come and look at what we did during our time on the KAT team and remember it with very positive feelings.



Thanks for the opportunity, from the KAT team.