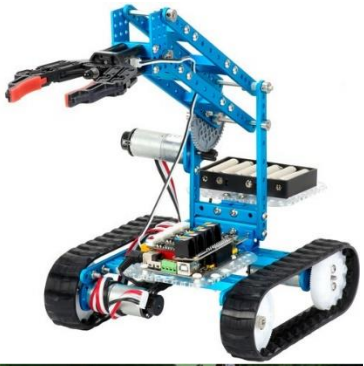
STEM Year 7 and 8 Project

Project Closure Report



Jacinta Penn
Director
Verb Farms Ltd
March 2023

FOOD & FIBRE CoVE
Learner-Focused, Industry-Led, Government-Enabled

STEM Year 7 and 8 Project Closure

Purpose

To provide a summary for the STEM Year 7 and 8 Project regards:

- Initiation and delivery oversight
- Project delivery and lessons learned
- Outputs produced and recommended next steps

Project Objectives

The primary objectives of the STEM Project were to engage and inspire students into roles in agriculture and technology, particularly Agritech with the creation of Agritech STEM kits to be used within the school curriculum. The target group is years 7 and 8 (11- and 12-year-olds) but the kits would be suitable for students from the age of 7 onwards.

Initiation and Delivery Oversight

A contract was signed on 31 December, 2021 for a price of $30,000 (excluding GST) with a completion date of 3 September, 2022. These were both varied;

- The project was delivered $1727 over budget as we had to include a variety of extra parts in the kits; USB power plugs for lights, greenhouse rain covers, jugs, extra peat pellets, batteries, RCDs, extra growpots, courier fees to the South Island.
- All deliverables were achieved. There was an extension to the project's completion date due to the Project Manager requiring unexpected surgery then contracting Covid-19. There were also Covid-19 issues within the schools that affected the project's timeline.
- Oversight of the project comprised of regular Steering Group meetings, weekly then fortnightly project team meetings and monthly progress reports.
- Invoicing was deliverable-based

Project Delivery and Lessons Learned

Delivery Activity	Lessons Learned
Deliverable 1: Procure prototype kit parts for testing and design, followed by testing and design of prototype	
There were initial delays with getting the parts to make the kits due to stock and supply chain issues. Costs also increased slightly and kits were found to have overseas power supplies in the initial products.	Ordering well ahead is the only way to avoid this issue. NZ stock of the hydroponic gardens is too expensive. Buying in bulk does unlock discounts and suppliers were happy to include NZ power adapters. Costs did increase for the overall project. For a larger project, a fixed quote should be obtained. Covid impacted the supply chain for the project as equipment was sourced from overseas, initially China and then Australia.

Delivery Activity	Lessons Learned
Some items were identified as not being needed. We also realised some schools were better equipped than others so some additional equipment was needed such as measuring jugs, water sprays, batteries and RCDs for safety of outdoor plugs.	Final equipment included in the kit: • 4 hydroponic garden kits (each kit can hold 6 plants) • Power adapter for oxygen pump (Chinese-A to NZ-I plug type) • Seeds • Spray bottle and measuring cylinder • One PH tester • One EC tester • Jiffy pots (24) • 3 sets of lights • Power adapter for lights (240v to USB) • One Makeblock Ultimate 2.0 Robot • Residual current device (RCD) electrical plug • 6 AA batteries • Rain cover for outdoor plants
Deliverable 2: Create lesson plans	
Lesson plans were completed and additional papers also identified as being needed such as garden instructions, robot programming guides and risk plan.	Having an experienced teacher as a consultant for lesson planning was ideal. Lesson plans include: • Lesson plan and activity sheets • Teaching robotics – teacher guide • Risk assessment and management form • Student recording sheets for challenges • Hydroponic planting instructions • Jiffy soil planting instructions • Mblock instructions • Student recording sheets • 4 partially completed block code programmes – Keyboard movement of robot, and 3 levels of Line following, beginner, intermediate, advanced
Deliverable 3: Train Teachers	
Hard copies of lesson plans and instructions were sent out with the kits, we then had requests from the Teachers for online materials.	Google classroom was set up and all instructions and lesson plans were shared.

Delivery Activity	Lessons Learned
Deliverable 4: Pilot Programme	
The robot arm was difficult to share among 30 students. Additionally, transport costs of shipping to NZ increased so cost of robot increased slightly. However, the robot was popular with schools and students.	If we change the plan from using a robot arm to pick up the plant, and instead use a robot to carry a tray of plants from one place to another, this would reduce cost and work better for a larger number of students. We can source 8 base Makeblock robots for the same cost as one with a robot arm. Additionally, many schools have these base robots already and can supplement with those. Alternatively, raspberry pi or Arduino controllers could be programmed to add water or nutrients. Of the three options this would actually be the smartest to focus on. It is relevant to our large greenhouse industry and part of a large export market.
The robot was complex to build, easy to make mistakes on, and could only be completed by one or two people.	The robot was built before sending to the schools and the focus for the students was on programming.
Deliverable 5: Evaulation and end of contract reporting	
Teachers struggled to fit it into current school terms. They needed at least one term just to look through the kit and plan how to use it in the following term.	We recommend the kit go to a school on a permanent basis, as opposed to the House of Science kits which are returned and sent to different schools.
We had a mixed response ab]out how easy the kit was to use with students.	Options are to simplify the lesson ideas or to leave the kits with the schools so they become more familiar with the equipment.
All schools asked to keep the kit, and had several plans for how they would use it in future and commented on other teachers also wishing to use it for their classes.	Leaving the kits with the schools to fit into their own curriculums seems to be a positive way forward. Once the teachers are familiar with the kit, it becomes part of the school equipment and integrated into curriculum, which is an ideal outcome.
Several teachers expressed that students had high engagement with the kits.	By applying to MPI/MoE for grants we can spread this learning to other schools. By simplifying the kits, we can make it easier for teachers to use and then get higher engagement. In future, we can check to see if current students in these areas increased in the number of agriculture/horticulture topics taken up.
Some teachers were unable to progress due to being ill with Covid-19.	One school cancelled part way through as the Teacher was very ill. Another school was easily found. In fact, we continued to get enquiries throughout the project from both schools and community groups.

Initial schools:	Final schools:
Iona, Hawkes Bay	Katikati, BOP
Paerata, Auckland	Paerata, Auckland
Pukeoware, Auckland	Pukeoware, Auckland
Darfield High, Christchurch	Darfield High, Christchurch
Hilmorton High School, Hoon Hay	Hilmorton High School, Hoon Hay, Christchurch
Stratford	Te Kura Kaupapa Maori Otepoti, Dunedin

Project outputs and recommended next steps

The overall output for the STEM Project was to create kits to use within schools, which was achieved.

Plans going forward:

- The 6 pilot kits will remain at the schools and be used by other teachers. Replacement sponges and nutrients etc. will be bought by the schools.
- Discussions will be held with FFCoVE and Verb Farms about moving forward with a grant application to MPI to fund a larger number of kits with the simpler lesson plans and an alternative programming activity using raspberry pi/arduino to control nutrients. This would be highly practical and relevant to both current and future farming practices, as nutrient controllers are used currently in greenhouse farming as well as vertical farms here and overseas, and are themselves a high value export product.
- We can also discuss the option of smaller robots for moving plants around, however the nutrient control is likely to be more immediately useful for the current market. We could suggest the robots as an additional purchasable kit.
- We would also approach our support partner Bluelab to see what technical support they could provide for this (and any funding). Bluelab is a premier global exporter of nutrient control equipment with an approximate revenue of $25 million per annum. They kindly provided one free EC and ph tester for our initial build and provided the EC testers at wholesale prices.

Acknowledgments

I would like to especially thank Jackie Lynch who supported me throughout the project and was so patient with the delays caused by Covid-19, and Lilla du Toit for her encouragement.
I would also like to thank all the teachers who took part:
Andrea Williams, Hilary Johnson, Natasha Luck, Stuart Gerritsen, Marcia Cassidy, Stefan Fernandes.

Feedback / comments from teachers:

We had a response from 4 out of 6 teachers in our feedback survey. We know one additional teacher became very ill and we had to transfer the kit to another school. The new school will use it this year 2023.

Feedback received:

The lessons were really good and well laid out. The students were really engaged and they enjoyed the fact that they had the special equipment to use! Now that I have the knowledge myself about how to use the kits and the lessons, we will be running this each term with a different group of students. Thank you so much for the opportunity to do this!

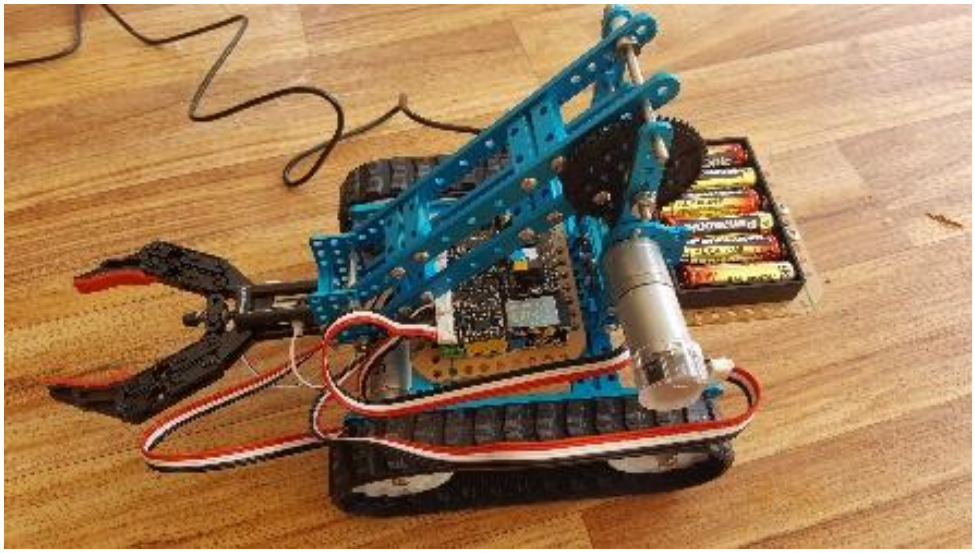
Lesson plans in electronic format would be great. Kit very well thought through. Simple for kids to put together. No time to progress to robot this year but would like to next year. More than happy to give some more detailed feedback as I have a few thoughts. Thank you for the opportunity to participate.

The robot was really difficult as only one student could focus on it while the rest mucked around. I would really like to try again with a younger group or earlier in the year (focus in Term 4 dwindles significantly in year 9s)

We weren't able to get the kit up and running due to a number of interruptions. We would like to keep the kit to use next year instead.

Kits assembled and ready for delivery

Robot



STEM Year 7 and 8 Project Closure

Students in action