**SELP Case Study Summary: Exploring Student Perception of STEM and STEM Careers**

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**Purpose:**
After three years as a year eight home group and STEM teacher, I have witnessed students with very strong beliefs and opinions of what they want to be, and which skills they deem as important. The aim of the program was to challenge student beliefs around STEM and its relevance to their future.

**Audience:**
As many of the futures-based programs are currently directed toward upper year levels (10-12) where many students have quite a fixed idea of what they want to do, this program was intended to act as early intervention and challenge the thinking of students who may think that success in STEM subjects isn’t relevant or achievable for them. Of the four classes of year eight students participating in the study, two were IGNITE and two were mainstream. Three teachers were also involved in facilitating the sessions, two of which were early-career teachers and the other being the maths/science coordinator.

**Program:**
The program consisted of eight 40-minute sessions conducted in consecutive weeks. Each session had a different focus as seen below:

1. **Introduction to a Community of Inquiry** – Students were introduced to the purpose and processes of the program and learned the community of inquiry protocols using a stimulus introducing the acronym STEM. They were also asked to draw a picture of any qualities they believe a scientist should have.
2. **Stereotypes** – Student illustrations from the previous session were collated and displayed at the beginning of the session and then students watched a stimulus video around stereotypes.
3. **How Do We Solve The World’s Problems?** – Students watched the RiAus video ‘Big Questions’ consisting of a range of responses from professionals when asked ‘What are the big questions you want science to solve?’.
4. **What is Engineering?** – Students watched a video highlighting the presence of technology developed by engineers in their day-to-day lives.
5. **Why Study Math?** – Students watched a TED Talk around the nature of mathematics as thinking.
6. **Girls in Science** – Students watched a video where Mayim Bialik (of Big Bang Theory) reflects on how she came to be both an actress and a neuroscientist and why she finds science exciting.
7. **Jobs and Skills of the Future** – Students watched a video highlighting that jobs of the future are increasingly involving STEM skills.
8. **STEM Careers are Everywhere** – Students visited the STEM Portal Careers Explorer and investigated information on a career path they found interesting.

After witnessing each stimulus, students participated in a ‘Community of Inquiry’ activity. Sitting in groups of approximately eight students, each student would have five tokens, which they could use to indicate they wished to contribute to the discussions. Students were explicitly taught to respond respectfully to others comments and encouraged to frame their thinking around the following sentence starters:

- I’m wondering if...
- I’m curious about...
- That makes me think of...
- I’ve heard that...

Each group also had a ball, which was held by whomever the speaker was at any given time. Once the students had exhausted their tokens, there was a final round where the ball was passed to the left until every member of the group had given their final thoughts or questions.

Once all groups had completed their final round, a member from each group fed back their main discussion points, which were recorded in question form on the board and then discussed. A survey was conducted before and after the program to gather data around student perception of STEM and STEM careers and things that might attract or put them off getting involved in STEM. A copy of the pre and post survey for students is attached to this document along with the post survey given to teachers and data summary. The stimulus videos used in the program can be accessed by teachers and students on any iOS device using the iTunesU app and searching for ‘STEM Perception and Careers’ in the catalogue.
Curriculum Links:
The program provides opportunities to cover all five descriptors of the year 8 Science as a Human Endeavour strand but the depth as to which each of these is focused on depends on the questions that the students ask. In this program, most of the discussions were focused around the ‘use and influence of science’. The program also facilitates students developing their critical and creative thinking, ethical understanding and science inquiry skills of questioning and predicting (ACSI139).

Outcomes:
The Community of Inquiry approach produced many substantial, in-depth and often heated discussions within the students. As a result, groups were able to come up with highly meaningful questions. Using the ‘Why Study Math?’ session as an example, the students showed a great level of insight into their perception of mathematics. The summary questions they formed were as follows:

- What if math didn’t exist? How would the world be different?
- Why do we get rewards in maths?
- How do our grades affect our perception of maths?
- How important is knowing our times tables?
- How is algebra relevant in our lives? Is it?
- How does our family’s attitude toward maths impact on our perception/success in maths?
- Is maths even hard if you’re good at concentrating and being patient?
- Does other social learning affect the way we learn science/maths?

From the initial drawings of student perceptions of what it means to be a scientist, it was clear that there was a range of opinions within the groups. The majority of the students drew pictures of stereotypical, male mad scientists, with messy hair, glasses and blowing things up. There was a small group of students who identified that ‘anyone can be a scientist’ or described a skill set, which would be useful when investigating science. Many of the discussion sessions were spent debating the relevance of STEM in real life and a high percentage (78%) of students believed science would be relevant to them in the future, but the data also showed a 5 per cent decrease in students believing that what they are learning is relevant to their lives currently. The program was successful in empowering students to see the connection between Science and solving real world problems as 80 per cent of students, a 29 per cent increase, agreed with the statement ‘I believe Science is about solving real world problems’. 43 per cent of students (a 4% increase) believed that they learn about things that are important to them in Science.

The data showed an increase in students wishing to work in the more obvious STEM fields of Digital Technologies, Health, Mining, Visual Arts, Building Things and Planning for the Future and a 9 per cent increase in the number of students who would like to pursue a specific STEM career. Students had also acquired a greater understanding of the availability and diversity of STEM jobs as there was a 13 per cent increase in students believing there were many or some STEM jobs in their chosen field. All of the teachers involved believed the Community of Inquiry approach to be effective in facilitating thinking and developing questioning skills. The program allowed students to consider STEM in a real world context, gave students space to think in an open environment and gave those who don’t normally speak, a voice. It showed students, that their thoughts and questions are valuable. All of the teachers involved have expressed an intention to apply the Community of Inquiry approach in their regular classrooms in the future.

Issues:
Each session would begin with at least 5 minutes of silence, as there were a large number of students not willing to be the first to speak. Many of the students did not know each other, as they were from different classes, but once one person contributed, these students generally engaged in the activity. If the program was run in home group sessions, the students may feel more comfortable sharing their thoughts and questions with their peers.

Several of the students could not see the relevance of the program and as a result did not take the activity seriously. These students needed a great deal of prompting, generally did not contribute to group conversations and often disrupted the process. They likely got very little out of this component of the sessions but many of them still contributed to the larger group discussions. Having individual discussions with these students around their interests and goals may have helped them to see the value in the program.
There were quite a few students present for half sessions or missing several sessions throughout the program. As all of the students had access to the videos via iTunesU, these students were asked to watch the video independently for homework, but this didn’t allow those students to participate in the rich discussions experienced by their peers.

It was also particularly difficult for the facilitators of the sessions to avoid guiding the sessions or engaging in interesting conversations. As this is such a critical part of the Community of Inquiry process, this is something that will need to be practiced by teachers delivering the program in the future. It has been suggested by one of the teachers that half of the students had just begun a unit on the rock cycle, which wasn’t particularly relevant to their current or future lives and that this could have contributed to the decline in students stating that they enjoy science and that the things they learn are relevant to their current lives.

**Future Directions:**
As the program has been successful in enhancing student perceptions of STEM it is intended to run for the other four year-eight classes in a similar way later this year. As teacher feedback suggested that students may have more genuine and constructive discussions if the classes were isolated, the program will be embedded into the current ‘Getting Started’ program for individual science classes at the beginning of the year for future year eight students. This will require up skilling all teachers to feel confident in facilitating the Community of Inquiry sessions.