ReMSTEP
Reconceptualising Mathematics and Science Teacher Education Programs

REMSTEP project report template

Project overview

- *Project name*

Students interacting with the scientists from the Institute of Frontier Materials (IFM)

- *Who was involved?*

Russell Tytler, Stuart Palmer, Leissa Kelly and a number of scientists from the IFM

At various stages, Pre-Service Teachers (PSTs) and teachers have also been involved (although they have not played a central role).

- *What was done (in broad terms)?*

This project is characterized by representing the work of a cutting edge science centre through the videoing of scientists and through the activities that exemplify contemporary material science concepts. In this sense it is different to other projects and no direct interactions between scientists and pre-service teachers have occurred.

Project rationale: what is the intention?

- *Is there a theoretical basis or model, or literature that informed the project?*

There is a documented need to engage students with science and maths in primary and secondary classrooms. By enabling interactions with scientists students gain insights into the kind of work that scientists do and the creative aspects of science and maths. This sits within the literature of authentic STEM practice and authenticity.

This project exposes students to current contemporary research and development practice with an emphasis on the broader perspective of STEM: Science and Engineering. In doing so, it introduces the idea of invention and innovation and theory and practice, Research and Development and the application of science and technology. This is fundamental to what goes on at the IFM where 'blue-sky' materials science research occurs side by side with industry funded applied engineering work. As such, IFM was seen to be an authentic environment and therefore an ideal context for exploring the broader concept of STEM in practice.

In this context we are using the term 'authentic' to mean to prove the ideas and the processes behind these things. The intention is to link the actual activities we are producing to contemporary science.

- *What gaps do you see are addressed with this project?*

One of the gaps addressed is the idea that school science tends to be deal with historical notions where examples or exemplars of current applications are given, but not necessarily explored in contemporary context. In this project, we are building on this by providing a sense of a living, breathing science, by engaging students with what teams of scientists do (hence the videos) and the contemporary practice of science.

Project activities

- *What was the nature of the activities – provide examples.*

Initially we undertook a scoping exercise where worked out what we were going to introduce or use to exemplify the IFM. From this we determined that the activities were to a) develop the videos of the scientists and then b) to come up with activities for schools. These were partly developed in collaboration and trialed with teachers. The activities include trialing with teachers and students.

Another aspect of the activities was the collateral development of relationships. Although this wasn't a specific aim in reality it is an essential part of making an activity such as this work in finding the connections and the willing friends.

- *What was the nature of engagement of PSTs or teachers with contemporary science/mathematics practices?*

We have had feedback from some teachers and PSTs and have undertaken limited trialing. These activities will be used in our PSTs courses and will be made available to teachers in general.

- *What aspects of science/mathematics practice were represented to the PSTs? How was this orchestrated? In what sense do you regard this as innovative or significant?*

This was influenced by the fact that we are working with the IFM so it is strongly around modern materials, science and engineering as a fairly pervasive example of the use and application of science and technology.

Within material science and engineering there is all sorts of generic and underpinning principles to do with science and engineering, so it draws in chemistry, structure and forces, and, in addition, there is scope for science as a human endeavour.

This was presented to the PSTs as a combination of video and image and practical work that exemplifies what IFM are doing. It is innovative and it is significant in that it tries to represent a view of science that is not usually done.

- *What changed curriculum / classroom practices are envisaged, flowing from the project? By what means were these changes supported?*

By including images of contemporary science and scientists, students (both PSTs and classroom students) will be exposed to what actual scientists' actually do and the way they work (although as yet we still haven't found a way of doing this that teachers say will really work) we are also designing activities to link students work to actual research that is taking place at the minute.

We are currently packaging this in a module that will be self-sustaining in schools.

- *What opportunities were there for science/mathematics students (undergrad or HDR) to reconceptualise their perceptions of school science or mathematics learning and teaching?*

For the IFM scientists, part of the effect was that it was a way of introducing them to the difficulties or the ways in which research may be represented and communicated in schools. For the PSTs and classroom students it was to change their perceptions of how scientists and engineers actually work and the nature of science. It is envisaged that their perceptions of the nature of science will change as a result of this.

One of the collateral things in the project is that it has required the scientists and engineers to think carefully about how they do represent their work for different audiences, specifically for the teaching and learning context for high schools, this has been quite challenging for them.

Results

Experience of participants

As addressed above, this project is characterized by representing the work of a cutting edge science centre through the videoing of scientists and through the activities that exemplify contemporary material science concepts. In this sense it is different to other projects and no direct interactions between scientists and pre-service teachers have occurred.

Anecdotal evidence has been obtained from showcasing the representative activities that we have developed through professional development sessions with teachers (generally via other funded projects such as 'Skilling the Bay'). This evidence suggests both the PSTs and the serving teachers find these resources of value and applicable to both secondary science classes and primary science curriculum.

Project outputs

Resources are being produced through ASELL for schools. These resources will be available through the ReMSTEP website and the ASELL for Schools website.

The IFM videos will be available via the ReMSTEP website.

Project outcomes: What were the outcomes for the different players?

As a direct result of this project, close links have formed and relationships have developed between the research scientists working at the Institute for Frontier Materials and academic staff from both the School of Education and the Faculty of Science, Engineering and Built Environments.

Concluding discussion

The project is not yet complete. What has been achieved to date is a sharper understanding of the operation of a contemporary science research and development institute and the exploration of ways to interpret this for the school curriculum. As part of this, the team has grappled with the nature of inter-disciplinary STEM practices with a strong focus on engineering and design. Significant progress has been also made in forging links across the science and education faculties, as a result of this work. Videos have been produced and refined for use in presenting the motivations

and research practices of young scientists, and activities are being developed, some of which have been trialed successfully with groups of teachers.

Challenges have included the difficulty of translating cutting edge science into 'do-able' and interesting school activities, and engaging schools in the project when resources have yet to be developed. There has been some difficulty in matching the work of IFM to the school curriculum which tends to focus on canonical science rather than inter-disciplinary developmental science and mathematics.

Once these activities have been refined and extended, the resources will be available more generally, and accompanying teacher education material will be written to help PSTs understand the nature of contemporary STEM and its relevance, and ways to interpret this for school students.