# USING *MAKERSPACES* TO FOSTER AUTHENTIC STEM ENGAGEMENT

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## Problem

Research in primary education has demonstrated a reluctance of teachers to engage with STEM subjects, and a lack of confidence in teaching mathematics and science (Hackling, Murcia, West, & Anderson, 2014). In addition there is evidence indicating that females do not engage in STEM activities in the same numbers as their male counterparts (National Research Council, 2012; US Department of Commerce, 2013). In the Bachelor of Education (Primary) at Curtin degree over 85% of the students are female (Blackley & Sheffield, 2015), and many demonstrate a deficit of skills, knowledge and confidence in STEM education. These attitudes and under-developed skills translate into the classroom, resulting in a cycle of poor STEM engagement. In pre-service teacher education courses STEM subjects are usually taught in individual units – although the E for Engineering is not addressed at all.

This project focused on **scaffolding females to work together in STEM education** by accessing and engaging with a STEM Makerspace that had a physical (Engineering Pavilion) and a virtual location (closed Facebook site).

## Plan

The methodology for this project was **interpretivist qualitative research**, based on an exploratory case study to examine participant engagement with and reflections on *Makerspace* STEM projects. The research was carried out at two sites: one Western Australian independent Catholic girls' school and on the Curtin University campus in the physical and virtual *STEM Makerspace*.
This project cycled through three iterations of the *Reflective Model of Professional Learning* (Blackley, Sheffield, Maynard, Walker, & Koul, 2016), and had two distinct phases:

Phase 1: **Learning-by-doing: create, make, and refine** the STEM Makerspace projects, and
Phase 2: **Learning-by doing: making in the primary school** that saw the implementation of the STEM Makerspace projects at a school site.

## Actions

1. **STEM Makerspace Community of Practice (CoP)**
   The students and project team staff from the School of Education and Engineering and Science formed a STEM CoP and decided upon the design of the STEM Makerspace physical and digital presence. Wenger, McDermot, and Snyder (2002) defined a Community of Practice as a cohesive group of individuals who seek to address a common concern, set of problems or interest with the intent to fulfil both personal and group goals. The functionality of Facebook facilitated an ad-hoc development of the CoP, and this very organic process suited the tertiary students and at times challenged the project team.

2. **Development of a suite of 3 STEM Makerspace projects**
   Each STEM Makerspace project had a specific science and engineering focus, and the STEM CoP developed resources to support the dissemination of each project in schools. Each STEM project was conceptualised, designed, created, tested, refined, and finally released at

intervals during the year of the project, as determined by the STEM CoP's availability. The education and engineering students in the STEM CoP were scaffolded to implement the projects in primary classrooms, including the creation of a question bank and strategies to encourage the school children to investigate and create their personalised project.

3. **Data Collection**
   CoP members' reflections and interview responses were collected over the year, as were school girl participants' survey responses. The posts on the Makerspace Facebook site were collected as Word documents, and analysed for themes in the text and images.

## Reflection

The implementation of the STEM Makerspace project in school classrooms provided the PSTs with additional opportunities to gain structured workplace experience. For ESs provided the opportunity for outreach to the community, which is a component of their industry standards, and to be role models for female students in primary schools.

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