

Enhancing Queensland Pre-service Teachers' Self-efficacy to Teach STEM By the Use of Remote Access Laboratories: A Mixed Methods Study

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Education for Science, Technology, Engineering, and Mathematics (STEM) is acknowledged as a priority around the world. However, many primary and secondary teachers are inadequately prepared for teaching STEM because of their limited exposure in their own schooling and teacher preparation. The Remote Access Laboratories for Fun, Innovation and Education (RALfie) project offer opportunities to provide a variety of STEM experiences available to students and teachers in schools, especially those in remote locations. They also have potential for influencing teachers' self-efficacy to teach STEM by building up their capacities and capabilities to teach technologies. The mixed methods research is investigating how engagement with RALfie influence teachers' self-efficacy for teaching STEM.

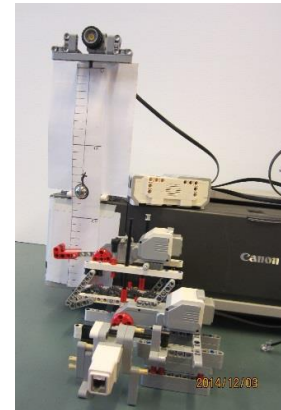
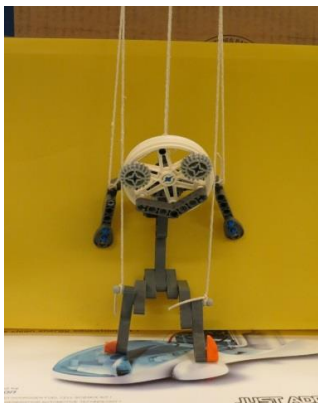
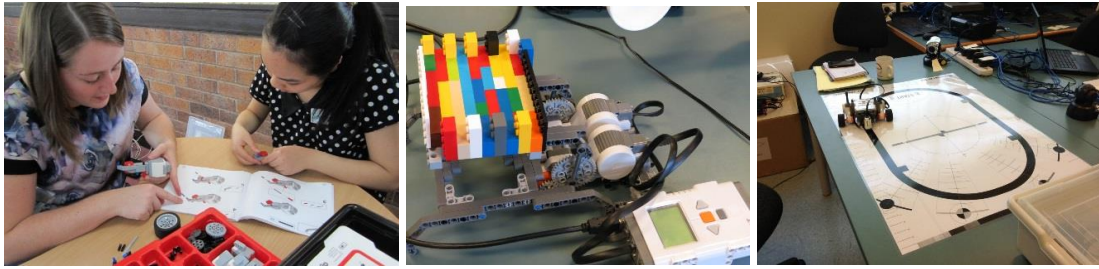
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Overview

The **Remote Access Laboratories for Fun, Innovation and Education (RALfie)** project aims to develop children's Science, Technology, Engineering and Maths (STEM) concepts whilst fostering a positive attitude towards STEM learning. RALfie is creating a learning environment and the associated technical systems to offer low cost RAL, using tools such as the Lego Mindstorms EV3 Programmable Brick, and share them with other learners online. Others can use the RAL creating two types of participants: Makers and Users of RAL. This study focused on a trial of the system with Pre-Service Teachers (PSTs) who worked with hands-on and online experiments. In the Maker Event, PSTs used Lego to build an experiment and then connect it to the RALfie environment using the interface called a RALfie Box. They also connected IP cameras to the RALfie Box allowing remote viewing of the experiment in action. A web-based interface enabled remote control. PSTs were then able to view the experiment and control it remotely. For the User Event, the RALfie team designed four online experiments which enabled PSTs to access STEM experiments remotely.

This research is about Queensland pre-service teachers' self-efficacy to teach technology. Remote Access Laboratories (RAL) is being used as a vehicle to influence pre-service teachers' self-efficacy to teach technology. The main research question is to investigate in what ways engagement with Remote Access Labs influences pre-service teachers' self-efficacy to teach STEM content. Bandura's self-efficacy theory (Bandura, 1977) is the conceptual framework in this research. Self-efficacy beliefs are derived from four principal sources of information, namely *enactive mastery experience*, *vicarious experience*, *verbal persuasion*, and *physiological and emotional status*. Based on Bandura's theory, the *Science Teaching Efficacy Belief Instrument (STEBI-B)* was developed for pre-service teachers (Enochs & Riggs, 1990). This research modifies the STEBI-B for use as the *Technology Teaching Efficacy Belief Instrument (T-TEBI)*.

Mixed methods were used to collect data. Participants were pre-service STEM teachers at the University of Southern Queensland. They study a technology course in which RAL activities were used as part of the course. The pre-test and post-test of the T-TEBI surveys were analysed to trace changes in their self-efficacy. Interview was used to investigate in what ways engagement with RAL influences their self-efficacy. The outcome of this research is to investigate the effects on primary and secondary pre-service teachers' self-efficacy to teach technology in schools using RALfie. Teachers' attitudes and beliefs about their capability to teach STEM have a great impact on students' attitudes and achievements in STEM learning. This research extends the application of self-efficacy in the RAL context. It expands the understanding of relationship between teachers' self-efficacy and their capacity for teaching STEM. It will also inform the ways of impacting and influencing pre-service teachers' self-efficacy using RAL as a vehicle.



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QR code for RALfie's CoLLAB website:

RALfie YouTube videos:



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Visit the websites RALfie Research Project: research.ralfie.org and the RALfie's CoLLAB: ralfie.org

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