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Abstract

The declining number of students considering a career in science related disciplines has often been linked to didactic teaching styles in classrooms, with an emphasis on transference of knowledge from the teacher to student and where text books are the main source of curriculum content. In physics, teaching is often focused on the application of mathematical formulae and lacks context for the student to apply to real world problems. Many students find physics a 'difficult and hard subject to study' leading to poor motivation and low engagement with the subject.

One approach to address these challenges is to consider the use of appropriate technology combined with a more suitable, student centred, pedagogical model. The affordances of microworld simulations to impact student engagement and motivation have been the subject of much research. These technologies can be highly immersive, incorporating interactive, construction features and have the potential to redefine a student's learning experience. However these technologies do not sit well in conventional classroom settings, where short class durations, didactic pedagogy and an emphasis on teaching to the curriculum prevail. An alternate pedagogical framework is needed. Research points to the benefit of a social constructivist, collaboration enabled pedagogy to impact conceptual understanding in physics. When learning is also contextualised, students can apply domain specific knowledge to real world problem solving situations.

This dissertation brings three key elements together –microworld technology, a social constructivist contextualised pedagogy and a 21st century learning model – to investigate the impact on student engagement and confidence in physics. An exploratory case study was carried out as part of the Bridge21 programme, an alternate 21st century learning framework that emphasises collaborative, problem based activities. A total of 39 secondary school students participated in 4 separate physics workshops, with students working in teams and using microworld simulations on dedicated workstations. The PhET Circuit Construction Kit microworld, developed at the University of Colorado, Boulder was used in each workshop.

A convergent, parallel, mixed methods case study methodology was used for this investigation. A validated attitudinal questionnaire (MTAS –Mathematics and Technology Attitude Survey) was adapted for quantitative data capture, while focus groups and observation provided rich qualitative data for triangulation. The findings from the data show statistically significant changes in student engagement, confidence in physics and an improvement in attitude to the use of technology for learning. The qualitative data provides context for these findings and through congruence with the quantitative data supports the conclusions reached from this case study investigation. The limitations of this small sample case study are also discussed and additional areas for future research suggested.