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Abstract

There are many challenges in STEM education including: a declining number of students considering careers in STEM, the use of didactic teaching styles, the restriction of traditional classroom environments, overloaded curriculum content, a lack of discussion of topics of interest and the absence of opportunity for creative expression.

In September 2016, the Irish National Council for Curriculum and Assessment (NCCA) introduced the new Junior Cycle Science specification for years 1-3 in Secondary Schools (ages 12-15 years). The Science specification consists of four contextual strands: Physical world, Chemical world, Biological world and Earth and Space. The four strands are overarched by one unifying strand, the Nature of Science. The Nature of Science is both a way of thinking and a collection of practices that scientists use to develop and evaluate knowledge (Flick & Lederman, 2006). Inquiry is a foundational principle in the Nature of Science. There is no specific content linked to the Nature of Science strand, its learning outcomes are underpinned by the activities and content in the contextual strands.

The new science specification is informed by the Framework for Junior Cycle document. This document will guide the implementation of the Junior Cycle in Irish schools and will inform the specification for each Junior Cycle programme. The Framework outlines eight key skills, and twenty-four statements of learning, that focus on the student's acquisition of 21st century competencies.

Inquiry Based Learning (IBL) is a teaching strategy often utilised in the STEM disciplines. This involves inquiry orientated instruction that engages students in the investigative nature of science. The characteristics of IBL greatly overlap with the defining characteristics 21st century

teaching and learning. 21st century skills are transversal, multidimensional and associated with higher order skills and behaviour that represent the ability to cope with complex problems and unpredictable situations. It is argued that the teaching and learning of 21st century skills, such as those in the new Junior Cycle Science specification, cannot easily be achieved in conventional classroom settings where didactic pedagogy predominates. It is further argued that an alternate pedagogical model is required to successfully implement a 21st century framework and curriculum. Research indicates that a social constructivist, collaboration enabled pedagogy would positively affect students' engagement with science and nurture the development of 21st century competencies.

Bridge21 is a learning model that involves moving away from teacher centred pedagogy and is designed to release the potential of student led, inquiry based, collaborative, technology-mediated learning. This dissertation uses the Bridge21 model to develop and implement lessons, underpinned by Inquiry Based Learning strategies, to achieve certain learning outcomes on the new Junior Cycle Science specification. This research examines the impact of using the Bridge21 learning model with a focus on student attitudes to science and the development of 21st century competencies.

A mixed methods case study (Creswell, 2003) methodology was used for this investigation. Two validated questionnaires were adapted for quantitative data capture. Survey One (Appendix E) is a modified Attitudes toward STEM survey (S-STEM) which used Likert-scale items to measure students attitudes towards Science (Friday Institute for Educational Innovation, 2012). Survey Two (Appendix F) a validated 21st Century Key Skills questionnaire (Ravitz, Jason, et al., 2012) is used to measure students attitude toward 21st Century Key Skills. Focus groups provided rich qualitative data for triangulation.

The findings from the data show changes in students' attitudes to science, evidence is presented in relation to the development of 21st Century Skills after the learning experience in science was delivered. The qualitative data provides a context for the findings and through congruence with the quantitative data the conclusions reached in this case study are supported.