

MODELLING WAVES: INTEGRATING TECHNOLOGY WITH MODELLING AND INQUIRY IN AN UNDERGRADUATE PHYSICS EXPERIMENT

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This project focuses on the novel idea of integration of technologies with inquiry skills and modelling (Crook & Sharma, 2013; Cornish et al., 2019; Gilbert, 2004) and associates these with students' cognitive engagement, behavioural engagement and emotional engagement (Muller, Sharma & Reimann, 2008; Kota, Cornish & Sharma, 2019). Using design-based research methodology, we integrated technology and inquiry to design an experiment on 'modelling waves on a rope', a standard topic in first-year undergraduate physics. Furthermore, we investigated how students engaged with the new experiment? It had three features; (1) qualitative description and kinaesthetic feel of waves being created on ropes, (2) taking measurements using video analysis software, and (3) a whole class comparison of experimental and theoretical values using a pre-designed EXCEL spreadsheet. The experiment was trialled in two tutor training sessions, and the final version was implemented in first year physics labs in 2018 and 2019. We used a survey (Barrie et al., 2015) that measures student experiences in labs by evaluating: how technology was integrated, how much inquiry skills are developed, and how well the students understand the modelling. We also collected observational notes and student logbooks and conducted interviews. Tutors were also surveyed. The sample size includes 406 students and 24 tutors. Findings show that students engaged in a hands-on experiment by creating waves on a rope, in using technology for data analysis and in developing ICT skills, and in understanding modelling using EXCEL spreadsheets. The experiment also fostered teamwork and required investment of an appropriate level of mental effort demonstrating that the experiment did engage students in a meaningful manner. The integration of digital technologies with 'modelling waves on a rope' resulted in higher overall enjoyment of the experiment and increased student engagement.

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