BUNJEE JUMPING: USING MODELLING AND TECHNOLOGY TO IMPROVE STUDENT ENGAGEMENT IN STEM

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THEME:

Engaging students in STEM education

BACKGROUND AND AIMS

Uncertainty analysis is a crucial component of experimental work. However, the teaching of uncertainties is challenging because it incorporates technical details about measurements, instruments, and statistical analysis, often adversely impacting student engagement (Buffler, Lubben & Ibrahim, 2009). This study, while occurring in undergraduate physics, is applicable to all STEM subjects. The experiment, Bunjee Jumping, was designed with a conceptual framework integrating technology and modelling to specifically 'engage' students cognitively, behaviourally, and emotionally (Sinatra, Heddy & Lombardi, 2015) with uncertainty analysis.

The aim of this study is to explore how first year undergraduate physics students engaged with the new experiment.

METHODOLOGY

The experiment, Bunjee Jumping, involved predictions, eggs oscillating at the end of springs, smashing eggs on the floor, entering data on spreadsheets and whole class discussions on safety factors in engineering design-uncertainty analysis. This was the first experiment in introductory labs for students enrolled in first year undergraduate physics units. To measure student engagement a survey with items on a Likert scale was administered at the end of the laboratory session and 110 students responded. The survey measures three types of student engagement; cognitive, behavioural, and emotional.

RESULTS AND CONCLUSIONS

The quantitative results indicate that students are cognitively, behaviourally, and emotionally engaged. From Fig 1, nearly 75% of students agreed that the experiment helped them in developing data interpretation and laboratory skills, and in improving understanding physics. 86% of students agreed that demonstrators help, the notes in the experimental procedure and teamwork were helpful. And 60% of students agreed that they enjoyed the experiment and felt happy, while 30% of students said it was boring and dull. Qualitative results indicate that the integration of technology and modelling was particularly effective in engaging students with uncertainty analysis; a topic often avoided. The implication for practitioners is that designing experiments 'featuring STEM' allow students to effectively engage in the scientific process of uncertainty analysis, as opposed to 'typical physics approach' to uncertainty analysis.

2022. J. Bobis & C. Preston (Eds.), Proceedings of the 7th International STEM in Education Conference (STEM 2022), University of Sydney, Sydney, Australia, November 23-26. University of Sydney.

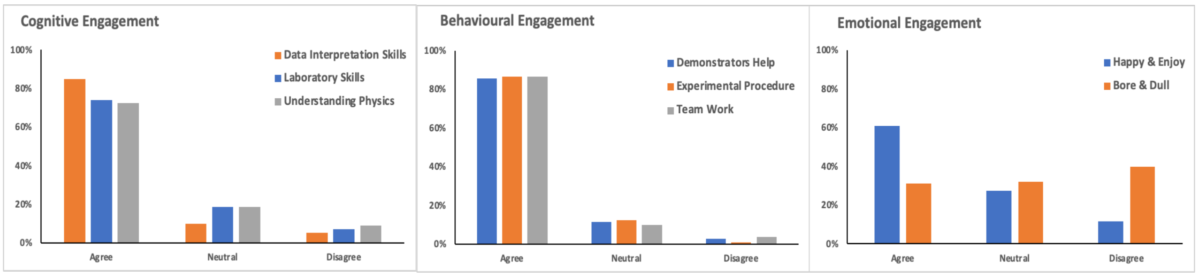

Figure 1: First year physics students' engagement in a new experiment on uncertainty analysis.

REFERENCES

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