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Snapshot on student voices in COVID-19 physics labs

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Abstract. This study explores how students engaged in experimental labs which were not designed for online delivery but were transferred online due to COVID-19. This created an interesting opportunity to measure the impact of online instruction, notably in somewhat stressful conditions. Data were collected in semester one of 2020 from first-year undergraduate students at two universities in Australia. We highlight student engagement using the two-factor theory of motivations in the shifted online labs.

1 Background and Context

Experiments designed using conceptual frameworks have shown better student engagement [1]. National wide projects have been focused on evidence-based research to improve undergraduate experiments and found that students' experiences are related to the two-factor theory of motivations 'experiment-based motivators' and 'course-level resources' [2]. Considering the fact that the labs are not designed for online delivery, this study focused on undergraduate lab programs with the following research aim:

Aim: To explore student engagement in undergraduate science labs in two universities.

2 Method

This study has been conducted at two large, research-intensive universities in Australia: The University of Sydney and The University of Melbourne. A survey focusing on students' engagement following approved Human Ethics protocols was administered at the end of the lab programs. There were 735 participants in total who responded to one open-ended question. The university names were deidentified to Uni X, Uni Y, and the samples are shown below in the table1.

Table 1: Sample sizes of first-year physics labs from two universities.

University Uni X Uni Y Total

Participants n=612 n=123 N= 735

3 Analysis & Results

The open-ended question, "What aspects of the experiments did you find most enjoyable and interesting?" was analyzed using thematic coding. Three researchers were involved in the coding to ensure correct interpretation was made with respect to lab delivery, as well as for validating the emerging themes. First, the primary researcher went through each response and identified the emerging themes, and validated with the other two researchers. The final themes were then aligned to two factors from the survey analysis, as listed in Table 2.

Table 2: Description of themes, quotes, and results from the thematic coding of student voices

Experiment-based motivators Course-level resources

Themes:

- Planning & Conducting, Hands-on
- Data Collection, Data Analysis, Data Interpretation
- Prediction, Understanding Physics, Physics Relevance, Writing Report Themes:
- Demonstrator's Help, Teamwork
- Technology
- Experimental Procedure, Background Information

Quotes:

- I found analyzing the data is very enjoyable
- The most fun is when you design experiments.
- Comparing the results to theory and how they correlate. Quotes:
- Using excel to use functions and graphs
- I found doing them in groups to be good.
- When seeing clear and helpful instructions.

4 Discussion

The results highlighted interesting and engaging aspects of the lab programs and the features that were retained during the online delivery. Despite the differences shown between the universities, students were more motivated from Hands-on experiences such as designing the experiments, data analysis which is not normally

shown as an interesting aspect for them, and finding the relevance of the experiments to real life. Being on-line, students were required support from their peers and demonstrators showing that teamwork was more helpful. Having more background information and clear experimental instructions were helpful resources.

Acknowledgments

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References

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