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AssessING laboratory SKILLS: SHARING something WE TRIED THIS YEAR

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PROBLEM
The teaching of experimental physics in laboratories is central to any physics course. Through the teaching of experimental skills, students learn to produce scientific knowledge following scientific methods, by developing expertise in identifying and designing experiments, critical thinking and problem solving skills, the capability to analyze scientific findings and to communicate them effectively to the scientific community.

However, in articulating the big picture, we must not lose sight of the basics of experimental work: students taking actual measurements and using equipment, analyzing data, and interpreting and connecting with knowledge. This was articulated by Kirkup (2009) who says 'Experimentation is at the heart of science… Many of the skills required to convert theory into reality and to explain measurements are learned through… a methodical and systematic approach to solving experimental problems and analyzing experimental data.' Richardson, Sharma and Khachan (2008) capture the development of these basics of experimentation as 'levels of sophistication'.

In our work, we have gone back to the basics and are incorporating these fundamental skills into our lab program, strategically utilising these to teach the broader skills such as critical thinking. Together with teaching the basics, we have developed and implemented tools to test whether students are actually acquiring them.

ACTION
We have introduced a new model for assessing student laboratory learning. Three learning outcomes are identified for each lab: an experimental approach, an analysis of the data acquired, and interpretation of the results in the light of theory. Over the semester, students practice this threefold approach to experimental work in each of eight separate experiments.

These skills are then assessed in three separate assessment tasks: an individual practical test, which tests the students' ability to perform an experimental investigation; a paper-based test which tests student's understanding of analysis and uncertainties, and a short lab report, which tests students' ability to interpret experimental data to address an experimental aim. The novelty of this approach is that we are assessing the process of experimental work, instead of the outcomes.

OUTCOMES
We introduced this model during semester 1 2018 in Junior Physics at the University of Sydney. We involved our lab tutors as partners in the development and implementation phases. This presentation will discuss our experience with the introduction of this new assessment model for experimental lab. Our initial results suggest that students are mastering the skills they need, and that this mastery is noticeably better once explicit assessment of the skills is introduced. We will discuss feedback from students and tutors, as well as how we can improve the schemes in future semesters.

REFERENCES
Kirkup, L.. Design template for the development of a physics laboratory program, in ALTC Associate Fellowship Report: New perspectives on service teaching: tapping into the student experience, July 2009.
Richardson, A., Sharma, M. D., Khachan, J. (2008) What are students learning in practicals? A cross sectional study in university physics laboratories. CAL-laborate International, 16(1), 20-27.

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