

Learning gains of students in differing delivery modes of physiology laboratory classes

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Introduction

Inquiry-based laboratory classes provide opportunities for students to reinforce knowledge and develop skills in scientific methodologies¹. However, with many courses now delivered in dual modes, it is unclear whether learning gains are equivalent between classes delivered face-to-face versus online. This study evaluated students' perceptions of their learning from inquiry-based laboratory classes in alternate delivery modes.

Methods

Biomedical science students enrolled in a second-year physiology course in internal (n=341) or external (n=117) modes undertook inquiry-based laboratory classes delivered either face-to-face or via zoom. Students worked in groups to design and present an experiment proposal. Internal students undertook their experiment and analysed the data, whereas external students analysed data generated by prior students. All students completed an individual laboratory report. Through open-ended questions, students identified learning gains they achieved. Responses were thematically analysed against an existing 'KIPPAS' framework².

Results

Responses from students in different modes did not differ in broad category of KIPPAS skills (Figure 1). However, within sub-categories, external students more frequently (p<0.05) reported gaining inquiry skills in **formulating aims and hypotheses** than internal students. In contrast, significantly more internal students reported gains in practical skills of **manipulative, procedural or data acquisition** and in the scientific communication, **presentation skills** than external students (p<0.05). Students' grades were *identical* in each mode.

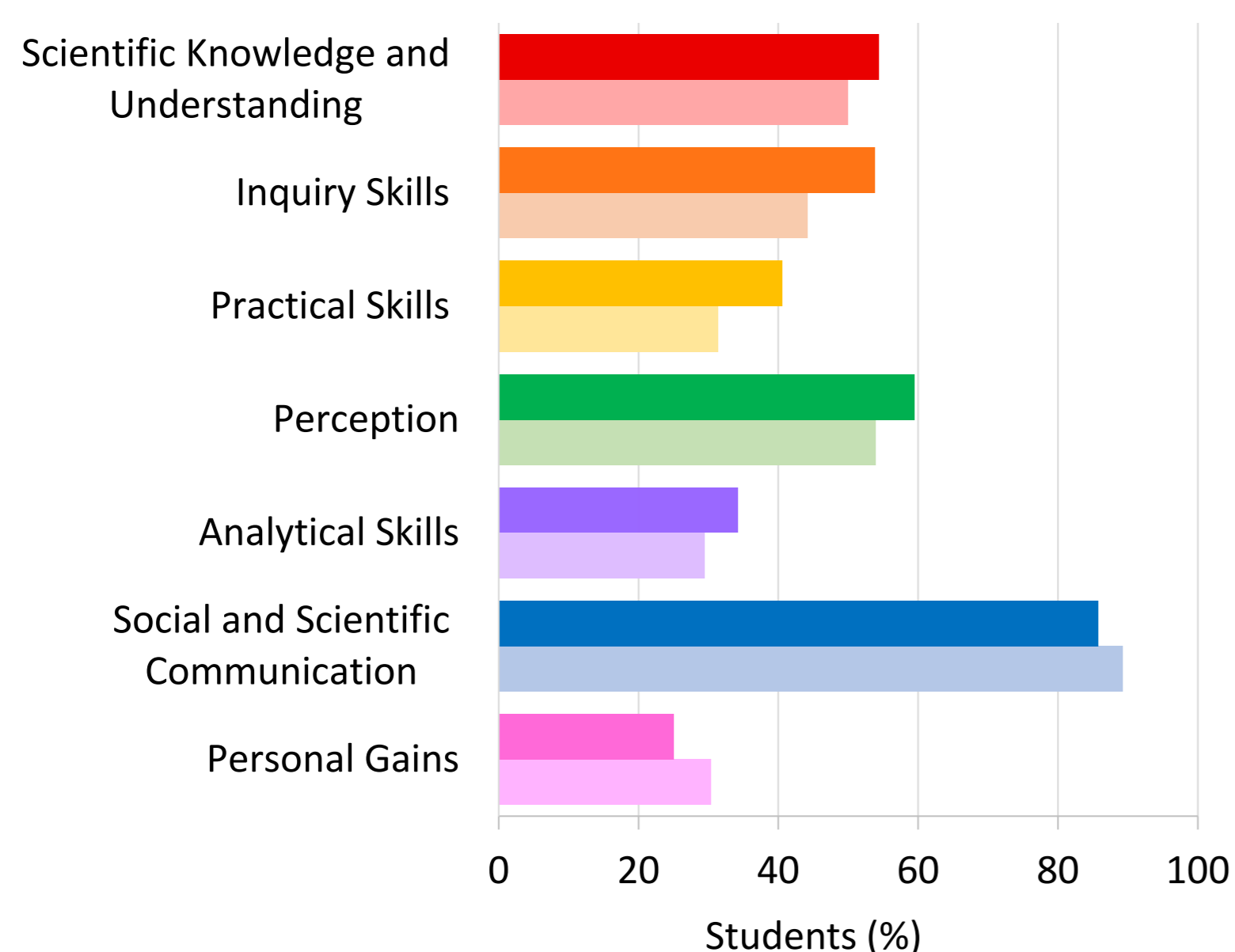


Figure 1. Internal (dark colour) and external (light colour) students' reported gains² from practicals and assessments.

Students said they gained...

Inquiry skills: *"I gained a deeper understanding on how to create a testable, falsifiable, concise and well written hypothesis."*

"I have gained skills in planning an experiment, determining the aim you are trying to achieve in it and creating a hypothesis."

Practical skills: *"I think that I have a greater understanding of some of the protocols associated with physiological measurements (e.g. blood pressure measurement, blood glucose measurement, etc.)..."*

Scientific communication skills: *"Being comfortable with presenting in front of the class and answering on the spot questions..."*

"The ability to present our ideas to the class was very useful in improving my presentation skills."

Outcomes & implications

- Inquiry-based laboratory classes in different delivery modes can promote learning of a broad range of valuable skills and allow students to achieve equivalent grade outcomes.
- External students may need targeted support to assist development of specific skills, for example manipulative and data acquisition skills.

References

1. Colthorpe et al. (2017). Assessing students' ability to critically evaluate evidence in an inquiry-based undergraduate laboratory course. *Advances in Physiology Education*, 41(1), 154-162.
2. Brinson. (2015). Learning outcome achievement in non-traditional (virtual and remote) versus traditional (hands-on) laboratories: A review of the empirical research. *Computers & Education*, 87, 218-237.