



# Students as producers: crowd-sourced learning objects

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## Summary

Results and implementation details are provided from a novel learning approach that extends the pedagogy of the Flipped Classroom (FC). Students in a large introductory physics class for non-majors (N=742) were tasked with the creation of two learning objects (LOs) over the course of the term, based on pre-reading material. An experienced TA screened the LOs for quality and relevance to the course, and the best ones were highlighted and incorporated into the lectures, tutorials, and examinations.

## Methods

**Scaffolding and Support:** Four experts introduced LOs to the Physics 101 students in their first tutorial sections using examples developed by an instructor. The same buoyancy question was presented as several different learning objects including: multiple choice question, explanation question, slideshow presentation, audio narration, pencast, video demo. Students were directed to an online resource for help on creating their first LO. We provided them with guidelines on how to choose a topic, narrow the focus with a question, answer the question, provide a detailed explanation, and finally present the information digitally. No additional scaffolding was provided, but students were allowed to ask questions about potential topics in a weekly virtual tutorial.

**Grading and logistics:** The class was divided into four cohorts and students in each cohort were assigned two due dates to submit at least two original LOs on pre-reading material. The LO component of the course totalled 5% and they were marked by a teaching assistant against a rubric that was available to the students as part of the LO creation guide. Students were able to submit one LO per week, and their two best LOs made up their LO grade.

**Submission survey:** Upon submission (online) of each LO, students filled out a brief survey that was used to collect data on how students chose their LO topic, how much time they spent, and how their understanding changed due to the LO.

## Results

### 1. Student participation

Students participation in the LO activity was high, as 90% of all students submitted at least one LO and over 80% submitted at least two LOs. Students were expected to come up with original content on material not yet covered in lectures, with many other assessment demands in this, and other courses. Experimentation and exploration of their chosen topic was encouraged and students could submit additional LOs if they wished. The number of assigned submissions remained fairly steady over the term, with the exception of a large spike at term's end - likely from students in all cohorts catching up on missed LOs.

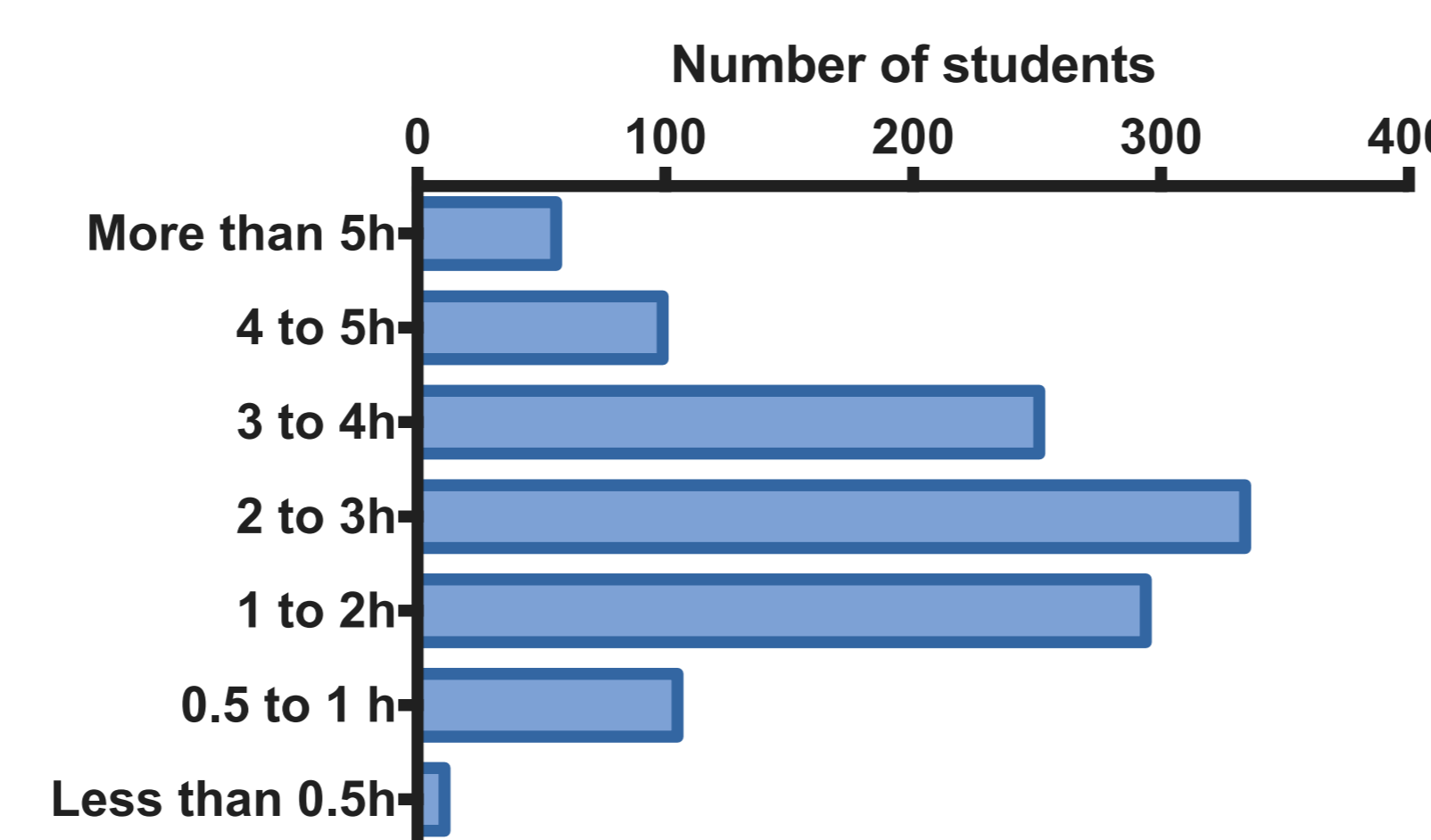


Figure 2. Distribution of the amount of time spent on LOs by students.

### 2. Quality of submitted learning objects

A large majority of students (65%) reported spending at least 2 hours on LOs while almost all students (99%) spent at least an hour. These are impressive engagement numbers because students spent time thinking about material not yet covered in class, ahead of the lecture. Furthermore, the quality of the content submitted was fairly high (as determined by application of a rubric to each LO) and the best LOs from each week are highlighted online at: <http://physics.lo.open.ubc.ca>. Students had the option to apply the Creative Commons NC-SA license to make their LOs freely available.

### 3. Students reported significant improvement in understanding after LO creation

In the survey, students responded to the question "before / after completing your LO, how would you rate your understanding of the topic you chose?" It is illustrative that after spending time working on an LO and likely struggling with foreign material, a vast majority of students believe their own understanding improved after the LO activity. The 5-level sentiment scale was mapped on to a 5-point scale to quantify the change in understanding (0 = No understanding and 5 = Excellent understanding) and self-reported understanding improved 1.5 points after creation of the LO, with Cohen's d effect size of 1.92 (N=742).

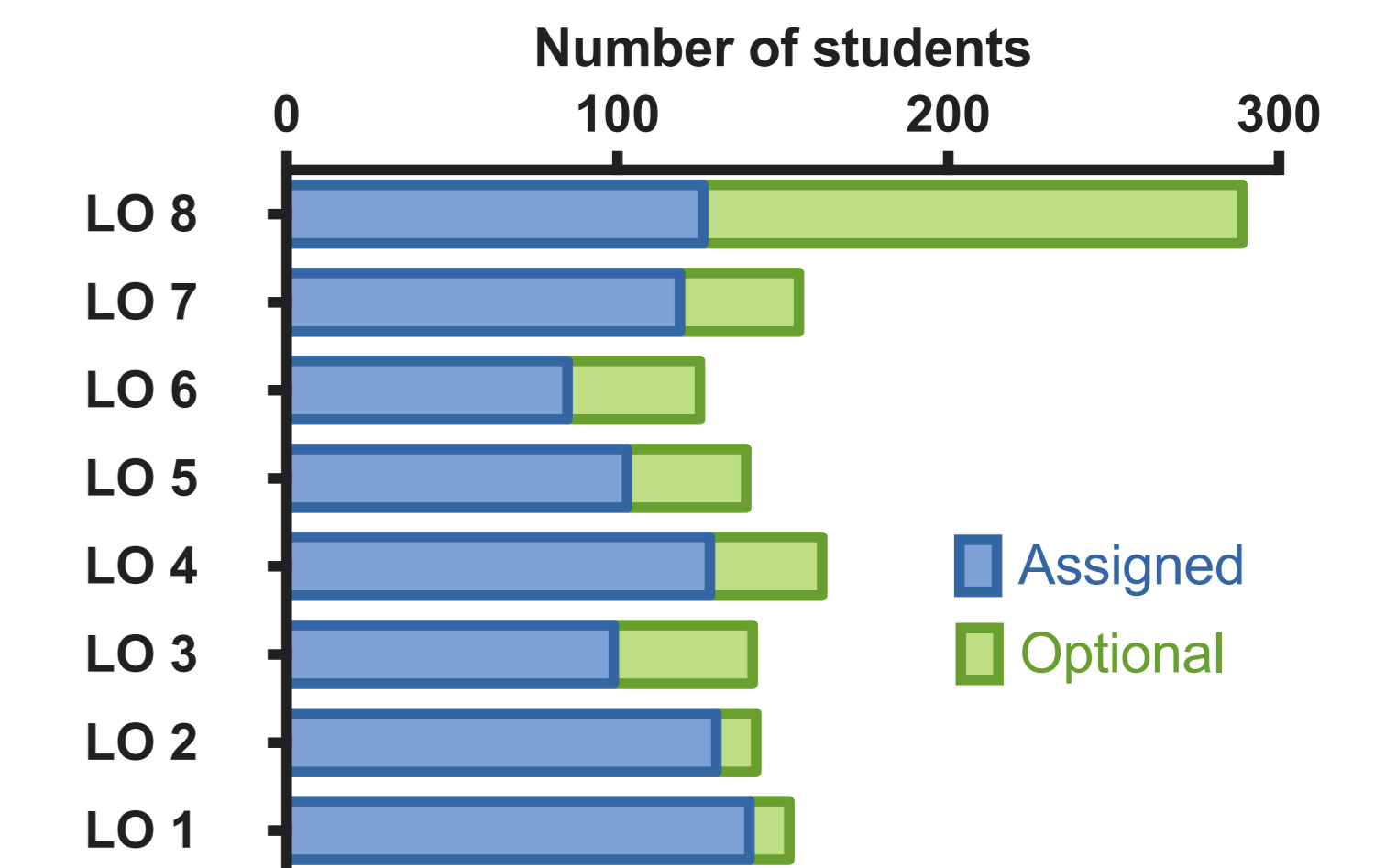


Figure 1. Submission of LOs over the 8 assigned weeks. Blue indicates LOs that were assigned and submitted, and green indicates LOs that were optionally submitted.

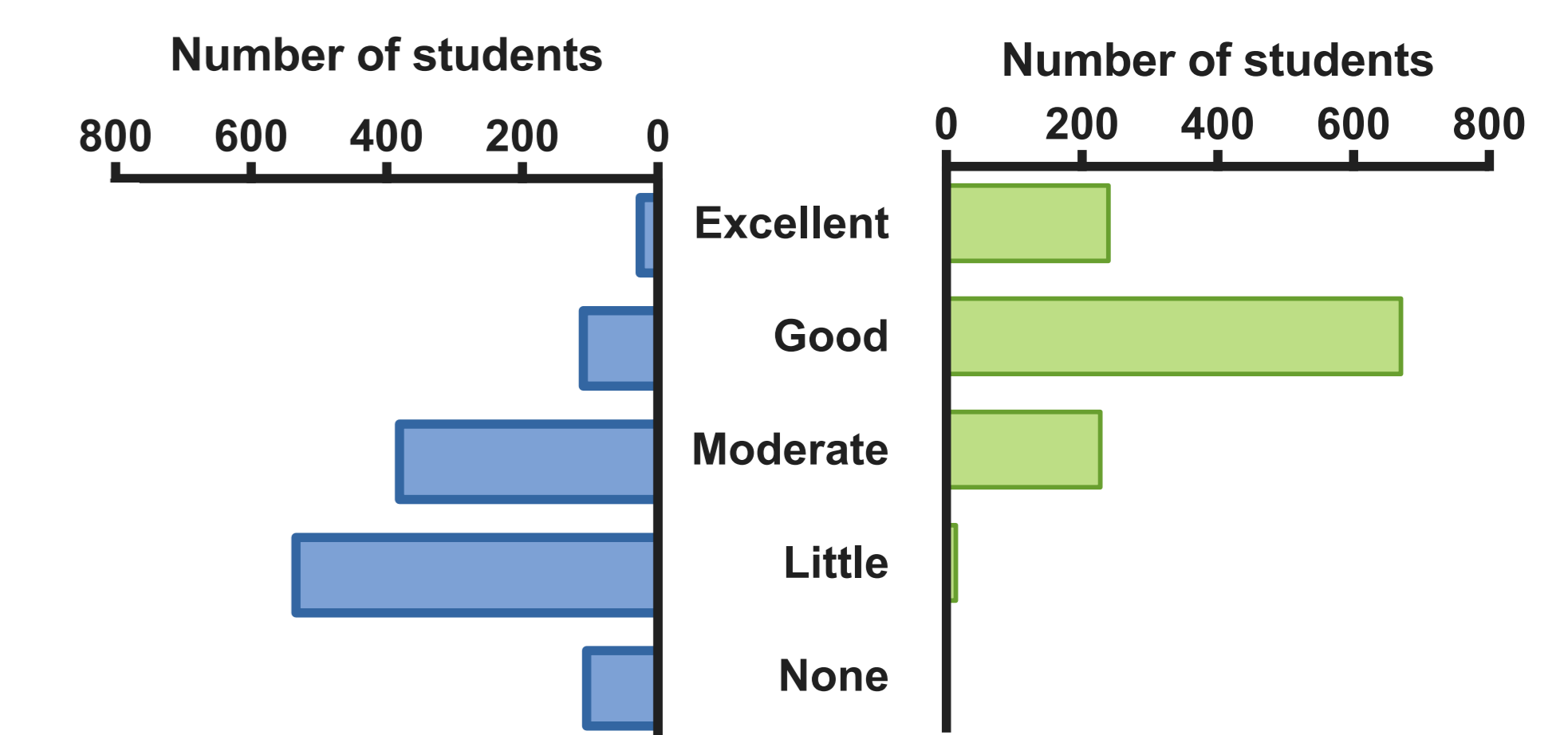


Figure 3. Self reported student understanding of the topic they chose for their LO submission, before (blue) and after (green) creating the LO.

## Conclusions

1. Students demonstrated a high level of engagement with a challenging task, despite multiple assessment requirements from this, and other courses.
2. Overall, LOs were generally of high quality and exceptional quality LOs were integrated into lectures, tutorials, and on summative examinations. Approximately 20% of the final exam was derived from student generated content.
3. There was a large increase in student understanding as self-reported by the students upon submission of their LOs.

