

Clickers: can a simple technology increase student engagement in the classroom?

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Introduction

Students learn best when they are actively engaged and can therefore deeply encode material. One simple and easy-to-use technology that has been used to promote active learning in the classroom is clickers. Clickers are wireless response systems that students use to anonymously and instantaneously answer questions posed by the instructor during a lecture. Clickers allow rapid, reliable feedback that the instructor and the students can use to gauge learning and adapt accordingly. The main goals of this work were to 1) Determine teaching practices that result in active engagement in large university classes; 2) Investigate how variations in the difficulty of clicker questions and how instructors follow-up clicker questions effects student engagement.

Methods

Classroom observations were conducted during 27 lectures in a first year Oceanography course with an enrolment of 170 students and two course instructors. Both instructors used a mixture of clickers and traditional lecture styles. During each 50-minute class period, ten students in close proximity to the observer were randomly selected and observed for 2-10 seconds in a cycle that repeated every few minutes. Students were considered engaged if they were on task and were listening and responding to the lecture, taking notes, reading notes or interacting with the instructor or other students about in-class material. Students were considered disengaged if they were unresponsive to the lecture (e.g. sleeping, day dreaming), off-task (working on another course, surfing the internet, playing with their phone), or interacting with another student about non-class related topics. Each cycle through the ten students made up an observation point and was marked with a time stamp and the number of students engaged out of ten. An observation point was taken with every PowerPoint slide change or a switch in classroom activity, which was also noted. The observer rotated through the different areas of the classroom each lecture so that by the end of the semester that whole lecture theatre was sampled. In total 720 observation points were recorded throughout the semester.

Results

Figure 1: Time series of student engagement over a 50-minute lecture for a typical class

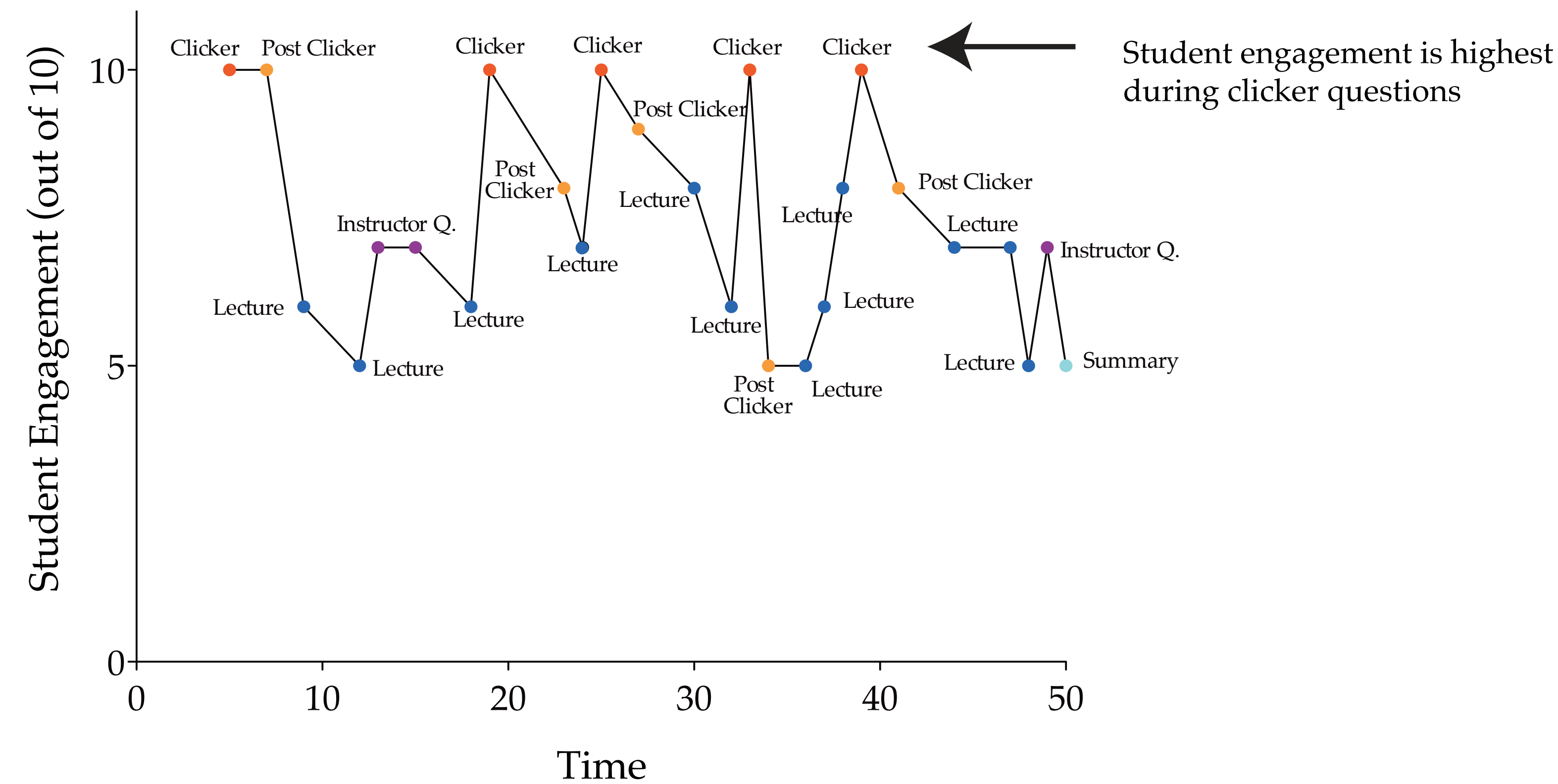


Figure 2: Student engagement based on instructional activity averaged over the semester for each instructor

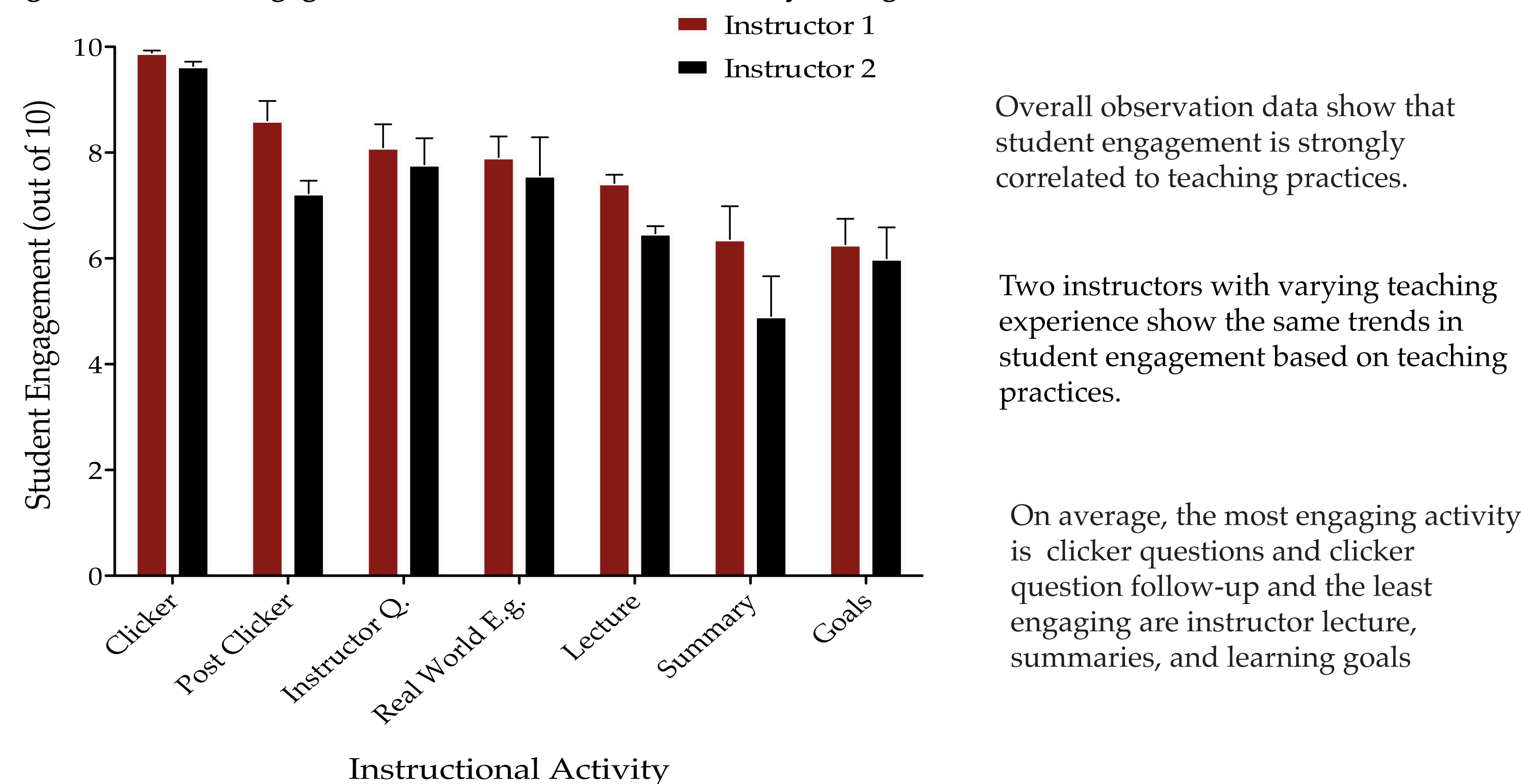


Table 1: The drop in student engagement over time immediately following a clicker question (units are in students per minute)

	Easy: >75% answered correctly	Moderate: 50-75% answered correctly	Difficult: < 50% answered correctly
Instructor explanation	-1.34 n=15	-1.49 n=9	-0.73 n=10
Student explanation	-1.66 n=3	-0.71 n=16	-1.22 n=10
In-class discussion	-0.19 n=4	-0.48 n=13	-0.47 n=10

Clicker questions were categorized based on (1) the percentage of students who answered correctly (Easy, Moderate, Difficult) and (2) the type of post-clicker-question follow-up:

Instructor Explanation: the instructor explained the question and the answer.

Student Explanation: a student explained their rationale for a particular answer.

In-class Discussion: the class participated in a discussion that was moderated by the instructor where several students provided their reasoning for and against picking the various answer choices.

- Overall, student engagement was sustained the longest (lowest numbers in Table 1) when questions generated were followed by learner discussion, regardless of question difficulty.
- Engagement dropped more quickly if the instructor merely explained the answer, or one student explained his/her answer.
- For difficult questions, instructor explanation retained engagement longer than for easy or moderate questions, but was not as effective as discussion.
- Student explanations retained some engagement for moderate questions, but again, were not as effective as discussion.
- If clicker questions are too easy and the majority of students get the correct answer, typically no discussion is generated and student engagement drops off quickly. Interestingly, four clicker questions that almost the whole class got correct generated in-class discussion. When analyzed further observation data showed that students got the right answer for the wrong reasons, which generated a lot of questions and discussion amongst students.

Suggestions for getting the highest engagement in your class when using clickers

- Write questions that involve challenging ideas or multiple plausible answers to help generate in-class discussion.
- If at all possible get the students to explain their answer choices.
- Repeat student explanations so the whole class can hear.
- Ask discussion-generating-type questions after a clicker question, e.g. "Can we eliminate any of these answers?" or "Why do you think someone might have chosen B?"
- Don't spend too much time on questions that the majority of the class got correct, but do make sure they got it correct for the right reasons.
- Give the students sufficient but not too much time to answer a clicker question. The level of student discussion and the number of votes is a good guide as to when to move on.
- When ~3/4 of the class has voted, announce time is almost up, then sound a warning sound, count down out loud or switch out the lights to pull students back.
- Attend the workshop on "CLICKERS: HOW TO EFFECTIVELY USE A SIMPLE TECHNOLOGY TO INCREASE STUDENT ENGAGEMENT IN YOUR CLASS" on Friday afternoon from 2:30-4pm in Hall III: LEFKAS, where you will learn how to respond to clicker histograms and promote in-class discussion.

Further Information

Please contact Erin Lane at elane@eos.ubc.ca for more information on this research

Educational Research happening in Earth and Ocean Sciences at UBC: www.eos.ubc.ca/research/cwsei/

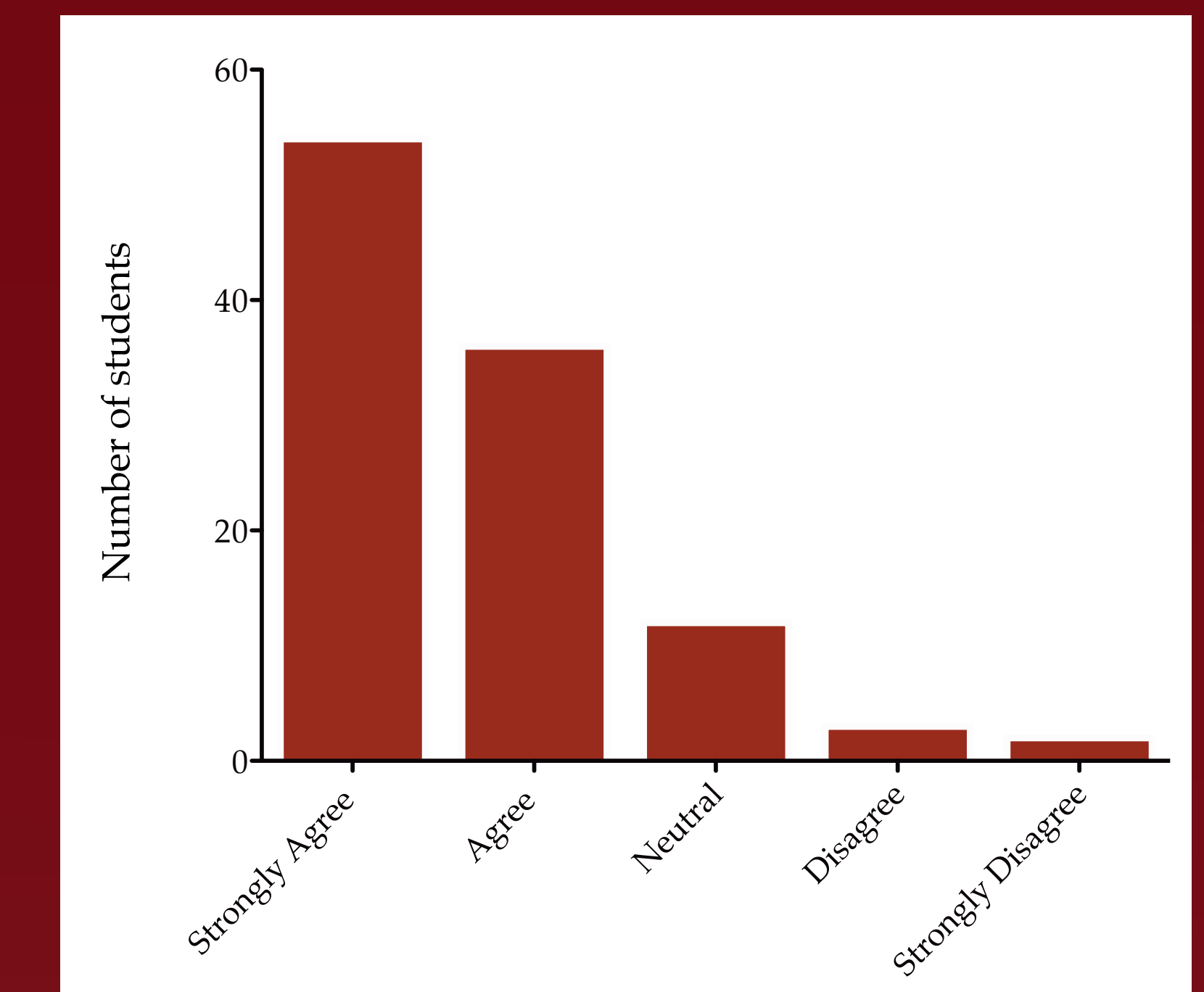
The Carl Wieman Science Education Initiative: www.cwsei.ubc.ca

Lots of useful resources about using clickers effectively: www.cwsei.ubc.ca/resources/clickers.htm

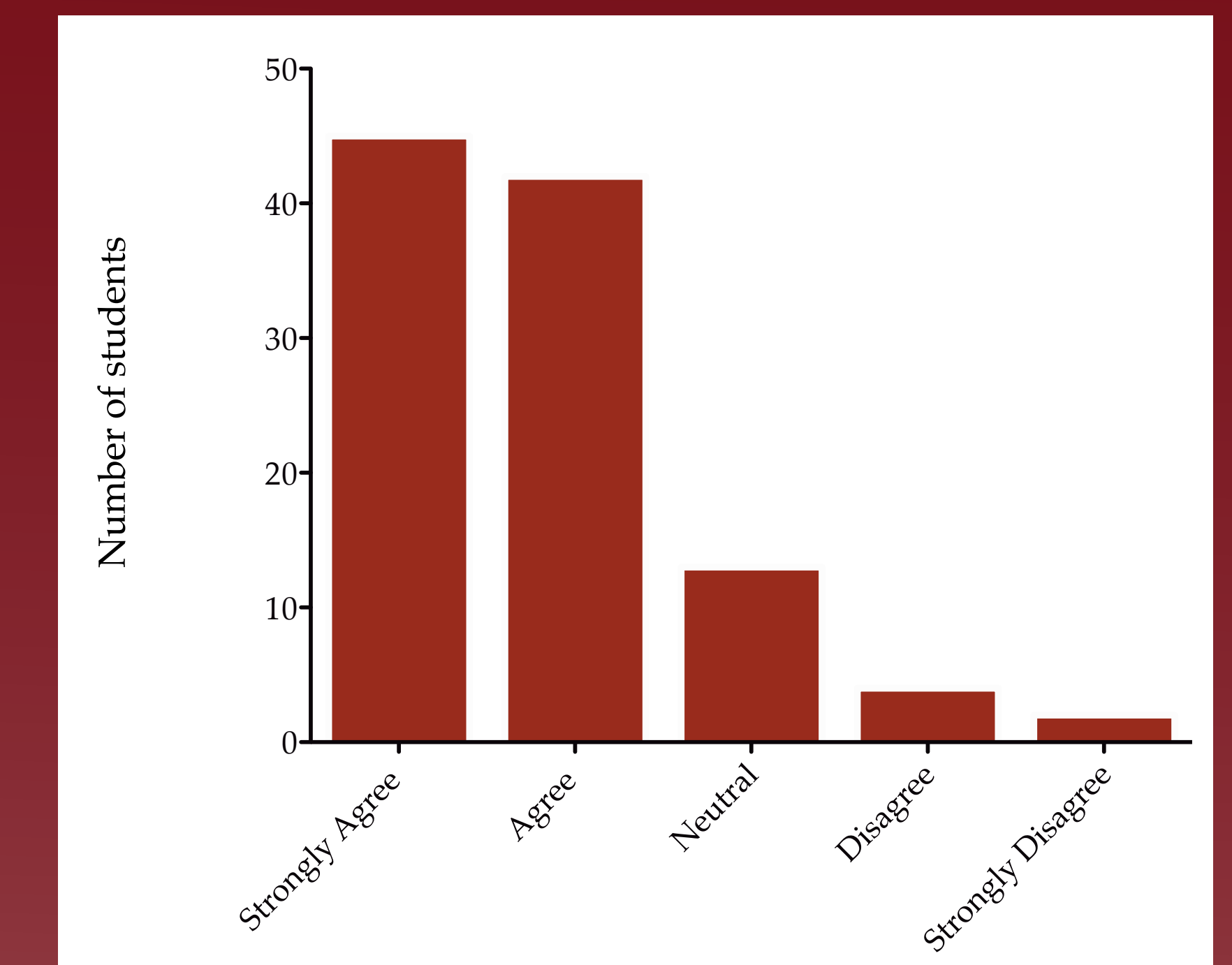


What did the students think about clickers when they were surveyed?

Clicker questions are useful for my learning



Clicker questions help focus my attention in class



Student Comments

Clicker questions were really helpful because they made me to think about the material during class

The clicker questions are a great way to involve the class and generate discussion and thought

Clickers helped me to pay attention lecture

It gave me a sense of what I understood and what I didn't