In-class anonymous student feedback and interactivity at the speed of light!

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Dr. Faisal Shaikh joined MSOE 5 years ago in a unique interdisciplinary engineering program called BioMolecular engineering. The program is a combination of molecular biology and chemical engineering and is unique in the nation. He developed most of the core chemical engineering courses in this program, albeit with a biological focus. He is also a champion of industry-academia partnerships and has been instrumental in bringing industry sponsorship to a number of the senior design projects in the program. He is also keen in engaging students in his classrooms using a variety of methods while developing some.

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Abstract

Despite their utility, traditional approaches to gauge student understanding and collecting their responses in class have multiple shortcomings. This paper discusses the shortfalls of these traditional methods (student raising hand, use of clickers, etc) and compares them with a new method (laser pointers used by students) that aims to solve the shortcomings of these popular methods. I have used this method in some of my classes with largely positive results. I will discuss how this can been used and how it compliments many of the common methods currently in use, while providing superior functionality.

Current popular methods for in-class student feedback

The popular methods commonly used for getting student feedback[1,2] are listed in Table 1, alongwith their performance on a set of criteria listed in the first column. The first method (students raising hand) satisfies most of the criteria listed in the table but suffers majorly from two big drawbacks. First, it is not able to involve introverts in an engineering classroom (that number around 50% at my institution). This happens clearly as it is not able to provide any anonymity to the student responding to a question. Second, this method only allows one student to respond to a given question at a given time. This results in significantly reduced student engagement especially when multiple students raise hands to answer a question and only one gets to. This results in lowering both, the student and faculty satisfaction in using this method.

The second method (clickers) solves these major drawbacks by providing the anonymity and engagement[1,2] but brings in high cost of hardware purchase and setup and use issues. The learning curve in being able to use these within powerpoint presentation and the setup prep times for this method has significantly limited its widespread adoption but is still a well researched and studied topic[3]**.** This method allows only discrete and limited types of responses (eg. A, B, C or D), so questions have to be restricted to multiple choice type of questions.

The third method (ABCD voting cards) in which each student has 4 big voting cards (each with A, B, C and D printed on it) and votes for an answer, solves the bigger drawbacks of the clicker method by simplifying the entire response process[4]. It ends up loosing anonymity (if students look at others' cards) and is also restricted to multiple choice type questions. Additionally, students do not get a glimpse of the class response in this method, unless the instructor informs them how the class voted. Counting of votes becomes impractical in a big class size.

The fourth method (internet/web/app based response methods) provide a solution to most of the shortcomings of the first 3 methods but bring in the complications of setup and the potential for technical problems (eg. internet signal loss during class). Additionally depending on each students mobile cellular network, there will be a certain time lag by the time all responses trickle in. The students need some internet device to be able to respond with this method. In light of all these attempts, a method is clearly needed that satisfies the performance criteria listed in table 1.

Methods Performance Criteria	**Student(s) raise hand(s)**	**Clicker**	**ABCD voting cards**	**Internet / App based**	***Proposed method: Laser pointers***
Easy and quick hardware/ software set-up	**x**		**x**		**x**
Low cost of setup and use	**x**		**x**		**x**
Low usage burden for students	**x**		**x**		**x**
Low/no learning curve for adoption by faculty	**x**		**x**		**x**
Zero potential for technical problems during lecture	**x**		**x**		**x**
Student responses reach instructor instantly (~1 second)	**x**	**x**	**x**		**x**
Class engagement: Bulk responses possible		**x**	**x**	**x**	**x**
On- the-fly questioning *	**x**		**x**	**x**	**x**
Not restricted to a few possible discrete answers (eg. A/B/C/D) *	**x**			**x**	**x**
High student satisfaction*					**x**
High faculty satisfaction*					**x**
Responses received and analyzed within 5 seconds*		**x**			**x**
Anonymous responses		**x**	**x**	**x**	**x**
All introverts respond*		**x**	**x**	**x**	**x**
Can be used in a powerpoint presentation and white/blackboard *	**x**		**x**		**x**

*This information is based on my experience in using these methods in my classes.

Table 1: Popular methods commonly used[1] for getting student feedback in an engineering classroom in comparison to the proposed 'laser pointer' method.

Proposed method: Students respond with laser pointers

The purpose of this method is to provide the instructor in a classroom a simple new method of receiving instant, real-time and anonymous student feedback and solve the problems of the 4 methods listed in table 1. Anonymous methods of student feedback are critical to encourage introvert students to participate in the learning process. The most common 'raising-hand' approach to respond to an instructors question misdirects the flow of the instructors teaching to the understanding of the extrovert student(s) who raised the hand. Getting *all* or most of the students to respond allows both the instructor and students to get an accurate impression of the extent of understanding that students have reached at any point during classroom instruction. This allows students to comfortably ask specific questions they may otherwise feel reluctant to ask. *In this proposed method, each student in the classroom is provided a laser pointer to point to the blackboard or presentation screen to provide feedback or responses.* Each question is generally addressed to the entire class and each student is expected to respond by pointing to specific locations on the blackboard/screen.

The barriers of technology (eg. internet based feedback, or cell phone messaging based feedback, clicker hardware setup, high setup costs, time lag in gathering responses) are removed and the proposed method provides significant improvements in all aspects of garnering student understanding and generating a considerably more interactive class environment. The cost of laser pointers is considerably low ($1 per pointer available nationwide in a common 'dollar' store) than clickers and provides more flexibility in asking questions(compared to asking only multiple choice 'a-d' questions) and interacting with the class along with no time wastage in hauling and setting up clickers in each class. Qualitative feedback, where students could point to an engineering design or chart (thermodynamic charts, specific terms in long engineering equations, electrical circuits, instrument design, equipment) can be smartly utilized to ease the teaching process. The burden on the instructor to design questions adapted to clicker feedback is nullified as the instructor can improvise during a lecture to ask a question gauging the understanding of a concept. Additionally, the degree of student understanding can be qualitatively obtained by simply drawing a short line segment for students to point to one extreme to signify 'no understanding' and to another for 'complete understanding' and anywhere in between to show the level of 'partial understanding'- all this in an instant with almost full participation by students. Student feedback regarding this method is evident in figures 1-3 where it is clear that 85% students prefer this method over two most popular common methods. Additionally it is evident that they like this method significantly(figure 2) and would prefer it being used multiple times in each class (figure 3).

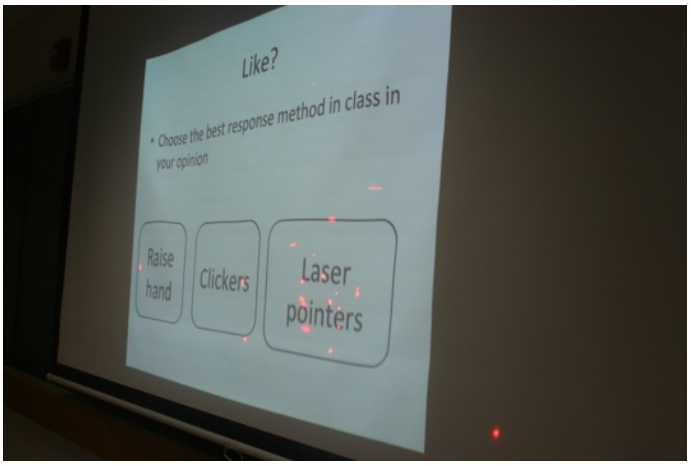

Figure 1: Students responding using laser pointers. In 20 responses, 5% prefer raising hands, 10% prefer clickers and 85% preferred the use of laser pointer. The anonymity imparted with this method also makes the data reliable.

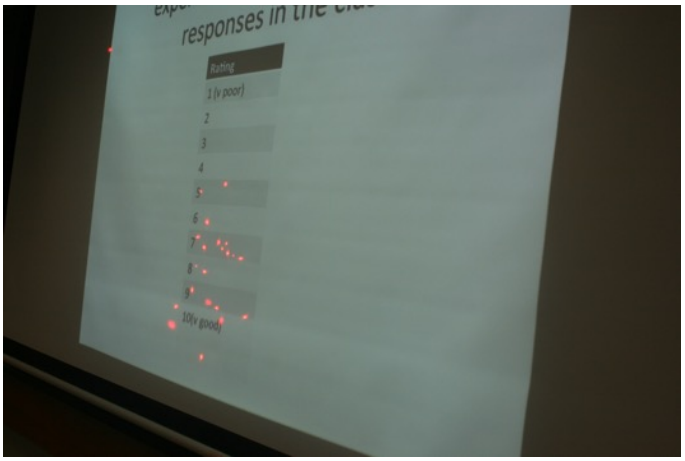

Figure 2: When asked how they would rate the use of laser pointers on a scale of 1-10 (10 being very good), the class responded positively with an average of about 8.

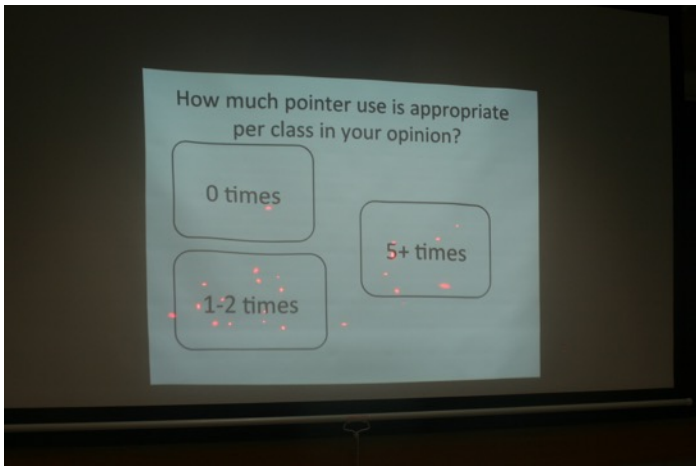

Figure 3: Students prefer the use of pointers multiple times during the class.

Conclusion

The method proposed here lets students respond with laser pointers to questions posed to them by an instructor in a classroom. I have found it quite useful in my lectures to engage the entire class for quite a variety to questions. This method is not expected to be the sole, comprehensive method to be used by instructors, but rather a simple and complimentary method that can be easily used in many situations in a classroom in addition to traditional methods instructors use. The strengths of this method lie in its quick and superior response mechanism and engagement of the entire classroom, including all introvert students. Future work in developing this technique would involve studying its impact in enhancing student learning in comparison to other audience response systems[4].

References

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