Slido as a student response system in engineering education

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Abstract

Student response systems (SRS) provide a real-time interface for solving class problems and asking questions. Prior research indicates that SRS increase student engagement, widen class participation with less vocal students, reinforce key concepts, consolidate learning, provide immediate feedback, improve motivation and confidence, and enhance comprehension. Some of these systems, such as Slido, are mobile phone-based, potentially reducing costs, training, and technical difficulties associated with SRS. The objective of our research was to understand the effectiveness of Slido in engineering education. To accomplish this objective, we surveyed 49 students enrolled in Civil and Environmental Engineering at The Citadel to understand whether engineering students find Slido beneficial. The survey results were overwhelmingly positive, with 92% of students wishing that the professor used Slido every class period, and 100% preferring that Slido be used at least once a week. The survey also indicated high levels of student engagement. Interestingly, students valued the anonymity of submitted responses, with 78% preferring to submit solutions to engineering problems anonymously rather than accompanied by their name. Our findings call for increased use of Slido in the classroom.

Keywords

Slido, Student Response Systems, Clickers, Student Engagement

Introduction

Today's teenagers check their phones more than 80 times per day[1]. High school seniors spend an average of two hours a day texting, two hours on the internet, and 90 minutes a day playing video games[1]. The learning styles of these 21st century learners is vastly different from those of their teachers. Modern students are highly comfortable with technology, learning on their own, seeking quick and succinct answers to address an immediate problem, and answering questions with a few clicks on a mobile device[2]. They seem to see their schools as behind the times, irrelevant in a fast-paced world of changing technology[1]. Surveys show that student interest in school has plunged since 2012, with fewer students reporting that they found school interesting, enjoyable, or meaningful[1].

Students expect that educators will shift from traditional lectures to a pedagogy with greater student interaction with the material, instructor and peers[3,4]. Gebbels encourages instructors in Higher Ed to accommodate students' alternative learning styles with more technology-driven, spontaneous, and multi-sensory approaches[4].

Many modern students do not remember life before smartphones. Teens watch videos rarely more than three minutes long, skipping between apps on their phones within seconds[1]. Perhaps because of technology, today's teens possess limited attention spans. In one study of college

students laptops, students switched between tasks every 19 seconds on average, with more than 75% of the students computer windows open less than one minute[1].

How then do we keep students alert and engaged in the classroom? One solution is the use of SRS, also known as clickers or audience response systems. SRS provide a platform for students to respond and ask questions in the classroom. Responses are tallied in real-time, and addressed immediately by the instructor. SRS also break up tedious lectures and help restart the attention clock[5]. SRS have been shown to engage students in real time[2]. College students are more attentive in a classroom with SRS[5–7].

In addition to improved attention, benefits associated with SRS include increased participation[6,8], motivation[4,6,8,9], engagement[4,6,7,10], creativity[8], memorization[3,8], satisfaction [4,6,8], attendance [6,7], critical thinking[10], discussion[7,10], active learning[4,10] and learning performance[3,4,7,9].

On the other hand, a negative aspect of SRS is the significant amount of time required to set up the system, train both students and instructors, hand out remote controls at the beginning of class, and collect them at the end of class[7–9]. There may be technical issues as well. Furthermore, SRS include a potentially high cost for the students who are typically responsible for purchasing the SRS, and those who do not purchase them cannot participate in the lesson[7]. Fortunately, there are now many free and low threshold methods to offer SRS including Slido, Socrative, and Kahoot[2]. These are mobile phone-based, potentially reducing costs, training, and technical difficulties associated with SRS.

The purpose of this study was to determine whether engineering students find Slido effective in the classroom. In the following sections, we discuss the methodology and results of a survey used to accomplish this goal.

Methods

We used Slido in three courses in the Civil Engineering Department at The Citadel, including two sections of Water and Wastewater Systems (n= 20, 12) and one section of Fluid Mechanics (n=17). We used Slido for formative assessment, that is, we conducted Slido without grades to determine student understanding of concepts in order to identify misconceptions and alter the course of classroom instruction[7], and also to increase interaction with students[2].

We frequently used Slido at the beginning of class to focus students' attention and assess what knowledge students brought from prior experience and classes. We also used Slido in the middle of class to break up the lecture and ensure that students were learning the lesson. We used a mixture of multiple choice questions and open-ended questions. Whenever students answered questions incorrectly, we would immediately clarify and provide a clear explanation behind the correct answer.

Approximately one month into the semester, we gave all 49 students in the three courses a survey with fourteen questions to understand the effectiveness of Slido (Table 1).

Table 1. Survey questions

Question	Survey
1	Slido helps improve my understanding of the material (1 to 5, 1= strongly disagree, 5= strongly agree)
2	How often should Slido be used? (every class, twice a week, once a week, twice a month, once a month)
3	Do you prefer multiple choice or open ended questions on Slido?
4	Do you benefit from seeing how the rest of the class answers questions? (1 to 5, 1= strongly disagree, 5= strongly agree)
5	Do you prefer Slido questions to quizzes? (1 to 5, 1= strongly disagree, 5= strongly agree)
6	Do you prefer to submit solutions anonymously or should you provide your name when submitting solutions on Slido?
7	Would you prefer to submit answers in groups or individually?
8	Do you agree with the following statement: It is less intimidating to submit questions anonymously via Slido than to ask questions in front of everyone in class? (1 to 5, 1= strongly disagree, 5= strongly agree)
9	Is Slido fun? (1 to 5, 1= strongly disagree, 5= strongly agree)
10	Slido makes the material more engaging (1 to 5, 1= strongly disagree, 5= strongly agree)
11	Could Slido distract you and make you more likely to respond to texts, emails, or social media posts? (1 to 5, 1= strongly disagree, 5= strongly agree)
12	What is your favorite aspect of Slido?
13	How do you think Slido could improve?
14	Please leave any other comments or feedback here regarding the use of Slido in this class.

Results and Discussion

We designed seven of the fourteen questions with a five-point Likert Scale. These questions were ranked from strongly agree to strongly disagree in Figure 1. Unsurprisingly, students agreed most with Question 5, that Slido is preferable to quizzes. This finding corroborated Kay and LeSage[7], who noted that students prefer to use SRS for formative assessment more than for tests.

Notably, 76% of the students agreed that Slido makes the material more engaging (Question 10). Similarly, eight students (16%) specifically cited increased engagement as their favorite aspect of Slido (Question 12) or praised engagement in the open-ended feedback question (Question 14) (Appendix).

Increased engagement is a strong benefit of SRS, as engagement is positively correlated with achievement and student success[2]. Student engagement improves because SRS promote frequent

and positive interaction, greater articulation of student thinking, more probing questions, an increased focus on student needs, effective peer to peer discussions, and active learning[7]. Indeed increased student engagement was likewise found in many studies that used SRS[3–5]. Surveyed students in one study found that SRS made tutorials more engaging, with an average Likert score of 4.8 out of 5[2]. Students in another study mentioned that SRS were "very engaging and made class more interesting"[3].

Questions 4, 9, 8, and 1 generated neither strong agreement nor disagreement. However, while 60% agreed that Slido is fun (Question 9), only 4% disagreed. Similarly, 49% agreed that Slido improves understanding of class material (Question 1), but only 6% disagreed.

The question with the lowest score, indicating least agreement, was question 11. Students were not likely to admit that Slido could distract from the lesson. Only 28% agreed and 48% disagreed that Slido could sidetrack and divert attention, and make students more likely to respond to texts, emails, or social media posts.

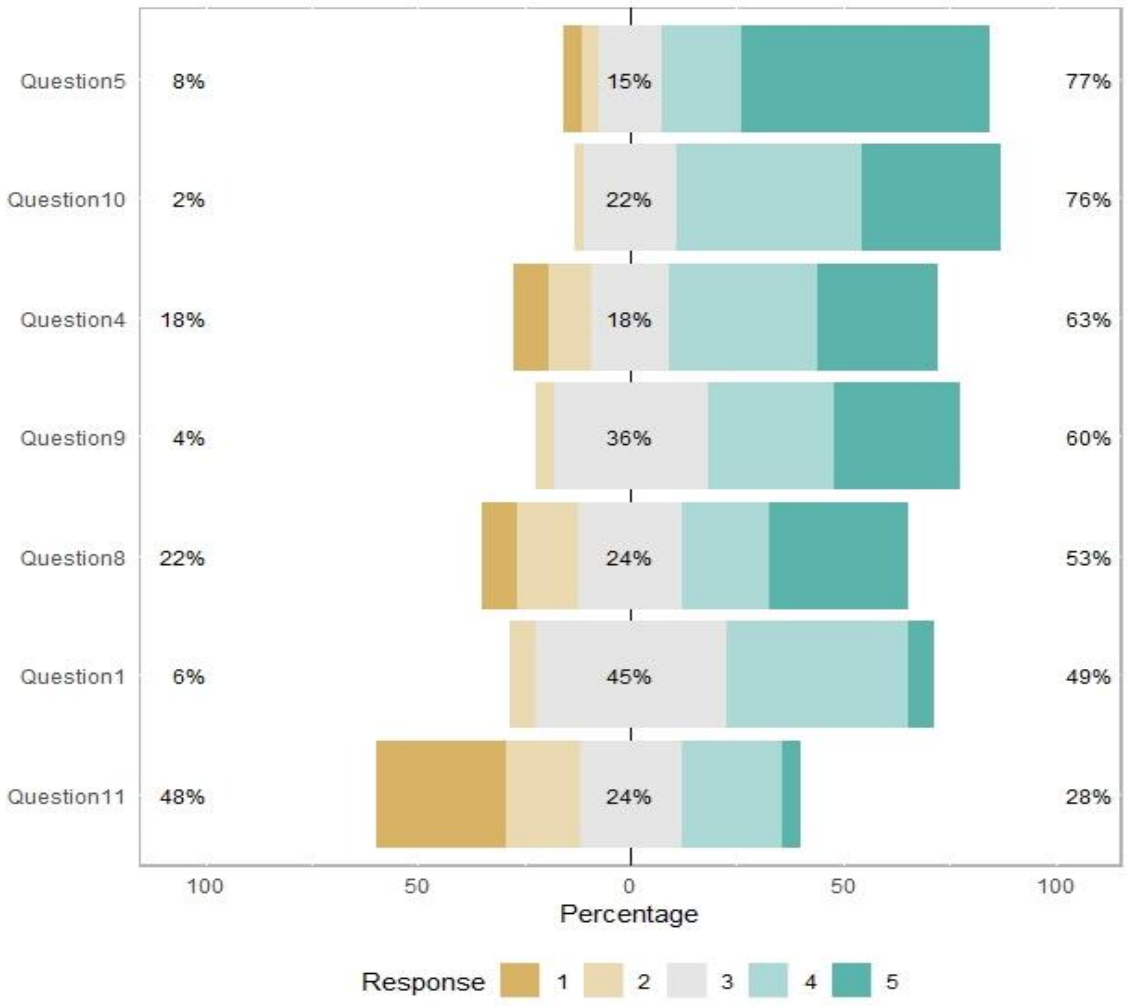

Figure 1: Seven questions with a five-point Likert Scale ranked from strongly agree to strongly disagree.

The survey results were overwhelming positive, with all students wishing that the instructors used Slido at least once per week (Figure 2). The open-ended questions (Questions 12 – 14) had identical results, as five students noted very positive comments, including (Appendix):

"Makes class more exciting," "It's perfect,", "It's the best",

Students generally are very positive about SRS[2–5,9]. In one study, 88% of students either frequently or always enjoyed using SRS in class, while 83% wished it was used in their other classes[5]. In another study, 78% of students agreed that SRS made the class more interesting and 68% found them enjoyable[9]. Students are more likely to recommend a class to others when SRS are used[4].

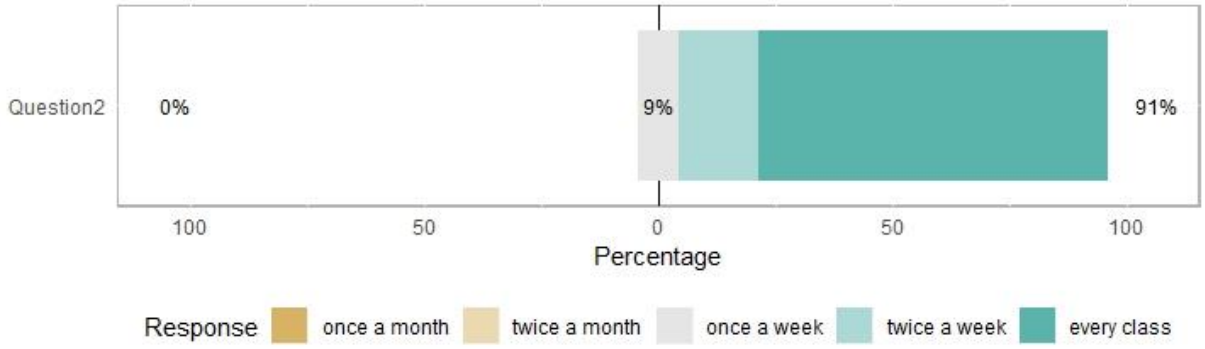

Figure 2. Responses to Question 2 = How often should Slido be used?

The surveyed students had a slight preference for multiple choice-type questions (52%), as opposed to 19% who preferred open-ended questions (Figure 3).

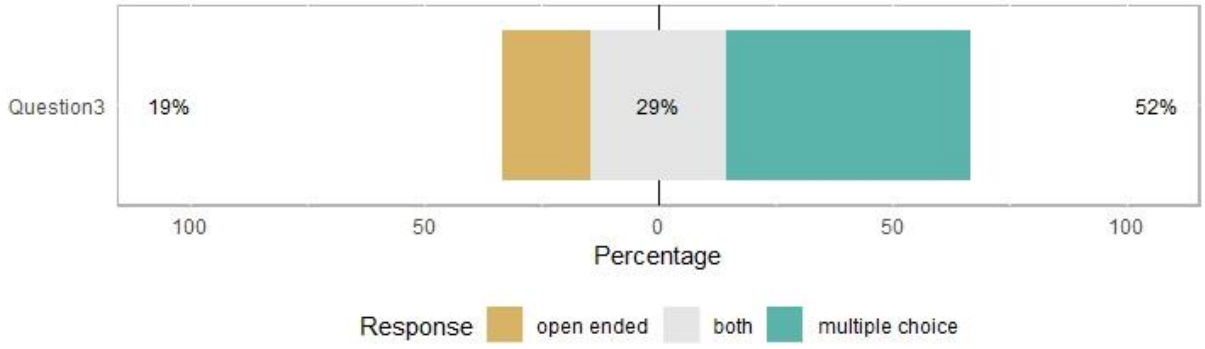

Figure 3. Responses to Question 3 = Do you prefer multiple choice or open ended questions on Slido?

Within Slido, the class has the option as to whether or not the responses should be submitted anonymously or in tandem with the student's name. The students largely preferred anonymous (79%) and only 15% preferred that their names accompany their solutions (Figure 4). Survey Question 12 (Appendix) reveals a similar result, as three students listed anonymity as their favorite aspect of Slido.

Kay and LeSage similarly reported that students appreciate the anonymity of responding without being judged by peers, and some students feel less confident using SRS when their names are associated with specific devices[7]. Rather than relying on vocal and confident peers, students are forced to pick their own answer, potentially building self-confidence[4]. The anonymity allows introverted students to present their questions and ideas with less hesitation[8].

This anonymity is lost with other methods of immediate feedback such as raising hands[4,7,9]. SRS also allow real time tallying and presentation of responses, which can improve feedback[4,9].

Feedback is the key to successful learning in many learning theories[2,4]. Prompting performance and providing feedback is highly correlated with student success[9]. Specifically, learning occurs quicker and stronger when feedback is timely[2]. Immediate feedback is linked to deep knowledge construction[3]. Several studies have shown that the immediate feedback associated with SRS improves feedback[2,5,9]. In contrast, traditional forms of feedback such as study guides completed by students well after learning the material, or quizzes returned after some time, avoid such immediate feedback[3]. With SRS, students can self-assess their own progress[9]. In addition, instructors learn what percentage of the class correctly understood their lesson[9] and can provide more targeted instruction, spending more time on particular theories or concepts[4]. In fact, the favorite aspect of Slido for three students we surveyed was the immediate feedback (Appendix).

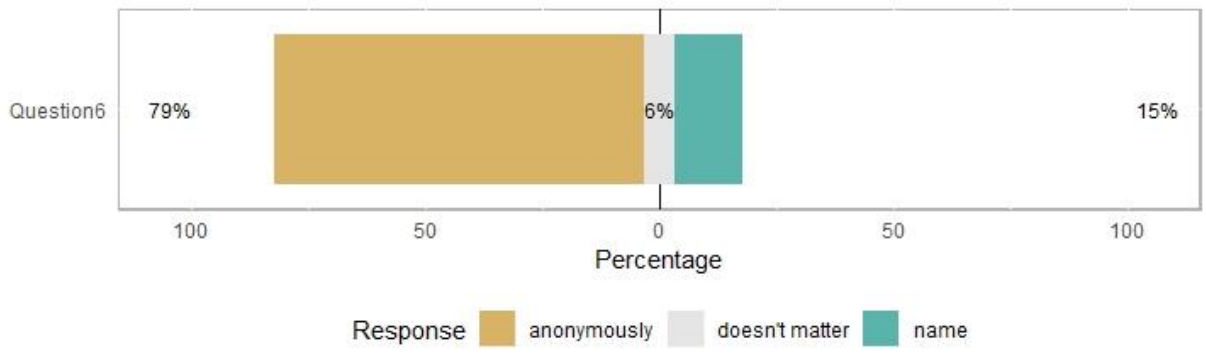

Figure 4. Responses to Question 6 = Do you prefer to submit solutions anonymously or should you provide your name when submitting solutions on Slido?

Students did not show a preference for submitting responses to questions in groups over submitting responses individually (Figure 5). Indeed, 24% of students opted to write-in “both,” despite this not being an option in the question.

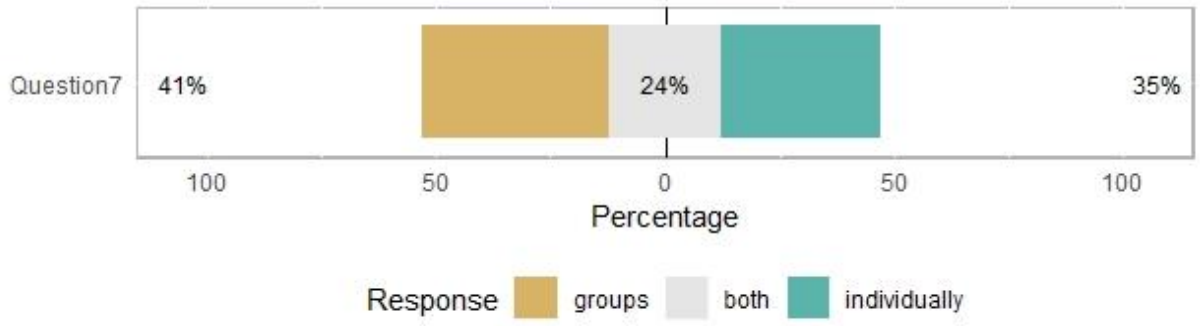

Figure 5. Responses to Question 7 = Would you prefer to submit answers in groups or individually?

Conclusions

We found that today's engineering students boast remarkably positive attitudes toward Slido and found it highly engaging. Our results support increased use of SRS in engineering classrooms, especially for formative assessment.

One possible limitation of our study is that we surveyed students after just one month of use; while students may be excited at the outset, after repeated use the novelty may be lost. However, this wear-off effect could be prevented if the SRS are "gamified" by encouraging competition[6]. In one study, even after regularly using the Kahoot SRS for five months, 94% still wanted to use it at least once a week, 90% still found it engaging, and 89% still reported that the game was fun[5]. By mimicking video games, which high school seniors play for 90 minutes a day on average[1], SRS may motivate students to learn even without their being aware of it.

Another limitation of our study is that we did not analyze any concrete education outcome, but rather focused on students' perception and preference. In fact, 45% of our surveyed students remained unsure whether Slido actually improves their understanding of class material (Figure 1). Future research may be necessary to test what is engaging about SRS, and determine whether or not the increased interaction is superficial or meaningful for long-term learning[7].

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Appendix – Responses to open-ended questions (Questions 12, 13, 14)

12. What is your favorite aspect of Slido?	13. How do you think Slido could improve?	14. Please leave any other comments or feedback here regarding the use of Slido in this class.
more convenient than buying clickers or using plickers	being free, or more free questions	-
it's an opportunity to free-speech answers anonymously	by not costing any money at all	N/A ---
ease of access and its easy to use	questions should have clear answers at end	-
easy to use	help the professors track how every one is doing	make the questions reviewable
being able to do problem as a class then see the answers	have an app	
you don't have to buy anything	make an app	N/A -
engages me in class	it's perfect	we should use slido as review material at the beginning of class
ability to think and see how others think	none	none
everyone is engaged	explanation after each question, go back to the question to review	
simplicity	N/A	
free and easy, unlike the $300 clickers	buttons for math notation	
the ability to test understanding of the material before the test		
not sure	we get access to the sido questions on citlearn	
immediate feedback	N/A	N/A
working out problems	use questions from test	
multiple choice	looks good to me	-
the flexibility of the platform	Have student/course accounts, track progress. Not for grades but for professor developing lesson plans	
staying engaged	no way it is perfect	
keeps me thinking in terms of the class	it's perfect	
engaging	N/A b/c it's the best thing since sliced bread	N/A
seeing the correct answer		
multiple answers	class walkthrough or discussion	
comparing answers	yes	
it is engaging and allows for problem solving in class in a competitive manner	-	-
It's a more engaging way to review	Steal the Kahoot.it theme song.	N/A
The open poll and when you can see others answers		
Being able to see everyone elses answer and see what we need to work on	yes	it's a good interactive program we can use
You get to see classmates' answers		
anonymous	N/A	
I like how the questions force you to dig in your notes to look for the correct answer. This forces you to think for yourself and find the answer on your own.	We should have to use our names so that we can get points for answering correctly	N/A
I learn more than just a pop quiz or test	group feature	
it is free	show results in real-time	I'm used to plickers and prefer it, but slido isn't bad overall. One con is that I usually have a low phone battery, so it won't be long before my phone dies during a Slido question
I learn more		
The knowledge we get	new colors	
Knowledge gained	more colors	
I like the multiple choice questions, and the teacher has a good talking point in class	Simpler layout	
the ability to have the whole class	no	N/A
openness	N/A	N/A
being able to answer open ended questions	Not being able to see others answers until after the question is done	

quick return/response from teacher	-	if classes are too big it may not work very well
Quick	be like Kahoot	N/A
Anonymously	Showing the correct answer	It helps engage the class
you see what everyone thinks	Team challenges	No other comments
my class more exciting	N/A	N/A
group interaction	more user friendly	