Using Nearpod to Improve Engagement in the Computer Science Classroom

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Abstract

The objective of this quality improvement initiative was to determine if Nearpod, a tool for creating interactive presentations, would lead to improved student engagement in university level computer science classes. Today's students are constantly immersed in digital content, social media, interactive apps, games, and videos[1,2,3]. Students are accustomed to receiving information in a digital format in a way that is individualized to their interests. Social media platforms present them with material they will find relevant and engaging. From the educator's perspective, many of us have noticed a change in student attendance and behavior in the years following the COVID pandemic where education was primarily completed online[1,3]. Instead of putting the blame solely on the students, some of the responsibility should be placed on the teachers' shoulders if they have not adjusted their teaching practices to use technology in a way that enhances the classroom experience and meets students where they are in their educational journey[1,3].

Nearpod is a web based tool that can be used to create interactive course content as well as student based activities. As of the time of this paper, Nearpod is free for teacher and students and has additional features that can be purchased by school administrators. Nearpod has been mentioned in numerous articles as a top choice for teachers creating interactive lectures[4,5] and interactive lectures have been shown to improve student attention span[2]. The Nearpod tool allows teachers to intersperse polls, quizzes, fill in the blank, matching, collaboration boards, and other interactive exercises into presentations. I will use Nearpod for the presentation, so the audience can see the variety of activity types that Nearpod has to offer. The paper gives a few examples of how I used Nearpod for my computer science classes. The Nearpod tool has applications beyond computer science courses and could be used as a useful tool in many subjects and grade levels from elementary school to universities. Outside observations of my classroom as well as my observations from the teacher's perspective showed that students were more engaged and asked more questions during Nearpod lectures. During the Nearpod lectures students asked 2-3 times as many questions as the non-Nearpod lectures. Survey results showed that the students overwhelmingly rated Nearpod as helpful to their learning and material retention. Based on the results of the survey, Nearpod should be incorporated into all my computer science classes.

1 Introduction

Many students think of computer science as a difficult topic to learn[6,7]. Teachers struggle to convey the complex topics and dropout rates in introductory computer science courses are

high[6,7]. Teaching today is made even more difficult by the fact that modern students are often looking at their phones during class time. Some research suggests that students are less interested in textbook and whiteboard and instead are move motivated by content they can interact with like games[8,9,10,11]. Studies suggest that without active learning strategies, within 10-15 minutes of a lecture starting, there will be a decline in student attention[12]. Problems holding student attention seems to have worsened during the pandemic and teachers are reporting problems with engagement and attendance in today's classrooms[3].

The modern student has come to expect that educators will use technology to enhance their learning experience[1]. Students in a classroom that utilizes active learning strategies do better than those not utilizing active learning[12]. Research has shown the importance of using interactive technology in the classroom to keep students motivated and alert during class[12,13].
The class that I sought to improve was CS225, Computer Science II. Forty-six undergraduate students were enrolled in the course at the beginning of the semester. This course is the third undergraduate programming course in the series. The class makeup was software engineers, simulation science and games majors, and other engineering majors seeking a minor in computer science. The CS225 course meets five times a week. Three of the meetings are lectures and two are labs were the students complete programming exercises and receive help on homework assignments. In my attempt to improve the quality of classroom instruction in my CS225 classroom, I utilized Nearpod for one lecture each week.

2 Incorporating Nearpod in CS225

The CS225 Computer Science II course is structured with the three lectures a week given on Monday, Wednesday, and Friday, and the two lab classes on Tuesday and Thursday. I used interactive Nearpod lectures every Wednesday throughout the Fall 2023 semester. My first step to creating the lectures was importing my PowerPoint slides, the method I used to teach the subject in the past and the way I continued to teach Monday and Friday's classes. Then I would add audience participation activities approximately every three slides and delete the PowerPoint slides that covered the same material in a less engaging way. I was able to use many of Nearpod's activity types: Fill in the Blanks, Polls, Quizzes, Time to Climb, Matching, Video Insertion, Open Ended Questions, and Drawing Questions. Figures 1-3 below show examples of a few of the Nearpod question formats that I added to the lectures. After a few weeks of class, I would hear comments from students like "Yeah! Today is a Nearpod day."
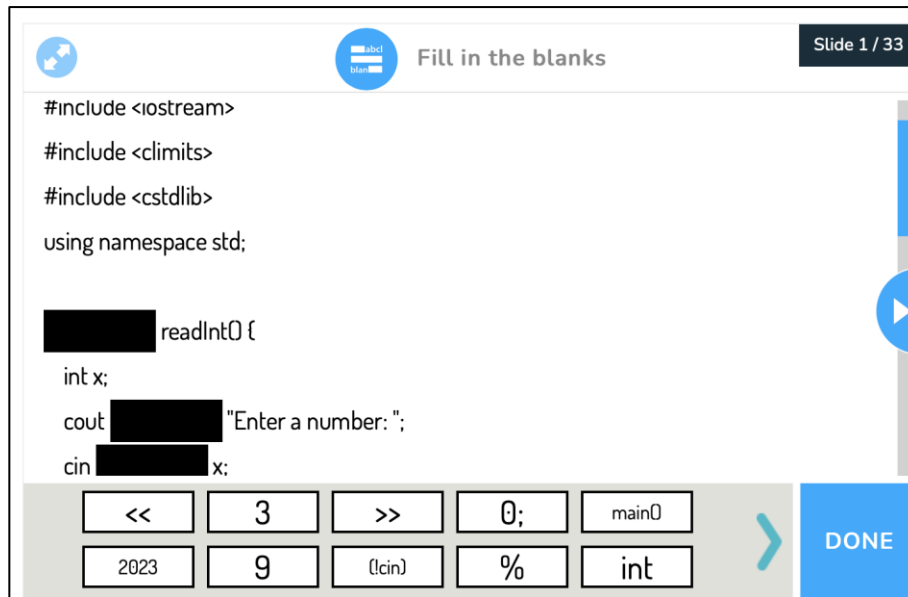
Figure 1: Nearpod Fill in the Blanks Activity

Nearpod allows the instructor to see aggregate student results in some cases and individual student answers for other question types. I found it very useful to get immediate feedback on how many students were following along with the lecture and how many were lost. This allowed me to customize the lecture based on what I was seeing in real time. For example, after I asked a poll or quiz question, I was able to see how many students answered with the correct answer. If most of the class answered correctly, I would move on to the next lecture topic. If I noticed a large percentage of the class answered incorrectly, I would take more time to explain the concept before moving on. At least once per Nearpod lecture, I would include an open-ended question like "Are there any questions about today's lecture?". Students could type whatever questions they had in an anonymous way.

Figure 2: Nearpod Drawing Tool
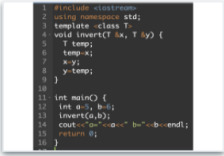
Figure 3: Nearpod Quiz

3 Student Perceptions of Nearpod

The students were surveyed about their perceptions of Nearpod during the mid-semester feedback and again during an end of semester feedback survey. Both surveys were optional and anonymous. The majority of the class polled said that Nearpod was helpful in learning and retaining the material. Figure 4 shows that 87% agreed or strongly agreed that Nearpod was helpful in learning and Figure 5 shows that 67% agreed or strongly agreed that Nearpod was

useful in retaining material. There was a small minority of the class that did not find Nearpod helpful in the class. Since the students responded so well to Nearpod, I wondered about incorporating it into every lectures. Figure 6 shows the results to a question about the ideal frequency of utilizing Nearpod in the classroom. Sixty eight percent of the students thought Nearpod was best used for occasional lectures while 32% thought it should be used for all lectures.

I believe utilizing Nearpod in class was helpful to my learning.

strongly disagree	2 respondents	6 %	
disagree	1 respondent	3 %	
neutral	1 respondent	3 %	
agree	15 respondents	48 %	
strongly agree	12 respondents	39 %	
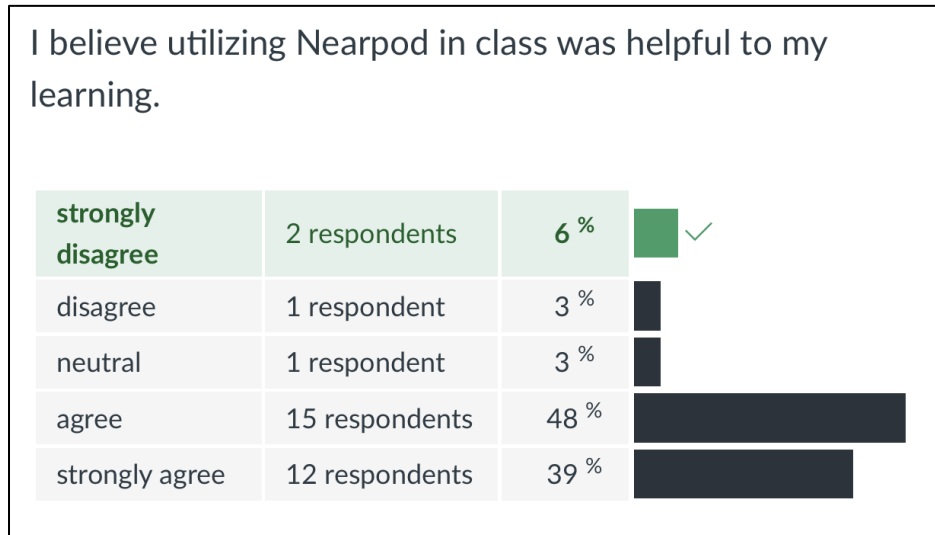
Figure 4 - Midsemester Nearpod Survey

Nearpod increased my retention of course material.

strongly disagree	2 respondents	6 %	
disagree		0 %	
neutral	8 respondents	26 %	
agree	10 respondents	32 %	
strongly agree	11 respondents	35 %	

Figure 5 - Midsemester Nearpod Survey

Nearpod should be used:

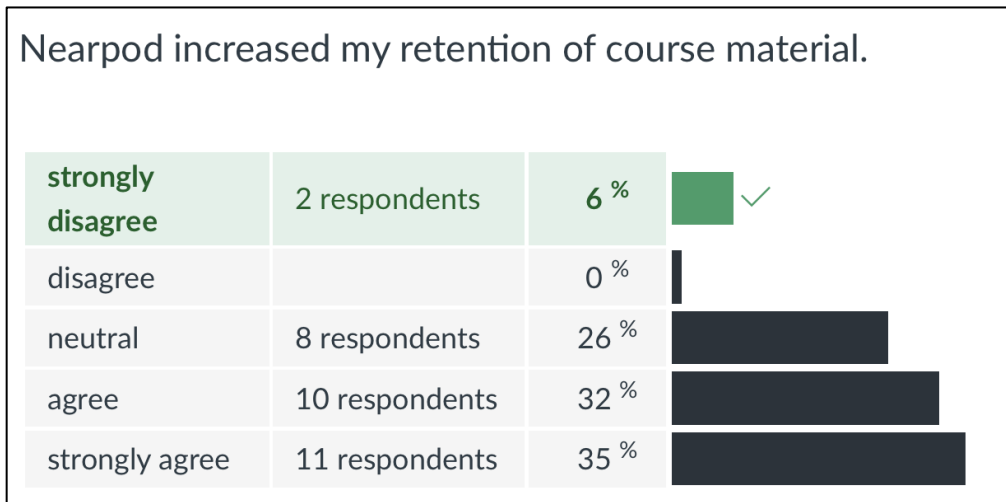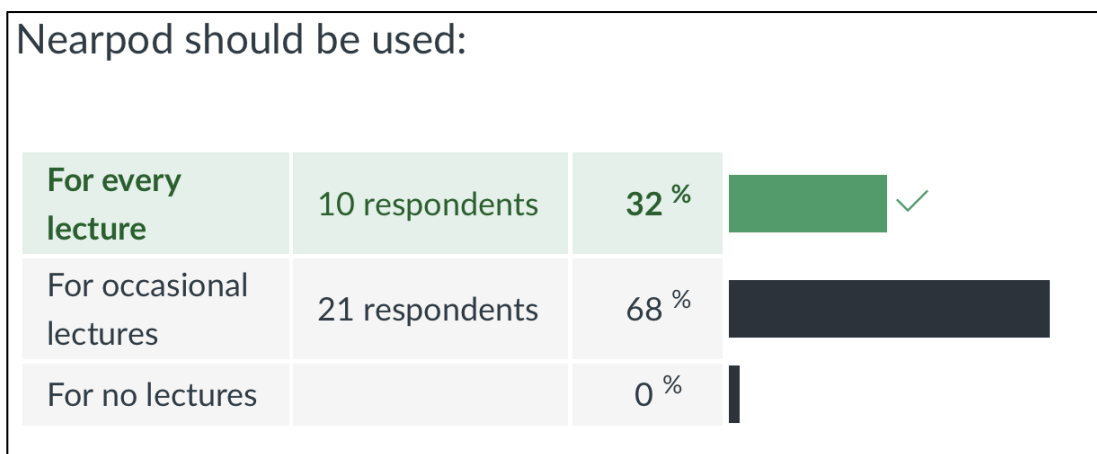| For every lecture	10 respondents	32 %	
For occasional lectures	21 respondents	68 %	
For no lectures		0 %	

Figure 6 - Midsemester Nearpod Survey

The end of the semester survey result were similar to the midterm survey results. In answer to the question "I found Nearpod enhanced my learning experience in this course", 89.6% of the students Agreed or Strongly Agreed. The end of the semester survey also contained an open-ended short answer question see Appendix A, asking users to "Please share at least one way that Nearpod positively enhanced your learning experience in this course". A few of the notable survey answers mentioned that Nearpod helped hold students' attention, keep them engaged and focused, and stay of track. A few of the survived students were neutral about Nearpod and one student was not a fan.

24 - I found Nearpod enhanced my learning experience in this course.

Response Option	Weight	Frequency	Percent	Percent Responses
Strongly Agree	(5)	16	55.17%	
Agree	(4)	10	34.48%	
Neutral	(3)	2	6.90%	
Disagree	(2)	1	3.45%	
Strongly Disagree	(1)	0	0.00%	

Figure 7 – End of Semester Survey

4 Instructor/CTLE (Center Teaching Learning Excellence) Perception of Nearpod

The University's CTLE (Center Teaching Learning Excellence) representative observed multiple lectures during the semester intentionally observing Nearpod lectures and non-Nearpod lectures to gain a better understanding of any differences. For the observations, our CTLE observer used the Classroom Observation Protocol for Undergraduate STEM (COPUS), which requires the trained observer to examine both student behavior and faculty behavior simultaneously. This protocol focuses on patterns of instruction and learning over the course of a given class session, with data collected continuously at two-minute intervals[14].

One surprising result was the difference in the number of student-initiated questions during the Nearpod lectures in comparison to the non-Nearpod lectures. Figure 8 shows that during the non-Nearpod lectures observed, students asked 2 and 5 questions. During the two Nearpod lectures observed, students asked 11 and 13 questions. The use of Nearpod seemed to encourage more

student questions and active participation. In addition to the increase in student questions, it was also noted that there was an increase in student-to-student questions. Students were more likely to ask questions to each other that invoked deeper discussions. This increase of questions and discussions helped students later demonstrate a better understanding of the content presented.
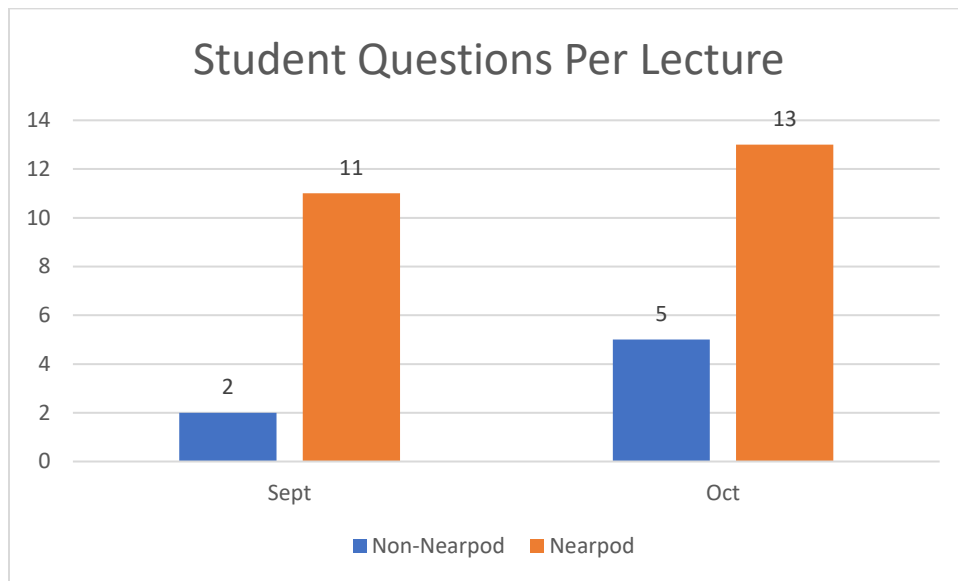

Figure 8 – Student Questions During Lecture

Based on the CTLE measurement of student engagement through observation at the back of the classroom, non-Nearpod lectures ranged from 25-64% high engagement and the Nearpod lectures ranged from 76%-89% high engagement. When students were more engaged in the learning, they also showed an increase of understanding of the material. This matches other research that shows that active learning will increase a student's attention span and understanding of the material[2],[16]. Students were given daily in-class activities to complete to showcase their understanding of the skills and topics taught for that class period. On the days students engaged in a class period with Nearpod, they asked for less support from the professor and the TAs when completing these tasks, giving an informal indicator that they understood the material better than on the class periods that they did not engage in Nearpod.

5 Conclusion

Overall, Nearpod use received very favorable feedback. As an instructor, I was able to see which parts of the lecture that students were understanding, and which areas required additional time and attention. Student engagement improved through the use of Nearpod. Nearpod is an example of using gamification and technology to improve the student classroom experience. I plan to utilize Nearpod in all my future Computer Science classes. Future research could be done to determine the optimal number of times during the semester to utilize the tool. Toward the end of the semester, I realized that there was a student paced setting on Nearpod that I could use to allow the students to review the lectures after class ended. That features eliminated my only concern about the Nearpod lectures, that I could not post them for students to review after class. Now that I know that feature exists, I will utilize it after every lecture so the Nearpod lectures become an additional tool that students can use when studying for quizzes and exams.

Appendix A - Student feedback to opened ended question given in the end of the semester survey.

25 - Please share at least one way that Nearpod positively enhanced your learning experience in this course.	
Response Rate	20/44 (45.45%)

• More interactive/held my attention.

• The quizzes in the middle helped keep me engaged in the lecture and tested if I did understand the concept completely

• It forced me to be engaged with lectures in class, which is something I struggle with in a lot of classes

• Keeps me focused during lectures.

• It kept me engaged during the lesson by having little activities to complete during the lecture.

• Encourage focus on lecture

• It forces students to contribute and focus on the material, or at least facilitates these things.

• Interactivity really helped with trying to determine the right answers

• Getting to test small bits of knowledge through out the lecture really helped me I think.

• The small quizzes in between the slides were useful. But I dislike most of it.

• It makes it easier to keep your focus during class and gives you a better understanding of your skills and how well you understand course content during the lecture. Sometimes its easy to think you understand what's going on in a lecture just to make many mistakes on the homework. Nearpod provides some opportunities to make those mistakes in class and learn from them without having to go out of your way to ask questions or go to office hours.

• I think the matching and the fill-in-the-blank minigames were most helpful to my knowledge

• Nearpod forced me to pay attention at times I wouldn't have otherwise.

• It allowed me to engage with the class without having to draw attention to myself.

• easy to learn

• Kept engaged!!

• Nearpod was very interactive. It helped me to stay focused.

• Having space to respond to a question or post to a discussion board helps me to stay engaged.

• I am personally not a fan of Nearpod, especially as a way of taking attendance. Personally, this is university. There should not be a requirement to attend every class excepting demerit. The students are invested in their own education, and will do as they believe necessary to accomplish their goals. That is one of my only issues with the course.

• It was a fun way to stay on track with the class. It was helpful for review

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