Faculty and Student Perceptions of Plickers

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Abstract

Plickers is a novel, robust, low-cost, audience response system. The Plickers system requires access to the Plickers website, an instructor smart phone with camera and Plickers app, and a Plicker card per student. Each Plicker card has a unique, simplified QR-style design labeled A, B, C, and D on each side. During class, the instructor uses his or her phone to present a multiple choice or true-false question to the class through the Plickers website. The students then hold up their Plicker cards with their indicated answer at the top of the card. The instructor uses his or her phone camera to scan the room, recording an answer for each student. The Plicker technology has facilitated an enjoyable interaction between professors and students in statics, dynamics, and surveying lectures. This paper describes the Plicker technology, the experiences of assistant professors implementing the technology, and student-perceptions of the Plickers learning experience.

Keywords

audience response system, clickers, student interaction, quiz method

Introduction

Teaching in engineering has always involved an aspect of question and answer between the instructor and student. In traditional lecture courses at the university level, instructor-driven interaction is typically limited to informal verbal questions and more formal written quizzes and exams. In the last two decades, the proliferation of computer technology in the classroom has permitted the use of various audience response systems (ARS) to facilitate the asking of questions during the lecture. Plickers is a novel ARS powered by widely-available instructor-controlled computer technology and printed student response cards. This paper describes the Plickers technology, the experiences of first year assistant professors implementing the technology in civil engineering courses at The Citadel, and the results of student surveys about their Plickers learning experience.

Instructors have long used the written pop quiz to encourage prepared class attendance. ARSs are typically implemented using proprietary clickers or smartphone apps and facilitate immediate feedback from students. The benefits of asking questions during a lecture and receiving immediate student feedback is well-documented. Instructors can see past "the vocal minority" that easily skews his or her perception of overall class comprehension [1]. Active, in-class quizzes can encourage student engagement and allow the instructor to assess student attendance, preparation, formative learning, and educational outcomes [2]. Establishing two-way communication between each student and the instructor keeps the students alert and engaged throughout the lecture [3]. The Plickers technology provides all these benefits, but also overcomes short comings of other quiz technologies.

Materials and Method

Plickers is a new ARS. The strength of Plickers is the simplicity of the student component, a printed card. A typical printed card is a half-page with a unique, simplified QR-style design as seen in Figure 1. Each side of the QR design is labeled A, B, C, and D, with a unique card number in the corners. Each student only interacts with his or her Plicker card. Plickers provides 63 plicker card patterns that may be purchased online or printed from free PDFs. The remain potions of the system are completely managed by the instructor.

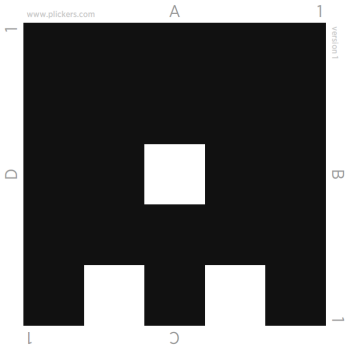


Figure 1. Example Plicker card.

Prior to class, the instructor must create an account and setup both the class and questions on the elegant Plicker website, plickers.com. First the instructor creates the class and optionally enters student names for assignment to Plicker cards. Student names can be efficiently entered using a single copy and paste operation from a class roster. A Plickers roll can then be generated indicating each student and their Plicker card number. The instructor may repeat the process, creating and populating multiple classes. The net result is that each class has a student assigned to card 1, another student to card 2, and so on. This allows the instructor to distribute and recollect one set of cards for all classes. More appropriately for the college-level, the instructor can provide each student with a card, asking them to write both their name and class with section on the back of the card. The instructor then maintains a single Plicker card set to provide students with cards should they forget to bring their own card. The low-cost, low-tech and ease of replacement and reuse of the student component overcomes the common challenges of electronic clicker-driven ARSs including student cost, dead batteries, missing clickers [2], and connectivity issues [4]. Additionally, students do not directly interact with the website in or out of the class illuminating the excuse of student technical difficulties.

Second the instructor uses the website to create a Library of Plicker questions as seen in Figure *2*. A simple form is used to capture a question in text and two or four responses. The correct response or responses can be identified and an image can be uploaded along with the question. On the website, questions can be sorted using a system of somewhat clunky folders (seen in the left side bar in Figure *2*), or found using a search feature. Each question can then be sent to the "Question Queue" for each class (shown in the right side bar of Figure *2*), essentially a playlist of planned questions organized by class. Questions can be queued for multiple classes and even repeated within the queue for a single class. With the class setup and questions queued, the instructor is ready for the classroom.

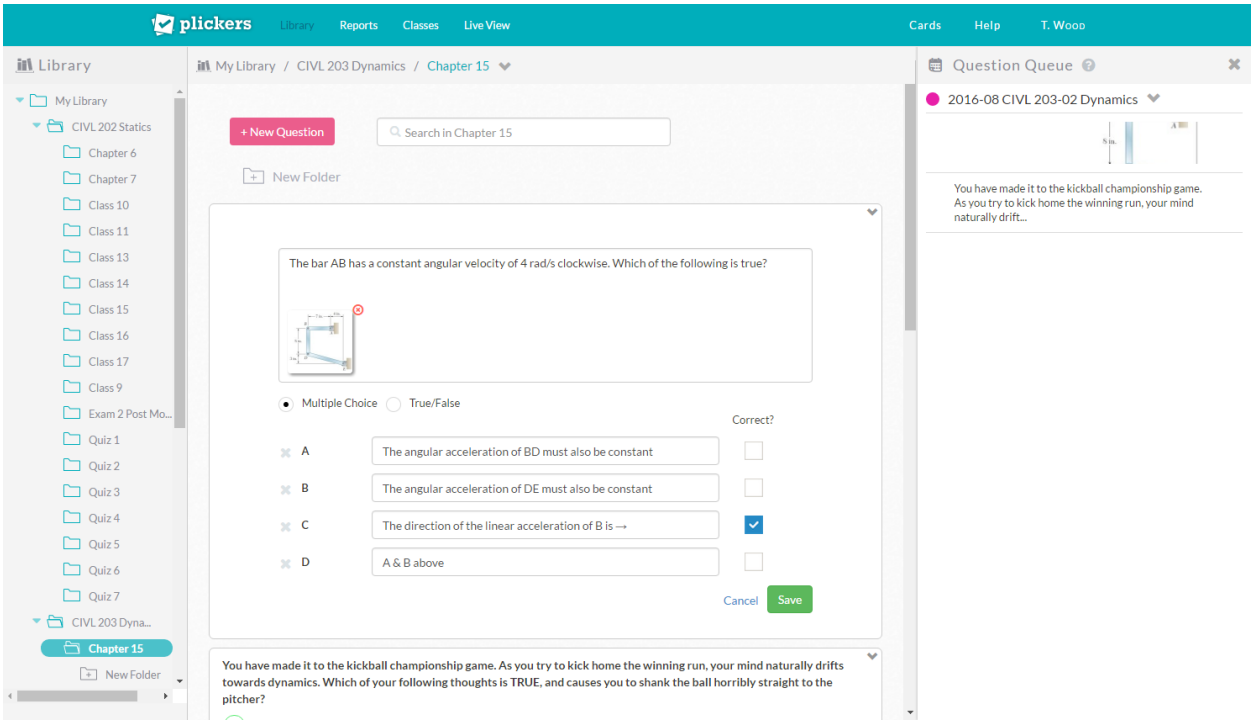
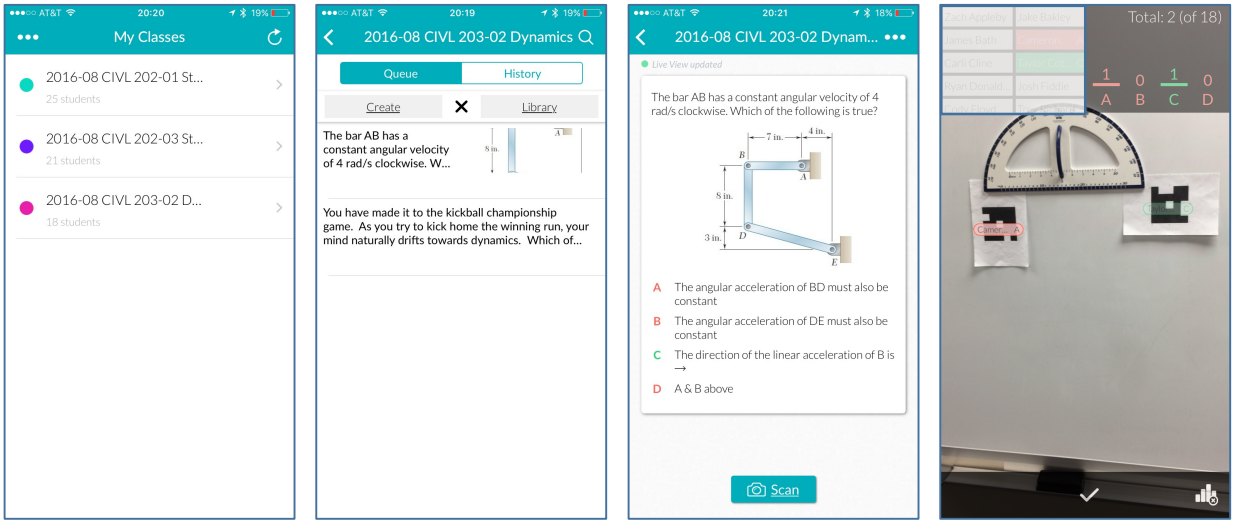
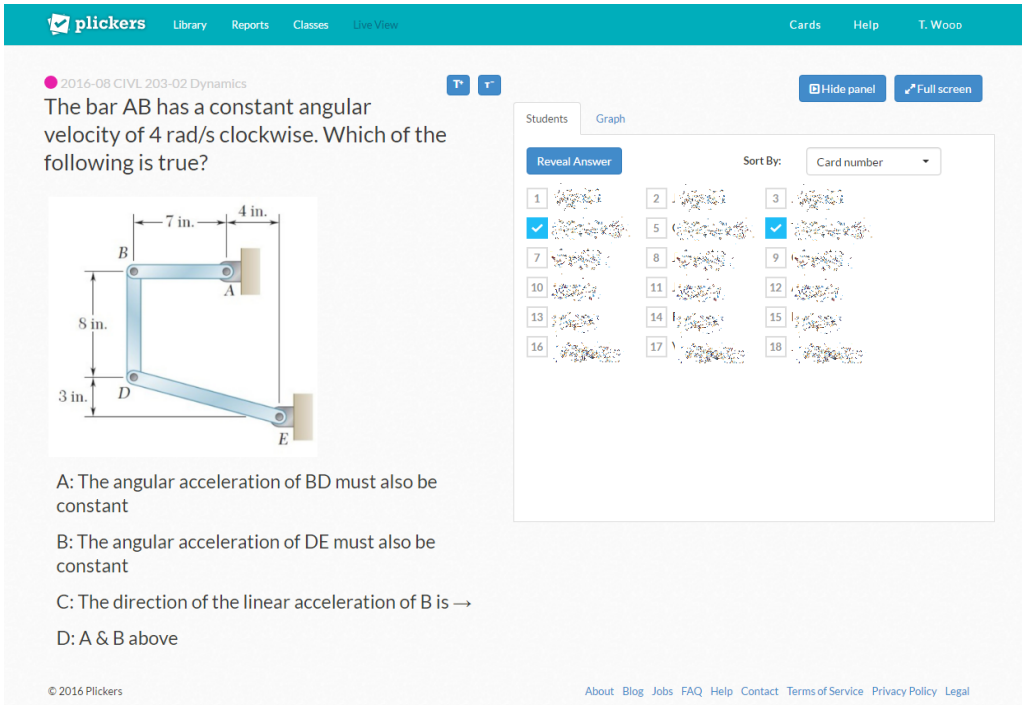


Figure 2. Plickers Library screen capture.

Three components are required for the classroom: (1) Plicker cards for each student, (2) an instructor smart phone with camera and Plickers app (available for both iOS and Android), and (3) an internet-connected computer with projector screen and web browser. The instructor navigates the on-screen computer web browser to the Plicker website's "LiveView". The instructor then opens the Plickers app on their phone, selects the current class (Figure *3*(a)) and selects a question (Figure *3*(b, c)). The question then automatically appears in the computer's web browser as seen in Figure *3*(e). On the right, each student's name and card number appears (blurred in the image to protect student identities). The students read the question, decide their response, and hold up their card with the image facing the instructor and their selected letter response at the top of the card. The instructor taps the scan button in the phone app and observes the student responses through the phone camera. Over the camera image of the card the screen shows the student's name, response, and whether or not the answer is correct (Figure *3*(d)). This provides immediate feedback, similar to flash cards, allowing the instructor to put a name and face to correct or incorrect answers and direct learning more carefully, all while maintaining the privacy of the student's response and freedom to be wrong without fearing peer-judgement [2]. The LiveView updates as the instructor scans the room alternatively showing which students have recorded responses, revealing what those responses are, or showing a bar chart of responses by A, B, C, or D. If a student decides to change their answer they can simply hold their card up again during the scanning phase. The instructor sees on the phone an immediate record of who has answered, how they answered and the percentage of correct answers scanned. The instructor can then close the question on his or her phone and select the next question or continue with the lecture.



(a) (b) (c) (d)



(e)

Figure 3. Plicker interface screenshots during quizzing: (a) course selection, (b) Question Queue, (c) selected question, (d) scanning view, (e) LiveView with active question.

Once the class is over, the instructor can review student responses on the website in two ways: (1) a question history shows student responses one question at a time, or (2) a scoresheet view tabulates all questions for a particular calendar range. The scoresheet includes summary statistics by student and question and can be downloaded as a comma-separated file for integration with a

traditional electronic gradebook. Additionally, the scoresheet serves as an easy attendance record.

Plickers is novel, robust and easy ARS. The technology implements extremely low-cost student components and readily-available instructor components to achieve a similar outcome as proprietary clickers-receiver-software ARSs. The Plickers website provides a cloud-based store house for quiz questions, and a permanent record of both class attendance and instantaneously-graded quiz performance. Compared to written quizzes and button-based clickers, Plickers quizzes encourage more movement (oddly humorous attempts at getting the correct answer at the top of card are not uncommon), a heads-up posture, and varying degrees of verbal and non-verbal communication with classmates and the instructor. The physicality of responding to a Plickers quiz question serves to reset attention and focus during the lecture, and promotes active participation in the class [2]. Plickers has served as a valuable tool to the authors in teaching sophomore and junior level statics, dynamics, and surveying courses at The Citadel.

Faculty Perceptions

The authors of this paper have implemented Plickers in various ways in their courses. The first author started each statics or dynamics class with a brief quiz over reading assignments in an attempt to encourage students to read the textbook before class. The mood during the initial Plickers quiz is typically fast paced and excited, focusing the students on the topics for the day while establishing a heads-up, interactive posture toward the instructor. Sadly, student response in these initial reading quizzes was typically poor. So later in the lecture, typically immediately following the introduction of the relevant topic, the questions were repeated, allowing the student to presumably improve their quiz score with an easy correct answer or the instructor to see the number and identity of students still struggling with the process. These mid-class repeated questions encourage a reset in student focus during what was otherwise simple direct-instruction.

The second author implemented Plickers quizzes in two surveying classes as part of a larger system of formative assessment including in-class assignments, group work, and written quizzes. Plickers quizzes were primarily used to evaluate student retention of pertinent concepts from previous classes. A paper survey providing feedback on instruction methods had positive feedback on Plickers. For the open ended question asking “what you like about the class”, one-third of the respondents liked participating in Plicker quizzes. This was more than all the other class activities combined. For the open ended question asking “what you do not like about the class”, only 8% of respondents preferred paper quizzes to the Plickers quizzes. The rest of the respondents had other comments not related to Plickers.

Student Perceptions

Approximately two-thirds of the way through the semester, a Plickers quiz was administered to two statics classes of mechanical engineering sophomores, a dynamics class of civil engineering juniors, and two surveying classes of mechanical engineering sophomores. Of the 114 complete student responses, the majority were very positive. Due to the maximum of four responses provided by Plickers, a modified Likert-scale was used that eliminated a neutral response as seen in Figure *4*. When asked if the consistent use of Plickers quizzes at the beginning of class encourage pre-class preparation such as reviewing previous notes or reading the text book, 92%

of students were encouraged to study. However, the lack of a neutral response and poor reading quiz performance suggest that the Plickers quizzes were not adequate motivators for prepared class attendance. But when asked if Plickers encouraged active participation in the class 63% of students were strongly encouraged to participate with another 33% feeling slightly encouraged. Only 4% of respondents felt that in-class participation was discouraged by the Plickers quizzes. A full 98% of students felt that Plickers quizzes encouraged their learning in the class and with 88% of respondents hoping that other classes and instructors would implement Plickers. This response made it clear that students enjoyed Plickers and found it to be a meaningful addition to their learning process.

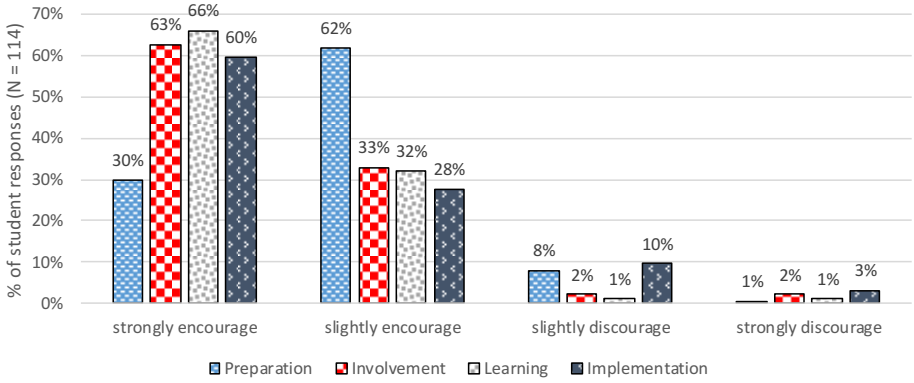


Figure 4. Student responses to perception questions concerning Plickers.

Student preference for Plickers against other quiz taking methods was also surveyed. Figure 5 shows that 83% of respondents preferred Plickers compared to written, paper quizzes. This preference was also shared by the authors who valued the faster pace of the Plickers quiz and the immediately graded results. When compared to other electronic, clicker-based, ARSs, 60% preferred Plickers. Verbal comments for students indicated they valued the low-cost, hassle free nature of Plickers compared to mandatory clicker purchases and registration codes of the electronic systems. Only 9% indicated that they would prefer paper or electronic quizzes instead of Plickers. Overall, the student response was again, very positive toward Plickers.

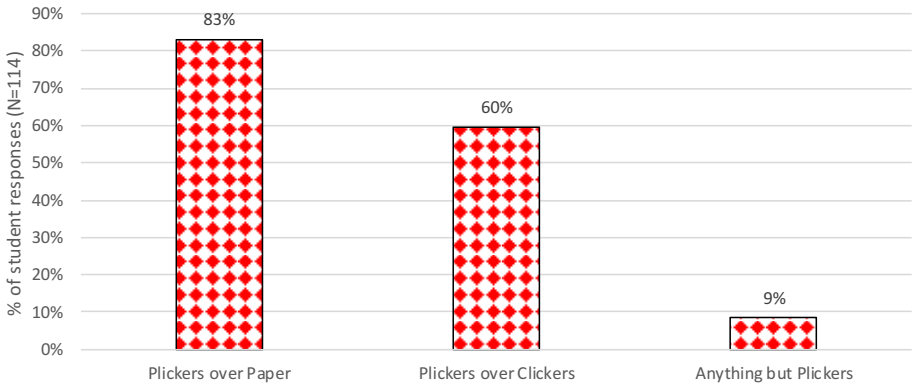


Figure 5. Student preference for Plickers compared to other quiz methods.

Conclusion

This paper has described a novel, low-cost, robust ARS called Plickers. Instructors have found it easy to use and maintain adding a helpful interactive and formative question component to their classes. Student responses from statics, dynamics, and surveying courses at The Citadel are also very positive toward Plickers.

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