Final course grades get a strong boost when iClicker is used in an elementary Statistics class

Macmillan Learning partnered with an Elementary Statistics instructor at Merced College to examine how using iClicker in their course is related to student academic performance

iClicker

Achieve more. | www.macmillanlearning.com/learningscience

macmillan learning

About iClicker

iClicker is built on the science of active learning. A synthesis of educational research in the areas of effective active learning, formative assessment, and interactive learning guided the development of iClicker. With its simple, reliable technology and focus on pedagogical content, iClicker makes it possible for instructors to take attendance, engage students in all sized classrooms and lecture halls, and use the students' responses to decide which topics to emphasize.

iClicker is a flexible solution that can adapt to an instructor's pedagogical approach. A 2017 implementation study identified the "engagement model" as one of the most often implemented approaches. In this model instructors write their own iClicker questions, pose the question to the class and ask them to respond. Responses are used to gauge understanding and spark classroom discussion. Students receive credit for participating in the iClicker activity and in some cases the responses are marked as correct or incorrect. The goal of this model is to increase comprehension and understanding through engagement.

Institution and course context

Merced College is a community college offering associate degrees and certificates both in person and online. The institution serves over 14,500 students with one main campus in Merced, California, and one regional campus. This Elementary Statistics course was taught face-to-face to 37 students. Students met twice a week and were expected to keep up with their reading and assignments throughout the week. The instructor has been teaching for 11 years and has been teaching in this specific department for six-and-a-half years. The instructor has used digital learning tools in the past and has been extremely comfortable implementing them.

Course challenges and goals

This instructor's goal was to find a tool that would provide a measure of student understanding and mastery, help engage students, and allow for better management of class pacing. The instructor also wanted to find a tool that allowed students to receive immediate feedback.

iClicker use case

The instructor used the participation and performance iClicker implementation models—in that the instructor presented questions to encourage participation but checked content mastery through student performance answering the questions. The instructor used a flipped classroom teaching technique, and iClicker questions guided classroom instruction. The instructor assigned text for the students to read prior to class. During class, the instructor presented iClicker questions related to the

"iClicker REEF has completely transformed my classroom into a dynamic two-sided environment."

- Instructor

text to students, and as a group, they solved and discussed the questions. Students were required to answer the questions correctly to receive a point. All iClicker points were totaled over the course of the semester for a quiz score that counted toward a student's final course grade. The instructor also used iClicker responses to track attendance, but a student's attendance was not included in their final course grade. The instructor presented iClicker questions in 71% (24 out of 34) of the classes, with a total of 139 iClicker questions presented over the course of the semester. Twenty-two percent of the questions were multiple-choice, 5% were short answer, 1% were target, and 72% were numerical.

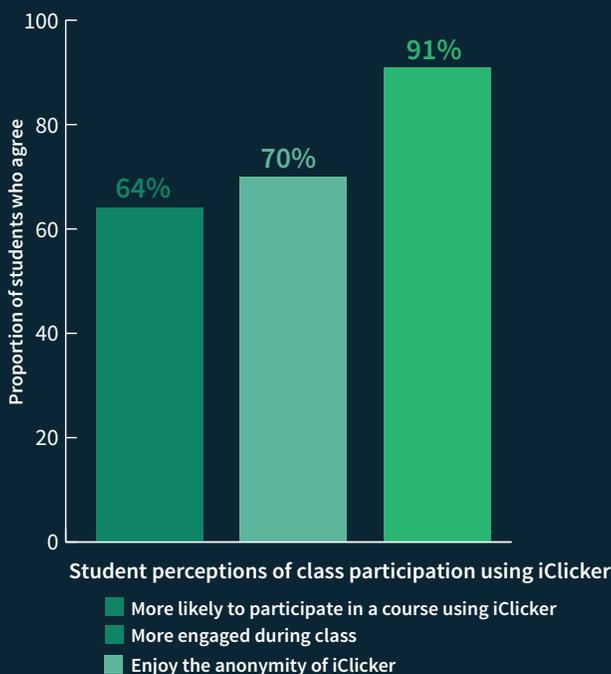### Figure 1. Student perceptions of using iClicker
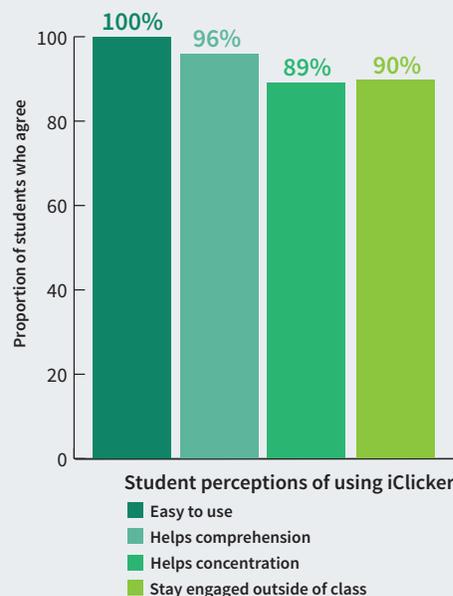
100% of students in the study reported that iClicker is easy to use, 96% said that the immediate feedback they receive helps them better comprehend the coures material. 89% of students say that using iClicker helped them concentrate in class

Legend:
- Easy to use
- Helps comprehension
- Helps concentration
- Stay engaged outside of class

iClicker Reef increases student participation and engagement.

Both the instructor and students reported that iClicker Reef increased student participation in class. Sixty-four percent of students said they were more likely to participate in a class that uses iClicker than a class where they must raise their hand to participate. Ninety-one percent of students said they enjoyed the anonymity iClicker provides. The instructor also reported that iClicker helps ensure each student takes part in discussions.

Seventy percent of students reported that they were more engaged in class material because they used iClicker Reef. Students rated their overall engagement levels as higher than average (3.82 on a 5-point scale). Students were asked to share their favorite iClicker feature in an open-ended question, and several students said they enjoyed asking and answering questions with iClicker. Students also reported that iClicker helped them compare answers with fellow classmates and that iClicker is efficient and encourages engagement in the classroom. Many students reported that they wished other instructors would use the tool.

Figure 2. Student perceptions of class participation using iClicker

Student perceptions of class participation using iClicker
- More likely to participate in a course using iClicker
- More engaged during class
- Enjoy the anonymity of iClicker

" iClicker Reef is the best formative assessment tool that I have used not only for the ease of use but also because of the variety of question types and applications that are available."
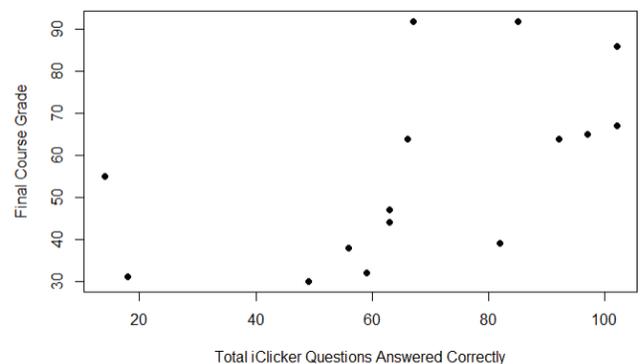
- Instructor

iClicker Reef is related to student academic performance.

There was a strong, significantly positive relationship (.738) between the number of iClicker questions students answered correctly and their performance in the course. Students who answered more iClicker questions correctly tended to have a higher overall course grade.

Conversely, students who answered fewer questions correctly tended to have lower course performance. There was also a significant positive relationship (.763) between the mean percentage of iClicker questions answered correctly over the course of the semester and student performance.

Figure 3. Relationship between number of iClicker questions answered and final course grades

Insights for Optimization

The instructor has provided insightful feedback on several features to integrate into iClicker Reef. The instructor wishes iClicker Reef could run on any operating system and would prefer it run directly from the internet without the desktop app. The results of this study have generated recommendations for the iClicker Reef product team.

Insights for Instructors

One of the most critical findings from this educator study is the strong positive relationship between the amount of iClicker questions answered and student course performance. As students participate more in the lecture by answering the instructor's iClicker questions—regardless of whether their responses are correct—student course performance tends to increase. Students believe that use of iClicker increases their active participation during lessons. Therefore, instructors in similar educational contexts might consider increasing the number of iClicker questions presented in class to increase overall student performance.

Study design

Clicker usage was documented through platform data along with mid-semester observations of classroom implementation and instructor interviews. Student learning data were collected at the end of the semester via course records shared by the instructor. End-of-semester surveys were used to gather data on instructor and student perceptions of the product along with student engagement. Data were matched across sources, and descriptive and correlational analyses were conducted.

Study limitations

Although the data are rich and the findings important for product optimization and insights for instructors, they are specific to this course and cannot be generalized to all instructors who use iClicker Reef. The results are also descriptive and correlational and should not be used to infer causation.

Amplifying the IMPACT

Research on iClicker suggests that trying these strategies may increase the positive impact of iClicker

1. Ask more in-class iClicker questions
this is related to higher final course grades

2. Mark responses as correct or incorrect and incorporate scores into student grades
this drives engagement

3. Share the distribution of results and discuss trends that stand out
this helps to fill skills gaps and correct any misconceptions

4. Explore peer-to-peer discussion of results
this drives engagement and comprehension

Ethics and Data Privacy

Prior to data collection, this study and the associated consent forms and instruments were reviewed and approved (found exempt) by the Human Resources Research Organization (HumRRO). HumRRO is an accredited third-party Institutional Review Board organization with no affiliation with Macmillan Learning. Macmillan Learning seeks third-party review to eliminate any bias in decision of exemption. The data in this study, which are provided by the instructor and consenting students, are initially identifiable. However, once a random identifier is generated identifiable data are destroyed. Data are provided in secure storage locations, and access is permitted only to the primary investigator in the study.

Note: These results are part of a larger iClicker Reef comparison study across multiple institutions. To access the full report and results, please visit http://www.macmillanlearning.com/catalog/page/learningscience.