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The Effects of Student Response System in University Foundation Courses

A Research Note from Grace Tuttle

In a quasi-quantitative study of the experimental and control groups of iClicker in university foundation courses, the results indicated some of the key findings:

Key Findings:

• Students from the experimental group (iClicker group) indicated they were more likely to get a higher final course grade than the non-iClicker group by a factor of 1.3

• Students from the iClicker group who self-identified as female indicated they were more likely to get a higher final course grade than male students by a factor of 1.8

Background

Tuttle (2021) conducted a quasi-experimental quantitative research on the effects of Student Response Systems (SRS) in the university foundation (UF) courses at Boise State University. The purpose of the research was to analyze the effect of iClicker use and whether it had significant impact on learning performance based on final course grades controlling for other independent variables such as age, gender, state residency, admission index, and participation. Student academic performance as measured by final grades, was compared between the experimental and control groups. Overall findings show there was a significant difference between students who used iClicker and students who did not use iClicker.

Treatment

iClicker Cloud, a student engagement platform or SRS from Macmillan Learning, was the technology in use for this research. This system is available on students' mobile devices, tablets, laptops, clicker remotes, and iClicker bases that were plugged into the existing classroom computers. The iClicker Cloud software was downloaded from the iClicker website. iClicker bases and instructor remotes were available at no cost to the departments and colleges.

Participants

There were a total of 7,812 students enrolled in university foundation (UF) courses between spring 2017 and fall 2019. The demographic characteristics of participants included 4,268 students who identified as female (54.6%), 3,543 students who identified as male (45.2%), and 1 student who did not report gender (.0%). The available data offered choices as male or female.

Students enrolled in university foundations courses where instructors who utilized iClicker in their classrooms were part of the experimental group. Students enrolled in UF courses where instructors did not use active learning strategies with iClicker and instead taught using passive learning lecture format were part of the control group.

Students who got Pass/Fail, incomplete, audit, unsatisfactory audit, and withdrew during the years of 2017-2019 were excluded from this study because students did not get a letter grade of A through F. The University uses a 4.0 grading scale and calculates grade-point averages. Students who repeated were excluded as they could have an advantage because of prior knowledge and understanding of the course material, teaching format, and/or methods over students who were taking the class for the first time. Students who were enrolled in online UF courses between spring 2017 and fall 2019 were excluded from this study because the iClicker technology did not have the flexibility to create pathways for student engagement and active participation asynchronously during those academic years.

Data Analysis

This study was designed to explore the relationships between iClicker use, student demographics, high school academic performance, and final course grades. Different analyses were used to explore these relationships. Univariate analyses were used to describe and find patterns that exist within the data. It examined the data using bivariate analyses, reported cross-tabulations and frequency distribution of the variable, listing the values acquired in the sample. It also examined multivariate analyses to determine which variables influence the outcome variable. The three measures of central tendency were used to calculate the mean, median, and mode of specific variables. The measures of the center and spread were used for estimating and predicting when analyzing univariate data. Chi-square, correlation, Welch and Brown-Forsythe t-test, analysis of variance (ANOVA), independent t-test, and logistic regression were used as measurements or tests to explore these relationships.

In this study, logistic regression was used to test if iClicker use significantly affected the final course grade which was the dependent variable. It measured the relationship between a binary outcome variable and combination of predictor variables (demographics, class academic performance, and high school academic performance) by estimating probabilities using a Log (p/(1-p).

Results

Results from the simple model of logistic regression analyses controlling for some variables indicate the likelihood of getting a final course grade of A or B is 1.3 times greater if students were using clickers versus not using clickers.

Results from these analyses also suggest that from the iClicker group, the likelihood of getting a final course grade of A or B is 1.8 times greater if you are female than if you are male.

Likelihood of Receiving a Final Course Grade of A or B with iClicker Use
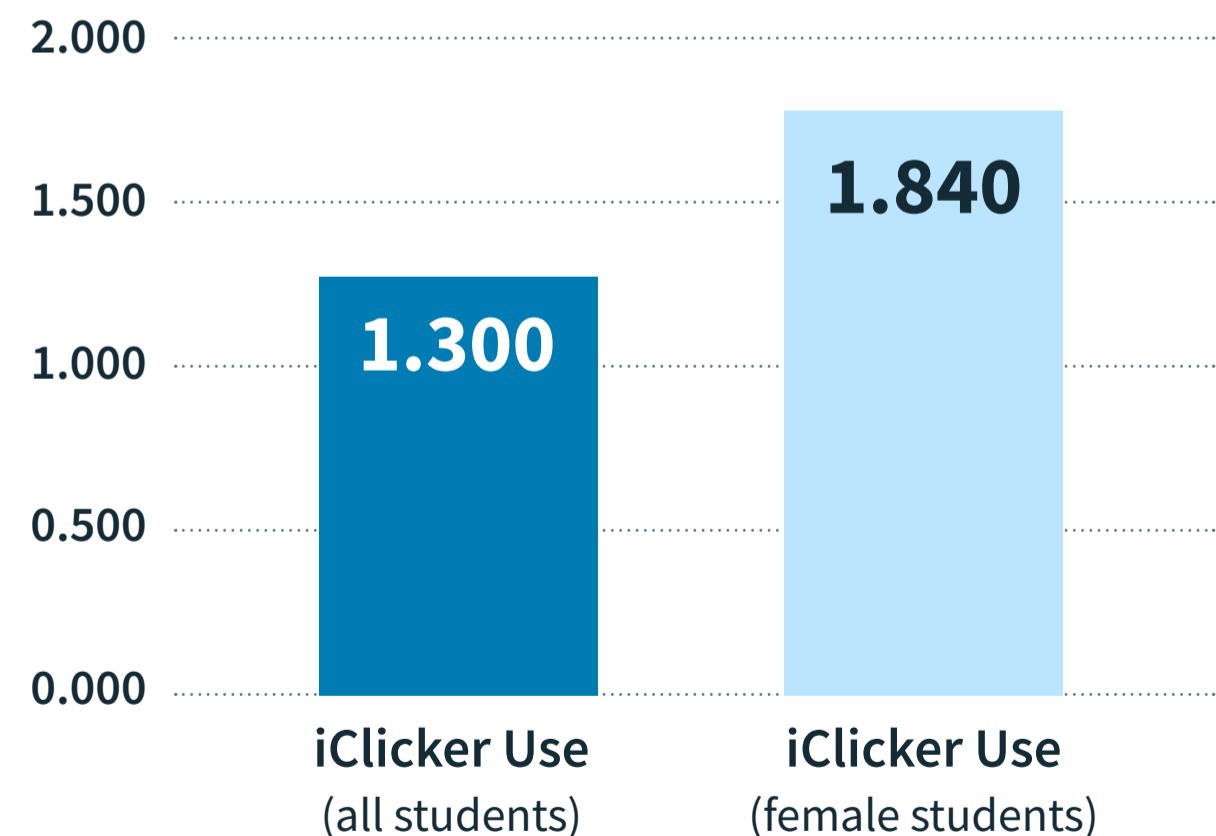
*Note: The available data only offered students female and male as gender

Discussion

The results from the research conclude that integrating iClicker into their learning systems and teaching practices positively improves the student learning process. It is important to put an in-depth understanding of the techniques behind the effects of student response systems on learning performance.

The results from the regression analyses indicated this study found some evidence to suggest the use of SRS in a large, college-level UF class contributed to student academic performance measured by final grades. It appears the use of iClicker supports generative learning because when students answer questions, they are encouraged to select relevant information and integrate it with their prior knowledge, thereby,improving academic performance measured by final grades.

Limitations

The researcher chose to conduct this study at the institution where she was employed, as it was practical, convenient, and accessible. Due to the nature of the study, the design did not use random assignment of students in constructing experimental and control groups. The entire class of students were assigned to groups when they enrolled in their respective courses.

With a large sample size of 7,812 for this study, the population was broadly defined as students who were enrolled in UF classes between spring 2017 to fall 2019. Furthermore, the results might be generalizable only to this institution. The shortcoming of this research was a failure to capture the contextual experiences of instructors and students. The researcher did not send out survey instrumentation. Because the researcher had access to the primary data, the researcher gathered minimum materials from the students and instructors, focusing more on attendance, performance, and participation scores that were available from the iClicker Cloud and Learning Management System gradebooks.

Photo credit: Prostock-studio

Future Research

Future research should examine the effects of the student response system on student learning by including other student characteristics like course themes or topics, study major, midterm exam, final exam, freshman, sophomore, junior, and senior, and capture the live experiences of faculty members. This would increase the ability to generalize the model at this university and other universities.

Additionally, future research should consider student participation using iClicker asynchronously. This would allow students to measure their understanding of the homework and collectively work on the same questions while receiving immediate feedback and evaluating team members, by employing team-based learning. This will also allow students to work through at their own pace and provide lightweight student assessment.

Ethics and Data Privacy

Institutional Review Board (IRB) approval was obtained for this research. The University's Office of Institutional Research (IR) provided historical and current data on matriculated students. IR collected student data that included demographic variables, admission index, state residency status, and final course grades. A computing system was used for the data analyses. The University's network drive was utilized to store the initial data collection. After the data were stripped of student-identifier information, the dataset was saved and any original datasets containing student-identifier information were deleted to comply with IRB guidelines.

The researcher had administrator privileges for both iClicker Cloud and Blackboard Learning Management System and collected students' identification numbers assigned to each student that matched the participation and attendance data from iClicker Cloud and Blackboard Learning Management System. The data from IR and the researcher's data were combined. Once the data were combined, all identifying data were removed before analysis.

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