

# Do 1<sup>st</sup> Day Challenge Activities & Study Skills Instruction reduce statistics anxiety in an Undergraduate Introductory Statistics Course?

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## Introduction

Many colleges and universities require undergraduates to take an introductory statistics course. Poor engagement, low content confidence, and limited learning in required, undergraduate, introductory statistics classes is a problem.

### Attitudes Toward Statistics

- Many people worldwide have negative attitudes toward quantitative research methods (Murtonen, 2005).
- Anxiety about statistics courses at university is well documented (Pretorius & Norman, 1992; Townsend, Moore, Tuck, & Wilton, 1998).
- Mathematical, statistical, and quantitative subjects are perceived to be more difficult than other subjects (Murtonen & Lehtinen, 2010).

### First Day Experience

- Teaching advice frequently stresses importance of first day on motivation and achievement (Lang, 2022; Anderson, McGuire, & Cory, 2011)
- Positive first-day experiences result in higher motivation and grades than negative first-day experiences (Wilson & Wilson, 2007).

### Study Skills

- Good study behaviors predict academic success (Crede & Kuncel, 2008; Karpicke & Roediger, III, 2008).
- Many students need to learn basic cognitive principles to become effective college-level learners. (Chew S.; Karpicke & Roediger, III, 2008).

**This study explores the effect of first day of class activities and study skills instruction on students' statistics anxiety and grades.**

## Statistics Anxiety Scale (SAS) $\alpha = .92$

### The SAS measures three constructs

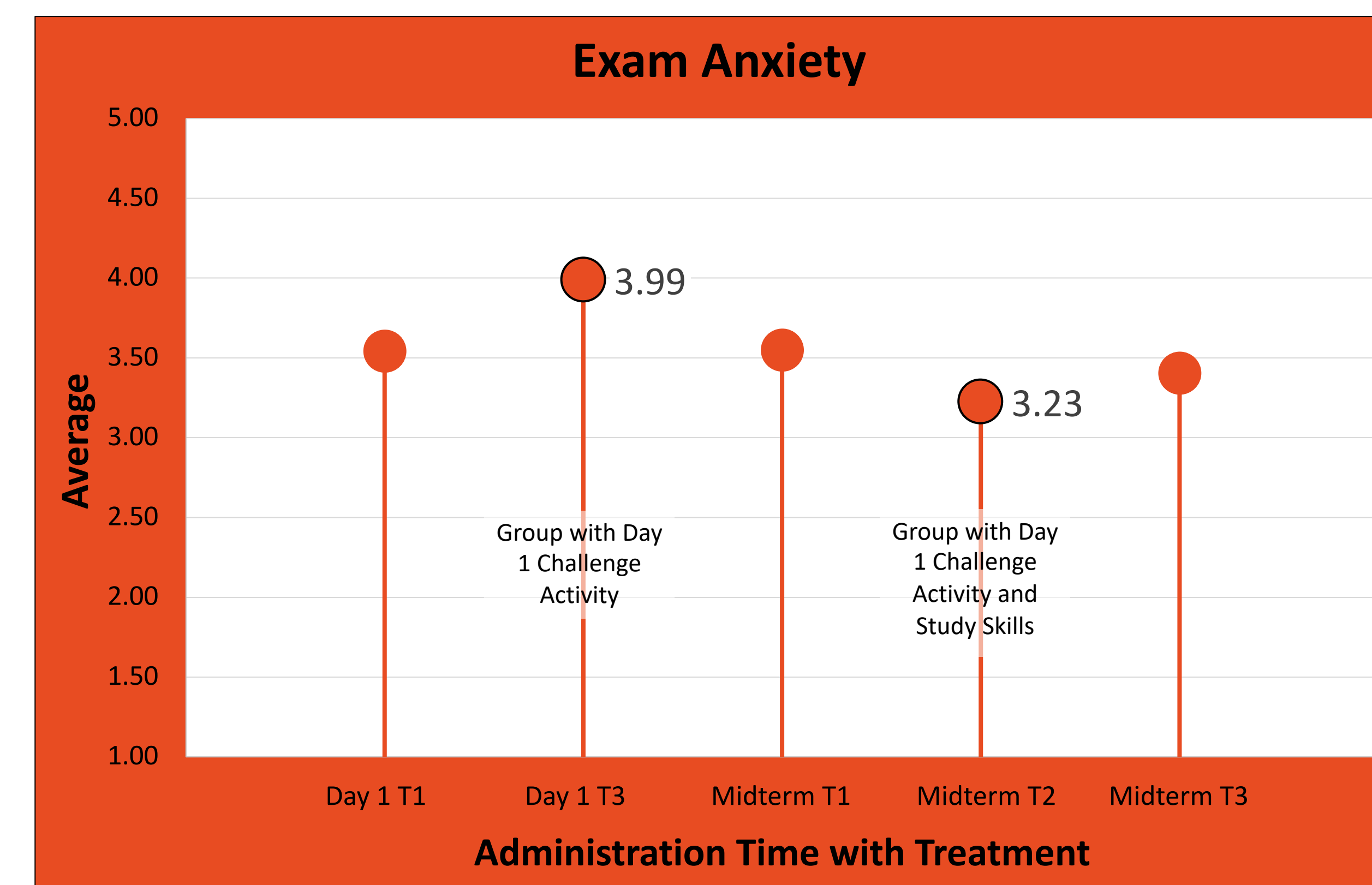
- 1. Examination Anxiety  $\alpha = .87$**   
Anxiety experienced when taking statistics exams.
- 2. Asking for Help Anxiety  $\alpha = .82$**   
Anxiety experienced when asking the course teacher, another student, or a tutor questions about statistics.
- 3. Interpretation Anxiety  $\alpha = .92$**   
Anxiety experienced when interpreting statistical data and understanding the formulation used in statistics.
  - ▶ Likert-type scale 1-5.
  - ▶ High scores suggest that students experience high anxiety in this construct.



Learn more about the SAS

## Results

Exam Anxiety at Midterm was significantly lower for the Dice and Study Skills group than the Dice group  $t(145) = 1.98, p = .03$ .



### Open-ended Survey Question

What are your thoughts on learning statistics with the "flipped" model of instruction?  
Responses were coded as Negative, Neutral and Positive. Students' opinions were more negative at week 7 than on Day 1,  $\chi^2(8, n=136) = 22.85, p = .004$  showing a dramatic 340% increase in negative responses.

Examination Anxiety  
 $F(4, 141) = 1.33, p = .261$

Interpretation Anxiety  
 $F(4, 141) = 0.35, p = .846$

Asking for Help Anxiety,  
 $F(4, 141) = 0.81, p = .520$

No statistically significant differences in midterm exam, final exam, or overall course grades.  
No statistically significant differences in student evaluations of the course or teacher.

## Methods

Subjects ( $n = 71$ ) - undergraduate students in three sections of a mandatory, ten-week introductory statistics course.

Course is taught using a "flipped" design where passive content (video lectures, textbook readings, practice activities) is delivered asynchronously, and active learning activities based on constructivist theory are delivered in the classroom shifting the focus from knowledge transmission to knowledge construction (Centre For Teaching Excellence, n.d.).

### Experimental Design

- Sections randomly assigned to treatments and control.
- SAS questions plus qualitative questions administered anonymously via Qualtrics survey.
- T1 and T2 completed dice challenge activity on day 1 of class
- T2 had study skills videos added to their course lecture videos (Chew S., n.d.). Researcher did not tell students videos were there. Questions added to daily quizzes to encourage watching the videos.
- All sections completed survey for participation points after 1st class.
- All sections completed the same survey for participation points in week 7.
- Midterm exam scores and final grades for all three sections were compared.

### Qualitative Survey Questions

What aspects of your statistics course excite you?  
What challenges do you expect to experience in your statistics course?  
What are your thoughts on learning statistics with the "flipped" model of instruction?

$(\alpha = .05)$

Day 1 Overall Statistics Anxiety in 3 Sections of INFO 1020 Fall 2022 ( $n=75$ )				
Construct	Mean	Standard Deviation	Lower Bound	Upper Bound
Exam Anxiety	3.60	.96	3.89	3.83
Assistance Anxiety	2.17	.88	1.97	2.37
Interpretation Anxiety	2.34	.94	2.14	2.55

Midterm Overall Statistics Anxiety in 3 Sections of INFO 1020 Fall 2022 ( $n=71$ )				
Construct	Mean	Standard Deviation	Lower Bound	Upper Bound
Exam Anxiety	3.39	.96	3.17	3.62
Assistance Anxiety	2.08	.87	1.88	2.29
Interpretation Anxiety	2.35	.93	2.13	2.57

### Subjects – INFO 1020 Students

Group	n	Treatment	First Day Survey #	Midterm Survey #
T1	25	Control	T1	T1
T2	25	Dice and study skills	T1	T2
T3	21	Dice	T3	T3

### Dice Challenge Activity

Before instruction, random pairs of students given two dice and a probability worksheet. Students tried to solve the worksheet problems. After 10 minutes, the instructor introduced the probability unit by working the problems on the worksheet.

## Conclusions

Students' opinions of learning in a flipped classroom fell dramatically from Day 1 to Week 7 of the ten-week course but the cause of the decline is unknown. One possible explanation is dissatisfaction with the pedagogy. Another is that by week 7 students have grappled with difficult content and are stressed by the approaching term end.

Study skills instruction may have helped students feel less anxious about taking exams as evidenced by the significant difference in Examination. However, the effect may have been larger if the videos had been explicitly required rather than embedding them with course content videos.

Treatment group 2 (T2) was inadvertently given the link to the Day 1 survey for T1. Consequently, the Day 1 results are combined for the control group (T1) and a challenge activity group (T2). It is impossible to separate results. This may mask meaningful results of the challenge activity.

In spite of limited significant quantitative results, the classroom climate seemed energized and collegial in all three sections. Perhaps, the interventions lead to improved classroom community which in turn supports the conclusion that active learning activities are useful to engage students in what – to them – is a very challenging course. Open-ended, end-of-course, student review comments support this conclusion.

## Future Directions

Analyze "What aspects of your statistics course excite you?" question from survey.

Analyze "What challenges do you expect to experience in your statistics course?" question from survey.

Explore challenge activities at start of each unit, not just start of class.

Explore community building activities to increase engagement with the class.

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