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Assessing the Effectiveness of Teaching and Learning in the STAT150 Course: Comparing Online and Face-to-Face Modalities

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Assessing the Effectiveness of Teaching and Learning in the STAT150 Course:
Comparing Online and Face-to-Face Modalities

A report submitted to the Office of Assessment

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by

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Introduction

Purpose and Goals of the Project

The purpose of the study is to improve teaching and students' learning experience in the STAT150 course. Specifically, this project focuses on assessing the impact of modalities (online versus face-to-face) on students' perceived teaching effectiveness and learning outcomes. The study addressed the following goals.

1) To understand the learning style preference and characteristics of students enrolled in the online and face-to-face sessions of the STAT150 course.

2) To investigate the perceived teaching effectiveness among online and face-to-face sessions of the STAT150 course.

3) To investigate the perceived learning experience and outcomes of students in the online and face-to-face sessions of the STAT150 course.

Background

At UNC, many undergraduate students from various majors are required to enroll in the STAT150 course as a requirement of their degree programs. The STAT150 course provides an introduction to key statistical concepts as well as techniques used in organizing data (e.g., measures of central tendency, measures of dispersion, probability distributions, point estimation, interval estimation, and testing hypotheses). Each semester, there are around ten sessions of STAT150 offered, and each session enrolls 20-25 undergraduate students. The STAT150 course offers both sessions in face-to-face (in-person) and online modalities. The instructors of the STAT150 course include faculty members and graduate student instructors.

Based on the research team members' observations and experiences of teaching the STAT150, we noticed some differences in students who chose to enroll in the face-to-face and online sessions of this course. We also observed some challenges in teaching and students' learning outcomes (e.g., DFW rates) in the STAT150 course. These challenges may hinder student success and the university's goal of promoting student retention. As part of Rowing, Not Drifting 2030, UNC has created a Students First Framework to advance strategic efforts related to improving enrollment, retention rates, and graduation rates. To support the university's mission, we would like to investigate factors that may affect effective teaching and student learning experience in the STAT150 course.

Identifying the reasons students drop or fail courses is critical in determining what strategies the institution needs to apply to ensure the successful completion of classes. While there are many factors that could impact student learning and course completion, literature has consistently suggested that teaching effectiveness is a key predictor of students' learning outcomes (e.g., Akram, 2019; Burroughs et al., 2019; Lazarides & Buchholz, 2019). In addition, students' characteristics, learning style preferences, and course modalities could also play an essential role in promoting student learning and course completion (e.g., Atchley et al., 2013; Fischer et al., 2020; Soffer & Cohen, 2019).

Therefore, this study aims to provide a deeper understanding of the learning style preferences and characteristics of students enrolled in the online and face-to-face sessions of the STAT150 course. In addition, this study investigates the relationship between teaching

effectiveness, course modalities, and students' perceived learning outcomes in the STAT150 course. This study addressed the following research questions.

1) RQ1: What are the demographic characteristics and learning style preferences of the students enrolled in the online and face-to-face sessions of the STAT150 course?

2) RQ2: Do students perceive teaching effectiveness differently in the online and face-to-face sessions of the STAT150 course?

3) RQ3: Do students' perceived learning outcomes differ in the online and face-to-face sessions of the STAT150 course?

Methods

Participants & Recruitment

The research team surveyed students who were taking the STAT150 course during Fall 2022 and Spring 2023. The research team reached out to the instructors of all 14 sessions seeking their approval for their students to participate in the study. The study's goals and objectives were explained to students in all 14 sessions, and students' participation in the study was voluntary. Students were asked to complete a consent form and survey online. Students were encouraged to contact the research team members if they needed further information about the project. Upon approval from instructors, the instructors sent a Qualtrics link to the study consent form and questionnaires to students via email and posted the survey link in Canvas. Each semester, there were about 200 students enrolled in the in-person sessions and 60 students in the online session. We had an overall response rate of 20% from the students. Upon completion of the survey, participants were offered a chance to win a monetary gift in a drawing (five $50 gift cards). Instructors were also offered a chance to win a monetary gift for encouraging their students to participate in the study (one $50 gift card). The drawing was conducted after the project data collection was completed.

Instruments

The variables investigated in this current project include students' perception of teaching effectiveness, learning outcomes, learning preferences, and characteristics of the students, instructors, and courses.

Teaching Effectiveness. The short-form of students' evaluations of teaching (SET; Dodeen, 2013) instrument was used to evaluate the effectiveness of teaching. The questionnaire comprised 29 items distributed in five dimensions, such as teachers' knowledge and organization (7 items), clear explanation (6 items), grading and evaluation (4 items), teaching methods (6 items), and relationship with students (6 items). Students were asked to respond to each item based on a 5-point Likert scale (from very poor =1 to very good = 5).

Perceived Learning Outcomes. We used three variables (i.e., expected grade, perceived learning, and learning satisfaction) as a proxy for students' perceived learning outcomes. Students were asked about the grade they expect to receive in the online course. Students' perceived learning was measured by three items assessing the amount of knowledge learning and the quality of the learning experiences in the online course (Eom et al., 2006). Participants' online learning satisfaction was measured with five items assessing students' satisfaction with the

knowledge gained, course activities, and learning experiences (Lin, 2005). Participants were asked to rate how strongly they agreed or disagreed with each item on a 5-point Likert scale.

Learning Style Preferences. The Learning Style Scale (LSS; Abdollahimohammad & Ja'afar, 2014) was used to assess students' learning style preferences. The LSS comprised 22 items distributed in five dimensions: students' perceptive (7 items), solitary (4 items), analytic (4 items), competitive (3 items), and imaginative (4 items) learning styles. Students were asked to respond to each item based on a 6-point Likert scale (from strongly disagree =1 to strongly agree = 6).

In addition, we collected students' demographic variables (e.g., gender, ethnicity, first-generation status, and prior stats/math preparation), instructors' demographic variables (e.g., gender, ethnicity, title, years of teaching experiences), and course information (e.g., required/ elective, face-to-face/online). We also included questions related to students' course engagement and learning self-efficacy in the survey. Although not the primary focus of the study, these social-cognitive variables were analyzed to provide a potential explanation of the relationship between teaching, learning, and course modality.

Data Analysis

To address our RQ1 (What are the characteristics and learning style preferences of the students enrolled in the online and face-to-face sessions of the STAT150 course?), we used a t-test and chi-squared tests to compare the differences in student characteristics and learning style preference between the two groups (i.e., face-to-face and online sessions). To address our RQ2 (Do students perceive teaching effectiveness differently in the online and face-to-face sessions of the STAT150 course?), we used a t-test to compare the differences in students' perceived teaching effectiveness between the two groups. To address our RQ3 (Do students' perceived learning outcomes differ in the online and face-to-face sessions of the STAT150 course?), we used a t-test to compare the differences in students' perceived learning outcomes between the two groups.

Sample Characteristics

The sample consisted of 86 undergraduate students enrolled in the STAT150 course. The majority of the students identified as female (73.3%) and as non-Hispanic students (74.7%). About 65% of the participants were the first person attending college in the family. More than half of the students spend four hours or more doing work for the STAT150 course.

Sample (N = 86)		Count	%
Gender	Male	19	22.1
	Female	63	73.3
	Others	4	4.7
Hispanic	Yes	22	25.3
	No	65	74.7
First-Generation College Students	Yes	56	65.1
	No	30	34.9
Hours per week spent on STAT150	0-3 hours	35	40.2
	4-7 hours	41	47.1
	8-11 hours	8	9.2
	> 12 hours	3	3.4

Key findings

RQ1: What are the demographic characteristics and learning style preferences of the students enrolled in the online and face-to-face sessions of the STAT150 course?

- Comparing the online v.s. face-to-face STAT150 courses, we did not observe a noticeable difference in terms of demographic characteristics and learning style preferences of students.

Our results suggested that there were no significant differences in gender, ethnicity, parent's education level, or years in school between the two modalities. Similarly, no significant differences in students' learning style preferences were observed. **The students from the two modalities reported similar demographic characteristics and learning style preferences.**
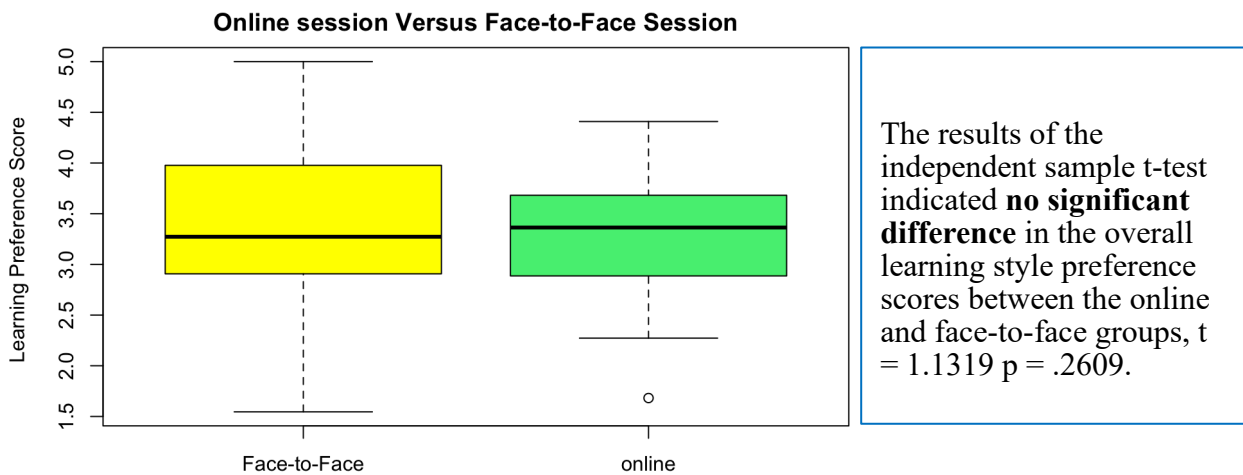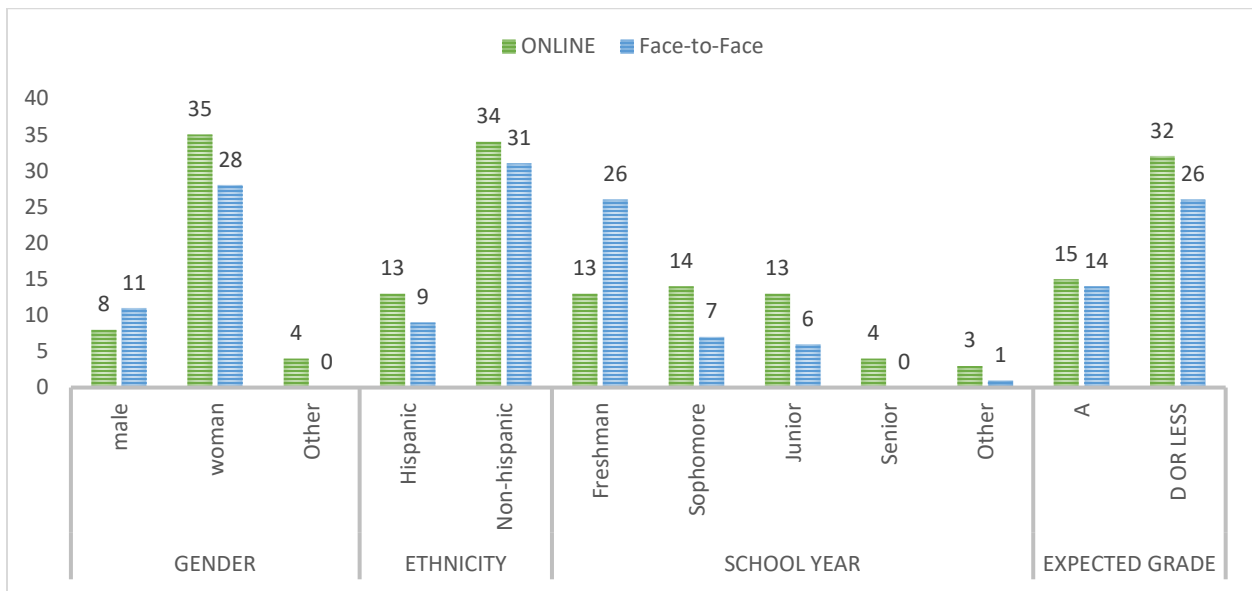
The results of the independent sample t-test indicated **no significant difference** in the overall learning style preference scores between the online and face-to-face groups, t = 1.1319 p = .2609.

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RQ2: Do students perceive teaching effectiveness differently in the online and face-to-face sessions of the STAT150 course?

- We observed some differences in other dimensions of teaching effectiveness. The differences may be due to the limited capacity of supporting instructor-student interactions in the online (asynchronous) modality.

Our results suggested that there were statistically significant differences (p<.05) across all dimensions of students' perceived teaching effectiveness, except for knowledge and organization. **Students in the face-to-face modality provided significantly higher ratings on most aspects of teaching effectiveness than students in the online modality** did. In our sample, students in the online modality were in asynchronous sessions. It is possible that student-instructor interactions are limited in the online asynchronous session. Based on Moore's (1989) interaction model, student-instructor interaction is one of the key components for effective online learning. Students in the online modality may have limited opportunities to observe different dimensions of teaching effectiveness (e.g., instructor-student relationship, teaching methods, grading, and explanations) of their instructor.
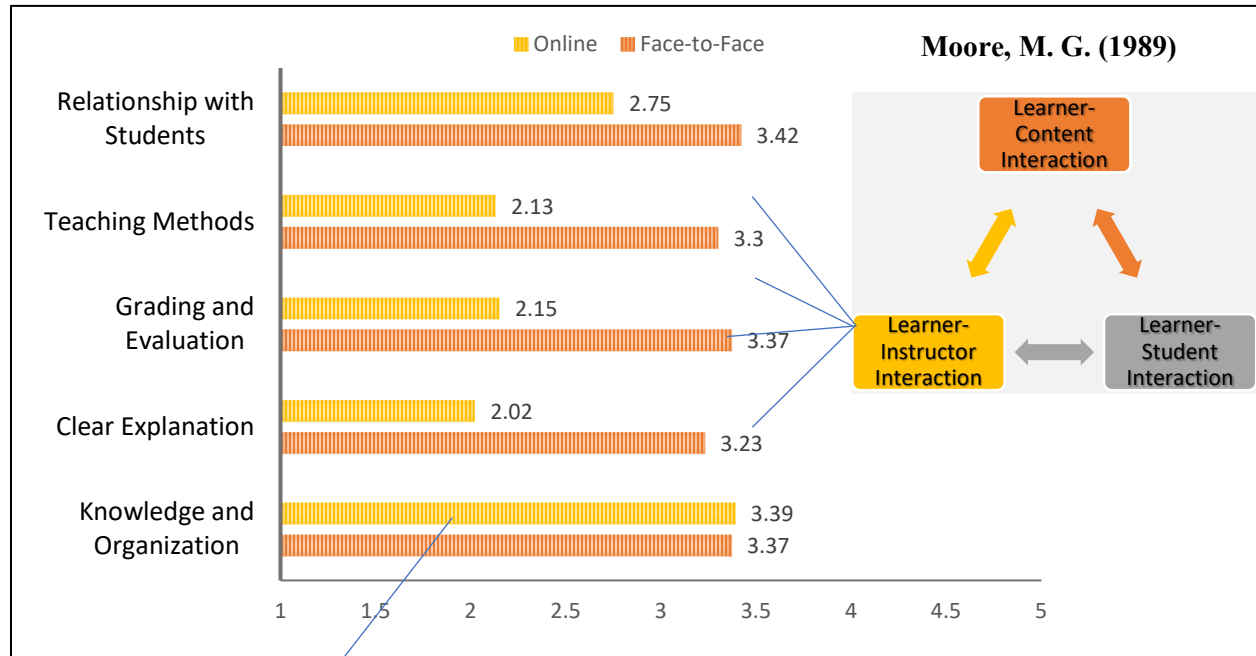
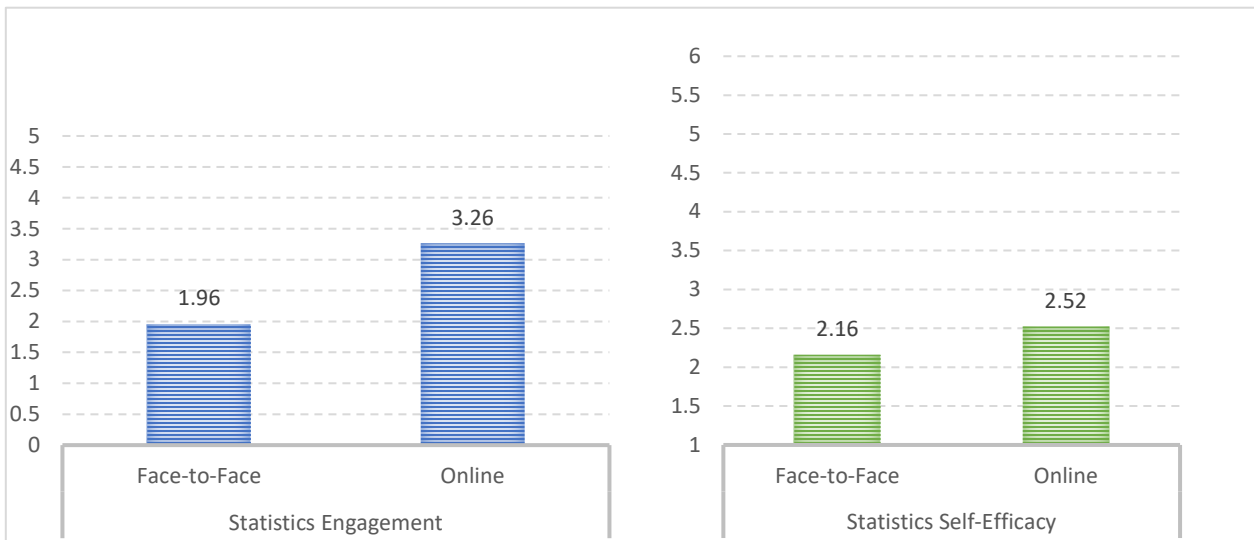Factor 1: Knowledge and Organization (7 items)

Item 2   The instructor is well-prepared in his/her course
Item 3   The instructor is informative when responding to students' questions
Item 4   The instructor states goals and objectives clearly
Item 5   Lectures are well organized
Item 6   Effective use of class time
Item 7   The class time is carefully planned
Item 9   Effective classroom management

The results of the independent sample t-test indicated **no significant difference** in students' perceived instructor knowledge and course organization.

RQ3: Do students' perceived learning outcomes differ in the online and face-to-face sessions of the STAT150 course?

- We observed that students' perceived learning was lower in the face-to-face sessions.

Our results suggested that there were statistically significant differences ($p<.05$) in students' perceived learning between the two modalities. Specifically, students in the online modality reported a higher level of amount of learning and quality of learning than students in the face-to-face modality did. **This finding may be due to differences in the students' statistics self-efficacy and engagement**. Particularly, we observed that students in the online sessions reported slightly higher statistics self-efficacy and much higher engagement (affective, cognitive, and behavioral engagement) than those in the face-to-face sessions. It is possible that these two different learning modalities may have an impact on students' engagement and self-efficacy in the STAT150 course. It is also possible that these two different learning modalities may draw students who have different levels of interest and motivations in learning statistics, which may, in turn, affect their engagement and self-efficacy in the course.

PERCEIVED LEARNING

1. I feel that I learned a lot in this STAT-150 course.
2. I feel that I learn more in this STAT-150 course than other courses.
3. The quality of my learning experience in this STAT-150 course is good.

	Face-to-Face	Online
Perceived Learning	1.7	3.03

	Face-to-Face	Online
Statistics Engagement	1.96	3.26

	Face-to-Face	Online
Statistics Self-Efficacy	2.16	2.52
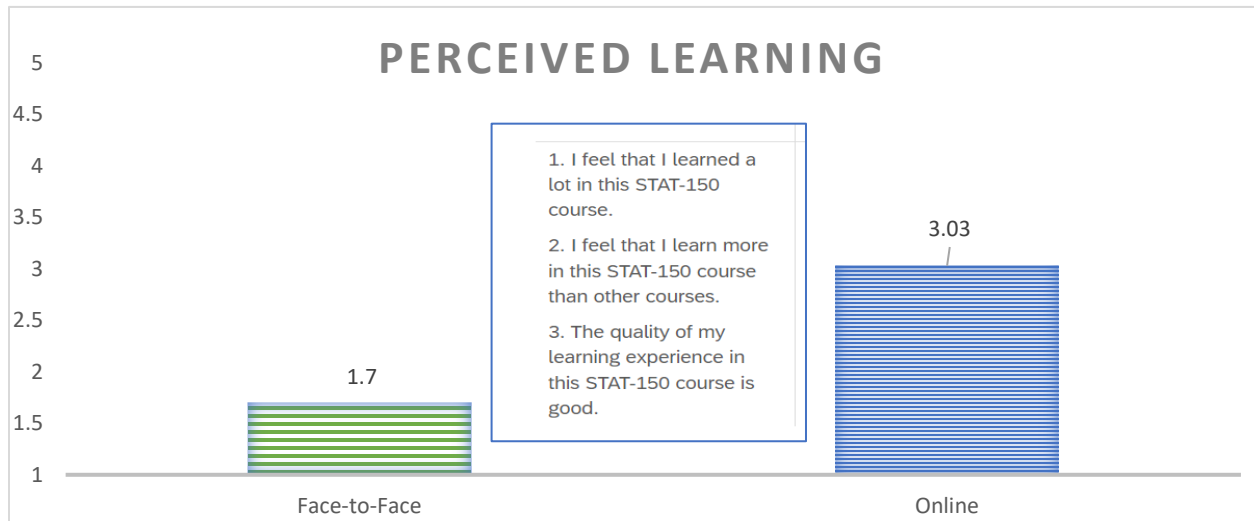
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