A Comparison of Teaching Methods in Introductory Statistics: Lecture-Based Class vs Team-Based Learning

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Introduction

The ability to work as a member of a team is among the top attributes employers seek in college graduates. (Hart, 2007; NACE, 2018)

Team-Based Learning (Michaelsen, Knight, and Fink, 2004) is a classroom strategy where students are placed in teams of 4 to 7 members for the duration of the course. Students are made accountable for

(1) pre-class preparation, and

(2) actively contributing to team activities during class.

Teams assignment by the instructor aims distribute assets and liabilities evenly across the groups.

MAT220 is an algebra-based introductory statistics course. The course provides an overview of the field of statistics and is a required course for students in a variety of majors, including the sciences and health professions. Concepts include:

- sampling
- experimental design
- data collection and organization
- descriptive statistics
- confidence intervals
- hypothesis testing
  - z-tests for proportions;
  - t-tests;
  - analysis of variance;
  - Chi-Square tests;
  - regression analysis.

Objectives

The primary goals of this investigation were to

1. assess learning in an undergraduate introduction to statistics course (MAT220), and
2. compare gains in statistical knowledge in two learning environments (lecture format and team-based learning).

Methodology

During a single semester, I taught four sections of Introduction to Statistics (MAT220).

- Two sections were taught using a traditional lecture format.
- Two sections were taught using a modified team-based learning approach (Dinan, 2004).

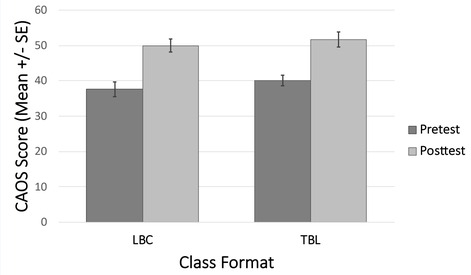
Students were administered the Artist CAOS (Delmas, Garfield, Ooms, & Chance, 2006) test during the first week and last week of the semester. Course outcomes were compared.

Results

Assessment of Course Learning Outcomes

- Significant difference in pretest and posttest CAOS scores for Lecture Format
- Significant difference in pretest and posttest CAOS scores for Team-Based Learning Format

Comparison of Mean Pretest and Posttest Scores
Lecture Format vs. Team-Based Learning



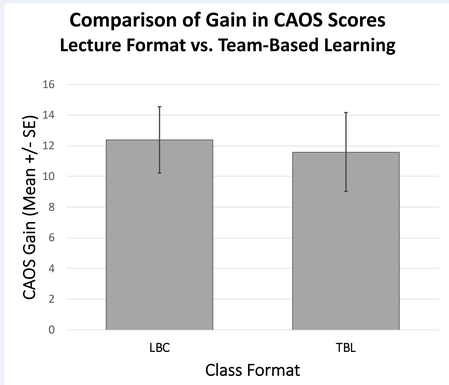
Paired Samples *t*–tests for Pretest and Posttest Scores
Lecture Format vs. Team-Based Learning

	LBC n = 23		TBL n = 25	
	Pre	Post	Pre	Post
Mean	37.61	50.00	40.10	51.70
SE	2.09	1.85	1.50	2.13
t	*t* = 5.74		*t* = 4.52	
p-value	*p* < .001		*p* < .001	
Cohen's d	1.20		0.90	

Comparison of Gains in CAOS Scores

- No significant difference in CAOS score gain between groups (LBC and TBL)

Comparison of Gain in CAOS Scores
Lecture Format vs. Team-Based Learning



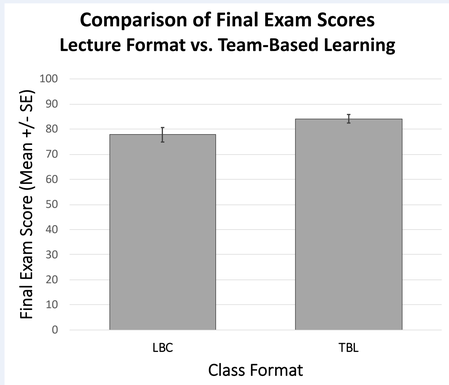
Independent Samples *t*–test for Gain in CAOS Scores
Lecture Format vs. Team-Based Learning

	LBC n = 23	TBL n = 25
Mean	12.39	11.60
SE	2.16	2.57
t	*t* = 0.24	
p-value	*p* = 0.814	
Hedges' g	*g* = 0.068	

Comparison of Final Exam Scores

- No significant difference in final exam scores between groups (LBC and TBL)

Comparison of Final Exam Scores
Lecture Format vs. Team-Based Learning



Independent Samples *t*–test for Final Exam Scores
Lecture Format vs. Team-Based Learning

	LBC n = 23	TBL n = 25
Mean	77.75	84.13
SE	2.89	1.70
t	*t* = -1.90	
p-value	*p* = 0.065	
Hedges' g	*g* = 0.560	

Discussion

Students achieved significant gains in both the lecture-based class and the team-based learning environment. However, there were no statistically significant differences in learning between the two teaching methods when assessed by the CAOS standardized assessment and final exam scores.

Many factors influence an instructor's choice of learning environment. Learning course content is of primary importance, but development of skills and attributes sought by employers is also vital.

The ability to work as a member of a team is among the top attributes employers seek in college graduates. (Hart, 2007; NACE, 2018). A practical approach to providing students with experience working as a member of a team is to implement team-based learning as an instructional strategy. Additional benefits of this learning strategy are that it promotes personal responsibility and provides opportunities for problem solving.

One of the primary challenges associated with implementing team-based learning is student resistance. Two factors that may contribute to resistance are

1. reluctance to work with an assigned group (possibly due to concern about social loafing), and
2. aversion to a "flipped classroom," especially for courses in mathematics and the sciences.

In my experience, team-based learning is better accepted by upper division students.

References

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