Implementing TBL to Foster Competency in Statics and Structural Systems Among Construction Management Students

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Introduction

- Accredited construction management programs require students to acquire understanding of structural systems
- Usually, statics and structural systems classes are more technically challenging
- It is common for Construction Management programs to get transfer students specially from Civil Engineering programs
- Civil Engineering students typically have more math and engineering classes, making the construction management student learning outcome easily attainable
- There is an opportunity to enhance student's competency by implementing team-based learning (TBL)

Objectives

The objectives of this study are listed as follows:

- 1. Develop a framework to implement TBL in an engineering-related construction management class
- 2. Implement the framework in fall 2023
- 3. Measure the effectiveness of TBL in the determined class

Discussion and Results (cont'd)



Figure 1. Pre and post knowledge survey results

Methodology

The development of the TBL framework was done as follows:

- 1. Develop a knowledge survey to determine each student's background
- 2. Divide the class into teams based on the knowledge survey results
- 3. Divide in-class assignment to be done into two steps
 - a. Step I individual in-class assignments with no feedback
 - b. Step II Team in-class assignment with feedback
- 4. Use summative assessment to measure student learning

Hypothesis: TBL helps students perform better in summative assessment when compared to traditional teaching pedagogy.

- 1. Collect summative assessment data for two groups:
 - a. Cohort A utilizing traditional teaching Fall 2022
 - b. Cohort B utilizing TBL Fall 2023

Discussion and Results

Knowledge survey

- 1. I can explain the difference between vector and scalar quantities.
- 2. I can explain what a force means.
- 3. I can explain the principles of static equilibrium.
- 4. I can explain what the moment is.
- 5. I can explain the relationship between moment, force, and moment arm.
- 6. I can explain different types of supports and reactions.
- 7. I can explain how to determine reactions using static equilibrium.
- 8. I can explain how external loads transfer through a truss structure.
- 9. I can explain why member trusses are under tension, compression, or none.
- 10. I can explain what is meant by the shear force and bending moment diagram.
- 11. I can explain how to calculate shear force and bending moment at a given X-section of a structural element.

Team formation

- 1. Each team consists of 4-5 students
- 2. At least one student with high score in the pre-knowledge survey
- 3. At least one student with low score in the pre-knowledge survey
- 4. Two-three students with average scores in the pre-knowledge survey
- 5. Teams work together throughout the semester

Summative Assessment

1. One exam results were collected for the two cohorts to test the research hypothesis

Table 1. Descriptive statistics data for the two cohorts

Cohort/Score	Min Score	Avg Score	Max Score
Cohort A	36.70%	68.90%	93.30%
Cohort B (TBL)	45.80%	75.29%	100%

- 1. The Levene test is used to ensure to determine the two cohorts have roughly equal variances
- 2. The t-test is used to measure statistical significance of the average exam score between the two cohorts
 - a. No significant difference at alpha = 0.05
 - b. Significant difference at alpha = 0.1

Conclusion

- 1. Applying TBL may be challenging to get students to sit in teams outside their comfort/friendship zone
- 12. I can explain the relationship between shear force and bending moment.
- 13. I can explain why understanding shear force and bending moment is important for construction trades and trade coordination.
- 14. I can explain the factors that affect the design of wood-spanning elements.
- 15. I can explain how to use the American Wood Council (AWC) wood span tables to determine the span of a joist.
- 16. I can explain the conditions and requirements for notching and boring wood-spanning elements.
- 17. I can explain load transfer for basic residential structures.
- 18. I can explain the relationship between deflection and structural beams.
- 19. I can explain the factors that affect deflection for beams.
- 20. I can explain the relationship between lateral bracing and spans for steel beams.
- 21. I can explain different modes of failure of steel beams.
- 22. I can explain why concrete and steel work well together to form structural elements.
- 23. I can explain the purpose of horizontal rebar in concrete beams or slabs.
- 24. I can explain the purpose of ties in concrete beams.

- 2. Preliminary data suggests that TBL can be an effective tool to enhance student's competency
- 3. Average exam score, min score and max score were higher when TBL was implemented

Limitations and Future Direction

- 1. May need to collect more data to provide more evidence
- 2. Measure student competency using difference assessment methods
- 3. Survey students regarding their thoughts about TBL
- 4. Application of TBL in large classrooms need for more TA support
- 5. How to get introverts/quiet people to participate in teamwork?