A Quantitative Comparison of Traditional to Fully Online Team-Based Learning Scores

Or

**Physical Versus Online Learning: How Equitable Are They?**

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**Disclosures**

- PA Holmes has no actual or potential conflict of interest in relation to this program/presentation.

- PA Holmes is an assistant professor at UNT HSC Fort Worth and uses male (he/him/his) pronouns

- PA Holmes does not normally speak of himself in the third-person.
Objectives

At the conclusion of this presentation, you should be able to:

- Discuss the use of Team-Based Learning (TBL)
- Compare the requirements for physical, hybrid, and online TBL environment settings
- Identify the appropriate group size for TBLs conducted in physical, online, and hybrid environments
- Compare the effectiveness of TBL in physical, hybrid, and online environments

Which methods?

Three different Methods
1. Traditional Paper-based TBL
   All aspects of the TBL are conducted in a physical setting w/ paper-based I-RAT, T-RAT, and Application activities
2. Hybrid (physical w/online) TBL
   Conducted in a physical setting but using an online TBL administration system
3. Fully Online TBL
   Conducted in a wholly virtual setting using video conferencing (Zoom, Teams, etc.) w/ an online TBL administration system
Team-Based Learning (TBL)

A multiphase activity that allowed learners to work in cooperative groups to enhance individual and team knowledge and skills

Michaelsen et al., 2004; Parmelee & Hudes, 2012

- Based on Social Constructivism framework
- Incorporates team / collaborative skills
- Allows the educator to become a facilitator

Historical TBL

- Began in 1992 as an educational strategy for accounting classes
  Dr. Larry Michaelsen, circa 1992

- Gradually incorporated into medical teaching in early 2000

- Has used a variety of technologies as new technology has become available

Constructive learning

TBL is a group-oriented collaborative learning (CL) implementation of the constructivist learning theory.

The conceptual framework foundation for TBL is constructivism, specifically social constructivism.

Hrynchak & Batty, 2012; Ramis et al., 2019
RATs in your method

**Readiness Assessment Testing (RAT)**

- Exercise to validate the pre-learning experience
  - 10-20 multiple-choice questions
  - Prepares the learner for the team and application learning experiences
  
  Assesses knowledge level
  
  Michaelsen et al., 2004; Parmelee & Hudes, 2012

**Individual & Team**

**I-RAT & T-RAT**

- **Individual Readiness Assessment phase (I-RAT)**
  - Assessment is initially taken alone
  - Includes the ability to split points

- **Team Readiness Assessment phase (T-RAT)**
  - The same multiple-choice exercise as the I-RAT, immediately following I-RAT
  - The first physical group experience
  - Contains elements of peer pressure
  
  Michaelsen et al., 2004; Parmelee & Hudes, 2012

**Confidence Based Testing**

Can provide more detailed information that a standard single-choice report

Allows more accurate targeting of ineffective distractors

Provides a higher sensitivity to overall student confidence in whether the material is truly understood.
## Confidence Based Testing

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Allows more accurate targeting of ineffective distractors

Provides a higher sensitivity to overall student confidence in whether the material is truly understood.

### How many points were allocated to each answer?

<table>
<thead>
<tr>
<th></th>
<th>Q1</th>
<th>Q2</th>
<th>Q3</th>
<th>Q4</th>
<th>Q5</th>
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<td><strong>% Allocation</strong></td>
<td>01</td>
<td>02</td>
<td>03</td>
<td>04</td>
<td>05</td>
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<tr>
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<td>47.0%</td>
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<tr>
<td>B</td>
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<td>C</td>
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### Point Allocation

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<td>189</td>
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<td>250</td>
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<td>3</td>
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<td><strong>Q5</strong></td>
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<td><strong>Average</strong></td>
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### How many points were allocated to the correct answer?

<table>
<thead>
<tr>
<th></th>
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<th>Q4</th>
<th>Q5</th>
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<td><strong>% Allocation</strong></td>
<td>01</td>
<td>02</td>
<td>03</td>
<td>04</td>
<td>05</td>
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<tr>
<td>4 Points</td>
<td>54.7%</td>
<td>38.7%</td>
<td>73.3%</td>
<td>94.7%</td>
<td>73.3%</td>
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<td>3 Points</td>
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<td>9.3%</td>
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<td>5.3%</td>
</tr>
<tr>
<td>2 Points</td>
<td>8.0%</td>
<td>4.0%</td>
<td>5.3%</td>
<td>1.3%</td>
<td>12.0%</td>
</tr>
<tr>
<td>1 Point</td>
<td>5.3%</td>
<td>5.3%</td>
<td>1.1%</td>
<td>0.0%</td>
<td>1.3%</td>
</tr>
<tr>
<td>0 Points</td>
<td>26.0%</td>
<td>45.3%</td>
<td>10.7%</td>
<td>0.0%</td>
<td>4.0%</td>
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</table>

### Point Allocation

<table>
<thead>
<tr>
<th></th>
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<th>B</th>
<th>C</th>
<th>D</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>4 Points</strong></td>
<td>41</td>
<td>29</td>
<td>55</td>
<td>71</td>
</tr>
<tr>
<td><strong>3 Points</strong></td>
<td>3</td>
<td>5</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td><strong>2 Points</strong></td>
<td>6</td>
<td>3</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td><strong>1 Point</strong></td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td><strong>0 Points</strong></td>
<td>21</td>
<td>34</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td><strong>Average (X of 4 points)</strong></td>
<td>2.5</td>
<td>1.9</td>
<td>3.3</td>
<td>3.8</td>
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</table>
Using TBL in training environments

<table>
<thead>
<tr>
<th>Physical</th>
<th>Hybrid</th>
<th>Fully Online</th>
</tr>
</thead>
<tbody>
<tr>
<td>Physical classroom for the full range of activities</td>
<td>Physical classroom for the full range of activities</td>
<td>Virtual classroom for the full range of activities through Zoom (Teams, Google Hangouts, etc.) with breakout room capabilities</td>
</tr>
<tr>
<td>Online pre-learning materials, paper I-RAT/T-RAT, physical response cards, &amp; application exercise sheets</td>
<td>Online pre-learning materials, I-RAT/T-RAT, &amp; application exercises</td>
<td>Online pre-learning materials, I-RAT/T-RAT, &amp; application exercises</td>
</tr>
<tr>
<td>Group Sizes: 5-7</td>
<td>Group Sizes: 5-7</td>
<td>Group Sizes: 4-5</td>
</tr>
</tbody>
</table>

Setting up the learning space

**Physical Classroom**

- Requires more space
  - Determined by the number of students
- Space between groups to have discussions
- Consider having class in non-traditional spaces

**Online Classroom**

- Virtual platform must provide breakout room function
  - Zoom
  - WebEx Teams/Training
  - Google Meet
- Educator proficiency with the platform functionality is essential

- Answer Key Sync
- Laptop, iPad, even mobile phones can be used
  - Power
  - Connectivity
- LMS can be used for standard MCQ testing
Learning environments

**Traditional TBL Methodology**
(Michaelsen et al., 2004)
- Pre-learning materials provided via Canvas 1 week prior to TBL
- Physical Classroom: Main classroom for class session/discussion, several breakout areas for group work
- Initial one-hour session on TBL including Practice TBL & team formation
  - Conducting preparatory sessions improved the outcomes and understanding of the TBL process (Gallegos & Peeters, 2011; McMullen et al., 2014)
- Individual RAT administered (20 minutes)
- Class dispersed to teams w/ IF-AT Cards (5 minutes)
- Team RAT Administered (20 minutes)
- RAT Explanation Packets provided* and Application Exercise Administered
- Activity concluded* with Testing Services collecting physical materials

**Online TBL Methodology**
(using InteDashboard, Zoom)
- Pre-learning materials provided via Canvas 1 week prior to TBL
- Virtual instructional method: Sessions were synchronous utilizing Zoom for video†
  †Modification made due to COVID Restrictions
- Initial one-hour session on TBL including software demonstration, Practice TBL, and team formation
- Individual RAT administered (20 minutes)
- Class dispersed to breakout rooms for T-RAT (1 minute)
- Team RAT Administered (20 minutes)
- RAT Explanation Packets provided by PDF* and Application Exercise Administered
- Activity concluded* with Testing Services collecting physical materials
  * Deviations from traditional methodology due to restricted time

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### How did the methods stack up?

<table>
<thead>
<tr>
<th>Score Type</th>
<th>Data Type</th>
<th>Range, Mean [SD]</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-RAT score</td>
<td>Ratio</td>
<td>10 – 100, M = 74 [SD = 13]</td>
</tr>
<tr>
<td>T-RAT score</td>
<td>Ratio</td>
<td>66 – 100, M = 95 [SD = 7]</td>
</tr>
</tbody>
</table>

Three Main Things that Affected the Scores

- Three Comparisons:
  - Method of Administration
    - Traditional / Online
  - Method of Instruction
    - Classroom / Virtual
  - Courses the TBLs were Administered in
    - Physical Diagnosis 2018, 2019
    - Evidence Based Medicine 2019, 2020
How was the data analyzed?

Inferential testing using Kruskal-Wallis (K-W) was used to examine for statistically significant variances between the IVs and DVs

- Normality: Kolmogorov-Smirnov
- Heterogeneity: Levene’s test
- Result:
  - Data heterogeneity and normality was not assured

K-W testing was most appropriate

Statistical Bottom Line

<table>
<thead>
<tr>
<th>What the numbers mean</th>
<th>Method of TBL Administration (Physical v. Online)</th>
<th>Instructional Method (Classroom v. Virtual)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lack of statistical significance with each of the I-RAT K-W statistics</td>
<td>I-RAT scores v. Method of TBL Administration: $n_{\text{Traditional}} = 588$, $n_{\text{Online}} = 584$ $H(1170) = 1.01$, $p = .316$</td>
<td>T-RAT scores v. Method of TBL Administration $n_{\text{Traditional}} = 588$, $n_{\text{Online}} = 584$ $H(1170) = 77.26$, $p &lt; .001$</td>
</tr>
<tr>
<td></td>
<td>Each course cohort $n_{\text{PD 2018}} = 300$, $n_{\text{PD 2019}} = 300$, $n_{\text{EBM 2019}} = 276$, $n_{\text{EBM 2020}} = 298$ $H(3) = 6.81$, $p = .078$</td>
<td>T-RAT scores between the four course cohorts $n_{\text{PD 2018}} = 300$, $n_{\text{PD 2019}} = 300$, $n_{\text{EBM 2019}} = 276$, $n_{\text{EBM 2020}} = 298$ $H(3) = 306.3$, $p &lt; .001$</td>
</tr>
<tr>
<td></td>
<td>Instructional method v. I-RAT scores $n_{\text{Classroom}} = 876$, $n_{\text{Virtual}} = 296$ $H(1) = 1.03$, $p = .309$</td>
<td>T-RAT scores v. Method of Instruction $n_{\text{Classroom}} = 876$, $n_{\text{Virtual}} = 296$ $H(1) = 43.28$, $p &lt; .001$</td>
</tr>
<tr>
<td>Presence of statistically significant results with each of the T-RAT scores.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Statistical Bottom Line

<table>
<thead>
<tr>
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<th>Method of TBL Administration (Physical v. Online)</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Lack of statistical significance with each of the I-RAT K-W statistics</td>
<td>• Was NOT a significant factor in the I-RAT scores, i.e., the Physical TBL scores were equitable to the Online/Virtual TBL Scores</td>
<td>• Was NOT a significant factor in the I-RAT scores, i.e., the Classroom setting was equitable to the Virtual setting in terms of scores</td>
</tr>
<tr>
<td>Presence of statistically significant results with each of the T-RAT scores.</td>
<td>• Was a significant factor in the team scores, i.e., the method DID impact the Team portion of the scoring.</td>
<td>• Was a significant factor in the team scores, i.e., the setting DID impact the Team portion of the scoring.</td>
</tr>
</tbody>
</table>

TBL Implementation Summary

• TBL incorporates constructivism and teamwork into medical training

• Previous partial technology replacements met with varying degrees of success.

• The findings in this study support the use of a fully online TBL system in both the classroom-based and virtual instructional settings.

• This well-aligned with current literature recommendations for a more robust technological framework in future medical training.
TBL Implementation Summary

- I-RAT and T-RAT mean score increased in the virtual setting
- Virtual versus Physical are equitable in scoring, improving educator confidence
- Educators look for confidence in equity (comparability of systems and scores) before using a new system

Davey et al., 2019; Khan et al., 2017; Secret et al., 2019

Summary (Objectives)

- Discuss the use of Team-Based Learning (TBL)
- Compare the requirements for physical, hybrid, and online TBL environment settings
- Identify the appropriate group size for TBLs conducted in physical, online, and hybrid environments
- Compare the effectiveness of TBL in physical, hybrid, and online environments

To check out a full copy of the research dissertation (the data behind this presentation), click here.

In case the link is disabled, the full URL is:
https://www.proquest.com/openview/773e29c67e87d94e325ff09c0d57fa8c/1.pdf?pq-origsite=gscholar&cbl=18750&diss=y
Questions?
REFERENCES


Davey, B., Elliott, K., & Bora, M. (2019). Negotiating pedagogical challenges in the shift from face-to-face to fully online learning: A case study of collaborative design solutions by learning designers and subject matter experts. *Journal of University Teaching and Learning Practice, 16*(1)


REFERENCES


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