Flipping the Classroom with Team-Based Learning ("TBL") for a More Active and Relevant Learning Experience

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August 2018

Centre for Technology and Development Spinout
Asian EdTech Startup of the Year Finalist
10 accepted research posters
3 best poster finalists
Technology Enterprise Commercialization Scheme Grant Recipient
Kaizen & INSEAD EduAward Winner
Arena Pitch Battle Runner Up
Objectives

After this session participants should be able to:

1. Define: team-based learning (“TBL”)
2. Explain: benefits and considerations of TBL
3. Describe: situations where TBL is being used
4. Describe: where to begin with TBL module design
5. Experience: parts of TBL as a student
Landing objective
Too fast?
Too slow?
Too high?
Too low?
My background

Consulting

Banking

Chief Financial Officer

Entrepreneur-in-Residence

Finance Professor

EdTech Founder
Mission

*Transform education by helping educators replace lectures with team-based learning (“TBL”)*
Proprietary IP

Global Customers

K-12
Supplemental
Higher Ed
Employability / Government
Corporate

EXCLUSIVE WORLDWIDE

Duke-NUS Medical School

patent license for optimized learning method

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Problem: employability gap

Learning 1.0

Laurentius de Voltoina, School of Bologna 14th century.

Learning 2.0

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Duke University (United States)

National University of Singapore (NUS)

**Duke-NUS Medical School**
(collaboration with Duke and NUS established in 2005)

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Segments

Academia (software)

Government (train-the-trainer)

Corporate (solutions)

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Products

For professors
- Content
- TBL
- Software

For trainers
- Content
- TBL
- Software

For corporates
- Content
- TBL
- Software

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All-in-one TBL software

Individual and **TEAM** assessments

Real-time faculty dashboard

Learning Management System ("LMS")

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History

Version 2

20 Academic beta sites

Version 1
In-house

2010 - 2015

2015 - 2018

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Past, present and future

Proof-of-concept:
Adaptive and predictive

Version 1

- IRAT
- TRAT

Version 2

- LMS integration
- Peer evaluation
- Applications
- Clarifications
- Point spreading
- Import & export
- E-gallery walk

Version 3

- Objective tagging
- Refreshed design

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Save time

Pre-work

IRAT
TRAT
Clarifications
Applications

Peer Evaluation

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Real-time results

IRAT Live Dashboard

TRAT Live Dashboard

Application Question Live Dashboard

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Be in good company

40+ institutions

Augusta University, Boise State University, Deakin University, Macquarie University, Southern Virginia University, University of Hawaii, University of Illinois - College of Nursing, University of South Alabama

93% faculty satisfaction

81% reported better outcomes

90% student satisfaction (includes 20% neutral responses)
5 things most LMS won’t do for TBL

#1. TRAT with immediate feedback

Q.10) Which speed is more important for a short-field takeoff?
- a) Vs
- b) Vr
- c) Neither is important
- d) Both equally important

Submit

#2. Peer evaluation

Q1. What is the typical retention rate for a typical one-hour lecture?
- 1) 10%
- 2) 20%
- 3) 60%
- 4) 75%
Points remaining: 1
Save

#3 IRAT with confidence based (“point spreading”)

#4 Team clarifications

#5 E-gallery walks
Part One:

TBL Overview
Example: team-based learning ("TBL")

1. Pre-work
2. Quiz
3. Team quiz
4. Clarify doubts
5. Team applications

Also 360° teammate evaluation

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TBL in practice

Originated in 1970s by Larry Michaelsen in Marketing

Used by 100s of universities globally

Many fields
• Health sciences (~50% of US medical schools)
• Business
• Computer science
• Engineering
• Social sciences
• Law

Emerging K-12, government, employability and corporate

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Why TBL?

• 99% engagement
• 40% better outcomes
• 30-70% less time
• 21st century skills
• Millennial learning preferences
1. Pre-work

Module 3 – Aircraft Performance Learning Objectives

After this module you should be able to:

- Calculate aircraft performance metrics:
  - Take-off and landing distances
  - Fuel consumption
  - Crosswind
  - Weight and balance
- Describe what factors affect aircraft performance such as altitude, temperature, weight, air pressure, head/tailwind, etc.
- Compare aircraft types on performance

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3. **Team Readiness Assurance Test ("TRAT")** with *immediate feedback*
4. Clarifications
5. Applications

**Significant problem**
**Same problem**
**Specific choice**
**Simultaneous report**

Canberra

Sydney

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After class appeals

- Students have an opportunity to provide a written “appeal” of any question
- Appeals help faculty to improve questions
- Appeals help students by requiring them to review material at a deeper level
After class: peer evaluation

- Team members “grade” each other on their performance as team members
  - Mitigates “free rider” problem
  - Learn by evaluating performance

Divide 20 points among your two teammates

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Individual versus team: Michaelsen

In a study of over 1,500 TEAMS...

Score of Best Member | Team Score: Delayed Feedback | Team Score: Immediate Feedback

+23%
My class: teams outperform individuals

BEFORE

Individual Test
76%

Team Test
93%

+22%

Source: Embry-Riddle Aeronautical University, Bachelor of Science in Aviation Business course in Airport Administration and Finance

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My class: individuals retain team gains

<table>
<thead>
<tr>
<th></th>
<th>Individual Test</th>
<th>Team Test</th>
<th>Individual Final Exam</th>
</tr>
</thead>
<tbody>
<tr>
<td>BEFORE</td>
<td>76%</td>
<td>93%</td>
<td>95%</td>
</tr>
</tbody>
</table>

Source: Embry-Riddle Aeronautical University, Bachelor of Science in Aviation Business course in Airport Administration and Finance

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My class: high-low range narrows

**Individual Test**
- **High:** 80
- **Low:** 54

**Team Test**
- **High:** 98 (+23%)
- **Low:** 92 (+70%)

**Individual Final Exam**
- **High:** 98
- **Low:** 92

Source: Embry-Riddle Aeronautical University, Bachelor of Science in Aviation Business course in Airport Administration and Finance

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# World Economic Forum future skills

## Top 10 skills required in 2020

<table>
<thead>
<tr>
<th>Skill</th>
<th>Lecture</th>
<th>TBL</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Complex Problem Solving</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>2. Critical Thinking</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>3. Creativity</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. People Management</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>5. Coordinating with Others</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>6. Emotional Intelligence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>7. Judgement and Decision Making</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>8. Service Orientation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Negotiation</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>10. Cognitive Flexibility</td>
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</tr>
</tbody>
</table>


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TBL supported by research

300+ journal articles

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Curriculum and resource savings

**Classroom time**
- Traditional: 
- TBL: 50% less

**Faculty time**
- Traditional: 
- TBL: 70% less

**Better exam scores**

Note: Classroom and faculty time are unpublished estimates. Exam scores versus US national average published as cited.

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Effectiveness in large classes

**Traditional class**
Outcomes *decline* as class size increases

**TBL class**
Outcomes *rise* and *maintain* better as class size increases
Considerations

- Design of TBL course materials (pre-work, questions and cases)
- Change management for educators and learners
- Administrative process to implement
Team formation

- Always instructor created
- Assembled to create a diverse team
- Same teams for the entire term
- Sizes:
  - Typically 5-7 in face-to-face
  - Online smaller usually 3 or 4
INDIVIDUAL readiness assurance test ("IRAT")

0 Form TEAMs of six or less

1 Access www.intedashboard.com

2 Click

3 Click "Login"

4 Enter ID and password

See paper for IDs
Number depends on your team
uk1#1 for team 1, member 1
Password = ID

5 Click on "Start IRAT"

6 Select the correct answer
For the TRAT or TEAM test: **ONLY ONE** person from the team clicks on "Start TRAT"

This person is the "team reporter"

**Team members discuss and decide upon a best team answer**

**The team reporter selects the answer and clicks submit**

- If correct (green check): go to next question
- If wrong (red X): Re-discuss and submit until the team gets the correct answer

Scoring
- 1st attempt correct = 4 points
- 2nd attempt correct = 2 points
- 3rd attempt correct = 1 point
TEAM application exercises

For the TEAM applications:
• **ONLY ONE** person from the team clicks on "Start Case"
• This person is the “team reporter”

For MULTIPLE CHOICE applications:
• Team members discuss and decide upon a best team answer
• The team reporter selects the answer and clicks submit

For FREE RESPONSE applications:
• Team members discuss and decide upon a best team answer
• The team reporter responds by typing or uploading an answer and clicks submit

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Part Two:

How
Backwards design

**TBL Class Flow**

- Pre-work
- IRAT
- TRAT
- Clarify
- Apply

**Backwards Design**

- Design RATs
- Select pre-work
- Create Application Exercises
- Form Learning Objectives
Designing TBL materials

▪ Objectives are paramount
▪ Application exercises: can modify existing cases or scenarios
▪ Readiness assurance test: questions can come from existing question banks and exams
▪ Pre-work: can come from lecture slides or assigned readings
Resource bank: all fields

Literature
Teaching Keats’ Poetry
Teaching Joyce’s “The Dead”

Kinesiology
Arousal and Performance in Sport
Feedback, Reinforcement, and Intrinsic Motivation
Leadership in Sport
Mental Health Benefits of Exercise
Motivational Interviewing
Personality in Sport and Exercise
Social Cognitive Theories and Models of Exercise Motivation

Pharmacology
Bad Blends: An Introduction to Pharmacology
Drug Discovery and Classification
Drug Development
Exploring Potential New Treatments For Alzheimer’s Disease
Geriatric Pharmacology
Introduction to Autonomic Pharmacology
Pharmacokinetics

TBL Course Management
Ensuring Student Buy-in and Engagement with TBL or Flipped Classes
TBL Starter Kit - Implementing TBL Tests in the Classroom
TBL Starter Kit - Introducing TBL Tests in the Classroom
Team-Based Learning in an Online Environment

Health Disciplines
Adolescent with Chest Pain
Arthritis Case
Asthma Case
Breaking Bad News
Cardiology Module for Physical Diagnosis
Care of Patients with Acute and Long-term Conditions: Shock
Dermatology RAT
EBM Course Orientation session materials
Example Syllabus for Evidence-Based Medicine Course
GI Response to a Meal
Global Health Microbiology
Health Assessment: Pulling it all Together
Health Care Systems
Individualized Decision Making
Infant with Failure to Thrive
Intra-Aortic Balloon Pumping (IABP)
Large Animal Urinary Surgery
Locate That Lesion
Malabsorption
Mechanisms of Sickle Cell Disease
Muscular Dystrophy Case
Newborn with Cyanosis
Pathophysiology of Stroke
Personality Disorder
Phagocytic Lysosome Deficiency
Rheumatology Case
Skin Rash: Microbiology
Substance Abuse
Toddler with Bruising
Vocal Pathologies

History
Cold War Consumers, and Civil Rights: U.S. History from 1945-1963

Human development
Bullying

Categories
Basic Sciences (5)
Business (20)
Health Disciplines (31)
History (1)
Human Development (1)
Literature (2)
Kinesiology (7)
Pharmacology (7)
TBL Course Management (4)

Basic Sciences
Cellular Membranes and Membrane Transporters
Compounds and Stoichiometry
Convection Introduction and External Flow Convection Elements
Units and Measurement

Business
A Stationary Manufacturer and Diminishing Returns
Adam Smith and International Trade
AI and the Phillips Curve
Developing a Stock Screen
Education and Positive Externalities
Farm Equipment and Exchange Rate Policy
Gasoline Supply and Demand
Home Buying and Supply and Demand
Hours Studying and Overall Success and Causality - Relation
Influencing the FED and Monetary Policy
Lawn Mowing and Comparative Advantage
Lawn Mowing and Oligopoly, Game Theory
Long-term Investing decision and Long-term macroeconomic growth
Market Experiment and Price Controls
Milton Friedman’s Nobel Lecture and Scientific Knowledge
Pollution and Negative Externalities
Shoes and International Trade Barriers
Sketchers and Rates of Return and the Efficient Market Hypothesis
Strategic Management, Strategic Planning, and Strategic Analysis
The Manager’s Job

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Resource bank: health sciences
ABCD Objectives by Dr. Sandy Cook

▪ **A is for Audience:** who are the participants?
▪ **B is for Behavior:** what is it you want participants to be able to do? what
▪ **C is for Conditions:** which environment do you want them to do it under (real conditions or simulated conditions: in a Cessna 172 aircraft, in a simulator or at a desk?)?
▪ **D is for Degree:** to which standard do you want them to perform? (land the airplane within 200 feet)
Learning objective: example

“At the end of this module, learners should be able to...”

**Could Be Better**

Know the symptoms of multiple sclerosis

- Not focused on behavioural outcomes
- No conditions specified

**Good**

Accurately diagnose multiple sclerosis in live patients

- Specifies desired behaviour ("accurately diagnose")
- Specifies conditions ("live patients")
“At the end of this module, learners should be able to...”

Could Be Better

Analyse a primary source
- No conditions specified
- No degree specified

Good

Analyse the origin and purpose of a primary source under exam conditions
- Specifies desired behaviour and degree ("Analyse"; "origin, purpose")
- Specifies conditions
Objective framework example

- Define it
- Explain why it's important
- Describe or demonstrate it
Applications

▪ **Follow the 4S:** Same, Significant, Specific, Simultaneous report

▪ **Formats**
  - **Multiple choice:** select the best or worst
  - **Free response:** critique something, improve something, create something

▪ **Higher order:** multiple answers and grey areas

▪ **Heart of TBL process:** >50% time; usually never complain to much time on applications
Applications: MCQ example

Career Skills:

“Which of the following is the most compelling answer to the interview question ‘Why us’?

A. “You have an attractive pay scale”
B. “I enjoy working in this industry”
C. “Your company has a great working culture”
D. “Your company’s values are in line with my own”
Applications: Free response example

Which line on this tax form would pose the greatest financial risk due to an IRS audit? Why?

- Significant problem (IRS audit!)
- Specific choice (‘which line’)

Michaelsen and Sweet, The Essential Elements of Team-Based Learning, p.21
Applications: Free response example

Career Skills:

▪ “Draft a 100-word approach email to request a coffee chat with an industry contact you were introduced to” [this is something you want participants to be able to go out and do the next day]

▪ “Here are 5 resumes: select the top resume in under 2 minutes” [helps participants understand why being concise on a resume is important]
Applications: writing example

Readiness Assurance

- IRAT/TRAT questions cover grammar and style rules

Application Exercise

- Multiple choice: Select the best way to answer a question
- Free response: Take an piece of writing and critique as a team
Applications: examples

- **Sales**: The customers says X, select the best response (multiple choice)

- **Project management**:
  - What is the biggest risk with this project plan? Free response
  - Which option for the project would you choose? (a) Internal or (b) Vendor

- **Communications**: Compose a 100 word email requesting an approval

- **Audit**: The Company management did the accounting by doing X – do you agree with the Company or not?
Applications

**Could Be Better**

*List the pros and cons of a lecture vs a TBL class.*

**Good**

*Rank the top 3 reasons a TBL class is better than a lecture.*

**No specific choice**

Specific choice – allows teams to compare their top 3; makes them evaluate each ("rank")
Pre-work examples

Generally

- **Assign readings** (textbook chapters, articles and presentations, ERUA airport class)
- **Lecture slides** (MNC programs, ERAU airport class)
- **Video lectures** (Duke-NUS)

*Pre-work is less critical than good learning objectives, MCQs and Applications that drive deep learning*
Pre-work best practices

▪ Short segments (6 to 10 minutes long)
▪ Start each segment with learning objectives
▪ End each segment with a summary
▪ Option to read versus just listen:
  ▪ Duke found through several million learners on Coursera that 80% of people would prefer to download slides and read a transcript rather than watch a video lecture
  ▪ Most people can read 3x faster than they can listen
  ▪ Could make both options available and assess data on learner preferences
Effective readiness assurance

- Designed to make sure learners understood the pre-work and are equipped to solve the applications
- More important topics should be given more space in RATs
- **Stems** must be clear and unambiguous.
  - Best written as a complete sentence/question
  - Keep as short as possible
- **Options** must also be clear; absolutely right or wrong.
  - All options must seem plausible and should be similar to one another in length, wording and style
Readiness assurance practices

Initially
- Review checklists
- Feedback from others
- Practice run of questions

Timing
- Some do 1 minute per question plus 5 minutes
- Hard to tell initially; best to track data and refine

Refinement (after first IRAT)
- Review discrimination index
- Academics have an appeal process if students think a question is unfair
TBL generates data

Each class will typically generate
Individual test data
Team test data
Team case data

Week

1 2 3 4 5 6 7 8 9 10 11 12

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Point-biserial correlation

The Point-Biserial Correlation Coefficient indicates item reliability.

How? It correlates student scores on one particular question with their scores on the test as a whole.

The driving assumption is simple: Students who score well on the test as a whole should score well on the question under review. Students who struggle on the test as a whole should struggle on the question under review. If a question deviates from this assumption (aka, a “suspect” question), the point biserial correlation lets us know.

The point biserial correlation ranges from a low of -1.0 to a high of +1.0.

The closer the point biserial correlation is to +1.0 the more reliable the question is considered because it discriminates well among students who mastered the test material and those who did not.

A point biserial correlation of 0.0 means the question didn’t discriminate at all. Imagine a test where all 20 students answered Question 1 correctly. Since Question 1 doesn’t discriminate among any of the students relative to how they performed on the rest of the test, its point biserial correlation of 0.0 makes perfect sense.

An negative point biserial correlation means that students who performed well on the test as a whole tended to miss the question under review and students who didn’t perform as well on the test as a whole got it right. It’s a red flag, and there are a number of possible things to check. Is the answer key correct? Is the question clearly worded? If it’s multiple choice, are the choices too similar?
Confidence-based IRAT “point spreading”

- Learners have a number of points per question that they can allot to different answers based on how confident they are about each.
- e.g. if I have 4 points, I can allot 3 to option A and 1 to option D if I am reasonably sure that A is the right answer but think that D might be as well.

Module: Interviews

<table>
<thead>
<tr>
<th>Points</th>
<th>Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>3</td>
<td>A) You have an attractive pay scale</td>
</tr>
<tr>
<td>0</td>
<td>B) I enjoy working in this industry</td>
</tr>
<tr>
<td>0</td>
<td>C) Your company has a great working culture</td>
</tr>
<tr>
<td>1</td>
<td>D) Your company’s values are in line with my own</td>
</tr>
</tbody>
</table>

Points remaining: 0

Questions answered: 0 of 1

00:03:15

Q1). Which of the following is the most compelling answer to the interview question “Why us”?
Adaptive IRAT and TRAT

<table>
<thead>
<tr>
<th>Questions:</th>
<th>Results:</th>
<th>Questions:</th>
<th>Results:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Q1, Q2, Q3, Q4, Q5, Q20</td>
<td>Q2, Q3, Q6</td>
<td>Q2, Q3, Q6</td>
<td>Q1, Q2, Q3, Q6</td>
</tr>
<tr>
<td><strong>Q4 Questions</strong></td>
<td><strong>Density altitude</strong></td>
<td><strong>Majority correct</strong></td>
<td><strong>New</strong></td>
</tr>
<tr>
<td>.</td>
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</tr>
<tr>
<td>Q20</td>
<td>Q20</td>
<td>Q20</td>
<td>Q20</td>
</tr>
<tr>
<td><strong>Q5 Questions</strong></td>
<td><strong>Density altitude</strong></td>
<td><strong>Majority wrong</strong></td>
<td><strong>Recycled Questions</strong></td>
</tr>
<tr>
<td>Q1, Q4, Q5</td>
<td>Q1, Q4, Q5</td>
<td>Q1, Q4, Q5</td>
<td>Q1, Q4, Q5</td>
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<tr>
<td><strong>Q5 Density Altitude</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
IRAT’s to predict final grades

13 weekly assessments

Predict final grades in three weeks

Source: Dr. Timothy Wertz; Lecturer, Yale-NUS College

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Learner preparation

- Explaining why

- Non-graded practice IRAT, TRAT and Peer Evaluation

Pedagogy

- **Lowest value learning:**
  - Adult attention span is six to ten minutes – you will recall only 10-20% of a one hour lecture and that will be forgotten in 30 days if not applied or used again

- **Highest value learning**
  - Teaching others
  - Applying what you learned

- **Highest value skills**
  - Applying knowledge to solve problems *(not just recalling facts)*

Caveats

- **High value learning:**
  - May be hard
  - May be different

- **Should learn a lot**
  - Aviation / finance
  - Teamwork
  - Communicating
  - Problem solving
  - Thinking

Things that matter to people who will hire you

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Assessment

Measurement – individual

- **Quiz (IRA):** 20% - individual, closed book / internet, done in most class periods for each module
- **Giving teammates feedback:** 5%
- **Board Papers:** 20% total (10% each) – individual
- **Midterm:** 15% - individual, closed book / internet
- **Final:** 15% - individual, closed book / internet (covers the entire course)

Total of about 75% of your grade based on individual performance

Measurement – team based

- **Team Quiz (TRAT):** 10%
  - Comes from your score as a group on the Group Readiness Assessment
- **Team Application Cases:** 10%
  - Evaluation of professor based on applied problem exercise in class
- **Teammate Feedback:** 5%
  - Comes from your team’s evaluation of you at the end of the course

Total of about 25% of your grade based on team performance

*Note: 100% of my evaluation at Skywest was based on team performance (revenue, profit, etc.)*
Faculty guides to support facilitation

Some faculty like to prepare a guide or “answer key” with explanations for RAT questions and applications

**Table of Contents**

**Introduction to Team-Based Learning**

**Time Allocation / Program Details**

<table>
<thead>
<tr>
<th>Time</th>
<th>Activity</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00-9:20</td>
<td>Introduction &amp; Brief Intro</td>
</tr>
<tr>
<td>9:20-9:55</td>
<td>Organizational teams</td>
</tr>
<tr>
<td>9:55-10:15</td>
<td>Individual Readiness Assurance Test (IRAT)</td>
</tr>
<tr>
<td>10:15-10:35</td>
<td>Group Readiness Assurance Test (GRAT)</td>
</tr>
<tr>
<td>10:35-10:50</td>
<td>Break</td>
</tr>
<tr>
<td>10:50-11:10</td>
<td>Application Practice</td>
</tr>
<tr>
<td>11:10-11:30</td>
<td>Report answer &amp; Discussion</td>
</tr>
<tr>
<td>11:30-11:45</td>
<td>Summary, follow by Q&amp;A</td>
</tr>
</tbody>
</table>

**Faculty Preparation**

1. Send participants the mandatory pre-workshop materials one week prior to workshop. Participants are expected to come to workshop prepared.

**RAT/GRAT Preparation**

1. Identify the total number of participants and teams for the session.
2. Prepare RAT and GRAT question papers and answer sheet(s) (via a template).

**Application Preparation**

1. Prepare Application exercise worksheet for each participant.
2. Prepare 4-m flash card for each team.

---

Copyright Brian O’Dwyer and Cognalearn Pte Ltd and www.intedashboard.com where applicable. Slides available from brian@cognalearn.com and may be used with attribution.
Facilitating with data analysis – IRAT

- Item analysis to zoom in on trouble points
  - 90% got question 7 wrong
  - 52% thought it was “D”
Facilitating with data analysis – TRAT

- Teams struggled with 6, 7 and 8 the most
Facilitating with clarifications

Instructor assigns teams to explain questions to the entire class

<table>
<thead>
<tr>
<th>Question</th>
<th>Class mean score</th>
<th>Team requesting clarification</th>
<th>Explanation assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. What is the purpose of a good pitch?</td>
<td>100%</td>
<td>3</td>
<td>None</td>
</tr>
<tr>
<td>2. What question does a 15 second pitch answer?</td>
<td>100%</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>3. What are the basic descriptors of a good pitch?</td>
<td>100%</td>
<td>3</td>
<td>None</td>
</tr>
<tr>
<td>4. What is “positioning”?</td>
<td>88%</td>
<td>2, 4</td>
<td>None</td>
</tr>
<tr>
<td>5. You should prioritize the skills most relevant to your employer, not you.</td>
<td>100%</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>6. What should the 90 second pitch provide?</td>
<td>63%</td>
<td>2, 3</td>
<td>None</td>
</tr>
<tr>
<td>7. When will a 90 second pitch be most useful?</td>
<td>25%</td>
<td>1, 2, 3</td>
<td>None</td>
</tr>
<tr>
<td>8. What are the elements of a cover letter introduction?</td>
<td>70%</td>
<td>1, 4</td>
<td>None</td>
</tr>
<tr>
<td>9. What should the “selling points” section of a cover letter include?</td>
<td>88%</td>
<td>1</td>
<td>None</td>
</tr>
<tr>
<td>10. What is the 10 x 10 rule?</td>
<td>88%</td>
<td>3</td>
<td>None</td>
</tr>
</tbody>
</table>
Facilitating with clarifications (cont’d)

Instructor assigns teams to explain questions to the entire class

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<td>2 4</td>
<td>Yes</td>
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<tr>
<td>5. You should prioritize the skills most relevant to your employer, not you.</td>
<td>100%</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>6. What should the 30 second pitch provide?</td>
<td>63%</td>
<td>2 3</td>
<td>Yes</td>
</tr>
<tr>
<td>7. When will a 90 second pitch be most useful?</td>
<td>25%</td>
<td>1 2 3</td>
<td>Yes</td>
</tr>
<tr>
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<td>10. What is the 10 x 10 rule?</td>
<td>88%</td>
<td>3</td>
<td>Yes</td>
</tr>
</tbody>
</table>

If your team doesn’t request clarification you could get called on to explain it.
Facilitating applications – gallery walk

- Team generate answers to an application
- When done, there is a voting process
- Each team votes for the best answer (but can vote for their own team)
- Allows them to see what other teams did
- Allows them to learn by critically evaluating what constitutes a “good” answer
- Can be time consuming
Time control

- Hard to predict initially
- Faster:
  - Fewer/less difficult RAT questions and mini-lecture
  - Faculty verbal reviews results of application exercise rather than the teams
- Slower:
  - Team clarification process and teams explain answers
  - More free response applications
  - Gallery walk facilitation
### 3-hour (1x per week)

**Readiness Phase (75 min)**
- IRAT (20 MCQ) 25 min
- TRAT (20 MCQ) 25 min
- Clarify doubts 25 min

[Break]

**Application Phase (75 min)**
- Application cases 3-6x (5-15 min each)

### 1-hour (3x per week)

**Monday**
- IRAT (10 MCQ) 15 min
- TRAT (10 MCQ) 15 min
- Clarify doubts 30 min

**Wednesday**
- Cases ~3x (5-15 min each)

**Friday**
- Cases ~3x (5-15 min each)
### Training schedule example

<table>
<thead>
<tr>
<th>With pre-work (90 min)</th>
<th>No pre-work (120 min)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intro (5 min)</strong></td>
<td><strong>Intro / presentation (20 min)</strong></td>
</tr>
<tr>
<td><strong>Readiness Phase (30 min)</strong></td>
<td><strong>Readiness Phase (45 min)</strong></td>
</tr>
<tr>
<td>▪ IRAT (10 MCQ) 10 min</td>
<td>▪ IRAT (10 MCQ) 15 min</td>
</tr>
<tr>
<td>▪ TRAT (10 MCQ) 10 min</td>
<td>▪ TRAT (10 MCQ) 15 min</td>
</tr>
<tr>
<td>▪ Clarify doubts 10 min</td>
<td>▪ Clarify doubts 15 min</td>
</tr>
<tr>
<td>[Break]</td>
<td>[Break]</td>
</tr>
<tr>
<td><strong>Application Phase (45 min)</strong></td>
<td><strong>Application Phase (45 min)</strong></td>
</tr>
<tr>
<td>▪ Application cases ~3x (~15 min each)</td>
<td>▪ Application cases ~3x (~15 min each)</td>
</tr>
<tr>
<td><strong>Evaluation (10 min)</strong></td>
<td><strong>Evaluation (10 min)</strong></td>
</tr>
</tbody>
</table>
Online synchronous

- Generally similar to face-to-face
- Can take longer
- Technology coordination
- Smaller team sizes
- More frequent peer evaluation (in academic context)
Online asynchronous example

Three weeks per topic

Week 1:
Readings and pre-work

Week 2/3:
Monday: IRAT (24 hours)
Tue-Wed: TRAT (48 hours)
Thur-Tue: Applications (6 days)
Wed-Sun: Applications discussion (5 days)

One week per topic

Monday/Tuesday
▪ IRAT

Wednesday/Thursday
▪ TRAT

Friday/Saturday
▪ Application exercises
Summary

- **Team-based learning ("TBL"):** specific type of blended learning

- **Benefits:** Positive impact on scores and alignment future skills

- **Considerations:** Upfront effort and change management to implement

- **Key steps:** objectives, applications, pre-work, readiness assurance, facilitation and evaluation

---

**Learn more**

Brian O’Dwyer

brian@cognalearn.com

Team-Based Learning Collaborative

www.teambasedlearning.org

TBL software

www.intedashboard.com
Appendix: TBL posters
Enhanced technology for Team-based learning (“TBL”): Impact of enhanced TBL software

Brian O’Dwyer

Commercial Founder and Executive Chairman, CognaLearn

Team-Based Learning Collaborative Conference 2018, San Diego, United States

INTRODUCTION

- The nature of a faculty member of a faculty member of a faculty-based instructional team for TBL was identified in a paper-based team-based learning (TBL) and was measured with a Faculty Survey. However, the TBL administrator’s survey was overwhelming. The reason for this challenge is the presence of student data.
- TBL software development for the TBL software provides a way to enhance TBL software development for a TBL. The software application provided a link to contact the student, and the student was involved in the creation and evaluation.
- Faculty were interviewed at a high level about the impact of technology. Results of the faculty were presented as a poster at the TBL Conference. The study faculty were exposed about the email addresses of the software.
- Faculty and students from 11 institutions surveyed the TBL software. They were not interviewed for the survey. The survey was conducted for the president and two times.

METHOD

- Faculty and students from 11 institutions were surveyed for the TBL software. They were not interviewed for the survey.
- The survey was conducted for the president and two times.
- The study was conducted for the president and two times.
- Results were compared to a survey of 100 TBL faculty and students.
- Results were compared to a survey of 100 TBL faculty and students.

RESULTS

- 56% of faculty and 5% of students were satisfied with the survey.
- 57% faculty and 10% of students were satisfied with the tool.
- 57% faculty and 10% of students were satisfied with the tool.
- Beginners were reported by faculty and students.
- Faculty and students were reported by faculty and students.
- Faculty and students were reported by faculty and students.
- Faculty and students were reported by faculty and students.

DISCUSSION

- Overall, the faculty were somewhat satisfied with the variance of the tool, which was different from last year but it is clear that all of the respondents agreed on all of the enhanced features.
- By implication, the overall satisfaction of faculty and students was different (5% for faculty compared to 76% for students), as students did not interact with the tool as extensively as faculty.
- Qualitatively, as expected there were real-time data and administration, and these were beneficial. However, concerns about academic integrity were prominent in this previous survey, but not reported by faculty this year who instead identified the need for additional peer evaluation forms and feedback for online learning.

CONCLUSION

- Given some of the constraints identified above, it may be difficult to reach all the conclusions. Instead it may be more appropriate to refer to the in-service pd for additional solutions to the tools.

ACKNOWLEDGEMENTS

This work is possible in the era of digital learning, contributing to the larger efficacy of these education and development tools.

AUTHOR

Brian O’Dwyer is the Co-founder and Executive Chairman of CognaLearn, an educational technology company specializing in team-based learning (TBL). He has over 15 years of experience in education technology and currently serves as the Chief Executive Officer at CognaLearn. Before co-founding CognaLearn, Brian served as the Chief Learning Officer at Frontline Education, a national education software company focused on student data management and assessment. Brian is a sought-after speaker and presenter, sharing insights on the future of education technology and team-based learning at conferences such as the National Association for College Student Affairs (NACSA) and the American Educational Research Association (AERA). He has also been a guest on a variety of podcasts, including the “EdTech Leader” podcast series. Brian holds a Bachelor of Arts degree in Political Science from Western Washington University and a Master of Science degree in Educational Technology from the University of Utah. He is a board member of the TBL Association of America and is actively involved in the TBL community. Brian can be reached at brian@cognalearn.com or follow him on Twitter @briandoewyer.
Arteries to Ailerons

Applying team-based learning ("TBL") methods from Duke-NUS Medical School to flip the classroom for active and relevant learning at Embry-Riddle Aeronautical University Asia

Brian O’Dwyer, Adjunct Faculty, Embry-Riddle Aeronautical University Asia

INTRODUCTION

- The adage, "carefully read, carefully review," has been adopted by Duke-NUS Medical School’s (D-School) team-based learning (TBL) methods.
- Projects have demonstrated that the model results in student engagement, but the implications for student performance are less clear.
- Asian references are included herein to better answer the question: are HBS students more engaged with the same or a different set of team members?

METHOD

- The class was taught with TBL for each of three modules as described below:
  - Prepare for the class before class, view the video and print the cases
  - After class, work in teams to review the cases
  - Apply team-based learning (TBL) methods from Duke-NUS Medical School to flip the classroom...

RESULTS

- 80% of Duke-NUS Medical School students reported that the TBL method was effective:
  - Improved student performance
  - Enhanced student engagement
  - Increased student satisfaction

DISCUSSION

- The TBL method was taught to TBL methods.
  - In class, the TBL method was used to engage
  - flip the classroom for active and relevant learning.

CONCLUSION

- Asian reference:...
Turbocharge student career readiness with team-based learning (“TBL”) at Embry-Riddle Aeronautical University Asia

INTRODUCTION
- Many students are entering the workforce from different and ambiguous (TVEA) job market due to rapid changes in technology and globalization.
- Addressing these issues requires preparation of students with better skills and changing requirements requires different preparation.
- These factors have contributed to an “unmatched to employability gap” as identified by the National Brevard Education Workforce Roundtable 2016 report that 25% of students lack the skills for the workforce compared to only 1% of business leaders in the 2015 Delphi Survey, and 90% of Chief Academic Officers according to a National Digital 360° survey.
- The authors, including the Chief Academic Officer, have been actively working to develop student career readiness in the multi-disciplinary curricula. diver...
Team-based learning (“TBL”) based techniques beyond the classroom
corporate and career skills case studies

Brian O’Dwyer, Commercial Founder and Executive Chairman, CognaLearn

METHOD

Several studies of how TBL is utilized at Singapore have been reported. These results suggest that TBL techniques are effective in improving student engagement and outcomes.

RESULTS

The results are promising, with an increase in student engagement and improved learning outcomes. The implementation of TBL techniques has been well-received by students and educators alike.

DISCUSSION

Generally, the pattern of scores from IRAT to TBLAT in Final Exam seemed similar to other results observed in academic settings where there is a bump in scores from IRAT to TBLAT which is sustained in this examination.

Both groups of learners had a very positive experience based on their qualitative and quantitative feedback.

The results are primarily based on learner reaction and knowledge which have limitations. A more robust analysis would attempt to measure learner behavior change and ultimate business outcome.

CONCLUSION

Elements of TBL can be effective outside of academic settings.

However, the learning experience must be carefully customized to a particular setting and perspective and more work could be done to assess behavior change and business impacts.

ACKNOWLEDGEMENTS

Thank you to all the dedicated members that were patient and thoughtful in providing guidance and encouragement and my colleagues in MEDIVIA and StepCareers.

CONTACT

Bryan O’Dwyer is a Team-Based Learning (TBL) instructor, author and entrepreneur. He is the Founder of CognaLearn, a technology-enabled learning company in Singapore. He has lectured locally and overseas in TBL and online education technologies in Asia, Europe, and the United States. He is an Independent Director at StepCareers, a provider of learning technologies and online education management services and also Independent Director at MediViva, a provider of education and training services in Liverpool, England. He is also an Advisory Board Member of the Asia-Pacific College of Health Care Administrators (APCHCA).

References:


Implementing Team-based learning ("TBL") in an online synchronous environment for a careers skills workshop

Brian O'Dwyer

Commercial Founder and Executive Chairman, CogniaLearn

Team-based Learning Collaborative Conference 2018, San Diego, United States

INTRODUCTION

- The author developed a series of 2-hour workshops to teach university students. Career Strategy, Building, Resume Writing, Networking and Interviewing. The workshops had been delivered in a face-to-face setting using two-hour team-based learning (TBL) with live handouts and elements.
- To run a series of 10 against the forecast projections with the knowledge gained in the previous session in the classroom.
- To familiarise the students with team-based learning (TBL).
- Students received participation agreements which was used to assess.
- The TBL was divided into two sessions, each session lasting 1 hour and 20 minutes.
- The team-based learning was conducted through the use of an online platform and multi-modal presentations.
- The TBL was facilitated by Bob Strong, an experienced team-based learning facilitator.
- The session began with an overview of the TBL session.
- The TBL was conducted using an online platform.
- The TBL was facilitated by Bob Strong, an experienced team-based learning facilitator.
- The session began with an overview of the TBL session.

METHOD

- Acceptance criteria for the online learning program at Duke University's Fuqua School of Business were applied to each workshop in the online session.
- Students were asked to complete a survey regarding their participation in the TBL session.
- Students received participation agreements which was used to assess.
- The TBL was divided into two sessions, each session lasting 1 hour and 20 minutes.
- The team-based learning was conducted through the use of an online platform and multi-modal presentations.
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- The TBL was facilitated by Bob Strong, an experienced team-based learning facilitator.
- The session began with an overview of the TBL session.

RESULTS

- Overall team-based learning (TBL) scores:
  - Students were asked to complete a survey regarding their participation in the TBL session.
  - The TBL was divided into two sessions, each session lasting 1 hour and 20 minutes.
  - The team-based learning was conducted through the use of an online platform and multi-modal presentations.
  - The TBL was facilitated by Bob Strong, an experienced team-based learning facilitator.
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  - The TBL was conducted using an online platform.
  - The TBL was facilitated by Bob Strong, an experienced team-based learning facilitator.
  - The session began with an overview of the TBL session.

DISCUSSION

- The metrics represent a range of outcomes which are both relevant and provide additional feedback to students about the different stages of the TBL process. For example, the team-based learning (TBL) sessions were conducted using an online platform and multi-modal presentations.
- The TBL was divided into two sessions, each session lasting 1 hour and 20 minutes.
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- The TBL was facilitated by Bob Strong, an experienced team-based learning facilitator.
- The session began with an overview of the TBL session.

CONCLUSION

- It is possible to conduct a workshop using TBL in an online synchronous format.
- Certain adaptations should be considered when shifting from face-to-face to online including smaller team sizes, longer time periods and lesser team response application.
- This is a unique area of TBL and one where more work could be done.

ACKNOWLEDGMENTS

The author would like to acknowledge the contributions of the students and faculty of the Coginlab Management Center at Duke University's Fuqua School of Business in particular and everyone involved in the TBL workshop and who has contributed to the success of this project.

The author is the Commercial Director of CogniaLearn and a co-founder of the Coginlab Management Center at Duke University's Fuqua School of Business. This project is the result of work by students and faculty at Duke University, and is supported by the National Science Foundation (NSF) under Grant No. 1903284.

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Utilizing Team-based learning ("TBL") data to analyze student performance, predict student outcomes and optimize learning outcomes

Brian O’Dwyer, Commercial Founder and Executive Chairman, Cognalize
Dr. Timothy Wertz; Lecturer, Yale-NUS College

TEAM-BASED LEARNING COLLABORATIVE CONFERENCE 2018, SAN DIEGO, UNITED STATES

INTRODUCTION

Background
- TBL has been described as the "new normal" because it is transforming how we teach learners to learn.
- Team-based learning ("TBL") with its frequent assessments has the potential to increase education costs by over $100,000 per year in a single course.
- The components of TBL consist of pre-lecture, peer instruction, and final examination. Collaboration is central to TBL results. TBL is a common approach used in higher education.
- The technology interface frequently used by TBLs can be tracked and analyzed online.

Method
- Three case studies of team TBL orientations were examined. TBL data.
- TBL data can be used to examine student performance, predict outcomes and optimize learning.

CASE 1: IRAT vs TRAT vs FINAL

By comparing the scores of IRAT, TRAT and Final Examinations, the effectiveness of exam performance of students can be observed. These three effects include:
- An increase in IRAT to TRAT scores of over 20%.
- A decreasing score range between the highest and lowest scores between the IRAT and Final Examination.
- Final Examinations scores closer to TRAT than IRAT.

CASE 2: PREDICTION

Can prediction of Final Course Grade be made using first three weeks of IRAT data?
- The analysis of this examination is to determine if IRAT results from the earlier weeks can be used to predict the final course result. This prediction of the first three weeks of IRAT was more reliable and used as the prediction model.

CASE 3: ADAPTIVE READINESS ASSURANCE TEST

Questions:
- Week 1: Questions:
  - New Questions: 0
  - Majority correct: 0
- Week 2: Questions:
  - New Questions: 0
  - Majority correct: 0
- Week 3: Questions:
  - New Questions: 0
  - Majority correct: 0

DISCUSSION

- The case represents samples of three approaches on how to use the data generated by TBL.
- The data in Case One is based on less than 10 students in Embry-Riddle Aeronautical University. The data in Case Two is based on 800 students in Yale-NUS College.
- These analyses were not designed to reach definitive conclusions per se but rather to provide examples of TBL data that could be used with the objective of laying the groundwork for more detailed and robust analysis in the future.

CONCLUSION

- There is enormous potential to use TBL data to analyze, predict and optimize outcomes.
- However, care must be taken not to blindly apply analyses from one set of learners to another.
- What could be done is to develop novel models for TBL data analysis that could be easily tested, customized and applied in various populations.

ACKNOWLEDGEMENTS

- The author wishes to thank Yale-NUS for allowing this project to be performed at this time.

AUTHORS

- Dr. Timothy Wertz; Lecturer, Yale-NUS College
- Brian O’Dwyer, Commercial Founder and Executive Chairman, Cognalize

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- For more information, visit: www.tvedashboard.com/resources/posterbank
Increasing student engagement and learning outcomes with technology enhanced team-based learning ("TBL") in a Mergers & Acquisitions guest lecture at the National University of Singapore

Brian O’Dwyer, Commercial Founder and Executive Chairman, CognaLearn
Miguel Soriano, Adjunct Professor, NUS Business School
Team-Based Learning Collaborative Conference 2018, San Diego, United States

INTRODUCTION

The author was approached by the chair of the conference for a guest lecture on team-based learning ("TBL") in a Mergers and Acquisitions ("MA") context, which included one hour of in-depth presentation and interactive TBL exercises.

METHOD

- **Student role**: Core of TBL is that students learn from each other.
- **Content**: Topics include strategic decision-making, financial, and qualitative analysis. Throughout the semester, students work in teams to learn and practice teamwork, communication, and critical thinking skills.

**TBL Format**

- **Group Discussion**: Students discuss the topic in teams before the lecture.
- **Question and Answer Session**: Students ask questions and receive feedback from the instructor.
- **Case Study Analysis**: Students analyze case studies using the TBL methodology.

**TBL 4h Application Exercise Format**

- **Group Work**: Students work in teams to apply the TBL methodology to a real-world scenario.
- **Discussion**: Teams discuss their solutions and share insights with the class.

**Typical TBL Format**

- **Student Presentation**: Students present their findings and conclusions to the class.
- **Instructor Feedback**: Students receive feedback from the instructor on their presentations.

**Guest Lecture TBL Format**

- **Student Engagement**: Students actively engage in the lecture and participate in discussions.
- **Interactive Learning**: Students participate in interactive exercises and activities.

**Guest Lecture Objectives**

1. **Explain the TBL methodology and how it enhances student learning.
2. **Demonstrate the effectiveness of TBL in a specific context (e.g., M&A).
3. **Encourage student participation and active learning.
4. **Address common TBL challenges and strategies for overcoming them.

**Free Response Application Example**

**Multiple Choice Application Example**

**Student Feedback**

**Student Feedback Measured with Non Promoter Score ("NPS")**

**SELECTED STUDENT COMMENTS**

WHAT COULD BE BETTER?

"Longer lecture would be better for digestion of information."

DISCUSSION

- **TBL as a tool to help students develop critical thinking skills.
- **The importance of active learning and student engagement.
- **The benefits of integrated learning experiences.
- **The role of technology in enhancing student engagement.

CONCLUSION

- **The use of modified Team-Based Learning methodologies with technology can be an effective way to review and apply content of a whole course in a realistic, guest lecture format.
- **This approach can also be used as a way to conduct purposeful subject matter expert led training in an active learning format.

ACKNOWLEDGEMENTS

The author would like to acknowledge the contributions of the National University of Singapore for their support and participation in the conference.

AUTHORS

Brian O’Dwyer, Commercial Founder, CognaLearn
Miguel Soriano, Adjunct Professor, NUS Business School

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Implementing Team-based learning (“TBL”) to provide continuing professional education for practicing accountants.

Brian O’Dwyer, Commercial Founder and Executive Chairman, CognaLearn

Team-Based Learning Collaborative Conference 2018, San Diego, United States

INTRODUCTION

- The author was approached by a Japanese software company about using TBL to train its key sales staff.
- The company’s training department did not have a clearly defined methodology to use for the project.
- The use of TBL was seen as beneficial for the company, as it would provide a structured approach to training.

METHOD

- The author had prior experience with TBL and its effectiveness.
- The training was planned with the company’s key stakeholders.
- The use of TBL was seen as beneficial for the company, as it would provide a structured approach to training.
- The training was planned with the company’s key stakeholders.
- The use of TBL was seen as beneficial for the company, as it would provide a structured approach to training.

RESULTS

- The training was conducted in a series of workshops.
- The workshops were seen as beneficial by the participants.
- The training was conducted in a series of workshops.
- The workshops were seen as beneficial by the participants.

DISCUSSION

- The training was conducted in a series of workshops.
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- The workshops were seen as beneficial by the participants.

ACKNOWLEDGEMENTS

The author would like to acknowledge the contributions of the software company and its training department.

AUTHOR

Brian O’Dwyer, Commercial Founder and Executive Chairman, CognaLearn

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Impact of tailoring team-based learning ("TBL") train-the-trainer workshops from academic to training environments

Brian O’Dwyer 1, Sandy Cook 2
1Commercial Founder and Executive Chairman, CognovaLearn
2Professor and Senior Associate Dean, DukeNUS
Team-Based Learning Collaborative Conference 2018, San Diego, United States

INTRODUCTION

- Duke-NUS routinely offers training programs in TBL. The audience is usually senior faculty members across many disciplines. Given the diversity of the audience, the materials need to be more generic.
- In 2014, the Public Utilities Board ("PUB") in Singapore requested Duke-NUS to teach their trainers to use TBL to train employees in property management.
- Level the Australian Employment Training Initiative ("AETI") asked Duke-NUS to teach AETIs in each state how to develop TBL modules to provide employability skills training to disadvantaged adults using TBL.
- The question was how to make training be more effective; the more TBL training material was tailored specifically to the audience requesting the training.
- Now, Duke-NUS conducts both training programs through CognovaLearn, which is a separate entity owned by Duke-NUS with the purpose of commercializing some of the TBL-related technology and techniques developed at Duke-NUS.

METHOD

- Trained 12 trainers from PUB and 20 trainers from AETI.
- Average IRAT, TRAT scores and "recommend course" from programs were compared.
- Feedback forms were distributed to participants to find out attitudes, effort, the efficacy of pre-work, and whether learning objectives for each module were met.
- There were 12 response options and each response was assigned a value: 5.0 for Strongly Agree, 4.0 for Agree, 3.0 for Neutral, 2.0 for Disagree, 1.0 for Strongly Disagree.
- The total value of all responses was tallied and divided by the total number of responses to derive the average value of each response in the questions the pre-work was effective.
- Average value of response was 2.5 points.
- Average value of course was 4.6 points.

RESULTS

<table>
<thead>
<tr>
<th></th>
<th>PUB</th>
<th>AETI</th>
</tr>
</thead>
<tbody>
<tr>
<td>IRAT</td>
<td>65%</td>
<td>68%</td>
</tr>
<tr>
<td>TRAT</td>
<td>74%</td>
<td>75%</td>
</tr>
</tbody>
</table>

Overall recommendation:
- 62% PUB
- 66% AETI
- 68% PUB
- 74% AETI

ACKNOWLEDGEMENTS

The Australian Employment Training Initiative ("AETI") is a training model and framework funded by the Department of Employment of the Australian government.

The Public Utilities Board ("PUB") is the Singapore regulatory board of the Ministry of the Environment and Water Resources. It is responsible for measuring the efficiency and maintainable water supply by regulating the country’s water usage cycle.

The authors would like to acknowledge the contributions of staff from AETI and PUB in helping the participants and organizing the TBL train-the-trainer workshops.

One author in the Commercial Finance of the Financial Model is in CognovaLearn. CognovaLearn commercializes TBL without ownership or control but as a partner with Duke-NUS (National Chairman of the Directors of the CognovaLearn management board). The methodology and work used to deliver the training sessions in this paper.

AUTHORS

Prof Sandy Cook is the Founder and chairman of the Team-Based Learning Collaborative (TBLC) Asia Pacific Conduit, and is a TBL course trainer and consultant. She is a professor and Senior Associate Dean at Duke-NUS Medical School. Prof Cook also acts as the Deputy Director of the Academic Medicine Education Institute.

Brian O’Dwyer is a team-based learning ("TBL") advocate, author, and spokesperson for academic and medical education. He is a security and information technology advisor for the Singapore Cybersecurity Agency, and is a partner in DMS Consulting. He is a graduate of Duke University and has a UIll from Columbia and a MBA from Duke University.

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Team-Based Learning ("TBL")

### Before class
1. Learn with pre-work on your own
   - Readings
   - Lectures slides
   - Videos

### In class: closed book
2. Individual readiness assurance test (IRAT)
3. Team readiness assurance test (IRAT) with immediate feedback
4. Clarification session

### In class: open book
5. Application exercises (4S)
   - Significant problem
   - Same problem
   - Specific choice
   - Simultaneous report

### After class: Appeals and Peer evaluation
Writing Effective MCQs: Guidelines

Test Items
—Relate directly to instructional objectives
—Test at the same level of learning as the objectives are designed to assess
—Reflect different levels of learning (recall, comprehension and application, problem solving)

Stems
—Provide a complete statement
—Include only relevant information
—Contain as much of the test item as possible
—Have a length as short as possible, commensurate with the level of learning being tested
—Ask for the correct, not the “wrong” answer
—Avoid absolute terms, such as always, never, all, or none
—Avoid imprecise terms, such as seldom, rarely, occasionally, sometimes, few, or many
—Avoid cues, such as may, could, or can
—Define eponyms, acronyms, or abbreviations when used

Options
—Follow grammatically from the stem
—Relate to each other in kind (eg, all diagnoses, all tests, all treatments)
—Are similar in grammar, length, and complexity, with distractors being plausible but clearly incorrect
—Avoid none of the above and all of the above
—Follow a logical order (eg, numeric, chronologic)
—Are independent and do not overlap
—Vary position of the correct answer

Collins, “Education Techniques for Lifelong Learning.”
RadioGraphics 2006; 26:543–551
Level 1: Learner reactions

- Recommendation rate: 98 to 100%
- Response rates: over 90%

**Diagnostic/priming**

“Good to do a test to know the gaps in our knowledge. This encouraged me to be more attentive to find out the answers.”

**Peer**

“The approach makes the team share their working experiences”

**Engaging**

“The learning approach is more interesting than usual classroom training”

**Deeper**

“more in-depth discussion rather than just listening”
Level 2: learner knowledge

#1 Teams perform over 23% better than individuals

#2 Individuals retain the gains of the team

Overall Improvement: +56%

Team Learning: +23%

#3 The range narrows as bottom learners gain the most

Source: CognaLearn corporate training engagement.
Timing example: workshop in patient safety (3hr)

INTRODUCTION (10 min)
• 10 minutes: introductory PowerPoint presentation

READINESS ASSURANCE (30 min)
• 5 minutes: pre-survey
• 10 minutes: TBL IRAT (10 MCQ)
• 15 minutes: TBL TRAT (10 MQC)

APPLICATION EXERCISES (2hr 15 min)
• 45 minutes: simulated application case 1: systematic analysis of a medical error
• 45 minutes: simulated application case 2: inter-professional handoff
• 45 minutes: simulated application case 3: safe discharge

CONCLUSION
• 10 minutes: wrap-up, questions/post-survey
Government of Singapore: Public Utilities Board

- Heard about TBL from NTU
- Wanted to use TBL for project management training for new engineers
- Five-day training, approximately 30 learners
- First WSQ eligible course taught with TBL
PUB feedback

- Overall 92% would recommend the workshop
- 83% of learning objectives met (average rating 4.0/5.0)
- 91% thought the TBL format was effective
- 100% thought the technology supported learning
"Class was **engaging**. Everyone has opportunity to participate in class discussions”

“Contextualising of training with relevant apply management context”

“**The immediate feedback** from the TRAT. The application exercise was difficult but the discussion and debate helped in the understanding of the concepts”

“TBL is a new learning way to me. This method makes me **absorb more** compared to conventional lecture. In addition, the **use of technology for Irat and TRAT has impressed me**”
Training provider (AETS) attended the keynote speech on TBL last year

- AETS used TBL to successfully tender for employability skills training program
- Multi-week program for unemployed youth

TBL gave the training provider a competitive advantage in a tender on the “innovative learning models” governments are looking for
Australian Government feedback

- 100% would recommend the workshop to others
- 100% thought the TBL format was effective
- 100% thought the technology supported learning
Big 4 accounting firm

- Heard about TBL at this conference last year
- Wanted to bridge theory with practice
- Piloted a half-day workshop in a technical accounting standard; planning business writing pilot next
- ~50 learners; 98% recommendation rate
- Adapted existing material in three weeks
Learner survey – what went well

Keywords: discussion, interactive, good, knowledge, facilitator, team, training, course, individual, learning, test, topic, impairment, examples, approach, team, test, went, training, learning, good, individual, interactive, knowledge, clearly, better, discussions, provide, assessment, effort, share, overall, new, well, provided, clear, better, context, improve, awareness, solutions, encourage, share, knowledge, progress, understanding.
### Clarification (continued)

<table>
<thead>
<tr>
<th>Question</th>
<th>Class mean score</th>
<th>Team requesting clarification</th>
<th>Explanation assignments</th>
</tr>
</thead>
<tbody>
<tr>
<td>7. The cash flows used in determining VIU include… i) Cash inflows from continuing use ii) Net cash flows from the ultimate disposal of the asset iii) Non cash items such as depreciation and amortization iv) Future restructuring plans that is approved by the BOD</td>
<td>72%</td>
<td>3</td>
<td>6</td>
</tr>
<tr>
<td>8. Entity X has a machine with a carrying amount of $280,000. • The entity is loss making and missed its budget by 50%. There were indicators of impairment • The fair value of the machine is $250,000 and the following costs of disposal have been identified: o Incremental cost in bringing the machines into sale condition $1,500 o Disposal costs $2,000 • Post tax future cash flow forecasts derived from the most recent budgets approved by management are: Year 1 $60,000 • Year 2 $62,000 • Year 3 $84,000 • Year 4 $66,000 • Year 5 $68,000 • WACC = 10% What is the amount of the impairment loss to be recognised, if any?</td>
<td>86%</td>
<td>None</td>
<td>None</td>
</tr>
<tr>
<td>9. On 1 January 20X6, entity X acquires an 80% interest in a subsidiary for $2 mil • The identifiable net assets of the subsidiary are $2 mil • The NCI is measured as a proportion of the net assets of the subsidiary • The subsidiary is a cash-generating unit • You are reviewing goodwill impairment • At 31 December 20X6, the recoverable amount of the subsidiary is $1.2 mil based on VIU approach • The carrying amount of the subsidiary is $1.3 mil • calculate the impairment loss for 20X6, if any.</td>
<td>56%</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>10. Which of the following are disclosure requirements under FRS 30? i) Fair value hierarchy when FV less cost to sell approach is adopted ii) Valuation techniques for those classified under level 1 and 2 iii) Key assumptions for those classified under level 3 only iv) Post tax discount rates when VIU approach is adopted</td>
<td>22%</td>
<td>4</td>
<td>8</td>
</tr>
<tr>
<td>11. Company Z allocates goodwill to the group of CGUs A, B, and C. Z uses the same IT system (corporate asset) for all its CGUs, A, B, C and D. Management concludes that the corporate asset’s carrying amount cannot be allocated to each CGU on a reasonable and consistent basis. There is an indication of impairment for CGU B. Explain how you would carry out the impairment testing. i) Test CGU B without goodwill and corporate assets ii) Test CGU B and goodwill but w/o corporate assets iii) Test CGU A, B, C and goodwill together but w/o corporate assets iv) Test all CGU and corporate assets but w/o goodwill v) Test all CGU, together with goodwill and corporate assets</td>
<td>52%</td>
<td>10</td>
<td>2</td>
</tr>
</tbody>
</table>
Results – learner reaction survey

- LO: Identify when FRS36 testing is required. 4.4
- LO: Level and sequence of impairment testing. 4.1
- LO: Determine recoverable amount and VIU. 4.0
- LO: Discount rate for VIU. 3.8
- LO: Sufficiency of disclosure. 3.9
- TBL is effective. 4.2
- Facilitator was effective. 4.4
- The workshop will help me with my work. 4.2
- Interested in attending more courses with TBL. 4.3

Source: Impairment Training for New Audit Managers; n=49; Rating based on 5 point Likert scale (Strongly Agree = 5.0; Agree = 4.0; Neither agree or disagree = 3.0; Disagree = 2.0; Strongly Disagree = 1.0).
Learner survey – what went well

Testing

- Having an individual and group test before providing theories. Understand the topic better.
- IRAT and TRAT are interactive and engaging.
- There were individual assessment prior to a team based learning so that I am aware from the start on what I am lacking.
- Good to do a test to know the gaps in our knowledge. This encouraged me to be more attentive to find out the answers.
- The training is interactive. It allows us to do a self-knowledge check as well as to discuss with other managers.
- The individual test and team test is excellent.
- Having the assessment first let us understand where we are at our level of understanding and subsequently having the team discussion to share our knowledge helps to strengthen the understanding and how others understand

Team

- Team discussion was more structured. Training matched the discussion questions.
- Team interaction was new and interesting
- Team discussions
- Group discussions
- the team discussion part
- team effort
- Team effort
- The team discussion
- The approach makes the team share their working experiences.
- Team based learning is a more interactive way of learning, encourage team discussion.

Facilitator

- clarification of questions
- Detailed explanation with illustrative examples
- The facilitator would go to the details and would repeat when unclear.
- Specific examples provides more insight in application of impairment
- discussion with experts
- Facilitator was good to engage the crowd
- Adrian explained the underlying concept and rationale simply and clearly. This helped in understanding and remembering the key items.
- The facilitator is very patient. - Information was articulated clearly.
- The guidance and sharing session was comprehensive. We are more clear on the impairment testing which is often took very long time to resolve
- Facilitator- very good.
- The presentation is clear and informative.
- Examples from ASG team

Overall

- Overall
- overall course went well
- Interactive
- Good job
- “The learning approach is more interesting than usual classroom training.
- interactive
- Overall was good.
- Class was interactive and provided us a refresher to us all about impairment.
- most things
- everything went good!
- the structure of the course as it provides a more in-depth discussion rather than just listening to standard materials.
- The approach is new and interesting.
- Better understanding of the topic
- The course provided the very detailed knowledge on FRS 36
- The training is effective and the facilitators have clearly explain/elaborate the content of the course.

Technology

- The use of the new tool
- Very efficient platform for us to test ourselves.
- Interesting system
Learner survey – even better if

Pre-work
- Send us the material earlier so we have time to look through.
- The notification received for this training was rather last minute. Also, as it has only 1 run, not everyone can make it. Would have been good to know the agenda of the training beforehand too.
- To provide the presentation slides as well as part of the course material before the training.
- To have the slides being shared before the workshop

Testing
- Know our own assessment results
- It might be more useful if we can access our assessment results prior to the clarification/debrief.
- To inform us of the individual results
- Test was rushed.

Clarifications / facilitation
- The debrief session could be further streamlined
- Solutions especially for the calculations to be flashed in the slides instead of written on the board, can’t really see from the room.
- Better explanation.

Content
- Include some real audit working paper and example would be better and how regulatory review the file
- To provide further examples
- More elaboration on how VIU is computed
- More in depth information could be provided.

Food
- Tea break with food
- No food
- No food and coffee. Needed for break.
- No food/snacks during break
- To provide food/coffee?

Other
- Perhaps smaller class sizes
- Respond from class
- Sitting people with their own peers before getting us to sit with unfamiliar faces. It would enhance more participation.

Nothing to improve
- All is good
- Everything is good.
- N/A
- N/A
- NA
- NA
- NA
- Nil
- Nil
- Nil
- No comment.
- No comments.
- No comments.
- None
- None
- None
- None
- Nothing
- Nothing
Learner survey – even better if
Employability skills

- Series of five workshops in career skills
  - Strategy, pitching, resumes, networking and interviewing

- Delivered with TBL in 1.5 to 2.0 hours for each topic
  - 2.0 version includes a 20 minute overview of pre-work
  - Typically face-to-face; piloted online version

- Used with university students in China, Singapore and the US
  - Typically four teams of 4-6, 24 total learners
Pharma examples

- Heard about TBL from Duke-NUS
- Used for employee training and external healthcare providers
- One to three day events
- Up to 70 learners (ten teams of seven)
Guest lecture / war story / leader lead training

- Guest lecture at NUS M&A class (mergers and acquisitions) with TBL application exercise only

- 20 minute overview of the deal then three mini-cases:
  - Part 1: Deal rationale, go/no go decision: teams work, report, debrief
  - Part 2: Valuation, cash versus stock: teams work, report, debrief
  - Part 3: Bid letter and due diligence top 3 items: work, report, debrief

- Adds rigor to the “war story” with experienced leader

- ~50 learners, eight teams of six
Breadth of TBL training

- **Technical skills**: asthma, diabetes, mental illness, impairment valuation, project management
- **People skills**: networking, interviewing, business communication
- **Modality**: mostly face-to-face, some online
- **Schedules**: 90 minute workshops, half-day to five day
- **Combination**: can be more effective when combine with other methodologies (simulations) and follow up testing
- **Global**: Asia, Europe, North and South America

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