Training the next generation in aviation with technology enabled team-based learning

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Objectives

After this session participants should be able to:

1. **Define:** team-based learning ("TBL")

2. **Explain:** benefits and considerations of TBL

3. **Describe:** the backwards design approach to TBL
Landing objective
Too fast?
Too slow?

Too high?
Too low?
Team-based learning...

Educator

Entrepreneur

Speaker

Parent

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My path

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Problem: employability gap

Laurentius de Voltoina, School of Bologna 14th century.
Problem

Boeing says Asia needs 240,000 pilots over next two decades

By Leitha Santorelli
BBC Business reporter

28 August 2018
Solution: team-based learning ("TBL")

<table>
<thead>
<tr>
<th>In class: theory</th>
<th>In class: apply</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Pre-work</td>
<td>5. Team applications</td>
</tr>
<tr>
<td>2. Quiz</td>
<td>2. Quiz</td>
</tr>
<tr>
<td>3. Team quiz</td>
<td>3. Team quiz</td>
</tr>
<tr>
<td>4. Clarify doubts</td>
<td>4. Clarify doubts</td>
</tr>
</tbody>
</table>

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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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
2. Individual Readiness Assurance Test (“IRAT”)
3. **Team Readiness Assurance Test ("TRAT")** with immediate feedback
4. Clarifications
5. Applications

- Significant problem
- Same problem
- Specific choice
- Simultaneous report
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

Quantitative Analysis

<table>
<thead>
<tr>
<th>Teammate</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Team member 1</td>
<td>9</td>
</tr>
<tr>
<td>Team member 2</td>
<td>11</td>
</tr>
</tbody>
</table>

Points Remaining: 0

Qualitative Analysis

To complete this section, you must answer all the questions marked with an asterisk.

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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

+11%

+23%

Source: Larry Michaelsen, David Ross Boyd Professor Emeritus of Management at the University of Oklahoma, Founder of TBL. Personal communication.

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My class: teams outperform individuals

76%  →  93%

Individual Test  BEFORE  Team Test

+22%
My class: individuals retain team gains

Individual Test BEFORE: 76%
Team Test: 93%
Individual Final Exam AFTER: 95%
My class: high-low range narrows

Individual Test BEFORE
High: 80
Low: 54

Team Test
High: 98  +23%
Low: 92  +70%

Individual Final Exam AFTER
High: 80  +23%
Low: 54  +70%

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## 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>
<td></td>
<td></td>
</tr>
</tbody>
</table>
TBL supported by research

300+ journal articles

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Curriculum and resource savings

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

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

Illustrative

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Considerations

▪ Design of TBL course materials (pre-work, questions and cases)

▪ Change management for educators and learners

▪ Administrative process to implement
Backwards design

**TBL Class Flow**

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

**Backwards Design**

- Design RATs
- Select pre-work
- Create Application Exercises
- Form Learning Objectives
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
### Schedule examples

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

<table>
<thead>
<tr>
<th>Phase</th>
<th>Duration</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Readiness Phase</td>
<td>75 min</td>
<td>IRAT (20 MCQ) 25 min, TRAT (20 MCQ) 25 min, Clarify doubts 25 min</td>
</tr>
<tr>
<td>[Break]</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application Phase</td>
<td>75 min</td>
<td>Application cases 3-6x (5-15 min each)</td>
</tr>
</tbody>
</table>

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

<table>
<thead>
<tr>
<th>Day</th>
<th>Activities</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monday</td>
<td>IRAT (10 MCQ) 15 min, TRAT (10 MCQ) 15 min, Clarify doubts 30 min</td>
</tr>
<tr>
<td>Wednesday</td>
<td>Cases ~3x (5-15 min each)</td>
</tr>
<tr>
<td>Friday</td>
<td>Cases ~3x (5-15 min each)</td>
</tr>
</tbody>
</table>
Summary

▪ Team-based learning ("TBL"): specific type of blended learning
▪ Positive impact on scores and alignment future skills
▪ Change management to implement

Learn more
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Team-Based Learning Collaborative
www.teambasedlearning.org

TBL software
www.intedashboard.com