Mar 27th, 3:00 PM - 3:45 PM

An Empirical Investigation of the Impact of the Dimensions of Problem-based Learning on Student Satisfaction

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An Empirical Investigation of the Impact of the Dimensions of Problem-Based Learning on Student Satisfaction

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Assistant Professor
Educational Technology
University of Hawaii – Manoa
Problem-Based Learning (PBL)

- Pedagogical approach that situates learning in problem-solving contexts
- Key characteristics of PBL:
  1. Real-world problem-solving
  2. Self-directed learning
  3. Collaborative learning
- While considered a successful pedagogy, difficult to assess impact due to many different PBL implementations or models.

Six representative PBL models in Barrows’ PBL taxonomy
Context of study

ETEC 668
Quantitative Research in Ed Tech: Summer 2011 - Dr. Peter Leong

Syllabus
Instructor: Peter Leong, Ph.D.
Wist Hall 228 956-3902 peterleo@hawaii.edu
Email is the best way to contact me
Also feel free to call to make an appointment to meet in my office or vOffice
vOffice: http://tinyurl.com/DrPeter-vOffice

COE Conceptual Framework
A sense of purpose, a sense of place
Preparing educators to contribute to a just, diverse, and democratic society

PBL scenario

Aloha & Welcome!

From: Director of Research
Subject: Aloha & Welcome!
Attachment(s):
Welcome to Akamai Consulting Group. I would like to personally welcome each of you to ourohana!

We are very excited to be able to hire a team of new market research analysts. In your first months here, you will learn about the quantitative research process and statistical analysis methods. You will be required to gather and analyze market data, devise methods and procedures for obtaining data, and make recommendations to clients based on data analysis. These assignments may take you out of your comfort zone and push you to think in new ways. However, we are certain that the excitement of solving these challenges will more than make up for the difficulties you might encounter.

We expect each of you to make the client’s needs your priority by contributing to your team and producing quality, finished products on time. We have worked hard to develop a reputation for excellence. We are currently the industry leader in market research. We hope to be the industry leader in the Asia Pacific region within the next five years. I hope you will be an integral part of helping us reach that goal.
**Research Question**

Investigate the impact of the different dimensions of PBL, i.e. real world problem-driven learning, self-directed learning and collaborative learning on students’ satisfaction of their learning.

**Session will be interactive:**
Live audience polling via texting, web & Twitter.
How To Vote via Texting

1. Standard texting rates only
2. We have no access to your phone number
3. Capitalization doesn’t matter, but spaces and spelling do

How To Vote via PollEv.com

1. Text a CODE to 37607
2. Submit a CODE to http://PollEv.com
3. Web Response

EXAMPLE
How To Vote via Twitter

1. Capitalization doesn’t matter, but spaces and spelling do
2. Since @poll is the first word, your followers will not receive this tweet

My students are satisfied with my PBL course/module.

- Strongly agree: 610213
- Agree: 610222 (67%)
- Neutral: 610223 (33%)
- Disagree: 610224
- Strongly disagree: 610235

Total results: 3
In your opinion, which aspect of PBL does your students like most?

- Text a **CODE** to **37607**
- Tweet @**poll** and a **CODE**
- Submit a **CODE** to **http://PollEv.com**

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Votes</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real-world problem-driven</td>
<td>611495</td>
<td>100%</td>
</tr>
<tr>
<td>Self-directed learning</td>
<td>611496</td>
<td></td>
</tr>
<tr>
<td>Collaborative learning</td>
<td>611500</td>
<td></td>
</tr>
</tbody>
</table>

Total Results: 2

---

In your opinion, which aspect of PBL does your students like the least?

- Text a **CODE** to **37607**
- Tweet @**poll** and a **CODE**
- Submit a **CODE** to **http://PollEv.com**

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Votes</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Real-world problem-driven</td>
<td>613373</td>
<td></td>
</tr>
<tr>
<td>Self-directed learning</td>
<td>613374</td>
<td>50%</td>
</tr>
<tr>
<td>Collaborative learning</td>
<td>613375</td>
<td>50%</td>
</tr>
</tbody>
</table>

Total Results: 2

---
Survey: Dimensions of PBL

- Real-world Problem (4 items)
- Self-directed (8 items)
- Collaborative (5 items)

References:

Preliminary Results
Sample demographics - Gender

Female 71%
Male 29%
n=28

Sample demographics – Year in College

Senior 30%
Junior 21%
Community College 18%
Graduate 18%
Sophomore 30%
Freshman 4%
n=28
Sample demographics – # of PBL courses/modules taken

<table>
<thead>
<tr>
<th>Number of Courses/Modules Taken</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 to 3</td>
<td>78%</td>
</tr>
<tr>
<td>10 or more</td>
<td>4%</td>
</tr>
<tr>
<td>7 to 9</td>
<td>14%</td>
</tr>
<tr>
<td>4 to 6</td>
<td>4%</td>
</tr>
</tbody>
</table>

n=28

Student Satisfaction with PBL

<table>
<thead>
<tr>
<th>Survey Item</th>
<th>Mean*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Dimension: Real-world problem-driven learning (RWP)</strong></td>
<td></td>
</tr>
<tr>
<td>This PBL course/module encouraged me to apply knowledge to the discussed real world problem.</td>
<td>4.68</td>
</tr>
<tr>
<td>This PBL course/module encouraged me to apply knowledge to other real world situations/problems.</td>
<td>4.46</td>
</tr>
<tr>
<td>As a result of this PBL course/module, I feel confident about tackling unfamiliar real world problems.</td>
<td>4.32</td>
</tr>
<tr>
<td>This PBL course/module helped me develop my problem solving skills, i.e. identifying the information that is known and needs to be known to solve the problem, generating and testing hypotheses and devising solutions.</td>
<td>4.43</td>
</tr>
<tr>
<td><strong>Dimension Average:</strong></td>
<td>4.47</td>
</tr>
</tbody>
</table>

* Likert-scale - strongly disagree (1), disagree (2) are neutral (3) agree (4) or strongly agree (5)
### Student Satisfaction with PBL

#### Dimension: Self-directed learning (SDL)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>This PBL course/module helped me obtain skills that are relevant to me for my career.</td>
<td>4.29</td>
</tr>
<tr>
<td>This PBL course/module allowed me to generate clear learning issues by myself.</td>
<td>4.29</td>
</tr>
<tr>
<td>This PBL course/module encouraged me to search for various resources by myself.</td>
<td>4.32</td>
</tr>
<tr>
<td>This PBL course/module has sharpened my own analytic skills.</td>
<td>4.50</td>
</tr>
<tr>
<td>This PBL course/module helped me develop the ability to plan my own work.</td>
<td>4.29</td>
</tr>
<tr>
<td>I was more motivated than usual throughout this PBL course/module.</td>
<td>4.04</td>
</tr>
<tr>
<td>I felt more self-directed than usual throughout this PBL course/module.</td>
<td>4.14</td>
</tr>
<tr>
<td>I think that the PBL course/module helps promote intrinsic motivation.</td>
<td>4.29</td>
</tr>
</tbody>
</table>

**Dimension Average:** 4.27

#### Dimension: Collaborative learning (CLL)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>This PBL course/module helped develop my ability to work as a team member.</td>
<td>4.50</td>
</tr>
<tr>
<td>This PBL course/module encouraged me to give constructive feedback about my group work.</td>
<td>4.46</td>
</tr>
<tr>
<td>This PBL course/module encouraged me to evaluate group collaboration regularly.</td>
<td>4.46</td>
</tr>
<tr>
<td>This PBL course/module provided me the opportunity to lead a team to complete a complex task.</td>
<td>4.36</td>
</tr>
<tr>
<td>This PBL course/module helped improve my interpersonal &amp; communication skills.</td>
<td>4.14</td>
</tr>
</tbody>
</table>

**Dimension Average:** 4.38

#### Overall student satisfaction (SS)

<table>
<thead>
<tr>
<th>Statement</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overall, I am satisfied with the quality of this PBL course/module.</td>
<td>4.64</td>
</tr>
<tr>
<td>I will recommend this PBL course/module to a fellow student.</td>
<td>4.68</td>
</tr>
<tr>
<td>I will participate in another PBL course/module in the future.</td>
<td>4.36</td>
</tr>
</tbody>
</table>

**Overall Satisfaction Average:** 4.56
Dimensions of Student Satisfaction with PBL

- Self-directed learning (M=4.27)
- Collaborative learning (M=4.38)
- Real-world problem (M=4.47)

Ongoing research

- Expanded study to a larger population of PBL students - collected more data in fall 2012
- Performed factor analysis to confirm dimensions of PBL
- Perform regression analysis to determine dimension that best predicts student satisfaction
- Check for differences between demographic groups (if any)
Data analysis

- 17 five-point Likert-type scale items used to gauge three dimensions of PBL: 1) real world problem-driven learning; 2) self-directed learning; and 3) collaborative learning, and student satisfaction with this type of learning
- 108 college students participated (n=108)
- Conducted confirmatory factor analysis

Confirmatory Factor Analysis

- Descriptive statistics indicates that most students tend to select “agree” and “strongly agree”, leading to noticeably skewed data (i.e., ceiling effects/many scores are clustered around 4 or 5).
- Hence, CFA with continuous indicators is inappropriate for analyzing such data.
- Instead, CFA with ordinal indicators is applied and implemented in Mplus.
Construct validity and reliability

• Validity
The sign and magnitude of the factor loadings and inter-factor correlations are consistent with our expectations, supporting the validity of each construct of interest. Moreover, the variance extracted are all above .5.

Variance extracted = .77 for real world problem solving
= .76 for self-directed learning
= .78 for collaborative learning
= .92 for student satisfaction

• Reliability

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Real world problem solving</td>
<td>0.94</td>
<td>0.95</td>
</tr>
<tr>
<td>Self-directed learning</td>
<td>0.92</td>
<td>0.95</td>
</tr>
<tr>
<td>Collaborative learning</td>
<td>0.95</td>
<td>0.95</td>
</tr>
<tr>
<td>Student satisfaction</td>
<td>0.97</td>
<td>0.97</td>
</tr>
</tbody>
</table>
The model fits the data very well

<table>
<thead>
<tr>
<th>Fit Measures</th>
<th>CFA Model</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chi-Square/Degrees of Freedom ($\chi^2$/df)</td>
<td>≤ 2.0</td>
</tr>
<tr>
<td>Bentler's Comparative Fit Index (CFI)</td>
<td>0.996</td>
</tr>
<tr>
<td>Tucker-Lewis Index (TLI)</td>
<td>0.995</td>
</tr>
<tr>
<td>Root Mean Square Error of Approximation (RMSEA)</td>
<td>&lt; 0.06</td>
</tr>
<tr>
<td>Weighted Root Mean Square Residual (WRMR &lt; 0.9)</td>
<td>0.533</td>
</tr>
</tbody>
</table>

Further analyses

- Preliminary regression analysis indicates that real-world problem-driven dimension best predicts student satisfaction; followed by collaborative learning. Self-directed learning is least predictive of student satisfaction.
- Qualitative open-ended responses will be analyzed to validate quantitative data.
Implications

• PBL instructors may increase student satisfaction by addressing the appropriate dimensions of PBL

• Certain dimension should be tailored to the developmental level of learners, e.g. developing SDL skills is difficult & multifaceted process (Hmelo-Silver, 2004)

• Survey could be adapted to be used as a diagnostic tool

Thank you for your kind attention

Any questions?