Assessing Success of Student-Oriented Faculty-Run Learning Centers at the University of Missouri-Rolla

http://lead.mst.edu/assist

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(UMR is now Missouri University of Science and Technology – all links in this PowerPoint have been updated from original presentation)

and

Director, New Faculty Programs (http://newfaculty.mst.edu) and Learning Enhancement Across Disciplines Program
(http://lead.mst.edu)
UMR Office of Undergraduate Studies

POD - Great Plains Conference
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- **Abstract**

It is sometimes difficult to convince some faculty and administrators about the efficacy of an innovation or change in educational approach to enhance student learning. Assessment tools may be limited; data may be direct or indirect; skepticism about change may be present. At UM-Rolla, physics faculty started to operate a student-oriented collaborative learning center as office-hours for a large engineering physics course. This session will discuss how and why this simple educational innovation has blossomed across campus over the past five years with 50 participating faculty in 12 departments.
Learning Enhancement Across Disciplines (LEAD) Program

... provides learning assistance to students for their success and retention

- LEAD employs ~30 accomplished undergraduate Peer Learning Assistants (PLAs) who undergo extensive training
- Annual budget: $50K (including salaries and wages)
- Implements the “Seven Principles of Good Practice in Undergraduate Education” – UMR style
  
  [http://lead.mst.edu/sevenprinciples/commentary.html](http://lead.mst.edu/sevenprinciples/commentary.html)
- Stresses student-centered learning, mastery of material, student responsibility and teamwork
LEAD Course-Based Collaborative Learning Centers

LEAD Learning Centers

» Collaborative learning with LEAD faculty on duty using modified Socratic techniques

» 45+ faculty run ~30 learning centers in 12 departments

» From Spanish I and College Algebra to Fluid Mechanics and Intro Quantum Chem

» Approximately 40% of students in a course attend its learning center for ~3 hrs/wk

~700 students/week vote with their feet to find success through Learning Centers
LEAD Learning Center (LC) Characteristics

- Operate during fixed hours each week for a specific course
  - location chosen by faculty (generally in department bldg)
- Staffed by
  - discipline-based faculty as office hours in an open environment
  - accomplished, trained undergraduate peer instructors
- Facilitate and project learning-centered education
  - more student-oriented, less teacher-centered
- Learning Centers directly promote ALL the
  - Seven Principles for Good Practice in Undergraduate Education

Video: S&T Physics Learning Center in Operation (2m30s)

http://lead.mst.edu/media/LCintro2m30s.mpg
A Masterful Move in Your Physics Education

LEAD Centers
and
LEAD Tutoring
(Learning Enhancement Across Disciplines)

Phys 23 Center:
T Th 2-4:30pm, 6-8:30pm,
129/130 Physics Bldg.

Phys 24 Center:
M W 2-4:30pm, 6-8:30pm,
129/130 Physics Bldg.

Phys 25 Center:
variable 11am-noon,
202 Physics Bldg.

Phys 31 Center:
T 9-11am, 6-8:30pm,
202 Physics Bldg.

Physics Tutoring:
M T W Th 7-9pm
204 Norwood Hall
The Beginnings

- The Physics Learning Center was established in 1997 for the course Engineering Physics I

(www.campus.mst.edu/physics/plc)

**Video:** Encouragement of group work (2m05s)
http://lead.mst.edu/media/LCformGroup2m05s.mpg

**Video:** Guide when needed but avoid hovering (1m25s)
http://lead.mst.edu/media/LCacrossRoomKibitz1m25s.mpg
What assessment helps to promote a good educational innovation?

- Was the success of the Physics LC just due to the personality of its initiator (Bieniek)?
- How do you promote it?
- Is it TRANSPORTABLE?
- Is it sustainable?

Think-Pair-Share Question:
What reasons might faculty give for not trying out this form of learning assistance?
(see presentation at this conference by N. Simpson)
~40% of Students Voluntarily Used the Physics Learning Center (Engr Phys I) (note dips are just BEFORE tests)
Impact of Physics Learning Center on Student Performance

**Engineering Physics I** for Fall 1999 (242 students)**

- % Attending PLC: 40%  
  course GPA: 2.9
- % Non-attending PLC: 60%  
  course GPA: 2.3

  increase of GPA 0.6 out of 4.0

**Engineering Physics II** for Fall 2005 (54 students in 2 rec secs)

- % Attending PLC: 30%  
  course GPA: 3.2
- % Non-attending PLC: 70%  
  course GPA: 2.3

  increase of GPA 0.9 out of 4.0

**In Fall 1999, the students in Engr Phys I who regularly attended the Physics Learning Center had the same average performance expectation (ACT+high school rank) percentile as those who were non-attending (82 ± 1 %).

Data compiled by R. Bieniek & A. Pringle, UMR Physics
Time for Success in Math through LEAD Tutoring and LEAD Centers (Learning Enhancement Across Disciplines)

Math 2, 3, 4, 6 Tutoring:
T Th 5:30-7:30pm, Norwood-204
Math 8, 14, 15, 21, 22 Tutoring:
T Th 6-8pm, Norwood-208

Math 4 Center:
M 4:30-5:30pm, W 4-5pm, Th 6:30-7:30pm, CSF-G5D/E

Math 8, 14 Center:
M T 6-7pm, W Th 5:30-6:30pm, CE-313/314

Math 15 Center:
W 5-9pm, Th 4-6pm, Rolla-G4/5
So, can the Physics LC be replicated? Compare the Calculus II Learning Center.

Eng Physics I  LC

Calculus II  LC
Self-reporting survey of student usage of learning assistance

**Usage and Ratings**

Several sources of learning assistance are listed below. Please indicate which types are available for this course. Then give the average number of **hours per week** that you are actually utilizing each one **currently**. If you are not regularly using a particular type at this time, just put a zero (0). Please also rate the usefulness of each form of assistance to you in **mastering material** in this course.

Use a **0, 1, 2, 3, 4 rating scale** with

- **4** = very useful or very good
- **0** = not useful

There are no "right" or "wrong" answers, just your own candid responses.

<table>
<thead>
<tr>
<th>Is this type of learning assistance available to you in this course?</th>
<th>How many hours/WEEK do you use this type of learning assistance for gaining mastery?</th>
<th>What rating do you give this type of learning assistance over course material?</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Y</strong> = Yes in this course?</td>
<td><strong>N</strong> = No</td>
<td><strong>D</strong> = Don’t know</td>
</tr>
<tr>
<td><strong>4</strong> = very useful</td>
<td><strong>0</strong> = not useful</td>
<td></td>
</tr>
</tbody>
</table>

| 1. Faculty in his/her office | Y | N | D | ____________ | ____________ |
| 2. Course Learning Center (LC) (in the department’s building) | Y | N | D | ____________ | ____________ |
| 3. Course tutoring | Y | N | D | ____________ | ____________ |
Typical data of student usage

<table>
<thead>
<tr>
<th>LEAD Learning Centers, Winter 2004</th>
<th>Fall 2002</th>
<th># of faculty participating in lieu of office hours</th>
<th># students enrolled in class</th>
<th>% Students completing survey</th>
<th>% Students who regularly attended Learning Center*</th>
<th>Average Hrs/Wk</th>
<th>Rating of usefulness for mastery (out of 4.0)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Department – Course with a Learning Center</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physics 23 – Engineering Phys I</td>
<td>5</td>
<td>364</td>
<td>70%</td>
<td>57±9%</td>
<td>3.9</td>
<td>3.4</td>
<td></td>
</tr>
<tr>
<td>Physics 24 – Engineering Phys II</td>
<td>4</td>
<td>231</td>
<td>60%</td>
<td>36±9%</td>
<td>3.2</td>
<td>3.7</td>
<td></td>
</tr>
<tr>
<td>Physics 21 – General Phys I</td>
<td>1</td>
<td>45</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>Physics 25 – General Phys II</td>
<td>1</td>
<td>25</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>4</td>
<td></td>
</tr>
<tr>
<td>Physics 31 – College Phys I</td>
<td>1</td>
<td>24</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>2.9</td>
<td></td>
</tr>
<tr>
<td>Basic Eng 50 – Statics</td>
<td>5</td>
<td>189</td>
<td>8%</td>
<td>14±11%</td>
<td>3.3</td>
<td>3.3</td>
<td></td>
</tr>
<tr>
<td>Chem E 145 – Chem Process Mat</td>
<td>1</td>
<td>52</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>Chemistry 1 – General Chem I</td>
<td>1</td>
<td>139</td>
<td>65%</td>
<td>18±4%</td>
<td>1.3</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>Civ Eng 230 – Fluid Mechnaics</td>
<td>1</td>
<td>45</td>
<td>82%</td>
<td>64±6%</td>
<td>2.8</td>
<td>3.9</td>
<td></td>
</tr>
<tr>
<td>Civ Eng 234 – Water Resource Eng</td>
<td>1</td>
<td>33</td>
<td>85%</td>
<td>79±6%</td>
<td>4.6</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>Comp Sci 153 – Data Structures I</td>
<td>2</td>
<td>92</td>
<td>NA</td>
<td>NA</td>
<td>NA</td>
<td>4.6</td>
<td></td>
</tr>
<tr>
<td>Comp Sci 158A – Discrete Math</td>
<td>1</td>
<td>24</td>
<td>88%</td>
<td>22±1%</td>
<td>2.1</td>
<td>2.6</td>
<td></td>
</tr>
<tr>
<td>IST 151 – Intro Data Struc &amp; Apps</td>
<td>2</td>
<td>40</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IST 211 – Web Develop &amp; Design</td>
<td>1</td>
<td>53</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Met 121 – Metallurgy for Eng</td>
<td>1</td>
<td>123</td>
<td>62%</td>
<td>5±1%</td>
<td>1.3</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>ME 211 – Linear Systems</td>
<td>2</td>
<td>76</td>
<td>78%</td>
<td>75±9%</td>
<td>1.3</td>
<td>2.1</td>
<td></td>
</tr>
<tr>
<td>ME 227 – Thermal Analysis</td>
<td>1</td>
<td>35</td>
<td>23%</td>
<td>61±39%</td>
<td>1.8</td>
<td>3.9</td>
<td></td>
</tr>
<tr>
<td>ME 231 – Thermo-fluid Mech I</td>
<td>1</td>
<td>42</td>
<td>17%</td>
<td>58±42%</td>
<td>1.4</td>
<td>3.9</td>
<td></td>
</tr>
<tr>
<td><strong>Totals and Weighted Averages</strong></td>
<td><strong>32</strong></td>
<td><strong>1632</strong></td>
<td><strong>56%</strong></td>
<td><strong>38±7%</strong></td>
<td><strong>2.9</strong></td>
<td><strong>3.3</strong></td>
<td></td>
</tr>
</tbody>
</table>

* At least one hour/week around 12th week of class. Plus number is usage by students completing survey on day it was administered; minus is usage based on total enrollment, conservatively assuming that all regular attendees filled out survey.

**38% of 1632 students = 620 students per week using LCs for ~3 hrs**
Unposed photos of Cooperative Learning and Social Dynamics in the intro Physics, Math, Chemistry Learning Centers

Offer:

Cookies
Pop corn
Easy access & EGRESS

Zero or small % points
LEAD Learning Centers and LEAD Faculty Associates

Number

Semester

Learning Centers

LEAD Faculty
Growth of LEAD Learning Centers

<table>
<thead>
<tr>
<th></th>
<th>Fall 2001</th>
<th>Fall 2006</th>
<th>over 5 yrs</th>
</tr>
</thead>
<tbody>
<tr>
<td># Learning Centers</td>
<td>8</td>
<td>29</td>
<td>260 %</td>
</tr>
<tr>
<td># Departments</td>
<td>5</td>
<td>12</td>
<td>140 %</td>
</tr>
<tr>
<td># LEAD Faculty</td>
<td>22</td>
<td>51</td>
<td>130 %</td>
</tr>
</tbody>
</table>

Data indicates that students who regularly attend Learning Centers do better in course grades
### Current LEAD Learning Centers (Fall 2006)

<table>
<thead>
<tr>
<th>General Chem I</th>
<th>Data Structures I</th>
<th>Elementary Fluid Mech</th>
</tr>
</thead>
<tbody>
<tr>
<td>Engr Phys I</td>
<td>College Algebra</td>
<td>Linear Systems Mech Engr</td>
</tr>
<tr>
<td>Engr Phys II</td>
<td>Calculus I with Analyt Geo</td>
<td>Thermal Analysis (Mech E)</td>
</tr>
<tr>
<td>College Physics I</td>
<td>Calculus II with Analyt Geo</td>
<td>Thermodynamics (Mech E)</td>
</tr>
<tr>
<td>Chem E Materials Balances</td>
<td>Calculus I for Engineers</td>
<td>Dyanmics (Mech E)</td>
</tr>
<tr>
<td>Chem E Fluid Flow</td>
<td>Calculus II for Engineers</td>
<td>Machine Dynamics (ME)</td>
</tr>
<tr>
<td>Elec Engr Circuits I</td>
<td>Engr Mechanics-Static</td>
<td>Elementary Spanish I</td>
</tr>
<tr>
<td>Digital Systems Design</td>
<td>Mechanics of Materials</td>
<td>Spanish Reading &amp; Comp</td>
</tr>
<tr>
<td>Intro Data Struct &amp; Apps</td>
<td>Engineering Dynamics</td>
<td></td>
</tr>
</tbody>
</table>
What next after usual suspects?

- Use new faculty programs (e.g., UM New Faculty Teaching Scholars) to generate interest in doing an efficient, effective, and noticeable “thing” in pedagogical best practices.

- Early-career faculty may experiment out of respect and *quid pro quo* for new faculty developer who devoted so much effort for new faculty success.

- Develop some assessment ammunition so that new faculty can “buy in” with good conscience.
Calculus II for Engineers (Spring 2006): Average Weekly LC Attendance (%) correlated to Course Performance

Data compiled by M. Bohner and E. Akin, UMR Math
Micro-analysis of usage of Calc II LC before Exam 3 (Sp 2006)

Student attendance by section

<table>
<thead>
<tr>
<th>LEAD 6</th>
<th>LEAD 7</th>
<th>LEAD 8</th>
<th>LEAD 9</th>
<th>LEAD 10</th>
</tr>
</thead>
<tbody>
<tr>
<td>17</td>
<td>10</td>
<td>13</td>
<td>13</td>
<td>53</td>
</tr>
<tr>
<td>13</td>
<td>13</td>
<td>23</td>
<td>9</td>
<td>57</td>
</tr>
<tr>
<td>8</td>
<td>9</td>
<td>10</td>
<td>4</td>
<td>45</td>
</tr>
<tr>
<td>1</td>
<td>4</td>
<td>53</td>
<td>10</td>
<td>13</td>
</tr>
</tbody>
</table>

Average attendance at LEAD sessions

<table>
<thead>
<tr>
<th>LEAD 6-10</th>
</tr>
</thead>
<tbody>
<tr>
<td>23.2</td>
</tr>
<tr>
<td>17.8</td>
</tr>
<tr>
<td>16.8</td>
</tr>
</tbody>
</table>

Average Exam Score

- Section A: 79
- Section B: 72.4
- Section C: 71.6
Assessing/Promoting Impact of an LC: Example of Chem 241 LC (Sp 2007)

Data supplied by K. Woelk, UMR Chemistry
Using good teaching ratings can backfire when promoting educational best practices

Method of Using Student Evaluations to Assess Professors Is Flawed but Fixable, 2 Scholars Say

by DAVID GLENN

Mr. Greenwald presented an analysis of the student ratings of more than 14,000 courses given at his university from 1997 to 2001. He was especially interested in exploring how average course ratings varied by department. Courses in U. Washington's dance department, for example, typically received high student evaluations, while chemistry, physics, and mathematics courses tended to rate poorly.

Not surprisingly, Mr. Greenwald said, he found that 70 percent of the variance in departments' average course-evaluation scores could be explained by differences in students' grades.

Recent knee-jerk interpretation: Faculty who give easy grades get high teacher ratings, while tough faculty don’t.

WITHOUT pondering such questions as: are higher teacher ratings related to how easy the grades are, or are higher grades a function of the teaching quality reflected by the ratings.
Using assessment data to promote open-environment collaborative learning centers

- Work with a faculty member who has a reputation as a “tough” teacher (i.e., one with a reputation of “holding up standards”).
- Pitch to a few target faculty [friends] who will be responsive to a good idea with rudimentary assessment data without becoming skeptics who repeatedly ask “But what about …?” or “How do you know that …?”.
- Think of them as paratroopers for the idea into departments.
- Assure departments that the innovation will not cause internal disruption BUT will display participating members as proactive about student success.
- Demonstrate that students actually use the approach.
- Spread the word and get adherents through New Faculty Programs.
- If there are “errors” in implementation, show the associated faculty a real-time working example and comment in general as to why it is working (“Oh! OK.”)
- Develop data that shows the approach improves student achievement to go beyond usual suspects and perhaps generate administrator interest/support.
- Be aware that some faculty might be turned-off if there is too much educational data presented – unless there is extreme control of identical conditions and populations (like behavior of electrons or machines).
QUESTIONS??

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