Pedagogical Practices of Physics Faculty in the USA

Melissa H. Dancy†, Charles Henderson*  
† Johnson C. Smith University, *Western Michigan University

A web-based survey was developed by the authors in consultation with researchers at the American Institute of Physics Statistical Research Center (SRC). The survey consisted of 61 questions and asked about:  
• Demographic information (years teaching, rank, employment status, gender, type of institution, etc.)  
• Information about a particular course the faculty member had taught recently (for example, calculus or algebra based, class size, structure of labs and recitation, number of sections, etc.).  
• Participant’s knowledge and use of 24 specific research-based strategies. Please see poster “The Impact of Physics Education Research on the Teaching of Introductory Quantitative Physics” for more information about the results from these questions.  
• General questions about teaching goals and practices.

The survey was administered in Fall 2008. The overall response rate was 50.3% resulting in 722 usable responses.

Methods

A web-based survey was developed by the authors in consultation with researchers at the American Institute of Physics Statistical Research Center (SRC). The survey consisted of 61 questions and asked about:

• Demographic information (years teaching, rank, employment status, gender, type of institution, etc.)
• Information about a particular course the faculty member had taught recently (for example, calculus or algebra based, class size, structure of labs and recitation, number of sections, etc.).
• Participant’s knowledge and use of 24 specific research-based strategies. Please see poster “The Impact of Physics Education Research on the Teaching of Introductory Quantitative Physics” for more information about the results from these questions.
• General questions about teaching goals and practices.

The survey was administered in Fall 2008. The overall response rate was 50.3% resulting in 722 usable responses.

Problem

The last 30 years has seen the development and dissemination of many Research-Based Instructional Strategies (RBIS). Although substantial time and money has gone into developing these RBIS, little effort has gone into understanding whether typical physics instructors use or even know about these products. In this poster we describe and present the results of a web survey designed to document the degree to which Physics Education Research (PER) has impacted the teaching of introductory physics.

Research Questions

1. What general instructional practices do physics faculty use?
2. Why don’t physics faculty use more research-based instructional strategies?

In the lecture portion of your introductory course, please estimate the percentage of class time spent on student activities, questions and discussion.”

• The average of all answers was 32% with a standard deviation of 22%
• Most of the time, in most classes, class time is spent in a passive learning mode.

In thinking about the last time you taught an introductory algebra- or calculus-based course, how frequently did you use...

• Top three most used methods are the ones where the instructor is active and students are passive.
• The most common type of question used on exams are well-defined quantitative problems that often lend themselves to “plug-n-chug”.

Traditional Lecture
- Students Discuss Ideas in Small Groups
- Students design experiments/activities
- Students required to work together
- Instructor solves/discusses quantitative/mathematical problem
- Instructor solves/discusses qualitative/conceptual problem
- Students solve/discuss quantitative/mathematical problem
- Students solve/discuss qualitative/conceptual problem
- Whole class voting

TABLE 2: Percentage of faculty reporting use of a particular teaching strategy.

<table>
<thead>
<tr>
<th>Institution</th>
<th>Rank</th>
<th>Gender</th>
<th>Semesters Taught</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-Year College</td>
<td>Lecturer 7%</td>
<td>Male 83%</td>
<td>1-4 Semesters 15%</td>
</tr>
<tr>
<td>Four-Year College</td>
<td>Assistant Prof 20.8%</td>
<td>Female 17%</td>
<td>5-10 Semesters 20%</td>
</tr>
<tr>
<td>Four-Year College (With graduate program)</td>
<td>Associate Prof 24.2%</td>
<td>&gt;10 Semesters 65%</td>
<td></td>
</tr>
<tr>
<td>Full Professor</td>
<td>35.6%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Other Rank</td>
<td>12.3%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

TABLE 1: Characteristics of Survey Respondents

TABLE 3: Percentage of faculty reporting use of particular types of test questions.

<table>
<thead>
<tr>
<th>Type of Test Questions</th>
<th>Never Used on Tests</th>
<th>Used Occasionally on Tests</th>
<th>Used Frequently on Tests</th>
<th>Used on All Tests</th>
</tr>
</thead>
<tbody>
<tr>
<td>Well-defined quantitative problems</td>
<td>2%</td>
<td>6%</td>
<td>23%</td>
<td>69%</td>
</tr>
<tr>
<td>Open-ended quantitative problems</td>
<td>59</td>
<td>30</td>
<td>8</td>
<td>3</td>
</tr>
<tr>
<td>Novel problems</td>
<td>22</td>
<td>45</td>
<td>23</td>
<td>10</td>
</tr>
<tr>
<td>Multiple choice questions</td>
<td>34</td>
<td>21</td>
<td>17</td>
<td>29</td>
</tr>
<tr>
<td>Conceptual questions</td>
<td>7</td>
<td>22</td>
<td>26</td>
<td>45</td>
</tr>
</tbody>
</table>

TABLE 4: Percentage of faculty indicating importance of goal and satisfaction of goal reached.

<table>
<thead>
<tr>
<th>Goal is “very important” or “extremely or somewhat satisfied”</th>
<th>“extremely or somewhat satisfied” with extent goal reached</th>
</tr>
</thead>
<tbody>
<tr>
<td>Problem Solving</td>
<td>90% 72%</td>
</tr>
<tr>
<td>Conceptual Understanding</td>
<td>92 69</td>
</tr>
<tr>
<td>Attitudes and Appreciation</td>
<td>51 47</td>
</tr>
</tbody>
</table>

TABLE 5: Reasons given for not using more research-based strategies. (coded qualitative data)

Conclusions

• Faculty are aware of research-based innovations and willing/motivated to try them.
• Faculty report non-supportive work environments.
• Dissemination is often undertaken without a clearly articulated change strategy. A model that accounts for the complexity of real classroom change is in need of development.