Physics Instructors' Knowledge About and Use of Research-Based Instructional Strategies: Preliminary Results from a Web Survey

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Summary
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 quantitative physics at the college level.

Research Questions
1. What Research-Based Instructional Strategies (RBIS) do faculty know about and use?
2. To what extent are RBIS modified during use?
3. What general instructional practices do faculty use?
4. Why don’t physics faculty use more RBIS?

Methods
A web-based survey was administered in Fall 2008 in consultation with the American Institute of Physics Statistical Research Center (SRC). The overall response rate was 50.3%, resulting in 722 usable responses. Questions included:
- Demographic information (years teaching, rank, employment status, gender, type of institution, etc.)
- Information about a particular course the faculty member had taught recently
- Participant's knowledge and use of 24 specific RBIS
- General questions about teaching goals and practices.

Results: Knowledge and Use
- 87.3% of faculty report knowing about 1 or more RBIS.
- 50.3% know about six or more.
- 48.1% of faculty say that they use 1 or more RBIS.
- In general, faculty knowledge and use at B.A. institutions is higher than that at two year colleges or Grad institutions.

RBIS % Who Know % Who Use
Peer Instruction 63.5% 29.2%
Physlets 56.3 13.0
Cooperative Group Problem Solving 49.3 13.7
Workshop Physics 48.2 6.7
Just in Time Teaching 47.7 8.4
Tutorials in Introductory Physics 47.0 7.9
Interactive Lecture Demonstrations 45.4 13.9
Activity Based Problem Tutorials 43.0 6.0
Ranking Tasks 38.7 15.4
SCALE-UP 34.3 3.5
Active Learning Problem Sheets 34.3 5.9
Modeling 32.7 3.2
Real Time Physics Labs 32.4 7.3
Context Rich Problems Overview Case Study Physics 30.4 8.3
Open Source Physics 24.7 1.7
Investigative Science 21.8 1.9
Learning Environment TIPERS: Tasks Inspired by Physics Education Research 21.1 1.6
Open Source Tutorials 20.0 6.6
Video Lab 18.6 3.1
Workbook for Introductory Physics 18.5 0.9
Experiment Problems 17.3 4.0
Socratic Dialogue Inducing Labs 16.3 1.9
Thinking Problems 15.1 1.1

TABLE 1: Percent of faculty reporting knowledge and use of RBIS.

Research Questions
1. Top three most used methods are the ones where the instructor is active and students are passive. The most common type of question asked on exams is well-defined quantitative problems that often lend themselves to “plug-n-chug.”
2. The last time you taught an introductory algebra- or calculus-based course, how frequently did you use …

<table>
<thead>
<tr>
<th>Instruction</th>
<th>Never</th>
<th>Once or Twice</th>
<th>Several Times</th>
<th>Weekly</th>
<th>For Nearly Every Class</th>
<th>Multiple Times Every Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>Traditional Lecture</td>
<td>4%</td>
<td>4%</td>
<td>6%</td>
<td>16%</td>
<td>17%</td>
<td>22%</td>
</tr>
<tr>
<td>Students Discuss Ideas in Small Groups</td>
<td>25</td>
<td>14</td>
<td>12</td>
<td>19</td>
<td>17</td>
<td>13</td>
</tr>
<tr>
<td>Students design experiments/activities</td>
<td>63</td>
<td>19</td>
<td>10</td>
<td>7</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Students required to work together</td>
<td>25</td>
<td>10</td>
<td>16</td>
<td>22</td>
<td>15</td>
<td>12</td>
</tr>
<tr>
<td>Instructor solves/discusses quantitative/mathematical problem</td>
<td>1</td>
<td>2</td>
<td>9</td>
<td>23</td>
<td>43</td>
<td>24</td>
</tr>
<tr>
<td>Instructor solves/discusses qualitative/conceptual problem</td>
<td>1</td>
<td>3</td>
<td>8</td>
<td>20</td>
<td>45</td>
<td>22</td>
</tr>
<tr>
<td>Students solve/discuss quantitative/mathematical problem</td>
<td>12</td>
<td>10</td>
<td>18</td>
<td>25</td>
<td>25</td>
<td>10</td>
</tr>
<tr>
<td>Students solve/discuss qualitative/conceptual problem</td>
<td>11</td>
<td>9</td>
<td>15</td>
<td>23</td>
<td>28</td>
<td>14</td>
</tr>
<tr>
<td>Whole class voting</td>
<td>22</td>
<td>9</td>
<td>18</td>
<td>14</td>
<td>18</td>
<td>19</td>
</tr>
</tbody>
</table>

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

Why do faculty not use more research-based practices?
- 70% report being interested in using more research based strategies.
- 92% report that their department is either very encouraging or somewhat encouraging about efforts to improve instruction.
- For the 70% of faculty who said they were interested in using more RBIS, time was the most common barrier mentioned.

What prevents you from using more of these strategies?
- TIME
  - Time to learn about and implement changes (28.6%)
  - Time (not elaborated) (24.1)
- LACK OF KNOWLEDGE ABOUT ACCESS to RBIS
  - Lack of familiarity with many RBIS (22.4)
  - Lack of access to RBIS (3.2)
- WEAKNESSES of RBIS
  - Difficult to cover material (uses too much class time) (8.0)
  - Not convinced of benefit (6.6)
  - Requires too much instructor time to use (2.4)
  - Student resistance (real or perceived) (2.1)
  - Lack of ready-to-use materials (0.7)
- LACK OF MOTIVATION TO ADOPT RBIS (other than TIME)
  - I don't follow one method, but adapt pieces of many to fit my teaching style (6.1)
  - Nothing (1.9)
  - Inertia (1.2)
- LACK OF FIT WITH DEPARTMENT OR INSTITUTION
  - Cost to implement (e.g., lab equipment, additional staff) (4.0)
  - Need to coordinate changes with colleagues (3.8)
  - Lack of appropriate classroom space/class scheduling (3.7)
  - Cost (not elaborated) (2.6)
  - College would not approve (2.1)
  - Cost for students (e.g., books, clickers) (0.7)
- UNCLEAR
  - Unclear response (4.7)

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

TABLE 4: Reasons given for not using more research-based strategies. (coded qualitative data)

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