The Impact of Physics Education Research on the Teaching of Introductory Quantitative Physics

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The last 30 years has seen the development and dissemination of many Research-Based Instructional Strategies (RBIS) for use in introductory college-level physics courses. 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 paper 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. Which RBIS do faculty know about?
2. Which RBIS do faculty use?
3. To what extent are RBIS modified during use?

This study was focused on college-level quantitative physics. By quantitative physics we are referring to the algebra- or calculus-based introductory physics classes that often go by the names of “college physics” or “university physics”.

Methods
A web-based survey was developed by the authors in consultation with researchers at the American Institute of Physics Statistical Research Center (SRC). One part of the web survey asked faculty to rate their level of knowledge and/or use of 24 specific RBIS. The following five categories were used: 1) I currently use all or part of it (current user), 2) I have used all or part of it in the past (former user), 3) I am familiar with it, but have never used it (knowledgeable nonuser), 4) I’ve heard the name, but do not know much else about it (little knowledge), 5) I have never heard of it (no knowledge).

The survey was administered in Fall 2008 by SRC. Sampling was done at three types of institutions: 1) two-year colleges, 2) four-year colleges that offer a physics bachelor’s degree as the highest physics degree, and 3) four-year colleges that offer a graduate degree in physics. SRC staff randomly selected institutions within each of the three types. Once selected, SRC staff asked department chairs to identify faculty who were likely to meet the selection criteria for the survey. Faculty were eligible for the survey if they had taught an introductory quantitative course in the last two years and were full-time or permanent employees (i.e., part-time, temporary faculty were not eligible).

Table 1 shows the number of institutions and faculty in the population and sample, the web survey response rate, and the number of faculty who responded to the survey. The overall response rate was 50.3%, resulting in 722 usable responses.

Table 2: Ranking of the 24 RBIS according to level of Knowledge (percentage of faculty who indicate that they are current users, former users, knowledgeable nonusers of the RBIS).

Table 3: Ranking of the 24 RBIS according to level of Use (percentage of faculty who indicate that they currently use the RBIS).

Conclusions
- Dissemination efforts have impacted the knowledge and practice of many faculty, but there is room for improvement.
- Faculty knowledge of RBIS appears to be relatively widespread.
- RBIS are typically not used as recommended by the developer and faculty do not always realize the extent of modification they have made. Additional work is needed to understand more about why and how faculty make these modifications and the extent to which modifications are typically constructive or destructive.
- Because of the high level of modifications, change agents may be more successful if they provide flexible curricula and substantial support and guidance during the implementation and customization process.