

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	34.5	3.3
Active Learning Problem Sheets	34.3	5.9
Modeling	32.7	3.2
Real Time Physics Labs	32.4	7.3
Context Rich Problems	30.4	8.3
Overview Case Study Physics	24.7	1.7
Open Source Physics	21.8	1.9
Investigative Science Learning Environment	21.1	1.6
TIPERS: Tasks Inspired by Physics Education Research	20.9	6.6
Open Source Tutorials	20.8	1.7
Video Lab	18.8	3.1
Workbook for Introductory Physics	18.5	0.9
Experiment Problems	17.3	4.0
Socratic Dialog Inducing Labs	16.3	1.9
Thinking Problems	15.1	1.1

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

Results: General Instructional Strategies

- 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".

The last time you taught an introductory algebra- or calculus-based course, how frequently did you use ...

	Never	Once or Twice	Several Times	Weekly	For Nearly Every Class	Multiple Times Every Class
Traditional Lecture	4%	4%	6%	16%	48%	22%
Students Discuss Ideas in Small Groups	25	14	12	19	17	13
Students design experiments/activities	63	19	10	7	1	0
Students required to work together	25	10	16	22	15	12
Instructor solves/discusses quantitative/mathematical problem	1	2	9	23	43	24
Instructor solves/discusses qualitative/conceptual problem	1	3	8	20	45	22
Students solve/discuss quantitative/mathematical problem	12	10	18	25	25	10
Students solve/discuss qualitative/conceptual problem	11	9	15	23	28	14
Whole class voting	22	9	18	14	18	19

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

	Never Used on Tests	Used Occasionally on Tests	Used Frequently on Tests	Used on All Tests
Well-defined quantitative problems	2%	6%	23%	69%
Open-ended quantitative problems	59	30	8	3
Novel problems	22	45	23	10
Multiple choice questions	34	21	17	29
Conceptual questions	7	22	26	45
Questions that require students to explain their reasoning	16	30	24	30

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

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	3.1
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
Colleagues would not approve	2.1
Cost for students (e.g., books, clickers)	0.7
UNCLEAR	
Unclear response	4.7

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

Results: Modifications

- RBIS are not typically used as recommended by the developer.
- faculty do not always realize the extent of modification they have made.

Faculty Self-Reported Modifications

	PI (N=195)	RT (N=99)	CGPS (N=96)	RTPL (N=47)
I used it basically as described by the developer.	16.9%	33.3%	8.3%	25.5%
I made some relatively minor modifications	35.9	38.4	16.7	53.2
I used some of the ideas, but made significant modifications	41.0	21.2	47.9	21.3
I am not familiar enough with the developer's description to answer this question	6.2	7.1	27.1	0.0
All Users	100	100	100	100

TABLE 5: Extent of modification identified by self-reported users of all or part of each of four RBIS: Peer Instruction (PI), Ranking Tasks (RT), Cooperative Group Problem Solving (CGPS), and Real Time Physics Labs (RTPL). The percentages listed are the percentage of users within each of the RBIS categories who answered the question.

Extent and Type of Modification is a Concern

For example, only 28% of self-reported users of Peer Instruction reported that "students discuss ideas in small groups multiple times every class."

Conclusions

- Dissemination efforts have impacted the knowledge and practice of many faculty, but there is room for improvement.
- RBIS are typically not used as recommended by the developer and faculty do not always realize the extent of modification they have made.
- 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.
- Most 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.

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