Variables that Correlate with Faculty Use of Research-Based Instructional Strategies

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RESEARCH QUESTION

What characteristics of physics faculty and their teaching situations correlate with knowledge about and use of Research Based Instructional Strategies (RBIS)?

Data Source

Web survey of 715 US physics Faculty. See Ref [1] for survey details.

20 potential explanatory variables developed from survey items.

Three Analyses

1. Relationship between explanatory variables and group membership.
2. Description of faculty groups using significantly correlated variables.
3. Logistic regression analysis to identify a minimal subset of variables that can predict group membership.

Correlated Variables

Variables that significantly correlate with knowledge about and use of research-based strategies:

1. Attending the New Faculty Workshop
2. Active in professional development
   - ❖ *Attend workshops and talks related to teaching*
   - ❖ *Interested in using more research-based techniques*
   - ❖ *Read journals related to teaching.*
   - ❖ *Discuss teaching with peers.*
3. Teaching Focused
   - ❖ *Work in an institution with no graduate program in physics*
   - ❖ *Teaching is more than 50% of their job*
4. Personal Traits
   - ❖ *Female*
   - ❖ *Younger*
5. Satisfied with meeting instructional goals

Who Uses the Most Research-Based Strategies?

1. Women: 43% of women report high levels of use compared to 20% of men.
2. New Faculty Workshop Attendees: 38% of NFW attendees report high levels of use compared to 22% of non-attendees. Nearly all NFW attendees report knowing about (99%) and using (74%) at least some RBIS.

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Result 1: Significance Level of Explanatory Variables

Variable Name	Description
ATND (p = 0.000)	Attended talks/workshops related to teaching.
GEN (p = 0.000)	Gender.
NFW (p = 0.000)	Attended physics and astronomy New Faculty Workshop.
RBIS (p = 0.000)	Interest in using more RBIS.
READ (p = 0.000)	Number of teaching-related journals read regularly.
INST (p = 0.000)	Type of institution. (two-year college, four year college BA, four year college grad.).
SATF (p = 0.001)	Satisfaction with meeting PER instructional goals of problem solving and conceptual understanding.
RSH2 (p = 0.002)	Number of research articles published in last two years.
JOB (p = 0.009)	Teaching as a main job responsibility.
PEER (p = 0.011)	Frequency of discussions with peers about teaching.
SIZE (p = 0.015)	Class size.
YEAR (p = 0.038)	Years of teaching experience.
PSTN (p = 0.065)	Type of position (full-time, permanent, full-time, temporary, part-time, permanent)
RANK (p = 0.200)	Rank. (lecturer, assistant professor, associate professor, full professor, other)
ENC (p = 0.242)	Level of departmental encouragement of efforts to improve instruction.
RSH3 (p = 0.348)	Currently have external funding for research (no, yes)
DGRE (p = 0.506)	Highest degree obtained. 1: undergraduate, 2: masters, 3: PhD
RSH1 (p = 0.721)	Number of research presentations made in last two years.
GOAL (p = 0.760)	Importance of instructional goals of problem solving and conceptual understanding.
CRSE (p = 0.874)	Course algebra or calculus based.

Four Faculty Groups

		Level of Use: None (0 RBIS)	Level of Use: Low (1-3 RBIS)	Level of Use: High (>3 RBIS)
Level of Knowledge	None (0 RBIS)	Group A, N=100 No knowledge, No use		
	Low (1-6 RBIS)	Group B, N=277 Some knowledge, No use	Group C, N=179 Some knowledge, Some use	
	High (>6 RBIS)			Group D, N=159 High knowledge, High use

Result 2: Faculty Profiles

Group A (no knowledge and no use)

•Less likely to work at a college offering only an undergraduate degree in physics, while more likely to work at a university offering a graduate degree in physics. (INST)
•More likely to be a permanent part time instructor. (PSTN)
•More likely to never or rarely correspond with peers about teaching. (PEER)
•More likely to have attended no meetings/workshops on teaching within last two years (ATND).
•Less likely to have attended New Faculty Workshop. (NFW)
•More likely to not regularly read any journals related to teaching. (READ)
•More likely to have more than 15.6 (study average) years of teaching experience. (YEAR)
•More likely to have no interest in using more RBIS. (RBIS)
•Less likely to be satisfied with meeting goals (SATF).

Group B (at least some knowledge but no use)

•Less likely to have attended 10 or more meetings/workshops on teaching within the last two years. (ATND)
•Less likely to have attended the New Faculty Workshop. (NFW)
•More likely to not regularly read any journals related to teaching. (READ)
•Less likely to be a female (more likely to be a male). (GEN)
•More likely to have more than 15.6 (study average) years of teaching experience. (YEAR)
•More likely to have no interest in using more RBIS. (RBIS)
•Less likely to hold an assistant professor position and more likely to have “other” position. (RANK)

Group C (at least some knowledge and some use)

•Less likely to work at a two year college. (INST)
•More likely to have 4 or more articles published within the last two years. (RSH2)
•More likely to correspond with peers about teaching more than once or twice per term. (PEER)
•More likely to have attended New Faculty Workshop. (NFW)
•More likely to have less than 15.6 (study average) years of teaching experience. (YEAR)
•More likely to have interest in using more RBIS. (RBIS)

Group D (high knowledge and high use)

•More likely to work at a college offering only an undergraduate degree in physics, while less likely to work at a university offering a graduate degree in physics. (INST)
•More likely to teach classes with fewer than 36 (study median) students. (SIZE)
•More likely to have teaching as more than 50% of the job responsibilities. (JOB)
•More likely to publish no articles within last 2 years. (RSH2)
•More likely to correspond nearly every day with their peers about teaching. (PEER)
•More likely to attend 4 or more meetings/workshops on teaching in the last 2 years. (ATND)
•More likely to have attended the New Faculty Workshop. (NFW)
•More likely to regularly read at least one journal related to teaching. (READ)
•More likely to be female (less likely to be male). (GEN)
•More likely to have interest in using more RBIS. (RBIS)
•More likely to be satisfied with meeting goals. (SATF)

Result 3: Logistic Regression Analysis

Many explanatory variables are highly correlated with other variables. The goal was to identify a subset of variables that can predict group membership.

Logistic regression models developed using backward elimination: explanatory variables were eliminated one by one based on low levels of significance. Models developed using all four faculty groups were inconclusive since, at many elimination points, several variables could be eliminated.

A strong model with five predictor variables was developed using the most extreme faculty groups: A and D. The model has a p-value of the Pearson’s goodness of fit of 0.434 and resulted in 83.5% correct classification. The generalized coefficient of determination, Nagelkerke’s R^2 is 0.5032. All these measures indicate a strong model.

This analysis resulted in five predictor variables.

Five Predictor Variables

New Faculty Workshop (NFW). NFW attendees were much more likely to be in the two groups of users (Group C and D) and were essentially nonexistent in Group A. The results suggest that all new faculty should be strongly encouraged to attend the NFW.

Attending talks and workshops related to teaching (ATND). As might be expected, faculty who have attended one or more talks/workshops in the last two years have the highest odds of being in Group D. It is unclear, though, why the odds of being in Group C are similar to those of being in Group B. This may be an indication that faculty in Group C attended talks/workshops more than two years ago to learn about a RBIS and then have maintained this use while faculty in Group D continue to seek additional knowledge about RBIS.

Satisfaction with meeting instructional goals (SATF). Faculty are more likely to be satisfied with meeting their instructional goals of developing student conceptual understanding and problem solving ability as their level of knowledge and use of RBIS increases.

Reading journals related to teaching (READ). It is not surprising that reading one or more of these journals is significantly related to use of RBIS.

Gender (GEN). Female faculty are much more likely to be high users of RBIS than otherwise similar male colleagues. Currently (2006) only 13% of physics faculty are female and 43% of physics departments have no female faculty [2]. Institutions should consider hiring more female physics faculty.

Correlations not Found

Class Size (SIZE). Class size is often seen as a barrier to the use of RBIS. Class size was significantly related to group membership overall, however, the relationship between class size and group membership was only statistically significant for Group D. Class size does not appear to be a barrier to the use of at least some RBIS, although it may be a barrier to high levels of use. (Median class size reported by each faculty group: A: 42, B: 35, C: 40, D: 32)

Research Productivity (RSH1, RSH2, RSH3). It is often thought that faculty cannot be highly productive in both teaching and research. Some researchers, though, have found almost no relationship between research productivity and teaching effectiveness. Our results are most consistent with the latter. Only one of our three measures of research productivity (RSH2 = number of research publications in last two years) was significantly correlated with group membership. The correlation is interesting, though, in that high numbers of publications is associated with Group C while no publications is associated with Group D. Both of these groups are users of RBIS. Thus, similar to class size, high levels of use of RBIS may be inconsistent with high levels of research, but high levels of research do not seem to present a barrier to at least some RBIS use.

[1] C. Henderson and M. Dancy, “The Impact of Physics Education Research on the Teaching of Introductory Quantitative Physics in the United States,” *Physical Review Special Topics: Physics Education Research*, **5** (2), 020107 (2009).
[2] R. Ivie, *Women in Physics and Astronomy Faculty Positions*, Available from: www.aip.org/statistics/trends/highlite/women3/faculty.htm.