Evaluation of the Physics and Astronomy New Faculty Workshop

Charles Henderson
Western Michigan University
Charles.Henderson@wmich.edu
homepages.wmich.edu/~chenders
The Role of Scientific Societies in STEM Faculty Workshops – May 3, 2012
Four Data Sets

1. Evaluation surveys directly after each NFW
   – 10 workshops offered since 2006
2. Evaluation survey of all NFW participants
   – Spring 2007, N=527, 76% response rate
3. National web survey of randomly-selected physics faculty*
   – Fall 2008, N=722, 50% response rate
4. Longitudinal study of NFW participants*
   – Five semesters, beginning Fall 2010, N=15

*NSF-funded projects in collaboration with Melissa Dancy, University of Colorado Boulder
The NFW Should Not Work

Based on a literature review of 191 articles, successful disseminating strategies involve more than one of*:
- coordinated and focused efforts lasting over an extended period of time
- use of performance evaluation and feedback
- deliberate focus on changing faculty conceptions

In contrast, the Physics New Faculty Workshop
- is a short (4-day) one-time intervention
- does not include performance evaluation or feedback
- Is focused primarily on providing information and motivation

But, the evidence from these four data sets suggest that the NFW does work.

1. Post-NFW Evaluation Surveys

- Due ~2 weeks after the NFW
- High response rate (>80%)
- Basic questions:
  - Satisfaction
  - Rating of each session
  - Suggestions for improvement
  - Many opportunities for open-ended comments
Results of Post-Workshop Surveys

- Participants are very happy with the workshop and feel that the workshop was a good use of their time.
  - “Very good workshop. It definitely exceeded my expectations, and I have picked up more than a few very useful ideas about effective teaching.”
  - “Thank you, I think this workshop has changed the way I view teaching. I no longer view it as passing on information, but as a place where students can learn physics themselves. It really helps to see myself as a coach and not the source of all knowledge.”

- In open-ended comments, when prompted, nearly all (typically > 95%) express an intention to use specific materials and ideas from the NFW in their teaching.
  - “I will incorporate more group work (Prather's astronomy workbook) into my introductory astronomy class. I also will change my "clicker" questions to be more conceptual rather than factual in the astronomy course.”

- Most common criticism of the workshop (10%-20% of respondents) is the intensive conference schedule.
  - “The days were very long. While the speakers were engaging, the schedule did test the boundaries of our attention spans. I would have been happy to stay another full or half day and have shorter days (like no talks after dinner).”
2. Comprehensive Evaluation Survey

• Spring 2007 web-based survey
  – All 690 NFW participants who were in academia and could be located
  – Response rate of 76%

• Results* → The NFW:
  – Increases knowledge about and attitudes towards research-based instructional strategies
  – Results in changes in teaching behavior

*Examples of supporting data will be presented on the following slides. More complete support can be found in:

# Increased Knowledge/Use of Research-Based Strategies

<table>
<thead>
<tr>
<th>Method</th>
<th>I currently use</th>
<th>I have used in the past</th>
<th>I am familiar, but have never used</th>
<th>Little or no Knowledge</th>
</tr>
</thead>
<tbody>
<tr>
<td>Astronomy Tutorials</td>
<td>8.7%</td>
<td>5.0%</td>
<td>30.2%</td>
<td>56.1%</td>
</tr>
<tr>
<td>Collaborative Learning</td>
<td>39.2</td>
<td>17.2</td>
<td>23.0</td>
<td>20.6</td>
</tr>
<tr>
<td>Cooperative Group Problem Solving</td>
<td>47.2</td>
<td>21.9</td>
<td>22.9</td>
<td>8.0</td>
</tr>
<tr>
<td>Interactive Lecture Demonstrations</td>
<td>46.1</td>
<td>24.2</td>
<td>23.4</td>
<td>6.3</td>
</tr>
<tr>
<td>Just-In-Time Teaching</td>
<td>22.9</td>
<td>18.0</td>
<td>50.9</td>
<td>8.2</td>
</tr>
<tr>
<td>Peer Instruction</td>
<td>54.1</td>
<td>21.4</td>
<td>22.4</td>
<td>2.1</td>
</tr>
<tr>
<td>Realtime Physics</td>
<td>5.2</td>
<td>7.5</td>
<td>46.6</td>
<td>40.7</td>
</tr>
<tr>
<td>Personal Response Systems</td>
<td>32.6</td>
<td>15.0</td>
<td>43.7</td>
<td>8.7</td>
</tr>
<tr>
<td>Physlets</td>
<td>19.7</td>
<td>21.4</td>
<td>41.3</td>
<td>17.5</td>
</tr>
<tr>
<td>Tutorials in Introductory Physics</td>
<td>13.1</td>
<td>20.9</td>
<td>45.8</td>
<td>20.3</td>
</tr>
</tbody>
</table>
Positive Attitudes

11. Right after the New Faculty Workshop weekend were you interested in incorporating some of the workshop ideas into your teaching?

<table>
<thead>
<tr>
<th>Response</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>93.7%</td>
</tr>
<tr>
<td>No</td>
<td>2.1</td>
</tr>
<tr>
<td>I don't recall</td>
<td>4.2</td>
</tr>
</tbody>
</table>
Changes in Instructional Practices

Self-Assessment of Overall Teaching Style

- Highly traditional
- Mostly traditional with some alternative features
- Mostly alternative with some traditional features
- Highly alternative

Legend:
- Pre-NFW
- Current
Current Instructional Practices Compared to Other Faculty in Their Department

- Significantly more traditional
- A little more traditional
- About the same
- A little more alternative
- Significantly more alternative

![Bar Graph](chart.png)
### Impact on Departmental Colleagues

#### Participants report sharing NFW ideas with their colleagues
- Informal conversations
- Colloquia or faculty meetings
- Discussions following pre-tenure teaching observations by colleagues

<table>
<thead>
<tr>
<th>From NFW Participants</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have you discussed some ideas from the New Faculty Workshop with colleagues in your department?</td>
<td>86.8%</td>
<td>13.2%</td>
</tr>
<tr>
<td>To the best of your knowledge, have any of your colleagues made changes in their teaching as a result of what you learned at the New Faculty Workshop?</td>
<td>39.8%</td>
<td>60.2%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>From Department Chairs</th>
<th>Yes</th>
<th>No</th>
</tr>
</thead>
<tbody>
<tr>
<td>Have the New Faculty Workshop participants had any influence on faculty in your department who have not attended the New Faculty Workshop?</td>
<td>51.0%</td>
<td>49.0%</td>
</tr>
</tbody>
</table>
Why is the NFW Effective?

Hypothesis: It is a gateway experience that introduces faculty to research-based instruction and motivates them to work on instructional improvement after the NFW.
Evidence for Gateway Theory

Participant self-report

• It [the NFW] provided an important seed, and in that sense has influenced much of what I've done.

• It's [the NFW] biggest impact was to make me aware of teaching issues. It led me to later participate in many other teaching workshops.
Evidence for the Gateway Theory:
More Changes Made As Time Passes

How much has your teaching changed since your participation in the NFW?

- 1996
- 1997
- 1998
- 1999
- 2000
- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- All

0% 20% 40% 60% 80% 100%

- Not at all
- Somewhat
- Considerably
- Fully

Legend:
- Not at all
- Somewhat
- Considerably
- Fully
3. National Web Survey

- Administered by American Institute of Physics Statistical Research Center, Fall 2008
- Random sample:
  1) two year colleges, 2) four year colleges with a physics B.A., 3) four year colleges with a physics graduate degree
- 722 useable responses (response rate 50.3%)
  - 13% had attended NFW
- Questions about:
  - knowledge and use of 24 Research-Based Instructional Strategies
  - 20 potentially important personal and situational variables

# Top 10 Research-Based Instructional Strategies

<table>
<thead>
<tr>
<th>RBIS</th>
<th>NFW Knowledge</th>
<th>NFW Use</th>
<th>No NFW Knowledge</th>
<th>No NFW Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peer Instruction</td>
<td>92%</td>
<td>56%</td>
<td>58%</td>
<td>25%</td>
</tr>
<tr>
<td>Physlets</td>
<td>78</td>
<td>20</td>
<td>52</td>
<td>12</td>
</tr>
<tr>
<td>Workshop Physics</td>
<td>57</td>
<td>6</td>
<td>46</td>
<td>7</td>
</tr>
<tr>
<td>Cooperative Group Problem Solving</td>
<td>67</td>
<td>17</td>
<td>45</td>
<td>13</td>
</tr>
<tr>
<td>Interactive Lecture Demonstrations</td>
<td>61</td>
<td>16</td>
<td>43</td>
<td>14</td>
</tr>
<tr>
<td>Just in Time Teaching</td>
<td>81</td>
<td>24</td>
<td>42</td>
<td>6</td>
</tr>
<tr>
<td>Tutorials in Introductory Physics</td>
<td>73</td>
<td>17</td>
<td>42</td>
<td>6</td>
</tr>
<tr>
<td>Activity Based Problem Tutorials</td>
<td>54</td>
<td>10</td>
<td>41</td>
<td>5</td>
</tr>
<tr>
<td>Ranking Tasks</td>
<td>48</td>
<td>23</td>
<td>37</td>
<td>14</td>
</tr>
<tr>
<td>SCALE-UP</td>
<td>55</td>
<td>7</td>
<td>31</td>
<td>3</td>
</tr>
</tbody>
</table>
Where do Faculty Exit

The Innovation Decision Process*
and Why

Knowledge → Persuasion → Decision → Implementation → Confirmation

知曉 1 或更多的 RBIS

Have tried 1 or more RBIS

Currently use 1 or more RBIS

*Rogers, Diffusion of Innovations
Impact Current Dissemination Strategies on Undergraduate Physics Instruction

- All Physics Faculty:
  - Know about 1 or more RBIS: 12%
  - Tried 1 or more RBIS: 26%
  - Currently use: 23%
  - Not tried any RBIS: 16%
  - Discontinued use: 23%
  - No knowledge of any RBIS: 32% Discontinuation

- High Users (3+ RBIS): 23%
- Low Users (1-2 RBIS): 26%
NFW vs. No NFW

*13% of all web survey respondents

*87% of all web survey respondents
### Correlated Variables†

<table>
<thead>
<tr>
<th>Variable</th>
<th>Know</th>
<th>Tried</th>
<th>Continue</th>
<th>High</th>
</tr>
</thead>
<tbody>
<tr>
<td>READ (teaching-related journals)</td>
<td>*</td>
<td>*</td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>NFW (Physics New Faculty Workshop)</td>
<td>******</td>
<td>***</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ATND (talks/workshops)</td>
<td>**</td>
<td>**</td>
<td></td>
<td>**</td>
</tr>
<tr>
<td>MORE (interest in using more RBIS)</td>
<td>*</td>
<td></td>
<td>*</td>
<td></td>
</tr>
<tr>
<td>GEN (gender)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>SATF (satisfied with meeting goals)</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PSTN (full-time, permanent vs. other)</td>
<td>*</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSH2 (research publications)</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>SIZE (class size)</td>
<td></td>
<td></td>
<td></td>
<td>*</td>
</tr>
<tr>
<td>INST (type of institution)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>CRSE (alg- or calc-based course)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DGRE (highest degree)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ENC (departmental encouragement for teaching)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>GOAL (instructional goals)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>JOB (% of job related to teaching)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PEER (frequency of talk w/ peers about teaching)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RANK (academic rank)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSH1 (research presentations)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RSH3 (research grants)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>YEAR (years of teaching experience)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

†Controlling for other study variables using a logistic regression model.  
*Strength of effect is based on size of odds ratios (each * ~ odds ratio of 2).
Odds Ratios – Measuring Size and Direction of Relationships

\[
\text{Odds (group 1)} = \frac{\text{Number of Females}}{\text{Number of Males}} = \frac{2}{1}
\]

\[
\text{Odds (group 2)} = \frac{\text{Number of Females}}{\text{Number of Males}} = \frac{1}{2}
\]

\[
\text{Odds Ratio} = \frac{\text{Odds (group 1)}}{\text{Odds (group 2)}} = \frac{2/1}{1/2} = 4
\]
Knowledge vs. No Knowledge

- READ (yes: no)
- ATND (attend: not)
- NFW (yes: no)
- MORE (interested: not)
- GEN (female: male)
- SATF (satisfied: neutral/not)
- PSTN (full-time, perm.: other)
- RSH2 (< 4: ≥ 4 articles: )
- SIZE (≤ 36: > 36 students, )
- INST (BA: PhD)
- INST (BA: TYC)

Single Variable Model
Multi Variable Model
High vs. Low User

READ (yes: no)
ATND (attend: not)
NFW (yes: no)
MORE (interested: not)
GEN (female: male)
SATF (satisfied: neutral/not)
PSTN (full-time, perm.: other)
RSH2 (< 4: ≥ 4 articles: )
SIZE (≤ 36: > 36 students, )
INST (BA: PhD)
INST (BA: TYC)

Single Variable Model
Multi Variable Model
4. Longitudinal study of NFW participants

• 15 participants in the Summer 2010 NFW
  – Indicated high motivation to implement changes

• Followed for 5 semesters:
  – Pre and Post Semester Interviews
  – Teaching Artifacts: Tests, Course Syllabi, Instructional materials
  – Teaching outcomes: Student Evaluations, Concept Test Results
  – Time spent on teaching
Preliminary Findings – Year 1

• As expected:
  – The NFW increased participant knowledge of research-based teaching methods.
  – The NFW increased participant attitudes towards using research-based teaching methods.
  – All participants implemented changes in their teaching after the NFW:
    • N=9, Peer Instruction
    • N=6, Just-In-Time-Teaching.
    • N=4, Interactive Lecture Demonstrations
    • N=4, Other (Integration of simulations, addition of group problem solving sessions, use of some tutorials, and generally trying to be more interactive)
  – All participants report discussing NFW ideas with colleagues.
Preliminary Findings – Difficulties

• Implementation results were mixed. Reported difficulties included:
  • Not feeling implementation was going well (N=6).
  • Students responding unfavorably to innovation (N=5).
  • Difficulty finding resources / need to develop own material increases preparation time (N=4).
  • Concerns about content coverage (N=3).
  • Desire to be more interactive, unsure how (N=2).

• All participants report continuing to modify their instruction to address difficulties. In some cases this meant a decrease in use of ‘new’ methods.
Implications

• Ongoing Support
  – Change is a long-term process (even after 2 years, it continues).
  – Post-workshop support would likely increase the success of participants in responding to implementation difficulties.

• Assessment
  – Faculty don't have good mechanisms to evaluate their own teaching effectiveness (e.g., overreliance on student evaluations or their own exams).
  – NFW has increased emphasis on assessment, but more work is still needed.
Summary – New Faculty Workshop

The NFW has been effective in meeting its goals of introducing new faculty to research-based ideas and materials and motivating faculty to try these ideas and materials.
Keys to success may be that:

1) It is sponsored and run by three major disciplinary organizations.

2) It introduces participants to a wide variety of research-based instructional strategies and materials.

3) Presentations are made by the leading curriculum developers in PER.

4) It targets new faculty

Disciplinary cultures can play an important role in faculty behavior.¹

Faculty are skeptical of workshops that “sell” one particular strategy.²

Reputation of the reformer and/or their institution impact how a reform message is received.³

New faculty are already struggling with their teaching.⁴


How Could the NFW be More Effective?

Based on a literature review of 191 articles, successful disseminating strategies involve more than one of*:
• coordinated and focused efforts lasting over an extended period of time
• use of performance evaluation and feedback
• deliberate focus on changing faculty conceptions

For a NFW-like model, this means developing follow-up activities that add these components.

One possible model is Virtual Faculty Learning Communities:
• Group of 8-12 faculty who teach similar courses and have similar instructional goals work together for 1 year following NFW.
• Meet electronically every 2-3 weeks:
  – discuss teaching strategies
  – give and receive advice
  – share resources
• Builds on existing models:
  – Faculty learning communities (Cox, Miami University)
  – Disciplinary Commons (Fincher, University of Kent)

Thank You


