The National Effective Teaching Institute: Assessment of Impact and Implications for Faculty Development

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BACKGROUND
The National Effective Teaching Institute (NETI) is a three-day teaching workshop that has been given annually since 1991 in conjunction with the Annual ASEE Conference. Its goals are to improve the participants' teaching effectiveness, promote their engagement in scholarly teaching and educational scholarship, and motivate them to engage in instructional development on their campuses. To evaluate the impact of the NETI on its participants, a Web-based survey was administered to alumni of NETI offerings from 1993 to 2006.

PURPOSE (HYPOTHESIS)
The study was designed to test the hypothesis that the NETI met its stated goals, and to the extent that it did, to identify factors in the workshop's structure and delivery that might have contributed to its success.

DESIGN/METHOD
An online survey collected information regarding the participants' awareness and use of selected teaching strategies, their students' and their own ratings of their teaching, and their engagement in scholarly teaching, educational research, and giving their own teaching workshops and seminars. The validity of the survey structure is supported by several published studies that compared self-assessments of teaching with external evaluations by trained observers.

RESULTS
The NETI has motivated many of its participants to adopt or increase their use of proven teaching strategies known to correlate with improved student learning; made them more student-centered, scholarly, and reflective in their teaching practice; and induced many of them to engage in instructional development and educational scholarship.

CONCLUSIONS
The NETI has satisfactorily met its goals. When interpreted in the light of a theory of adult motivation, the results support the effectiveness of discipline-specific faculty development for engineering educators.

KEYWORDS
faculty development, National Effective Teaching Institute, NETI

I. INTRODUCTION

Every January, deans of engineering and engineering technology in the U.S. are invited to nominate up to two of their faculty members for the ASEE National Effective Teaching Institute. Nominations are accepted on a first-come-first-served basis up to a maximum of 50. James Stice of the University of Texas and Richard Felder of North Carolina State University conceived of the workshop at the 1988 Annual ASEE Conference in Portland, Oregon and spent the next two years planning it and arranging ASEE and industrial sponsorship. With Rebecca Leonard of North Carolina State University, they gave the first offering at the 1991 Annual ASEE Conference in New Orleans, Louisiana. Since that offering, the NETI has been attended by 992 professors from 216 different schools. Besides Stice, Felder, and Leonard, the facilitators have included Rebecca Brent of Education Designs, Inc. and Michael Prince of Bucknell University. A full history of the NETI is given by Felder and Brent (2009a).

Topics covered in the NETI include designing instruction to address the full spectrum of student learning styles, planning courses and getting them off to a good start, effective lecturing, active learning (students working on course-related in-class activities other than watching and listening to a lecturer), cooperative learning (students working on assignments and projects in teams under conditions that meet several criteria, including individual team member accountability for the full content of the work), assessment of learning, teaching problem-solving skills, and dealing with a variety of problems that commonly arise in the careers of engineering instructors. Inductive teaching methods such as inquiry-based and problem-based learning are introduced but minimal instruction in them is given. During the afternoon of the second day, two parallel 90-minute sessions are held: one for relatively new faculty members on getting academic careers off to a good start, and one for more experienced faculty members on promoting effective teaching on individual campuses. For each topic addressed in the workshop, methods are recommended and the research attesting to their effectiveness is cited and discussed. The workshop is highly interactive and includes many opportunities for participants to discuss and practice the methods.

Participant evaluations collected at the conclusion of each NETI offering have been consistently and strongly positive, with roughly 80 percent of the respondents giving the workshop the top rating of "Excellent," but they provide no real indication of what the workshop has actually accomplished. In the spring of 2008, the authors designed and administered a survey to all of the NETI participants in the 1993–2006 offerings whose contact information could be

located. The survey—which is shown in the Appendix—asked the participants about their teaching practices, their students' and their own ratings of their teaching, the effects of the NETI on their practices and their ratings, their involvement in educational research and instructional development, and the role of the NETI in promoting their involvement in both activities. It was administered to 607 NETI alumni, of whom 319 submitted usable responses for a 53 percent rate of return. Three of the questions on the Alumni Survey were duplicates of questions in pre-workshop surveys administered to the 2005 and 2006 NETI participants, so a direct assessment could be made of changes in those participants' teaching practices from just before they participated to two or three years afterward.

This paper reviews the principal findings of the NETI Alumni Survey and discusses the implications for engineering faculty development. For a history of the NETI, a full description of the design and administration of the survey, and summaries of the detailed responses to all survey items, see Felder and Brent (2009a).

II. Evaluating Faculty Development Programs

Van Note Chism and Szabó (1997) observed that evaluation of a faculty development program can be performed at three levels defined by the following questions:

- Level 1: How satisfied were the participants with the program?
- Level 2: What was the impact of the program on the participants' teaching practices and on their attitudes toward teaching and learning?
- Level 3: What was the impact of the program on the participants' students' learning?

The ultimate goal of teaching is learning, and so the ultimate measure of the effectiveness of a teaching workshop is the improvement in the participants' students' learning that can be attributed to the workshop (Level 3). Improvements in students' learning cannot be assumed to follow from their teachers' satisfaction with a workshop (Level 1), and may only be inferred indirectly from changes in the teachers' instructional practices following workshop attendance (Level 2). The Level 3 question is therefore the one that really matters in our evaluation of the NETI, and if we could get an unequivocal answer to it there would be no need to ask the other two questions.

Unfortunately, we cannot get that answer. There is no way to retrospectively assess the learning of students taught by hundreds of engineering professors at roughly 200 universities during a 15-year period—and even if it could be done, there would be no way to determine how much of any observed learning gains could be attributed to the workshop. We must therefore resort to indirect evaluation, asking Question 2 and using the survey respondents' appraisals of how the NETI affected their teaching to infer the answer to Question 3.

In adopting this approach, we are following standard practice in faculty development program evaluation. When teaching workshops are evaluated at all, the evaluation generally consists of surveying the participants immediately afterwards, asking them to rate the workshop and the presenters on a Likert scale and perhaps to comment on what they liked and disliked (Level 1 assessment). Van Note Chism and Szabó (1997) found that 85 percent of the faculty development programs on the 200 campuses they surveyed assessed at this level. It is of course important to assess participant satisfaction to identify problems and obtain guidance on how to improve subsequent offerings, but satisfaction surveys provide no indication of the subsequent impact of the workshops on either teaching or learning. Fewer than 20 percent of Van Note Chism and Szabó's respondents indicated that they always or usually evaluated the impact of their services on teaching (Level 2), and none had attempted to evaluate the impact on students' learning (Level 3).

The only Level 3 evaluations we found in the literature were indirect measurements in which Ho, Watkins, and Kelly (2001) and Gibbs and Coffey (2004) assessed students' approaches to studying (surface vs. deep) before and after the students' instructors had received instructional training. While such an assessment falls short of a direct evaluation of learning it still has merit, since students who take a deep approach have been shown to display a wide range of superior learning outcomes relative to students who take a surface approach (relying heavily on rote memorization of facts rather than conceptual understanding) (Meyer, Parsons, and Dunne, 1990; Ramsden, 2005). However, even an indirect Level 3 evaluation was not possible for the NETI Alumni Survey given the impossibility of contacting and surveying the NETI participants' former students.

The construct validity of using participants' self-assessments of their teaching for workshop evaluation has been examined by D'Eon et al. (2008), who cite a number of studies comparing self-assessments with external evaluations by trained observers. Those studies collectively support two conclusions:

- An individual's assessment of his or her teaching skill before or after a workshop cannot be taken at face value, but aggregated self-assessments from workshop participants generally match closely with external assessments and can provide the basis for a valid and reliable evaluation of workshop effectiveness.
- Individual gains in skills calculated from separate pre-workshop and post-workshop assessments are also suspect, since before the workshop individuals often lack a legitimate basis for judging their skill levels. On the other hand, individuals' retrospective (post-workshop) self-assessments of pre-post workshop gains in skill levels correlate reasonably well with more objective external ratings.

The Alumni Survey called on past NETI participants to assess retrospectively the impact of the workshop on their teaching skills and attitudes, and their responses were aggregated and used to gauge the effectiveness of the workshop. The validity of this approach is supported by the conclusions of D'Eon et al. (2008).

III. Design and Administration of the NETI Surveys

The goals of the NETI are to improve the participants' teaching and to motivate them to become more scholarly teachers, engage in educational research, and give their own teaching seminars and workshops. The Alumni Survey was designed to assess

how well each of these goals was met. The survey addressed the following questions:

1. *How did the NETI affect the participants' teaching?* Questions related to the participants' awareness and use of selected teaching concepts and strategies, their students' ratings of their teaching, and their self-rating of their teaching irrespective of student ratings.
2. *Did the NETI promote engagement in scholarly teaching and the scholarship of teaching and learning?* Questions concerned the participants' adoption of practices that characterize scholarly teaching (reading education-related papers; joining ASEE; attending education-related seminars, workshops, and conferences; reflecting on teaching and learning and on their students' learning strengths, weaknesses, and preferences; and using classroom research to assess the effectiveness of their teaching), and their presenting and/or publishing results of educational research studies.
3. *Did the NETI motivate participants to give teaching seminars and workshops on their home campuses and elsewhere?*

Other questions solicited demographic information and asked about the participants' attitudes toward various teaching philosophies and practices.

We designed the Alumni Survey early in the spring of 2008 and attempted to get as complete a list as possible of NETI alumni names and current e-mail addresses. No participant lists could be found from the 1991 and 1992 offerings of the workshop, and we chose not to ask the 2007 participants to evaluate the impact of a workshop they had taken only six months earlier. We initially located 692 e-mail addresses from the lists for the 1993–2006 offerings and sent e-mail announcements of a forthcoming NETI impact survey. Many of those messages were returned as undeliverable. We searched the Web for the current e-mail addresses of the alumni whose messages bounced and re-sent the survey notification to those whose addresses we located, and arrived at a final list of 607 alumni with valid addresses. We administered the survey to them using Survey Monkey® (www.surveymonkey.com), sent reminder e-mails to all who had not responded within two weeks of receiving the survey, and sent a second set of reminders to non-respondents after another three weeks. We received completed surveys from 319 alumni, a 53 percent rate of return. Sue and Ritter (2007) and Babbie (2004) suggest that a survey return rate above 50 percent is acceptable for publication.

Beginning in 2005, all NETI participants had been asked to complete an online pre-workshop survey, both to provide demographic information and to furnish a basis for eventual comparisons of their teaching practices, attitudes, and student ratings before and after attending the workshop. Questions in the pre-survey were replicates of Questions 7, 14, and 19 of the Alumni Survey. The pre-workshop surveys were administered to all registered participants using Survey Monkey® about a month before the NETI, and a reminder was sent several weeks later to non-respondents. A paper version of the survey was given at the beginning of each workshop to everyone who did not respond electronically. Most paper surveys were completed and turned in during the preliminary registration period, and the remaining ones were collected at the first break, a little over an hour after the workshop began.

Fifty-one workshop participants completed both the pre-survey and the NETI Alumni Survey: 23 from 2005 and 28 from 2006. A paired sample *t*-test was used to test for significant differences between pre-workshop and post-workshop student ratings (Question 7 of the Alumni Survey). The categorical responses to Questions 14 and 19 were converted to numbers (1–5), and Wilcoxon Matched Pairs Tests were used to analyze pre-post response differences in awareness and use of specified concepts and teaching strategies (Question 14) and differences in agreement or disagreement with certain beliefs about teaching (Question 19). The statistical tests were carried out using StatPlus:mac® and Excel®. Responses to open-ended questions were tabulated and sorted into categories that emerged in the course of the tabulation. Detailed summaries of the results are given by Felder and Brent (2009a).

IV. Survey Responses

In the remainder of this paper, references to "the survey" and to survey responses should be understood to refer to the NETI Alumni Survey unless specific mention is made of the 2005 and 2006 pre-workshop surveys.

A. Demographics

Since most of the alumni surveyed had attended the NETI many years previously, it is not surprising that 68 percent of the respondents were full or associate professors. Eighty-one percent were at Ph.D.-granting institutions and 69 percent were currently involved in research.

We are under no illusion that the survey respondents are representative of all American engineering educators: they are, after all, people who volunteered to attend a 3-day workshop on effective teaching. We also have no way to determine whether the 319 individuals who completed and returned surveys are representative of the 731 who attended the NETI in the specified years, or the 607 who were sent surveys, although that is a reasonable assumption. However, our purpose is not to use the survey results to make general inferences about engineering educators; it is rather to examine influences of the NETI on some of its participants and to explore the implications of the results for engineering instructional development. Our sample is suitable for that purpose.

B. Pedagogical Knowledge and Practices

The goal of a teaching workshop is for the participants to learn some new course planning, teaching, and assessment techniques, and to identify and correct teaching mistakes they may have been making. If they subsequently adopt or increase their use of teaching methods known to correlate with improved student learning, then improved learning can be reasonably inferred as a workshop outcome.

Question 14 of the survey asked the alumni to rate their awareness and use of certain concepts and teaching strategies, and Question 15 asked them to judge the impact of the NETI on their incorporation of those concepts and strategies into their teaching. The frequency distributions of the responses are summarized in Table 1. Pre-workshop survey responses to Question 14 were submitted by 51 participants in the 2005–2006 NETI offerings, and Table 1 also summarizes the average pre-post workshop response differences.

Concept or Strategy	Role in NETI[A]	Awareness & Use[B]	Impact of NETI on Use[C]	Pre-Test Response Mean (SD)[D]	Post-Test Response Mean (SD)[D]	p^E
Learning styles	(a)	**(1)**–0%, **(2)**–0.6%, **(3)**–8%, **(4)**–48%, **(5)**–43%	**(1)**–9%, **(2)**–24%, **(3)**–33%, **(4)**–34%	3.59 (0.96)	4.30 (0.69)	0.0002***
Learning objectives	(a)	**(1)**–0.3%, **(2)**–1%, **(3)**–1%, **(4)**–21%, **(5)**–77%	**(1)**–7%, **(2)**–18%, **(3)**–32%, **(4)**–43%	4.24 (0.86)	4.67 (0.62)	0.005**
Bloom's Taxonomy	(a)	**(1)**–2%, **(2)**–7%, **(3)**–17%, **(4)**–46%, **(5)**–27%	**(1)**–26%, **(2)**–19%, **(3)**–33%, **(4)**–22%	2.67 (1.47)	3.90 (1.00)	<0.0001***
PowerPoint (or equivalent)	(c)	**(1)**–0%, **(2)**–0%, **(3)**–12%, **(4)**–47%, **(5)**–40%	**(1)**–56%, **(2)**–23%, **(3)**–16%, **(4)**–5%	4.39 (0.70)	4.37 (0.67)	0.85
Active learning	(a)	**(1)**–0%, **(2)**–0%, **(3)**–2%, **(4)**–41%, **(5)**–57%	**(1)**–6%, **(2)**–20%, **(3)**–34%, **(4)**–40%	3.67 (1.16)	4.49 (0.58)	<0.0001***
Cooperative learning	(a)	**(1)**–0%, **(2)**–2%, **(3)**–7%, **(4)**–51%, **(5)**–39%	**(1)**–13%, **(2)**–22%, **(3)**–37%, **(4)**–28%	3.43 (1.22)	4.06 (0.76)	0.0003***
Problem-based learning	(c)	**(1)**–0.3%, **(2)**–2%, **(3)**–5%, **(4)**–44%, **(5)**–49%	**(1)**–20%, **(2)**–26%, **(3)**–37%, **(4)**–18%	3.76 (1.03)	4.18 (0.74)	0.014*
Inquiry-based learning	(b)	**(1)**–2%, **(2)**–12%, **(3)**–16%, **(4)**–48%, **(5)**–22%	**(1)**–39%, **(2)**–26%, **(3)**–26%, **(4)**–8%	2.76 (1.11)	3.69 (0.95)	<0.0001***
Web-based tutorials	(c)	**(1)**–0.3%, **(2)**–0.3%, **(3)**–55%, **(4)**–33%, **(5)**–11%	**(1)**–74%, **(2)**–16%, **(3)**–9%, **(4)**–1%	3.37 (0.60)	3.35 (0.74)	0.82
Distance education	(c)	**(1)**–0%, **(2)**–0.6%, **(3)**–71%, **(4)**–18%, **(5)**–10%	**(1)**–88%, **(2)**–8%, **(3)**–3%, **(4)**–1%	3.14 (0.57)	3.27 (0.63)	0.15
Boice's new faculty strategies	(b)	**(1)**–39%, **(2)**–27%, **(3)**–16%, **(4)**–14%, **(5)**–4%	**(1)**–83%, **(2)**–8%, **(3)**–7%, **(4)**–2%	1.75 (1.09)	2.75 (1.31)	<0.0001***

Legend

[A] **(a)**–major topic, **(b)**–moderately addressed, **(c)**–slightly addressed

[B] *N*=310. **(1)**–never heard of, **(2)**–not sure what it is, **(3)**–never use, **(4)**–use occasionally, **(5)**–use frequently

[C] *N*=310. **(1)**–no effect, **(2)**–slight effect, **(3)**–moderate effect, **(4)**–substantial effect

[D] *N*=51. **(1)**–never heard of, **(2)**–not sure what it is, **(3)**–never use, **(4)**–use occasionally, **(5)**–use frequently

[E] Significance level from Wilcoxon's Matched Pairs Test. *=significant at 0.05 level, **=significant at 0.01 level, ***=significant at 0.001 level

Table 1. Pedagogical knowledge and practices.

The first topic discussed in the workshop is *learning styles* of engineering students, teaching styles of engineering professors, consequences of mismatches, and ways to teach so as to address the needs of all learners (Felder and Brent, 2005). Ninety-one percent of the survey respondents indicated that they had made occasional or frequent use of the concept of learning styles in their teaching, and 68 percent reported that the NETI had a moderate or substantial effect on their doing so. The difference between pre-workshop and post-workshop awareness and use of learning styles in teaching was highly significant.

The topic addressed after learning styles is using *learning objectives* as the basis for designing instruction and assessment (Stice, 1976). Learning objectives (also known as instructional objectives) are explicit statements of what students should be able to do (define, explain, calculate, model, design, critique,...) if they have learned what the instructor intends them to learn. *Bloom's Taxonomy* (Anderson and Krathwohl, 2001) is a hierarchical system used to classify learning objectives in increasing order of complexity, from pure rote memorization at Level 1 through basic conceptual understanding (Level 2), ability to apply course-taught methods to solve new problems (Level 3), analytical thinking (Level 4), critical thinking (Level 5), and creative thinking (Level 6). A NETI session is devoted to learning objectives and Bloom's Taxonomy, during which the participants write objectives at different Bloom levels for a course they teach. Because of their prominent role in the ABET Engineering Criteria, learning objectives are likely to be familiar to most engineering professors, and 98 percent of the respondents indeed reported making occasional or frequent use of them, but 75 percent stated that the NETI had a moderate or substantial impact on their doing so. Bloom's Taxonomy (which is not part of the ABET criteria) was used by 73 percent of the respondents, with 55 percent reporting that the NETI had a moderate or substantial impact on their doing so. Pre-post workshop gains in awareness and use of learning objectives and Bloom's Taxonomy were statistically significant, highly so in the case of the Taxonomy.

The third main focal point of the NETI is *active learning* (engaging students in course-related in-class activities other than watching a lecture) (Felder and Brent, 2009b). It is used throughout the workshop and addressed formally in two separate sessions: a general one on different active learning strategies and another one on using the active learning strategy called *Thinking-Aloud-Pair-Problem-Solving* (Lochhead and Whimbey, 1987) to help students develop problem-solving skills. Ninety-eight percent of the respondents reported making occasional or frequent use of active learning and 74 percent credited the NETI with having played a moderate or substantial role in their doing so. The pre-post test results in Table 1 also show a highly significant gain in awareness and use of active learning following the workshop.

The survey also showed that the NETI motivated many participants to adopt or increase their use of cooperative learning, with 90 percent of the respondents reporting occasional or frequent use of it and 65 percent acknowledging the moderate or substantial impact of the NETI in their decision to use it. The 2005 and 2006 NETI participants who completed pre-workshop surveys also reported a dramatic increase in their awareness and use of cooperative learning following their participation.

The results shown in Table 1 for problem-based learning and inquiry-based learning should be interpreted with care. While both of those approaches are mentioned favorably in the NETI, we do not really discuss them in the detailed way we do with active and cooperative learning. Thus, while 93 percent and 70 percent of the respondents respectively said they use problem-based and inquiry-based learning and the pre-post workshop gains in awareness and use were significant for both strategies, we suspect that not all of the respondents had in mind what experts on those methods would qualify as inquiry, and even fewer were envisioning genuine problem-based learning. The low impacts of the NETI reported in Table 1 on the use of PowerPoint, Web-based instruction, and distance education—topics which the NETI does little more than touch on—are undoubtedly more realistic.

The unimpressive results in Table 1 for the use of Robert Boice's (1992) success strategies for new faculty (e.g., *budget regular time for writing, avoid overpreparing for classes, and network regularly with colleagues*) are understandable. We only started presenting this material when we initiated a breakout session for new faculty members in 2002, so respondents who attended the NETI before that year and respondents who attended the other breakout session in the 2003–2006 offerings would not have seen it. Nevertheless, roughly 10 percent of the respondents found that the NETI had a moderate or substantial influence in motivating them to make use of the strategies, and the pre-post survey results (which are only applicable to recent participants who experienced more extensive coverage of the Boice material than their predecessors did) show a clear impact of the NETI on the respondents' awareness and use of the strategies.

In short, the results summarized in Table 1 suggest that the NETI successfully increased the participants' awareness of the main concepts and instructional methods discussed in the workshop, and it also persuaded many of them to incorporate some of those concepts and methods into their teaching. Since correlations with improved student learning have been found for teaching to balance the needs of students with different learning styles (Felder and Brent, 2005), writing explicit learning objectives and making them clear to students (Hartley and Davies, 1976), getting students actively engaged in course-related activities in class (Prince, 2004), and getting students to work in teams under conditions that assure individual accountability and meet the other defining criteria of cooperative learning (Johnson, Johnson, and Stanne, 2000), we infer that the NETI-motivated adoption or increased use of these teaching strategies by the nearly 1000 NETI participants has led to greater learning by the hundreds of thousands of students whom the participants have taught.

C. Student Ratings of Teaching

A common fear of instructors is that if they start using active learning (or another of the learner-centered teaching methods advocated in the NETI), some of their students will not like it (which is true enough) and the instructors' teaching ratings will suffer. The possibility of decreased ratings certainly exists, especially for outstanding instructors who are already getting the highest ratings possible. To investigate the link between NETI attendance and ratings, we asked the survey respondents to indicate what happened to their ratings in the years following their attendance. Six of the respondents skipped this question and 17 said that it was inapplicable to them (perhaps because they did not do any teaching in the years after the NETI). The distribution of the remaining 290 responses is shown in Figure 1.

The effect of the NETI on student ratings was clearly overwhelmingly positive. Sixty-seven percent of the respondents reported increases in their ratings following the workshop; the ratings stayed roughly the same for 29 percent; fewer than 6 percent reported a decrease of any magnitude at all, and only one reported a substantial decrease. The drop in student ratings that many instructors fear will result from the adoption of learner-centered methods obviously did not occur for the overwhelming majority of the NETI respondents. We should point out, however, that instructors who adopt a method like problem-based learning—which requires students to take an unusually high level of responsibility for their own learning and which is not stressed in the NETI—might initially expect to see moderate-to-large drops in their ratings, followed by recovery as they become more experienced and confident in using the method.

D. Involvement in Instructional Development

One of the goals of the NETI is to encourage and equip participants to give presentations to colleagues on what they learned in

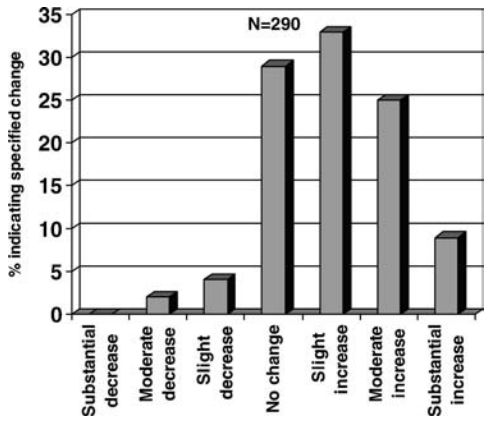

Figure 1. Changes in student ratings following the NETI.

the workshop. Question 12 of the survey asked about the participants' involvement with instructional development. Of the 313 respondents to this question, 44 percent had given presentations (9 percent extensively and 35 percent occasionally), 21 percent had not but planned to in the future, 32 percent had no prior or anticipated involvement, and 3 percent responded with "other." In other words, 65 percent of the respondents were interested in instructional development, the majority of whom had actually done it. In response to Question 13, which asked whether the NETI motivated the respondents to engage in instructional development, 52 percent responded affirmatively and 48 percent negatively. Our conclusion is that the NETI met its goal of transforming some of its participants into potential change agents on their campuses.

E. Engagement in Scholarly Teaching and the Scholarship of Teaching and Learning

Hutchings and Shulman (1999) introduced the distinction between *scholarly teaching* and the *scholarship of teaching and learning*. Instructors doing scholarly teaching inform themselves of the latest ideas in pedagogy and assessment, take those ideas into account as they introduce changes in their teaching, and assess the effects of the changes. Instructors engaged in the scholarship of teaching and learning approach teaching in the same scholarly way, and in addition they present and publish descriptions of their teaching innovations and their assessment results in a form others can evaluate, replicate, and build on.

Questions 16–18 of the survey asked about the participants' engagement in certain scholarly teaching practices (belonging to ASEE, attending education conferences, and reading education-related journals) and their involvement in unpublished classroom research (further evidence of scholarly teaching), and in the scholarship of teaching and learning (presenting research results at conferences and publishing results of unfunded and funded research). Responses are summarized in Table 2.

Substantial percentages of the survey respondents reported engaging in scholarly teaching practices, with many indicating that the NETI played a role in motivating them to do so. Three-quarters of the respondents reported having done informal classroom research and/or formal educational research, with 50 percent indicating that their research activity was motivated by the NETI. The survey did not ask the respondents to indicate the role of the workshop in promoting each individual category of research involvement (classroom research, conference presentations, journal publications), but the other responses in Table 2 suggest that significant fractions of those who have presented or published research were stimulated to do so by the NETI. The NETI devoted relatively little time to promoting the scholarship of teaching and learning, and the fact that it had the effect it did on so many participants came as a pleasant surprise.

F. Participants' Recollections and Comments

Question 11 of the survey asked the respondents to reflect on the effect of the NETI on the quality of their teaching, irrespective of student ratings, and Question 20 invited them to share their recollections of the NETI and to offer any comments they might have about it. Individual responses are tabulated by Felder and Brent (2009a).

Of the direct assessments of the effect of the workshop on teaching quality, 87 percent were clearly positive and the remainder were neither positive nor negative. This high level of retrospective satisfaction with the NETI is consistent with the previously cited immediate post-workshop ratings (80 percent excellent, 20 percent good, <1 percent average, and none fair or poor). Many of the responses to the open-ended questions reflected perceptions that the NETI had a positive effect on the quality of the respondents' teaching and/or of their students' learning, and many more cited learning new teaching methods and getting better at applying previously used methods. Of the methods cited, active learning was named most often, followed by the systematic use of learning objectives.

	Yes	NETI Motivated[a]
[b]Read education-related journal articles?	89%	47%
[b]Participated in an education conference	73%	31%
[b]Belong to ASEE	69%	21%
[b]Done educational research of any type	76%	50%
[b]Done unpresented & unpublished classroom research	25%	
[c]Presented educational research results at a conference	33%	
[c]Done unfunded educational research and published results	27%	
[c]Done funded educational research and published results	25%	

[a]Percentages are of the total number of respondents (309)

[b]Scholarly teaching

[c]Scholarship of teaching and learning

Table 2. Engagement in scholarly teaching and educational scholarship (N = 309).

Most college instructors are never taught about teaching and so they simply repeat what they observed from their own college instructors without reflecting on the effectiveness of that instructional approach in promoting learning (Schön, 1983). Numerous respondents indicated that the NETI made them more reflective in their teaching practice, indicating that they had become more aware of teaching and learning processes in general and that they had begun to think more consciously about their own teaching. The workshop outcomes they mentioned included their greater awareness of students' learning needs and learning style differences, greater learner-centeredness in their teaching, and a generally better understanding of and rapport with students.

V. Summary

Multiple measures were used to assess the impact of the National Effective Teaching Institute on its participants' teaching. Their satisfaction with the workshop was first assessed, the rationale being that participants who are unhappy with a teaching workshop are unlikely to incorporate workshop recommendations into their teaching practices. Other assessed measures of the effectiveness of the NETI were the extent to which it (a) helped make participants aware of proven but nontraditional teaching methods and influenced them to adopt those methods; (b) affected how their students felt about the quality of their teaching; (c) motivated them to provide instructional development on their home campuses and beyond; (d) inspired them to be more scholarly and reflective in their teaching and induced them to engage in educational research. The outcomes are summarized below.

1) **Participants' satisfaction with the NETI:** The level of immediate post-workshop participant satisfaction with the NETI has been extremely high. In its 19 offerings, the workshop has received a total of 871 overall ratings of which 79.6 percent were "Excellent," 19.7 percent were "Good," 0.7 percent were "Average," and none were "Fair" or "Poor." The retrospective evaluations gathered in the Alumni Survey were similarly affirming. Of the respondents' open-ended assessments of the effect of the workshop on teaching quality, 87 percent were clearly positive, 13 percent were neutral, and none were clearly negative.
2) **Awareness and use of effective teaching practices:** The teaching strategies most heavily emphasized in the NETI are designing instruction to address the full spectrum of student learning styles, writing learning objectives and using them as the basis for course planning, instruction, and assessment, and getting students actively engaged in course-related tasks during classes (active learning). Substantial percentages of the respondents incorporated learning styles, learning objectives, and active learning in their teaching and credited the NETI with having a moderate or strong influence on their doing so. These results along with many reported adoptions of other NETI-recommended strategies indicate that the workshop had a significant effect on participants' teaching practices.
3) **Student ratings:** Sixty-seven percent of the respondents reported increased student ratings following the NETI, 29 percent saw no change, and 6 percent experienced decreased ratings, with only one of the reported decreases being substantial. In their open-ended responses, most of those who experienced drops in their student ratings expressed beliefs that the NETI-motivated changes in their teaching had nevertheless improved their teaching and their students' learning.
4) **Instructional development:** Fifty-two percent of the respondents felt that the NETI motivated them to get involved in instructional development; 44 percent had engaged in it (9 percent extensively and 35 percent occasionally), and 21 percent had not yet done so but planned to in the future.
5) **Scholarly teaching and the scholarship of teaching and learning:** High percentages of the respondents reported engaging in practices that characterize scholarly teaching: 89 percent stated that they read education-related journal articles and 73 percent had participated in an education conference, with roughly half of each group having been motivated to do so by the NETI; and 69 percent belonged to the ASEE, roughly a third of whom were persuaded by the NETI to join. Three-quarters of the respondents had engaged in classroom research and/or formal educational research, with 50 percent having been stimulated to do so by the NETI.

In short, the Alumni Survey results suggest that the NETI has consistently achieved its goals. It successfully motivated many of its participants to adopt or increase their use of proven teaching strategies known to correlate with improved student learning; made them more student-centered, scholarly, and reflective in their teaching practice; increased student ratings of teaching for most of them and decreased ratings for very few; and induced many of them to engage in instructional development and educational scholarship.

VI. Discussion

A. What Accounts for the NETI's Success?

Engineering faculty members are not known for their enthusiasm about teaching workshops. Directors and staff of campus teaching and learning centers frequently complain that few engineers attend their workshops, and those who come tend to dismiss what they hear as irrelevant to their courses and students. However, there are significant exceptions to this pattern: some well-established instructional development programs have attracted and influenced many engineering faculty members. Judging from the Alumni Survey responses, the NETI falls in this category.

The question is, what do the successful programs do that most programs fail to do? We propose that at least part of the answer lies in the adult learning literature. Wlodkowski (1999) suggests that five attributes of a learning environment have a motivational effect on adult learners (see Table 3).

Many campus teaching workshops fail to meet most or all of the criteria listed in Table 3. Let us first consider the perceived expertise of the presenters and relevance of the content. Teaching and learning center directors and staff tend to come from education and psychology, and most workshops they give are intended to address faculty in all disciplines. The presenters are normally quite knowledgeable about learning theories and good pedagogical practices; however, they lack the disciplinary content knowledge to construct examples that would make the workshop material clearly relevant to engineering faculty. Even if the presenters had that knowledge, they would probably

1.	**Expertise of presenters.** Adults expect their teachers/trainers to be experts in the material being taught and to be well-prepared to teach it. While teachers may occasionally be able to improvise successfully, adults are usually quick to detect inadequate background knowledge and/or lack of systematic preparation and they often react negatively when they do.
2.	**Relevance of content.** Adults may quickly become impatient with material for which they cannot see an immediate use. Once they understand the relevance of presented material to their needs and interests, they become much more willing to do whatever it takes to learn it.
3.	**Choice in application**. Adults respond well when given options about when and how to apply recommended methods. They are skeptical (usually appropriately) of "one size fits all" prescriptions, having learned by experience that no two situations are ever exactly alike.
4.	**Praxis (action plus reflection).** Adults appreciate opportunities to see implementations of methods being taught, to try the methods themselves, and to reflect on the outcomes.
5.	**Groupwork**. Working in groups has repeatedly been shown to promote almost every conceivable learning outcome for students of all ages, including for adults as long as the activities are well implemented and clearly relevant to the learning objectives of the instructional program (Prince, 2004; Johnson, Johnson, and Stanne, 2000).

Table 3. Factors that motivate adult learning (Wlodkowski, 1999).

refrain from using it for fear of losing participants from other disciplines. Some engineers may be imaginative enough to envision how they could apply the workshop content in their courses, but most who do not quickly see the relevance of the content (Criterion 2) tend to reject the notion that the presenters can tell them anything useful about how to teach (Criterion 1).

Teaching workshops are frequently prescriptive in their recommendations (to teach well, you must do *x*, *y*, and *z*), giving the participants no choice in whether, when, and how to implement each recommendation (Criterion 3). The participants get the message that they have been teaching wrong and must make the recommended changes to be acceptable teachers, a message most do not appreciate. Many workshops consist almost entirely of lectures on educational theories and methods, with little opportunity to practice the methods (Criterion 4), and provide few or no content-related interactions among participants (Criterion 5). In an absurd extreme of a Criterion 5 violation, one of the authors attended a workshop on active learning that consisted of three hours of straight lecturing on the importance of getting students actively involved in class!

We believe that the success of the NETI derives in large measure from the extent to which it has met Wlodkowski's (1999) criteria.

1) **Expertise:** In every offering of the NETI, at least two of the NETI facilitators were well-known engineering educators, and all but one of the five who have been facilitators have made substantive contributions to the engineering education literature, with much of their work being highlighted in the workshop. Even the most critical participant could not argue that the facilitators did not understand engineering content and students.
2) **Relevance:** The NETI emphasizes methods of designing and teaching engineering courses and assessing learning. Relevant theories and research studies are cited and discussed, but only to provide support for the suggested methods and not as ends in themselves. The word that comes up most often in favorable open-ended responses in post-NETI evaluations is "practical," and many participants draw explicit contrasts between the practicality of the NETI and the theoretical nature of other teaching workshops they have attended.

   Engineering-specific examples are used throughout the workshop. When the participants are given an example of how to teach a course topic in a way that addresses the full spectrum of learning styles, the course is fluid dynamics; when they critique illustrative learning objectives, the objectives are for common engineering courses; and when they view videoclips that illustrate active learning in a large lecture, the clips are of one of the NETI facilitators teaching an engineering class.

   Even though the research supporting the recommended methods is not emphasized in the workshop presentation, its presence in the workshop materials is vital. Engineering educators are trained scholars, and they are likely to demand evidence that something works before they commit themselves to trying it. We encourage the NETI participants to not simply take our word for any of our recommendations, but to do what they have been trained to do and examine the supporting research for themselves. Even though most of them may not choose to do it, when they see summaries of the research results and citations of references where they can find all the data, they are willing to accept that the recommended methods have solid backing.
3) **Choice in application:** The participants are repeatedly told that if they attempt to implement every workshop recommendation in their next course, they will fail so thoroughly that they will never want to try anything new again. They are cautioned instead to choose just a few new ideas that look appealing; try them several times to get a sense of how well they work; keep doing the ones that work and drop those that do not; and add another one or two ideas in the next semester. They are also assured that there are no recipes for successful teaching, and they will need to experiment to find the balances that work best for them between theoretical and practical course content, lecturing and active learning, individual and group work, etc.
4) **Praxis:** Demonstrations and activities illustrate and/or provide practice in every major method suggested in the NETI. After different learning styles are described, the participants assess their own styles and reflect on how those styles are different from the styles of most of their students. They critique good and bad learning objectives for engineering courses and then write their own; they critique a poorly written test and contrast it with a much better but still imperfect version of the same test; they plan class activities to help their students develop a skill specified in one of their learning objectives; they generate and critique possible instructor responses to common problem scenarios (disruptive classes, students in crisis, cheating,...), and so on.
5) **Groupwork:** The facilitators rarely present for more than 15 minutes without engaging the participants in content-related activities. The activities are sometimes done individually, more often in groups of 2-4, and sometimes individually

followed by small group processing ("think-pair-share"). When active learning is formally discussed on the second day, the participants have already practiced a number of the structures described. Over the years, many participants have expressed appreciation of the extent to which the facilitators practice what they preach.

B. Making Engineering Faculty Development Effective

Based on the results and analysis of the NETI Alumni Survey, we offer the following recommendations for making instructional development for engineering faculty as effective as possible.

1) ***Design workshops specifically for engineering faculty and perhaps faculty in other STEM disciplines (science, technology, engineering, and mathematics).*** There is much to be said for bringing together faculty from different disciplines. Workshops and other faculty development programs on discipline-independent topics such as using course management software, dealing with academic misconduct, surveying recent developments in cognitive science, and balancing personal and professional life can be presented very effectively to campus-wide audiences. However, practices in other topics, such as writing and assessing learning objectives and designing active and project-based learning experiences, vary dramatically across disciplines, and presentations on those topics tend to be ineffective without discipline-specific examples. If you try to reach everyone on campus with a teaching workshop that covers such topics, you run a considerable risk of reaching no one.
2) ***Accentuate the practical.*** Most engineering faculty members who attend teaching workshops are interested in what they can do to become better teachers, and not so much in general education theories or detailed accounts of educational research studies. Emphasize proven course design, instruction, and assessment methods in the workshop presentation, and bring in theories and research only as needed to provide support for the recommendations.
3) ***Engage engineering faculty members who are excellent teachers to present the workshops or to co-present them with experts in general pedagogy.***
4. ***Suggest, do not prescribe; give choices; and caution participants not to try too much at once.***
5. ***Illustrate most or all recommended teaching methods with examples and demonstrations drawn from engineering courses.*** To the greatest extent possible, use the recommended methods yourself in presenting the workshop. Practice what you preach!

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Appendix. NETI Alumni Survey

1. How many years have you taught?
   ___ <1 ___ 1–2 ___ >2–5 ___ >5–10 ___ >10

2. How many years have you worked in industry, not counting co-op or summer internships when you were a student?
   ___ 0 ___ <1 ___ 1–2 ___ >2–5 ___ >5–10 ___ >10

3. How is your current institution classified?
   __ RU/VH (Research I university)
   __ 4-year university or college, Ph.D. granting
   __ 4-year university or college, non-Ph.D. granting
   __ Technical/community college
   __ Other (please specify) _____

4. What has your average ANNUAL teaching load been in the past two years?
   ___ 0 courses ___ 1–2 courses ___ >2–4 courses ___ >4–6 courses ___ >6 courses

5. How many teaching workshops have you ever attended, including the NETI?
   ___ 1–2 ___ 3–4 ___ 5–10 ___ >10

6. How many courses on teaching have you taken?
   ___ 0 ___ 1–2 ___ 3–4 ___ 5–10 ___ >10

7. On a 1 (poor)—5 (excellent) scale, estimate your average student rating in undergraduate courses over the past two years, rounding off to the nearest 0.1. Enter a zero if you have not taught any undergraduate courses in the past two years.
   _____

8. On a 1 (poor)—5 (excellent) scale, estimate your average student rating in graduate courses over the past two years, rounding off to the nearest 0.1. Enter a zero if you have not taught any graduate courses in the past two years.
   _____

9. What happened to your average student ratings in the years after you attended the NETI?
   ___ Decreased slightly ___ Increased slightly ___ Fluctuated or didn't change much
   ___ Decreased moderately ___ Increased moderately ___ Not applicable
   ___ Decreased substantially ___ Increased slightly

10. What effect do you think the NETI had on your teaching ratings?
    ___ none ___ slight ___ moderate ___ substantial ___ my ratings didn't change

11. What effect do you think the NETI had on your teaching (regardless of ratings)?
    _____

12. What is your involvement with providing instructional development (that is, giving teaching workshops and/or seminars). Check the first response that applies.
    ___ Extensive in the past
    ___ Occasional in the past
    ___ None in the past, but plan to engage in it in the future
    ___ None in the past, and anticipate no future involvement
    ___ Other (please specify) _____

13. Did the NETI motivate you to get involved in instructional development?
    ___ No ___ Yes

14. Rate your awareness and use of the concepts and teaching strategies listed below, checking the first applicable button for each one.

	Never heard of it	Not sure what it is	Never use it in teaching	Use it occasionally	Use it frequently
Learning styles	O	O	O	O	O
Learning objectives	O	O	O	O	O
Bloom's Taxonomy	O	O	O	O	O
PowerPoint (or equivalent)	O	O	O	O	O
Active learning	O	O	O	O	O
Cooperative learning	O	O	O	O	O
Problem-based learning	O	O	O	O	O
Inquiry-based learning	O	O	O	O	O
Web-based instructional tutorials	O	O	O	O	O
Distance education	O	O	O	O	O
Robert Boice's success strategies for new faculty	O	O	O	O	O

15. What effect did the NETI have on your incorporation of the following concepts and strategies into your teaching?

	No effect	Slight effect	Moderate effect	Substantial effect
Learning styles	O	O	O	O
Learning objectives	O	O	O	O
Bloom's Taxonomy	O	O	O	O
PowerPoint (or equivalent)	O	O	O	O
Active learning	O	O	O	O
Cooperative learning	O	O	O	O
Problem-based learning	O	O	O	O
Inquiry-based learning	O	O	O	O
Web-based instructional tutorials	O	O	O	O
Distance education	O	O	O	O
Robert Boice's success strategies for new faculty	O	O	O	O

16. How much have you been involved with research on teaching and learning? (Check all responses that apply.)
___ I have done funded research and published results
___ I have done unfunded research and published results
___ I have done research and presented results at a conference
___ I have done classroom research to improve my teaching but never published or presented
___ I have never done educational research

17. Did attending the NETI motivate you to do research on teaching and learning?
___ No ___ Yes

18. Respond to the following questions
___ No ___ Yes Do you belong to the ASEE?
___ No ___ Yes Did the NETI motivate you to join the ASEE?
___ No ___ Yes Have you ever participated in an education conference?
___ No ___ Yes Did the NETI motivate you to participate in such conferences?
___ No ___ Yes Do you ever read education-related journal articles?
___ No ___ Yes Did the NETI motivate you to read more such articles?

19. Rate your agreement with the following statements.

	Strongly disagree	Disagree	Neutral	Agree	Strongly agree
The most important characteristic of good teaching Is to have complete and accurate lecture notes.	O	O	O	O	O
Teachers should give students frequent course-related group activities in class.	O	O	O	O	O
Teachers should give students detailed study guides for tests.	O	O	O	O	O
Giving tests that only the top students have time to complete sorts students effectively according to their understanding of the material.	O	O	O	O	O
Teachers should deliver lectures primarily via transparencies or PowerPoint.	O	O	O	O	O
It is acceptable for teachers to give assignments on material that has not been explicitly covered in class.	O	O	O	O	O
You can teach people to be critical thinkers.	O	O	O	O	O
You can teach people to be creative thinkers.	O	O	O	O	O

The next two questions are optional, but we'd be grateful if you respond to them.

20. Please share with us your recollections of and comments about the NETI and your evaluation of its effect on your teaching.
_____

21. Do you have any suggestions for making the NETI more effective?
_____

We are requesting the following information for purposes of correlation. Your responses will be integrated into a large statistical database, and no one but the survey coordinator will ever know how you responded to any questions.

22. What is your name? (Last, First) This question is optional.

23. In what year did you attend the NETI? (Estimate if you're not sure.) _____

24. How many years had you taught before attending the NETI?
___ <1 ___ 1–2 ___ >2–5 ___ >5–10 ___ >10

25. What is your current position?
___ Full professor
___ Associate professor
___ Assistant professor
___ Lecturer/instructor
___ Graduate student
___ Other (please specify) _____

26. Are you
___ female ___ male

27. What are your principal responsibilities? (Check all that apply.)
___ Research
___ Undergraduate teaching
___ Graduate teaching
___ Administration
___ Advising/counseling
___ Instructional development
___ Other (please specify) _____

28. What is your principal academic discipline (in which you have done most of your teaching)?
__ Aerospace engineering
__ Bioengineering
__ Chemical engineering
__ Chemical engineering technology
__ Civil engineering (non-environmental)
__ Civil engineering (environmental)/Environmental engineering
__ Computer engineering
__ Computer science
__ Electrical engineering
__ Electrical engineering technology
__ Freshman engineering/general engineering
__ Industrial engineering/management science/operations research
__ Materials science/engineering
__ Mechanical engineering
__ Mechanical engineering technology
__ Nuclear engineering
__ Biological sciences
__ Physical sciences (chemistry, physics, earth and marine sciences)
__ Mathematical sciences (mathematics, statistics)
__ Other (please specify) _____

Thank you for taking the time to complete our survey.