ANALYSIS OF FIFTEEN YEARS OF THE NATIONAL EFFECTIVE TEACHING INSTITUTE[*]

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ABSTRACT

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. In the early spring of 2008, a web-based survey sent to 607 workshop alumni asked about the effects of the NETI on their teaching practices, their students' and their own ratings of their teaching, their involvement in educational research and instructional development, and their attitudes regarding various aspects of teaching and learning. Valid responses were received from 319 of the survey recipients. This paper briefly reviews the history of the NETI, summarizes and analyzes the survey responses, and discusses their implications for engineering faculty development.

INTRODUCTION

The National Effective Teaching Institute is given annually on the Thursday, Friday, and Saturday preceding the Annual Conference of the American Society for Engineering Education. It is sponsored by the Engineering Research and Methods and Chemical Engineering Divisions of the ASEE, and the ASEE program staff manages the finances, registration, and logistical arrangements. Every January, all deans of engineering and engineering technology in the U.S. are invited to nominate up to two of their faculty members for the NETI, and applications are accepted on a first-come-first-served basis up to a maximum of 55. In the years 1991–2008, the workshop has been attended by 935 professors from 209 different schools (Appendix A). Information about the NETI can be found at <*http://www.ncsu.edu/felder-public/NETI.html*>.

Topics covered in the NETI include designing instruction to address the full spectrum of student learning styles; planning courses (including writing learning objectives covering all cognitive levels of Bloom's Taxonomy); assessing and evaluating learning; effective lecturing; active learning; teaching problem-solving skills; time management; and dealing with a variety of problems that commonly arise in the careers of engineering educators. Cooperative learning and inductive teaching methods such as inquiry-based learning 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 techniques for promoting effective teaching on individual campuses. For each topic addressed in the workshop, practical suggestions are offered and the research attesting to their effectiveness is cited and discussed.

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Participant evaluations collected at the conclusion of each workshop offering have been consistently positive. In the eighteen years that the workshop has been given, 820 overall ratings have been submitted of which 84% were "Excellent," 16% were "Good," <1% were "Average," and none were "Fair" or "Poor." As gratifying as this level of participant satisfaction is, however, it provides no real indication of what the workshop has actually accomplished. In the spring of 2008, we designed and administered a survey to all of the NETI participants in the 1993–2006 offerings whose contact information we could find. The survey—hereafter referred to as the *NETI Alumni Survey*—is shown in Appendix B. It asks the participants about their teaching practices, their students' and their own ratings of their teaching, the effects of the NETI on both their practices and their ratings, their involvement in educational research and instructional development, and several demographic questions. The survey was administered to 607 NETI alumni, of whom 319 submitted usable responses for a 53% 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 and attitudes from just before they participated to two or three years afterwards.

This paper briefly reviews the history of the NETI, offers some general considerations regarding evaluation of faculty development programs, describes the design and administration of the Alumni Survey and the pre-workshop surveys, summarizes and analyzes the responses, and discusses their implications for engineering faculty development.

A BRIEF HISTORY OF THE NETI

For several years prior to 1988, the term "National Effective Teaching Institutes" had been applied to half-day and one-day workshops on various topics sponsored by the Educational Research and Methods Division of the ASEE and given at ASEE Conferences. At the 1988 ASEE Conference in Portland, Oregon, James Stice of the University of Texas and Richard Felder of North Carolina State University had the idea that a more extended program offered every year to engineering faculty at large—not just conference attendees—might have a greater impact on American engineering education and might also induce more engineering educators to join ASEE. Felder had been giving three-day workshops at N.C. State University since 1986, and the two chemical engineering professors decided to use a 3-day format similar to the one used at N.C. State. They sought and received agreement from the ERM and CHE Divisions of ASEE to sponsor the NETI, and Stice solicited and received financial support from several companies (Dow Chemical, Dupont, Exxon-Mobil, and Union Carbide).

Early in 1991, all engineering deans on the ASEE membership list were invited to nominate up to two of their faculty members to attend the NETI, and the first offering was given to about 50 attendees at the 1991 ASEE Annual Meeting in New Orleans. The first presenters were Stice, Felder, and Rebecca Leonard, a professor of communication at N.C. State. That offering took place immediately following the conference, and all subsequent offerings have been on the Thursday, Friday, and Saturday preceding it. The sponsoring companies maintained their support for varying lengths of time, and starting in 2008 the NETI has supported itself entirely from participant registration fees.

Stice and Felder have co-facilitated every NETI since the inception of the program. Becky Leonard presented from 1991 through 1994, and beginning in 1996, Stice and Felder were joined by Rebecca Brent, a former professor of education at East Carolina University and now president of Education Designs, Inc., an educational consulting firm in Cary, North Carolina. In 2001, with a view toward creating a cadre of teaching leaders who could disseminate the methods being taught in the NETI throughout the engineering education community, Stice, Felder, and Brent created the "NETI Fellow" program, inviting rising stars of the field to co-present with them each year. In 2002, P.K. Imbrie of Purdue and Mike Prince of Bucknell served as the inaugural NETI Fellows. Subsequent fellows were Lisa Bullard of N.C. State, Kay C. Dee of Rose-Hulman, Gary Huvard of Virginia Commonwealth, Glen Livesay of Rose-Hulman, and Matt Ohland of Purdue.

Jim Stice has announced his intention of stepping down as NETI co-director after the 2009 offering in Austin, but the other members of the team have persuaded him to accept the post of Director Emeritus, in which capacity he will continue on occasion to share his wisdom with the NETI participants and presenters. In anticipation of Jim's retirement, Mike Prince was invited to become a permanent co-director of the NETI, a post he assumed at the 2008 NETI in Pittsburgh. The NETI Fellow program will resume in 2010.

SURVEY DESIGN AND ADMINISTRATION

Evaluating Teaching Workshops

Van Note Chism and Szabó[1] observe that evaluation of a teaching workshop (or any other faculty development service) can be performed at three levels defined by certain focus questions:

- Level 1: How satisfied were the participants with the workshop?
- Level 2: What was the impact of the workshop on the participants' teaching?
- Level 3: What was the impact of the workshop 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 participants' having attended 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 at 100–200 universities during a 15-year period by several hundred engineering professors before and after they attended the NETI—and even if it could be done, there would be no way to determine how much of any observed learning outcome improvement 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 and their students' learning to speculate on 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 some numerical or verbal scale and perhaps to comment on things they liked and disliked (Level 1 assessment). Van Note Chism and Szabó[1] found that 85% 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% of Van Note Chism and Szabó's respondents indicated that they always or usually evaluate the impact of their services on teaching (Level 2), and virtually none have attempted to evaluate impact on students' learning.

The construct validity of using participants' self-assessments of their teaching for workshop evaluation has been examined by D'Eon *et al.*,[2] who cite a number of studies that compared self-assessments of teaching with external evaluations by trained observers. Those studies 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 skill 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 retrospectively assess the impact of the workshop on their teaching practices and quality, and their responses along with their statements about the impact of the workshop on their student ratings were aggregated and used to evaluate the effectiveness of the NETI. The validity of this approach is supported by the conclusions of D'Eon *et al.*[2]

Structure and Administration of the NETI Alumni Survey

The original goals of the NETI were to improve the participants' teaching, to persuade some of them to pass on what they learned in the NETI to colleagues on their home campuses (i.e., to engage in instructional development), and to encourage them to join ASEE. Inspired by the publication of Boyer's *Scholarship Reconsidered*[3] and subsequent work at the Carnegie Foundation for the Advancement of Teaching by Hutchings and Shulman,[4] we expanded our goals to include promoting scholarly teaching and the scholarship of teaching and learning. The Alumni Survey was designed to assess how well each of these goals was met in the 1993–2006 offerings of the NETI.

The survey, which is shown in its entirety in Appendix B, addresses the following questions:

1. *In what ways and to what extent has the NETI improved its participants' teaching?* Questions relate to students' ratings of the participants' teaching in undergraduate and graduate courses, how the ratings changed in the years following NETI attendance, and the participants' opinions about the effects of the NETI on their ratings and their teaching irrespective of ratings (Questions 7–11 and 20); the participants' awareness and use of selected teaching concepts and strategies and the effect of the NETI on their incorporation of those concepts and strategies into their teaching (Questions 14 and 15); and their agreement or disagreement with several teaching practices advocated in the NETI and several common misconceptions that the NETI challenges (Question 19).
2. *To what extent has the NETI motivated participants to engage in instructional development?* Question 12 asked the participants to state whether they had ever provided instructional development and asked those who had not done so whether they intended to provide it in the future, and Question 13 asked them whether the NETI motivated them to become involved in instructional development.
3. *Did the NETI motivate participants to join the ASEE?* Question 18 asked whether the participants were members of the ASEE and whether the NETI motivated them to join.
4. *Has the NETI promoted scholarly teaching and the scholarship of teaching and learning?* Questions 5, 6, 16, and 18 asked (a) whether participants had engaged in practices that characterize scholarly teaching (reading education-related papers, attending education-related seminars, workshops, and conferences, using classroom research to assess the effectiveness of their teaching, and reflecting on and attempting to understand the processes of teaching and learning in general and their students' learning strengths, weaknesses, and preferences), and (b) whether they had engaged in the scholarship of teaching and learning (publicly presenting and/or publishing results of educational research studies). Question 17 asked whether the NETI motivated the participants to do research on teaching and learning.

The remaining survey items provided demographic information about the respondents.

We designed the Alumni Survey early in the spring of 2008 and concurrently made an effort to get as complete a list as possible of NETI alumni names and current email 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 email addresses from the lists for the 1993–2006 offerings, sent announcements of a forthcoming NETI impact survey, and gave the recipients the option to not participate. (Five of them exercised that option.) Many of those messages were returned as undeliverable. We then searched the Web to try and find current email addresses for the recipients of the returned messages, and in many cases we were successful and re-sent the survey notification to verify that new addresses were correct.

Once we had a usable list of emails, we administered the survey using Survey Monkey® (<*www.surveymonkey.com*>). We sent reminder emails to alumni who had not responded within

two weeks of receiving the survey, and a second set of reminders to non-respondents after another three weeks. Tables 1 and 2 show the final response statistics. Considering the fact that we were surveying individuals with whom we last had contact as much as 15 years earlier, we were pleased that we were able to obtain usable e-mail addresses for 88% of the NETI participants and that 53% of those receiving surveys completed and returned them. Sue and Ritter[5] report an analysis of e-mail surveys showing response rates that varied from 24% to 76%, and they and Babbie[6] suggest that above 50% is acceptable for analysis and publication and 60% is good.

Table 1. Overall survey response statistics

(a) Number of NETI participants in 1993–2006	731
(b) Number of participants with usable email addresses	607 [83% of (a)]
(c) Number of valid responses	319 [53% of (b)]

Table 2. Responses by year of NETI attendance

Year	$(N)_{attending}$	$(N)_{surveyed}$	$(N)_{responding}$
1993	51	39	17 (44%)
1994	48	37	20 (54%)
1995	49	38	14 (37%)
1996	57	44	22 (50%)
1997	52	44	22 (50%)
1998	54	43	27 (63%)
1999	56	38	19 (50%)
2000	56	42	20 (48%)
2001	52	48	31 (65%)
2002	47	41	23 (56%0
2003	46	41	16 (39%)
2004	56	51	25 (49%)
2005	53	49	31 (63%)
2006	54	52	32 (62%)
Total	**731**	**607**	**319 (53%)**

Administration of the Pre-Workshop Surveys

Beginning in 2005, all NETI participants have been asked to complete an online survey before coming to the workshop, both to provide demographic information and to furnish a basis for eventual comparisons of pre-workshop and post-workshop teaching practices, attitudes, and student ratings. Questions 7, 14, and 19 of the Alumni Survey (Appendix B) are replicates of questions in the pre-survey.

Fifty-one workshop participants completed both surveys—23 in 2005 and 28 in 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 letter responses (a–e) to Questions 14 and 16 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®.

The pre-workshop surveys were administered to all registered participants using Survey Monkey about a month before the workshops were given, and one 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 had not responded electronically. Most paper surveys were completed and turned in during the preliminary registration period, and the remaining ones were collected at the first coffee break a little over an hour after the workshop began.

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 shown in Appendix B, unless specific mention is made of the 2005 and 2006 pre-workshop surveys.

Demographics

Table 3 summarizes responses to the survey items related to the demographics of the respondents. Since most of the alumni surveyed attended the NETI many years previously, it is not surprising that 68% of the respondents were full or associate professors. Eighty-one percent were at Ph.D.-granting institutions and 69% were currently involved in research. The percentage who had been involved with research at any time in their careers would be greater, since it would also include faculty who had moved into administration or ended their research programs for some other reason.

Table 3. Demographics and experience of respondents

	N	Responses
Current position	302	full prof.–26%, assoc.–42%, asst.–21%, lecturer/instr.–2%, grad. stud.–0%, other–9%
Gender	302	female–19%, male–81%
Current inst. classification	319	RU/VH (Res. I)–47%, 4 yr. univ. with Ph.D.–34%, 4-yr. univ. w/o Ph.D.–17%, tech./community coll.–0.3%, other–2%
Principal responsibilities	302	research–69%, undergrad. teaching–85%, grad. teaching–58%, administration–32%, advising/counseling–42%, instructional development–18%, other–7%
Years taught	319	(<1)–0%, (1-2)–0.3%, (>2-5)–13%, (>5-10)–26%, (>10)–61%
Years taught before NETI	302	(<1)–17%, (1-2)–33%, (>2-5)–22%, (>5-10)–13%, (>10)–15%
Av. annual teaching load in past two years (courses/yr)	319	(0)–4%, (1–2)–18%, (>2–4)–48%, (>4–6)–21%, (>6)–9%
Years worked in industry not counting internships	319	(0)–34%, (<1)–8%, (1-2)–12%, (>2-5)–18%, (>5-10)–14%, (>10)–13%

We are under no illusion that the survey respondents are representative of American engineering educators as a class: the respondents are, after all, people who volunteered to attend a 3-day workshop on effective teaching. We also have no way to determine the extent to which the 319 individuals who completed and returned surveys are representative of the 731 who attended the NETI or the 607 who were sent surveys. Our purpose, however, is not to draw general inferences about engineering faculty members from the survey results; it is simply to investigate the impact of a long-standing engineering faculty development program on its participants.

Participants' Open-Ended Statements about Impacts of the NETI on their Teaching

Question 11 of the survey asked the respondents to comment on the effect of the NETI on the quality of their teaching, irrespective of student ratings, and 295 of them responded. The responses were tabulated and sorted into categories that emerged in the course of the tabulation, with some responses falling into two or more categories. A summary is given in Table 4.

Of the 412 entries in Table 4, 131 reflected perceptions that the NETI had a positive effect on the quality of the respondents' teaching and/or of their students' learning; 12 noted feelings of greater confidence (or comfort or control) in teaching; and 22 indicated that the NETI either had a slight or negligible effect on teaching quality or that the respondents did not know or could not remember its effect. In short, 87% of the 165 direct assessments of the effect of the workshop on teaching quality were clearly positive, 13% were not positive, and none were clearly negative. Several respondents noted post-NETI drops in their teaching ratings but expressed beliefs that their teaching had nonetheless improved. In their opinion, the rating declines occurred because their teaching had become more challenging and learner-centered after the NETI and some of their students did not welcome the change. This high overall level of satisfaction with the NETI is consistent with the previously cited post-workshop ratings (84% excellent, 16% good, <1% average, and none fair or poor).

The remaining 281 responses to Question 11 noted specific benefits that resulted from NETI participation. The most frequently named benefit (131 entries) was learning new teaching methods or getting better at applying previously used methods. Of the methods specified, active learning (active engagement of students in class) was cited most often (41), followed by the systematic use of learning objectives and/or Bloom's Taxonomy (21). Responses to closed-ended questions to be summarized shortly suggest that the number of participants who actually learned about and adopted new strategies was much greater than the number who thought of mentioning them in response to Question 11.

The next most common category of responses to Question 11 had to do with the respondents' improved understanding of students (62 responses)—their greater awareness of students' learning needs and differences in their learning styles (a major topic in the NETI) and greater incorporation of those needs and differences into the respondents' teaching (30), greater learner-centeredness in their teaching (21), and a generally better understanding of and rapport with students (11).

Most college instructors are never taught about teaching and so simply repeat what they saw their own college instructors do, without reflecting on the effectiveness of that instructional approach in promoting learning.[7] Twenty-five responses to Question 11 indicated that the NETI made the respondents more reflective in their teaching practice, with 14 indicating that they had become more aware of teaching and learning processes in general and 11 stating that they had begun to think more consciously about their own teaching. As was the case with teaching strategies, the number of participants who actually became more reflective practitioners was undoubtedly much greater than the number who thought to mention it explicitly in their open-ended responses.

Table 4. Effect of NETI on Teaching (Open Responses)

	Sample Comments
Affected quality positively (131) Helped teaching, improved teaching a lot/moderately, improved student learning	- The pedagogy was invaluable as were the assessment techniques that I still use. - One year after taking NETI, I received our College Outstanding Teacher Award. - Most significant factor in my success. - This was the best thing I could have done at the start of my tenure track. Thanks. - NETI changed my life and probably saved my career.
More confident, comfortable, in control (12)	[NETI] gave me more confidence to experiment with new or different teaching techniques.
Better organized/more efficient (6)	Helped me to organize lectures better, therefore use time much more efficiently.
More creative (2)	I was encouraged to use my creativity to approach teaching with innovation [as I approach] research.
Affected quality slightly or not at all, or effect unknown (22)	- I had seen (and applied and taught) most of the material covered in NETI already. - It has been so long, it is hard to say.
Learned/improved teaching methods (131) Unspecified (46) Active learning/engagement of students (41) Learning objectives/Bloom's Taxonomy (21) Collaborative/cooperative learning (9) Assessment, testing & grading (8) Course preparation (4) Research on teaching (2)	 - Helped me identify strategies for increasing student mastery of concepts. - My motto changed to "No more than 15 minutes of lecture without some active learning exercise." - Was very helpful in matching course objectives with student deliverables. - It opened my eyes to cooperative learning. - Improved the way I write homeworks and exams. - It improved the way I plan a course, taking into account students and the program. - It exposed me to the opportunities to practice the scholarship of teaching.
Improved understanding of students (62) Aware of/use learning/teaching styles (30) More learner-centered (21) Better understanding of /rapport with students (11)	 - I became aware of different learning styles and how to effectively address each of them. - Classes are much more student learning focused than they would otherwise be. - I do think it helped me develop a better appreciation for the students' perspective.
More reflective about teaching (25) More aware of teaching & learning processes (14) More reflective about own teaching (11)	 NETI essentially made me really think about teaching styles and approaches. It began to get me thinking seriously about what I do in the classroom and why.
Improved mentoring/faculty development (6)	I attended NETI to enhance my skills as a workshop planner and faculty mentor. IT WAS GREAT—and gave me the courage of my convictions.
Reinforced what I was already doing (6)	I am certain that quality went up [but] for me the workshop was more a matter of reinforcing and organizing things in my mind.
Helped network with colleagues (5)	Confirmation that there was a community of engineering professors interested in teaching.
Gave research/theory backup for recommended teaching strategies (4)	Confirmed that my teaching style had a scientific background to prove that what I was doing was the right thing to do.

Pedagogical Knowledge and Practices

An obvious goal of a teaching workshop is that the participants learn some things—new planning or teaching or assessment techniques, and perhaps mistakes they have been making—that lead them to make changes in how they teach. As long as those changes have been shown by research to correlate with positive learning outcomes, making the changes can reasonably be presumed to lead to greater student learning.

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. Not all of the concepts and strategies listed were focal points of the NETI. Some, such as learning styles and learning objectives, were major workshop topics; others, such as inquiry-based instruction, were addressed peripherally; and still others, such as distance education and Web-based tutorials, were barely mentioned in the NETI. The frequency distributions of the responses are summarized in Table 5. Pre-workshop survey responses to Question 14 were submitted by 51 participants in the 2005–2006 NETI offerings, and Table 5 also summarizes the average pre-post workshop response differences.

The first topic discussed in the workshop is learning styles of engineering students, teaching styles of engineering professors, and consequences of mismatches. Ninety-one percent of the survey respondents indicated that they had made occasional or frequent use of the concept in their teaching, and 68% reported that the NETI had a moderate or substantial effect on their having done so. The difference between pre-workshop and post-workshop awareness and use of learning styles in teaching was statistically highly significant. That only 30 of the 412 responses summarized in Table 4 (7%) explicitly mentioned learning styles supports our argument that open-ended response frequencies seriously underestimate the true effects of the NETI on teaching practices.

The topic after learning styles is using learning objectives as the basis for designing instruction and assessment. Learning objectives (also known as instructional objectives) are explicit statements of what students should be able to do (define, explain, calculate, derive, model, design, critique,...) if they have learned what the instructor intends them to learn. *Bloom's Taxonomy* 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 concepts and procedures to solve new problems (Level 3), analytical thinking (Level 4), critical thinking (Level 5), and creative thinking (Level 6). James Stice—who introduced the concept of learning objectives to engineering education in a landmark paper[8]—leads a NETI session on objectives and Bloom's Taxonomy, and the participants are given practice in writing 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 engineering professors whether or not they attended the NETI, and 98% of the respondents indeed reported making occasional or frequent use of them, but 75% 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 made use of by 73% of the respondents, with 55% reporting that the NETI had a moderate or substantial impact on their use.

Table 5. Pedagogical Knowledge and Practices

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)	.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)	.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)	<.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)	.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)	<.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)	.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)	.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)	<.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)	.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 (.63)	.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)	<.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 .05 level, **=significant at .01 level, ***=significant at .001 level

The third main focal point of the NETI is *active learning* (getting students involved in class doing course-related activities other than watching and listening to a lecture). It is used throughout the workshop and addressed formally in two separate sessions: one led by Felder and Brent on different active learning structures and strategies for making implementation of active learning as effective as possible, and one led by Stice on using the active learning strategy called *Thinking-Aloud-Pair-Problem-Solving* (TAPPS)[9] to help students develop problem-solving skills. Our experience is that most faculty members who come to the NETI have a limited and frequently incorrect idea of what active learning is, but 98% of the respondents reported making occasional or frequent use of it and 74% credited the NETI with having played a moderate or substantial role in their doing so. Further evidence of the influence of the NETI is provided by the pre-post test results in Table 5, which show a highly significant increased awareness and use of active learning following the NETI.

The survey also showed that the NETI motivated many participants to adopt or increase their use of cooperative learning (team-based learning under conditions that include holding all team members individually accountable for the complete content of the team assignments or projects), with 90% of the respondents reporting occasional or frequent use of it and 65% acknowledging the moderate or substantial impact of the NETI in their decision to do so. 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 5 for problem-based learning and inquiry-based learning should be taken with a grain of salt. While both of those approaches are mentioned favorably in the NETI, we do not really "cover" them in the detailed way we do with active and cooperative learning. Thus, while 93% and 70% 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 strongly suspect that experts on those inductive methods would not qualify what many of those respondents are doing as either PBL or inquiry. The low impacts of the NETI reported in Table 5 on the use of 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 5 for the use of Robert Boice's[10] success strategies for new faculty (*budget regular time for writing, avoid overpreparing for classes, network regularly with colleagues,* and *do long-term strategic career planning*) 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. Also, the strategies are not nearly as concrete and easy to adopt as are such things as writing learning objectives and getting students actively involved in class. Boice found that it took a 12-week program to induce and prepare new faculty members to adopt his strategies. Nevertheless, roughly 10% 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 5 suggest that the NETI was successful in both increasing the participants' awareness of the main concepts and instructional methods discussed in the workshop and persuading 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,[11] writing explicit learning objectives and making them clear to students,[12] getting students actively engaged in course-related activities in class,[13] and getting students to work in teams under conditions that assure individual accountability and the other defining criteria of cooperative learning,[14] we infer that the NETI-motivated adoption or increased use of these teaching strategies by many participants led to greater learning by their students.

Student Ratings of Teaching

Student ratings alone are indicators but not self-sufficient measures of teaching quality. They have, however, been repeatedly shown to correlate well with peer ratings and other quality metrics,[15] and students are uniquely qualified to evaluate the extent to which instructors display certain attributes of teaching effectiveness (e.g., motivating students, holding their interest, being available and willing to help them outside class, etc.). The survey asked the respondents to estimate average student ratings for undergraduate and graduate courses they taught in the previous two years, with 5=excellent, 3=average, and 1=poor. There were 287 valid responses for undergraduate ratings and 205 for graduate ratings. The average undergraduate rating was 4.1 (SD=0.6) and the average graduate rating was 4.4 (SD=0.4). Figure 1 shows histograms of the results. Although we cannot say anything definitive about the respondents' teaching based only on those results, it appears that there were relatively few poor teachers among them, and that on average most were good to excellent.

A common fear of instructors is that if they start using learner-centered teaching methods, some of their students won't like it (which is true enough) and their 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 decreased 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 2.

Clearly, the feared drop in ratings was the exception and not the rule. Only one of 290 respondents reported a substantial drop following the NETI and fewer than 6% reported a drop of any magnitude at all. For 29% the ratings neither decreased nor increased, and 67% reported increases. We also asked the participants to judge the impact of the NETI on their ratings. Of the 313 who responded to that question, 15% stated that either their ratings did not change following the NETI or the workshop had no effect on whatever change may have occurred, 32% said it had a slight effect, another 32% a moderate effect, and 21% credited the NETI with having a substantial effect. Given the responses to the previous question, for the overwhelming majority of the respondents reporting an effect, the effect was clearly positive. Also, inspection of individual responses shows that many who reported negative or negligible changes in their ratings had high ratings to begin with, so there was nowhere to go but down.

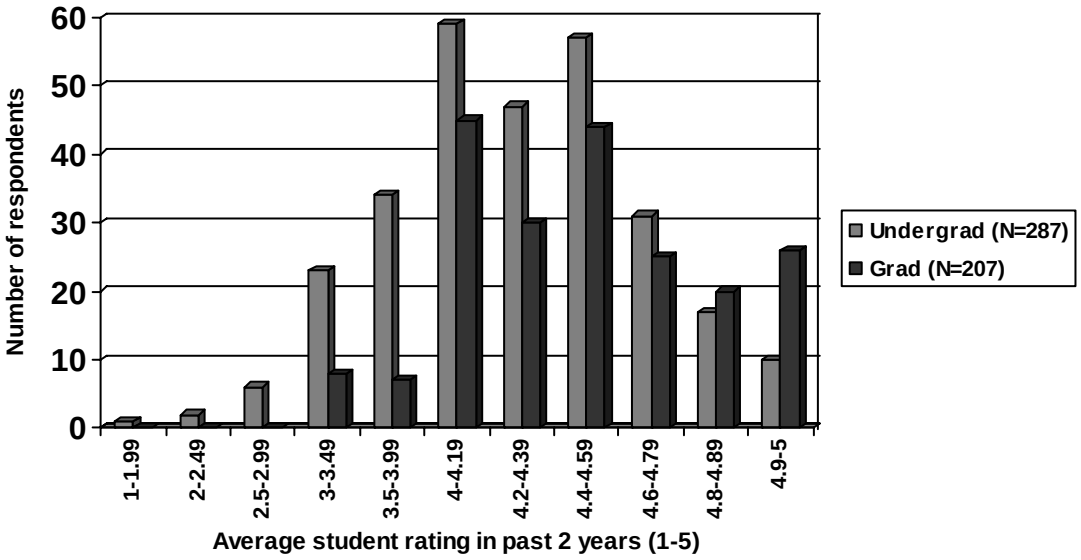

Figure 1. Student rating histograms

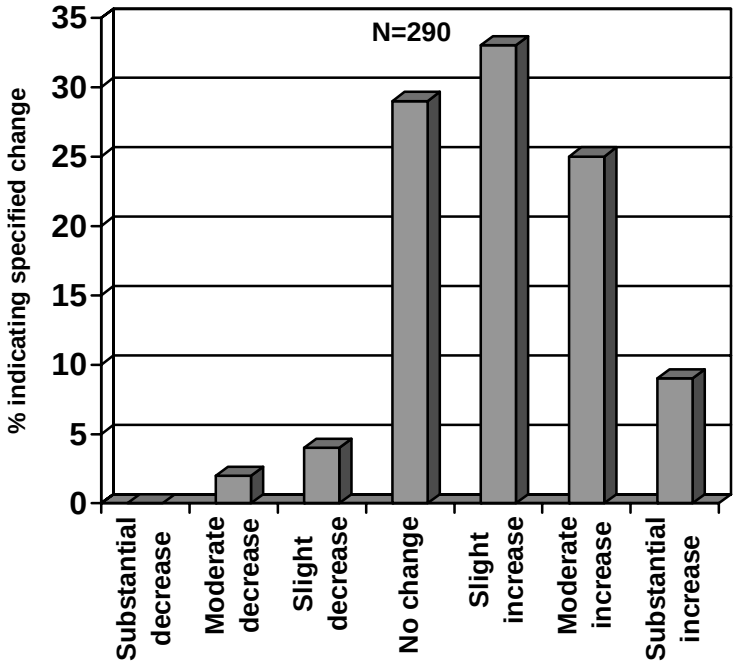

Figure 2. Changes in student ratings following the NETI.

The pre-post workshop response comparisons tell a similar story. Forty-seven of the 2005 and 2006 workshop participants estimated their student ratings before the workshop and 2–3 years after it, with the results shown in Table 6. Of those 47 respondents, 64% reported increases, 15% reported no change, and 21% reported decreases, and the increase in the mean rating was close to statistically significant at the .05 level. Since the percentage of decreased

student ratings was substantially greater than the 6% reported in the Alumni Survey (Figure 2), we examined how the 10 respondents who reported pre-post workshop ratings decreases answered Alumni Survey Questions 10 ("What effect do you think the NETI had on your teaching ratings?") and 11 ("What effect do you think the NETI had on the quality of your teaching regardless of ratings?"). Of the nine who responded to both questions, five thought that their ratings had been improved or unchanged (suggesting that either their pre-workshop or post-workshop estimates may have been inaccurate), one thought that increases in his teaching load and changes in his responsibilities accounted for the drop in ratings, and all thought that the NETI had improved their teaching.

Table 6. Pre-Workshop and Post-Workshop Student Ratings (N=47)

Student ratings*	
Pre-workshop mean (SD)	3.75 (0.69)
Post-workshop mean (SD)	3.96 (0.59)
p**	.059
% reporting increases	64%
% reporting no change	15%
% reporting decreases	21%

* 5=excellent, 3=average, 1=poor
** Matched-pair t test

We conclude that increases in student ratings following the NETI were far more common than unchanged or decreased ratings. The decreases that did occur were slight, and the few instructors who experienced them were nevertheless likely to view their teaching as having become more effective as a consequence of their participation in the workshop.

Beliefs about Teaching

. Question 19 of the survey asked the respondents to express their agreement or disagreement with several teaching strategies and beliefs about teaching. Table 7 lists the statements in roughly decreasing order of their emphasis in the NETI, states the position advocated in the NETI, and summarizes the responses. In the discussion that follows, we will briefly outline the positions the NETI advocates without going into detail on their theoretical and empirical bases. Interested readers can find justifications in standard references on pedagogy, including McKeachie & Svinicki.[16]

Most engineering classes are taught in a traditional lecture format, with PowerPoint being used to a growing extent. By far the most heavily emphasized message in the NETI is that students should be actively engaged in classes for meaningful learning to take place, and in recent years the column "Death by PowerPoint"[17] has been included in the NETI notebook to support several warnings about over-reliance on prepared visuals in lectures. The survey respondents heavily supported the point of view advocated in the NETI: 73% agreed that class activities are desirable and only 3% disagreed, and less than 4% agreed that lectures should be delivered primarily via prepared visuals and 79% disagreed.

Table 7. Beliefs about Teaching

Belief	NETI position	Role in NETI[A]	Attitude[B]	Pre-Test Response Mean (SD)[C]	Post-Test Response Mean (SD)[C]	p[S]
Teachers should give students frequent course-related group activities in class.	Yes	(a)	**(1)**–0%, **(2)**–3%, **(3)**–24%, **(4)**–51%, **(5)**–22%	3.84 (0.76)	3.98 (0.79)	.27
Teachers should deliver lectures primarily via transparencies or PowerPoint.	No	(a)	**(1)**–40%, **(2)**–39%, **(3)**–18%, **(4)**–3%, **(5)**– <1%	2.00 (0.92)	1.76 (0.84)	.03*
Giving tests that only the top students have time to complete sorts students effectively according to their understanding of the material.	No	(b)	**(1)**–34%, **(2)**–46%, **(3)**–14%, **(4)**–6%, **(5)**–0%	2.39 (0.83)	1.88 (0.82)	.0007***
Teachers should give students detailed study guides for tests.	Yes	(b)	**(1)**–4%, **(2)**–19%, **(3)**–42%, **(4)**–27%, **(5)**–8%	2.98 (0.84)	3.53 (0.92)	.003**
You can teach people to be critical thinkers.	Yes	(b)	**(1)**–1%, **(2)**–2%, **(3)**–13%, **(4)**–63%, **(5)**–21%	3.90 (0.73)	3.96 (0.92)	.58
You can teach people to be creative thinkers.	Yes	(b)	**(1)**–1%, **(2)**–7%, **(3)**–25%, **(4)**–54%, **(5)**–13%	3.61 (0.88)	3.63 (0.87)	.91
The most important characteristic of good teaching is to have complete and accurate lecture notes.	No	(c)	**(1)**–13%, **(2)**–29%, **(3)**–35%, **(4)**–19%, **(5)**–4%	2.67 (0.95)	2.80 (0.94)	.33
It is acceptable for teachers to give assignments on material that has not been explicitly covered in lectures.	—	(c)	**(1)**–9%, **(2)**–48%, **(3)**–24%, **(4)**–14%, **(5)**–5%	3.57 (0.85)	3.33 (1.01)	.10

Legend

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

B. N=308. **(1)**–strongly disagree, **(2)**–disagree, **(3)**–neutral, **(4)**–agree, **(5)**–strongly agree

C. N=51. **(1)**–strongly disagree, **(2)**–disagree, **(3)**–neutral, **(4)**–agree, **(5)**–strongly agree

D. Significance level from Wilcoxon's Matched Pairs Test: *=significant at .05 level, **=significant at .01 level, ***=significant at .001 level

Since a substantial fraction of the participants indicated that they used activities in their teaching and that they had been motivated to do so by the NETI (Table 5), it appears that the NETI was successful in promoting a positive attitude toward active learning. The gain in awareness and use of active learning shown by the pre-post test results was not significant, perhaps reflecting a growing awareness of active learning among younger faculty members, whose mean pre-test score was quite high. By the same token, the growing practice of delivering lectures primarily using prepared visuals did not have many supporters, and the pre-post test results indicate that the NETI played a significant role in raising the respondents' level of disapproval.

A common feature of traditional engineering courses is a heavy reliance on long quantitative problem-solving tests that few students can finish, with average grades commonly on the order of 60/100 or less. A heavily stressed point in the NETI is that such tests discriminate unfairly against students who work carefully and methodically but slowly, who have the potential to be excellent engineers but are likely to fail long tests even if they understand the material. In their survey responses, 80% of the respondents disagreed with the statement that long tests sort students according to how well they understand the material and only 6% agreed with it. The level of approval dropped significantly in the pre-post test results.

Another common characteristic of engineering tests is that they often contain surprises, such as problems requiring mathematical manipulations different from any that the students have practiced in homework, with the rationale being that we need to find out if the students can "think for themselves." Like the ability to solve quantitative problems quickly, the ability to figure out such puzzles in the artificial environment of a time-limited test has never been shown to correlate with success in engineering or science; in fact, several studies have shown an almost complete lack of correlation between grades in college and subsequent career success.[18–20] In the NETI, we propose that the more instructors make their expectations explicit and clear—particularly expectations of high-level thinking and problem-solving skills—the more likely their students will be to meet those expectations.

A strong NETI recommendation (particularly in the past 5–10 years) is for instructors to express their expectations as learning objectives and share them with the students in study guides for tests. This is one of our most controversial recommendations, since it contradicts a common faculty belief that making expectations too explicit amounts to "spoon-feeding" or "coddling" the students, lowering standards and opening the door to unqualified students being certified to practice engineering. Only 35% of the respondents agreed with the recommendation but even fewer (23%) disagreed with it, and there were more neutral responses (42%) than for any other issue. The pre-post test results are much more encouraging, showing a highly significant shift from neutrality to approval.

The next two questions had to do with whether critical thinking and creative thinking can be taught. Many people think that they cannot be, particularly creativity, which they regard as an innate talent that one either has or not. The NETI does not focus on how to teach those two skills, but it strongly recommends that instructors write learning objectives that address Levels 5 (evaluating, or critical thinking) and 6 (creating, or creative thinking) on Bloom's Taxonomy and then provide students with practice and feedback on tasks that require thinking at those levels.

Eighty-four percent of the survey respondents agreed that critical thinking can be taught (3% disagreed) and 67% agreed that creative thinking can be taught (8% disagreed). The mean pre-workshop level of agreement was fairly high among the 2005 and 2006 respondents, and was not materially changed by participating in the NETI.

Next, when presented with a statement that the most important characteristic of good teaching is having complete and accurate lecture notes, 23% agreed and 42% disagreed, with the approval rate increasing slightly in the pre-post test results. This statement expresses the common misconception of many new faculty members that if they prepare good lecture notes, effective teaching and learning will automatically follow.[10] We speculate that the level of agreement would have been even lower if the question had been better worded, since some respondents might have equated disagreement with a belief that complete and accurate notes are not important.

The final statement ("*It is acceptable for teachers to give assignments on material that has not been explicitly covered in lectures*.") is problematic. Our intention was to ask about beginning instruction with challenges and then presenting material on a need-to-know basis in the context of the challenges (as inductive teaching methods such as inquiry-based and problem-based learning do), but the statement sounded more like a proposal to grade students on assignments for which they have not been prepared, which is antithetical to the NETI philosophy. Not surprisingly, only 19% of the respondents agreed with the statement and 57% disagreed, and the approval rate decreased slightly in the pre-post test results. We attribute this outcome both to the poor wording of the question and the peripheral role of inductive methods in the workshop.

Involvement in Instructional Development

One of the goals of the NETI founders was to encourage and equip participants to give presentations to colleagues on what they learned at the NETI. Question 12 of the survey asked about the participants' involvement with instructional development. Of the 313 respondents to this question, 44% had been involved (9% extensively and 35% occasionally), 21% had not been involved but planned to be in the future, 32% had no prior or anticipated involvement, and 3% responded with "other." In short, 65% of the respondents were interested in instructional development, the majority of whom had actually done it. Question 13 then asked "Did the NETI motivate you to get involved in instructional development?" Of the 313 respondents, 52% responded affirmatively and 48% negatively, with the latter including some individuals who had begun doing instructional development before attending the NETI. The clear inference is that the NETI succeeded in transforming some of its participants into potential change agents on their campuses.

Engagement in Scholarly Teaching and the Scholarship of Teaching and Learning

Hutchings and Shulman[4] introduced the now familiar 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 attempt to improve their teaching, and subject their attempts to self- and/or external assessment and evaluation. Instructors engaged in the scholarship of teaching and learning

approach teaching in the same scholarly way, but 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.

Question 18 of the survey asked about the participants' engagement in scholarly teaching—as evidenced by their belonging to ASEE, attending education conferences, and reading education-related journals—and whether attending the NETI motivated their engagement. Question 16 asked about their involvement in doing unpublished classroom research (further evidence of scholarly teaching) and in the scholarship of teaching and learning—presenting research results at a conference and publishing results of unfunded and funded research. Question 17 asked whether the NETI had motivated them to do educational research. Responses are summarized in Table 8.

Table 8. Engagement in Scholarly Teaching and Educational Scholarship (N=309)

	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

Substantial percentages of the survey respondents reported engaging in practices associated with scholarly teaching, with many indicating that the NETI played a role in motivating them to do so. Close to 90% had read education-related journal articles (47% were motivated by NETI), over 70% participated in at least one education conference (31% NETI); around 70% belonged to ASEE (21% NETI); and 25% had done unpublished classroom research. A concept related to scholarly teaching is reflective practice,[7] wherein teachers reflect on and attempt to understand the general processes of teaching and learning and as much as they can about how their students function and what facilitates their learning. The open-ended responses shown in Table 4 make it clear that the NETI served to make many of the respondents more reflective practitioners and so more scholarly teachers.

The NETI devoted relatively little time to promoting the scholarship of teaching and learning, and the fact that it had that effect on so many participants came as a pleasant surprise. Three-quarters of the respondents reported having done informal classroom research and/or formal educational research, with 50% indicating that their research activity was motivated by the NETI. A third of the respondents had reported on their research at a conference, and roughly

a quarter of them had published research results. The survey did not ask the respondents to indicate the role of the workshop in promoting each individual category of research involvement, but the other responses in Table 8 suggest that significant fractions of those who have presented or published research were stimulated to do so by the NETI.

Recollections and Comments

Question 20 invited the respondents to share their recollections of the NETI and to offer any comments they might have about it. There were 208 responses to this invitation. Most of the recollections (189) were clearly positive, ranging from "It was good" to detailed descriptions of major career changes induced by the NETI. Several examples follow.

> *NETI expanded, deepened, and changed what I thought I knew about learning and teaching and forced me to think about every aspect of my course preparation.*
>
> *The workshop helped me to focus on seeing my teaching from the student's perspective and to aim to optimize student learning.*
>
> *Attended about ten years ago. Two specific things I did as a result: 1) I started keeping a box of Kleenex in my desk (and have been twice nominated for the university-wide advising award); 2) I give many more open book exams. I now do many more group activities and problem sessions. It slows* [me] *down to the students' pace and, if they are willing, it engages them. The biggest impact was just getting a sense of how hard and honestly good teachers work at teaching.*

A few respondents said that they liked the workshop and had tried some of the ideas from the NETI but had been discouraged by resistance from students and/or faculty colleagues and/or a lack of support for teaching in the faculty reward system, and they subsequently went back to more traditional teaching:

> *When I first got back I tried several of the techniques over the course of a couple of years with mixed results. I still retain a few of them, but students are generally reluctant to embrace them, at least from me.*
>
> *I enjoyed NETI and it opened my eyes to what academia should or could be. Unfortunately, with a dictator department head and lack of support from senior faculty, I felt hampered and discouraged from many activities.*

Some who had taken the NETI as relatively new teachers talked about how it had gotten their careers off to a good start:

> *I enjoyed NETI, and was grateful that my dean identified this opportunity for me as a new faculty member. It reinforced some of the "crazy" ways I was running my classroom compared to the older faculty, and it gave me new ideas about why my teaching methods weren't working for all my students prior to NETI.*

Others who were more experienced when they attended noted that the NETI helped them to clarify their ideas about teaching and to better understand some of the techniques they had discovered independently.

> *Years ago I developed my own teaching style by emulating those who I thought were excellent teachers, i.e., those teachers whose style worked for me. The NETI helped me to understand why most of the stuff I do works but it also opened my eyes to several new things* [learning styles, learning objectives, group work] *which I am convinced have improved my teaching.*

> *The main effect of NETI was to reinforce what I already knew and to demonstrate the principles. It was important that I was a participant in the active learning techniques so that I could experience what my students experience. NETI also helped me to think about ways to use active learning in my conference presentations.*

Some mentioned using the NETI as an inspiration or model for their own faculty development activities.

> *NETI was one of my great experiences as a faculty member. It motivated me not only to introduce a repertoire of learning activities in class, but also to increase my involvement as a leader of teaching workshops.*

> *I came to NETI to prepare (i.e., steal ideas) for a teaching workshop I was planning. It was very successful in giving me a solid overview of topics I should include. Most importantly, it confirmed my suspicion that I should not focus the workshop on teaching specific [disciplinary] topics but on broader learning methods, such as active learning. The resulting workshops were highly successful.*

Several spoke in terms of the NETI having a significant impact on their career beyond simply improving their teaching.

> *I still remember NETI vividly, and I think of the workshop as a defining moment in my career. The workshop had a profound impact on my enthusiasm for teaching. After it, I was really sure that I wanted to devote my career to engineering education and that I would find a way to craft a career with a main focus in this area. I am fortunate to work with colleagues who inspire, mentor, support, and encourage me to reach my potential as an engineering educator.*

> *NETI was a "professional life-changing" experience for me. I was struggling with all sorts of issues making the transition from being a traditional researcher in BioChE into doing something more "educational." At many levels [the NETI] transformed my approach not just to classroom teaching, but to professional life in general. It confirmed many of the things I was doing in the classroom, but gave me so much more to use, and helped me change what needed changing. It*

catalyzed a path to educational scholarship in general that probably would not have happened otherwise.

And finally, a number of respondents were struck by the communal experience provided by the NETI.

What I do remember of NETI is that I really enjoyed it, talking with others, getting exposed to new ideas, revisiting existing ideas in new ways. Perhaps what NETI did as much as anything was help me keep my enthusiasm up, remind me that there are lots of educators who want to talk about teaching and engage in thinking deeply about it.

Of the 208 responses to Question 20, 15 could be characterized as neutral, expressing neither satisfaction nor dissatisfaction with the NETI. Most of these respondents said something to the effect that they couldn't remember much about the workshop ("*I only recollect that it was in conjunction with an ASEE meeting in Anaheim, a long time ago*."); others made remarks about the workshop having no lasting effects ("*There was an immediate short-term impact but, over time, the impact diminished*."); and several made noncommittal remarks such as "*It was OK*."

Only four respondents were distinctly dissatisfied. One thought that there was too much lecturing in the workshop and also expressed doubts about the value of teaching workshops in an educational climate that does not support quality education. Another complained about insufficient emphasis in the workshop on the basics of classroom delivery. The third found some of the information too "preachy" and did not find any applications that he/she could take into the classroom, and the fourth expressed frustration over the negative impact of the NETI on his/her research productivity:

Effective teaching, and getting motivated to try new things as the result of NETI, actually created some potential problems for me. (I did get tenure and promotion, on time, by the way. I have taken a little longer than most to reach full prof., but it has happened.)

SUMMARY

We are using multiple measures as indicators of the impact of the NETI on its participants' teaching and by inference on their students' learning. At the lowest level of assessment, we have summarized the participants' satisfaction with the workshop, the rationale being that participants who are unhappy with a teaching workshop are unlikely to incorporate workshop recommendations into their teaching practices. We then examined the extent to which the NETI helped make participants aware of proven but nontraditional teaching methods and influenced them to adopt those methods; influenced their attitudes and beliefs about teaching and learning; affected how their students felt about the quality of their teaching; engaged them in instructional development on their home campuses and beyond; inspired them to be more scholarly and reflective in their teaching; and motivated them to engage in educational research. The outcomes are summarized below.

- **Participants' satisfaction with the NETI.** The level of immediate post-workshop participant satisfaction with the NETI has been extremely high. In its 18 offerings, the workshop has received a total of 820 ratings of which all but five were positive (649 "Excellent" and 122 "Good") and the remaining five were "Average". The retrospective evaluations gathered in the Alumni Survey were similarly affirming. Of 165 open-ended assessments of the effect of the workshop on teaching quality, 87% were clearly positive, 13% were neutral, and none were clearly negative, and of 208 shared recollections of the workshop, 91% were positive, 7% were neutral, and 2% were negative. We conclude that the level of participant satisfaction with the workshop is as high as anyone could wish for.

- **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 comprehensive 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). As Table 5 shows, 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 responses reporting adoptions of other NETI-recommended strategies make it clear that the workshop had a significant impact on participants' teaching practices, and since the three named strategies have been repeatedly shown to facilitate learning, it is fair to infer that the teaching changes made by the NETI participants led to improved learning by their students.

- **Attitudes toward teaching, learning, and students**. The NETI clearly made its participants more student-centered in their teaching. For example, 73% of the survey respondents agreed that teachers should give frequent group activities in class and only 3% disagreed; awareness and use of other student-centered teaching methods such as cooperative learning, problem-based learning, and inquiry-based learning was also quite high; the gains in awareness and use of all of these methods from before the workshop to after it were statistically significant; and many respondents credited the NETI with motivating them to use the methods. Also, many of the free responses in Table 4 expressed an improved understanding of and/or rapport with students.

- **Student ratings.** Of 290 respondents, 67% reported increased student ratings following the NETI, 29% saw no change (some of whom had close to the maximum rating before they came and so there was little room for improvement), and 6% experienced decreased ratings, with only one of the decreases being substantial. In the pre-post workshop test results, the mean rating increased to an extent slightly short of the .05 level of significance, with 64% reporting increases, 15% no change, and 21% decreases, most of them slight. In their open-ended responses, many of those who experienced drops in their student ratings expressed beliefs that the NETI-motivated changes in their teaching had improved their students' learning.

- **Instructional development.** Fifty-two percent of 313 respondents felt that the NETI motivated them to get involved in instructional development; 44% had engaged in it (9% extensively and 35% occasionally), and 21% had not been involved but planned to engage in

it in the future. The goal of the NETI to convert at least some of its participants into change agents on their home campuses was clearly realized.

- **Scholarly teaching and the scholarship of teaching and learning.** Significant percentages of the respondents reported engaging in practices that by definition characterize scholarly teaching: 89% stated that they read education-related journal articles and 73% had participated in an education conference, with roughly half of each group having been motivated to do so by the NETI; and 69% 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% having been stimulated to do so by the NETI.

In short, the Alumni Survey results strongly suggest that the NETI 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 the student ratings of most of them and decreased the ratings of very few; and induced a number of them to engage in instructional development and educational scholarship.

DISCUSSION AND RECOMMENDATIONS

What makes the NETI as successful as it has been?

Engineering faculty members are not noted 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, students, and problems. There are significant exceptions to this pattern, however: some well-established instructional development programs have attracted and influenced many engineering faculty members. As the previous section indicates, the National Effective Teaching Institute falls in this category.

The question is, what do the successful programs do that most programs fail to do? We propose that the answer lies in the adult learning literature. Wlodkowski[21] suggests that five attributes of a learning environment have a motivational effect on adult learners (see Table 9).

Let us first consider the expertise of the presenters (more precisely, the workshop participants' perception of the presenters' expertise). 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, and even if they had that knowledge they would probably refrain from using it for fear of losing participants from other disciplines. Some engineers may be perceptive enough to see immediately how they could apply the workshop content in their courses but most are not, and those who don't see the relevance of the content tend to reject the idea that the presenters can tell them anything useful about how to teach.

Table 9. Factors that Motivate Adult Learning[19]

1. **Expertise of presenters.** Adults expect their teachers/trainers to be experts in the material they are presenting and to be well-prepared to teach it. While teachers may occasionally be able to "wing it" successfully, adults are usually quick to detect inadequate background knowledge and/or lack of systematic preparation.
2. **Relevance of content.** Adults may quickly become impatient with material for which they cannot see an immediate use. Once they see the relevance of workshop content to their needs and interests, they will be much more willing to attend to presentations of general instructional methodology and theory.
3. **Choice in application**. Adults respond particularly well when encouraged to be flexible in choosing how and when 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**. Extensive research on active and cooperative learning has shown conclusively that working in groups enhances learning and helps participants form learning networks.[13,14] While some workshop participants (like many students) may initially feel skeptical about group activities, as long as the activities are well implemented and clearly relevant to the workshop learning objectives, most participants eventually come to appreciate them.

Many campus teaching workshops also fail to meet the other criteria listed in Table 9. An overemphasis on general educational theories and the absence of engineering-specific examples that cause engineers to discount the expertise of the presenters (Criterion 1) also cause them to consider the workshop content irrelevant to their needs and interests (Criterion 2). 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 don't appreciate. Many workshops consist almost entirely of lectures on educational theories and methods, with no demonstrations or opportunities to practice the methods (Criterion 4), and provide few or no opportunities for interactions among participants (Criterion 5). In an absurd extreme of a Criterion 5 violation, one of the authors once attended a workshop on active learning that consisted of three hours of straight lecturing on the importance of getting students active in class!

We believe that the success of the NETI derives in large measure from the extent to which it has satisfied Wlodkowski's criteria in addressing its audience of engineering educators.

1. **Expertise.** At least two of the facilitators in each NETI offering and all of the NETI fellows have been award-winning engineering educators. In addition, the presenters have all made substantive contributions to the engineering education literature, and much of their work is highlighted in the workshop presentation. Whatever else the participants may think, they cannot claim that the presenters don't understand engineering content, students, and classroom problems.

2. **Relevance.** Engineering-specific examples are used throughout the workshop. When an example is given of how to teach a course topic in a way that addresses the full spectrum of learning styles, the course is fluid dynamics; when illustrative learning objectives are shown and critiqued by the participants, they are objectives for common engineering courses; when videoclips are shown to illustrate how active learning can be implemented in a large lecture class, the clips are of one of the workshop presenters teaching an engineering class.
3. **Choice in application.** The message is repeatedly given in the workshop that if the participants attempt to implement every recommendation in the first week of 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 reasonable; try them several times to get a sense of how well they work; keep doing the ones that work and drop those that don't; and add another one or two ideas in the next semester. They are also assured repeatedly that there are no recipes for successful teaching. 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.** Almost nothing is taught in the NETI that is not illustrated by demonstrations and/or participant activities. 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 generate and critique possible instructor responses to common problem scenarios (disruptive classes, students in crisis, cheating,...), and so on. Over the years, many participants have remarked that they appreciate the extent to which we practice what we preach.
5. **Groupwork.** The workshop facilitators rarely present for more than 15–20 minutes without engaging the participants in content-related activities. The activities are sometimes done individually, sometimes in groups of 2–4, and sometimes individually followed by small group processing ("think-pair-share"). Even with that level of activity, a common request in post-workshop evaluations is for more.

Recommendations for instructional development in engineering

Based on the results of the NETI Alumni Survey and the discussion just concluded, we offer the following recommendations for making teaching workshops for engineering faculty (and by extension, for engineering graduate teaching assistants and graduate students participating in "Preparing the Professoriate" programs) as effective as possible.

1. *Design workshops specifically for engineering faculty and perhaps members of related disciplines (particularly physical and mathematical sciences).* In trying to reach everyone with a teaching workshop, you run a considerable risk of reaching no one.
2. *Bring in engineering faculty members who are excellent teachers to present the workshops or to co-present them with experts in general pedagogy.*

3. *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 (i.e., practice what you preach).
4. *Cite the research base.*
5. *Suggest, don't prescribe; give choices; and caution participants not to try too much new at once.*
6. *Get the participants to work in small groups to generate many of the ideas you want to present to them.* If you just list the ideas, you're lecturing at them; if the participants generate the ideas themselves, you're affirming them. When you use the latter approach, the participants are much more likely to be receptive to the ideas and appreciative of you for acknowledging and empowering them.

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Appendix A
NETI Participants' Institutions — 1991-2008

1. Ajou Univ. (Korea) (2)
2. Arizona State Univ. (5)
3. Auburn Univ. (1)
4. Baylor Univ. (2)
5. Binghamton Univ. (4)
6. Boise State Univ. (3)
7. Brigham Young Univ. (1)
8. Bucknell Univ. (12)
9. California State Univ. – Los Angeles (4)
10. Case Western Reserve Univ. (5)
11. Central Connecticut State Univ. (2)
12. Clarkson Univ. (1)
13. Clemson Univ. (25)
14. Cleveland State Univ. (2)
15. Colorado School of Mines (2)
16. Colorado State Univ. (2)
17. Cornell Univ. (10)
18. Cuyahoga Community College (1)
19. Dartmouth College (4)
20. DeVry Inst. Of Technology – Addison (1)
21. DeVry Inst. Of Technology – Columbus (1)
22. Duke Univ. (3)
23. Ecole Polytechnique de Montreal (4)
24. Ecole de Technologie Superieure (Montreal) (1)
25. Embry-Riddle Aeronautical Univ. (3)
26. Florida Gulf Coast Univ. (2)
27. Florida Inst. Of Technology (1)
28. Florida International Univ. (3)
29. Franklin Univ. (1)
30. Gaston College (1)
31. Georgia Inst. Of Technology (9)
32. George Washington Univ. (1)
33. Gonzaga Univ. (3)
34. Grand Valley State Univ. (1)
35. Howard Univ. (3)
36. Humboldt State Univ. (1)
37. Illinois Inst. Of Technology (4)
38. Indiana Univ.-Purdue Univ. at Indianapolis (15)
39. Iowa State Univ. (11)
40. ITESM-CEM (Mexico) (1)
41. Kansas State Univ. (10)
42. Kettering Univ. (12)
43. Kuwait Univ. (1)
44. Lafayette College (2)
45. Lake Superior State Univ. (2)
46. Lamar Univ. (2)
47. Lawrence Technological Univ. (1)
48. Lehigh Univ. (6)
49. Louisiana State Univ. (1)
50. Louisiana Tech Univ. (7)
51. Loyola Marymount Univ. (4)
52. Manhattan College (3)
53. Marquette Univ. (2)
54. Massachusetts Inst. Of Technology (1)
55. Mercer Univ. (3)
56. Metropolitan State College of Denver (1)
57. Miami Univ. (Ohio) (4)
58. Michigan State Univ. (13)
59. Michigan Technological Univ. (8)
60. Milwaukee School of Engineering (7)
61. Mississippi State Univ. (10)
62. Missouri Univ. of Science and Technology (36)
63. Montana State Univ. (3)
64. New Jersey Inst. Of Technology (2)
65. New Mexico Inst. Of Mining and Technology (3)
66. North Carolina A&T State Univ. (8)
67. North Carolina State Univ. (2)
68. North Dakota State Univ. (6)
69. Northeastern Univ. (6)
70. Northern Alberta Inst. Of Technology (2)
71. Northern Arizona Univ. (2)
72. Northern Illinois Univ. (3)
73. Northwestern Univ. (2)
74. Ohio Northern Univ. (3)
75. Ohio State Univ. (4)
76. Ohio Univ. (10)
77. Oklahoma Christian Univ. (2)
78. Oklahoma State Univ. (2)
79. Old Dominion Univ. (1)
80. Olivet Nazarene Univ. (1)
81. Oregon State Univ. (1)
82. Penn State Univ. (1)
83. Penn State Univ. – Erie (1)
84. Polytechnic Inst. Of New York (2)
85. Portland State Univ. (1)
86. Purdue Univ. (18)
87. Purdue Univ. – Calumet (1)
88. Purdue Univ. – Columbus (1)
89. Queens Univ. (1)
90. Rensselaer Polytechnic Inst. (2)
91. Rice Univ. (3)
92. Rochester Inst. Of Technology (14)
93. Rose-Hulman Inst. Of Technology (8)
94. Rowan Univ. (13)
95. Royal Military College of Canada (2)
96. Ryerson Univ. (1)
97. Saginaw Valley State Univ. (2)
98. San Jose State Univ. (1)
99. Santa Clara Univ. (2)
100. Seattle Univ. (1)
101. South Dakota State Univ. (14)
102. Southern College of Technology (1)
103. Southern Illinois Univ. (9)
104. Stanford Univ. (1)
105. Stevens Institute of Technology (2)
106. St. Louis University (1)

107. SUNY – Binghamton (1)
108. SUNY – Buffalo (7)
109. Texas A&M Univ. (11)
110. Texas A&M Univ. – Qatar (3)
111. Texas Tech Univ. (3)
112. The Citadel (2)
113. Trinity Univ. (2)
114. Tri – State Univ. (10)
115. Tufts Univ. (1)
116. Tulane Univ. (4)
117. Tuskegee Univ. (2)
118. Univ. De Las Americas – Puebla (Mexico) (2)
119. Univ. Del Turabo (Mexico) (1))
120. Univ. Del Valle (Colombia) (1)
121. Univ. Of Akron (11)
122. Univ. Of Alabama (7)
123. Univ. Of Alberta (10)
124. Univ. Of Ancona (Italy) (1)
125. Univ. Of Arizona (13)
126. Univ. of Arkansas (4)
127. Univ. of Calgary (2)
128. Univ. of California – Berkeley (6)
129. Univ. of Colorado (3)
130. Univ. of Colorado at Denver (1)
131. Univ. of Connecticut (6)
132. Univ. of Dayton (2)
133. Univ. of Delaware (2)
134. Univ. of Denver (1)
135. Univ. of Detroit–Mercy (1)
136. Univ. of Evansville (1)
137. Univ. of Florida (13)
138. Univ. of Georgia (2)
139. Univ. of Hartford (1)
140. Univ. of Hawaii (2)
141. Univ. of Houston (2)
142. Univ. of Illinois (5)
143. Univ. of Iowa (1)
144. Univ. of Kansas (12)
145. Univ. of Kentucky (2)
146. Univ. of Louisville (8)
147. Univ. of Maine (7)
148. Univ. of Manitoba (1)
149. Univ. of Massachusetts – Dartmouth (1)
150. Univ. of Memphis (5)
151. Univ. of Michigan (15)
152. Univ. of Michigan – Dearborn (1)
153. Univ. of the Minho (Portugal) (1)
154. Univ. of Missouri – Columbia (1)
155. Univ. of Nebraska (5)
156. Univ. of New Haven (1)
157. Univ. of New Mexico (5)
158. Univ. of North Carolina at Charlotte (9)
159. Univ. of North Dakota (2)
160. Univ. of Notre Dame (7)
161. Univ. of Oklahoma (3)
162. Univ. of the Pacific (5)
163. Univ. of Pittsburgh (2)
164. Univ. of Pittsburgh at Johnstown
165. Univ. of Portland (2)
166. Univ. of Puerto Rico at Mayaguez (1)
167. Univ. of Rochester (1)
168. Univ. of San Diego (4)
169. Univ. of Saskatchewan (2)
170. Université de Sherbrooke (1)
171. Univ. of South Carolina (5)
172. Univ. of Southern Colorado (2)
173. Univ. of South Florida (2)
174. Univ. of Tennessee (4)
175. Univ. of Tennessee at Martin (9)
176. Univ. of Texas – Austin (16)
177. Univ. of Texas – Tyler (4)
178. Univ. of Toledo (3)
179. Univ. of Toronto (3)
180. Univ. of Vermont (1)
181. Univ. of Washington (16)
182. Univ. of Waterloo (3)
183. Univ. of Wisconsin (2)
184. Univ. of Wisconsin–Platteville (5)
185. Univ. of Wyoming (3)
186. U.S. Air Force Academy (14)
187. U.S. Military Academy (4)
188. U.S. Naval Academy (1)
189. Utah State Univ. (5)
190. Valparaiso Univ. (14)
191. Vanderbilt Univ. (2)
192. Villanova Univ. (2)
193. Virginia Military Inst. (2)
194. Virginia Polytechnic Inst. (23)
195. Washington State Univ. (7)
196. Wayne State Univ. (9)
197. Webb Inst. (2)
198. Western Kentucky Univ. (3)
199. Western Michigan Univ. (1)
200. Western Washington Univ. (2)
201. West Virginia Inst. Of Technology (2)
202. West Virginia Univ. (6)
203. Wichita State Univ. (23)
204. Widener Univ. (1)
205. Wilkes Univ. (2)
206. Winona State Univ. (2)
207. Worcester Polytechnic Inst. (2)
208. Wright State Univ. (9)
209. Youngstown State Univ. (1)

Appendix B. 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 & marine sciences)
__ Mathematical sciences (mathematics, statistics)
__ Other (please specify) _____

Thank you for taking the time to complete our survey.