ATE Program for Physics Faculty

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Evaluation Report
Year Three: June 1, 2008-May 31, 2009

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Charts and Tables

Section One
Introduction to the Evaluation for the ATE Program for Physics Faculty

The ATE Program for Physics Faculty, directed by Thomas O'Kuma and Dwain Desbien, engaged Momentum Group, Fort Worth, TX to conduct an external evaluation of the ATE Program for Physics Faculty (ATE/PPF). The purpose of this report is to summarize evaluation activities and findings of the ATE/PPF project during the third year of the project, June 1, 2008 through May 31, 2009. As this project draws to a close, the evidence suggests that the project has addressed all of the goals outlined in the proposal and conducted a series of high quality workshops for high school and two-year college instructors that have made a significant impact on the participants' teaching practices.

In Year Three of the ATE/PPF project, four workshops were conducted at various sites. These workshops were: Project-Based Physics (PBP), Mt. San Antonio College, CA (June 12-14, 2008); Virtual Instruments and Control Systems (VICS), Southeast Community College, NE (September 25-27, 2008); Tools for Introductory Physics (TIP), Lee College, TX (November 13-15, 2008) and Instructional Strategies for Introductory Physics (ISIP), Estrella Mountain Community College, AZ (April 23-25, 2009). In addition to the participant feedback from attendees at these four workshops, information on the post-implementation efforts of participants attending the New Faculty Training Conference at Delta College, MI (March 6-8, 2008) and the Tools in Introductory Physics (TIP) workshop at Estrella Mountain Community College, AZ, (April 17-19, 2008) is included in this report.

The primary external evaluation activities conducted by Momentum Group in Year Three included the following:

- Consulted with the PIs at the AAPT Summer Meeting and via email during the year
- Prepared the Post-workshop Questionnaires for administration
- Administered the Plans for Implementation Questionnaire to participants in the PBP, VICS, TIP, and ISIP workshops. Conducted follow-up.
- Administered the Post- Implementation Questionnaire to participants in the NFTC (March 2008), TIP (April 2008), PBP (June 2008), VICS (September 2008), TIP (November 2008) workshops. Conducted follow-up.
- Reviewed and analyzed project materials including the Final Day Workshop Evaluation.
- Prepared an evaluation report for Year Three of the project.

The ATE/PPF project evaluation, both internal and external components, is intended to provide information to the project staff and other stakeholders on the extent to which the project activities are addressing the goals of the NSF ATE program, the specific goals and underlying objectives of the ATE/PPF project, and the needs and expectations of the physics faculty who participate in the workshops with the intent of improving instruction for their students. To this end the evaluation is guided by several questions that focus on project implementation, participants' efforts to implement what they learned in their own classrooms, and the impact of those instructional changes.

Methodology and Data Sources

The PIs conducted internal evaluative activities as a part of their protocol for continuously improving the workshops. The Final Day Workshop Evaluation (FDWE) served as the primary post-workshop evaluation tool[1] to provide the PIs with information about the workshop content as well as information about the arrangements/logistics for the workshop. Follow-up electronic communications with the participants served as another formal means for securing internal evaluative information. The results of the internal post-workshop evaluation were made available to the external evaluator, and the participant responses and commentary from the FDWE are used in this report. The PIs were thoughtful and diligent about forwarding unsolicited comments they received from the workshop participants to the external evaluator. These unsolicited comments, coupled with those received independently by the evaluator and solicited on the Post-Implementation Questionnaire, are included in this report.

In addition to the internal evaluation instrument, the Post-Workshop Questionnaire, the Implementation Plans and Actions Questionnaire, and the Post-Implementation Questionnaire[2] were developed and used by the external evaluator to provide feedback on the value of the workshop to the participants and the extent to which the workshop influenced the participants' interest in, intent to, and practice of implementing changes in their own classrooms. Since the plans for implementing changes in the classroom varied for each participant, i.e. some participants intended to implement changes immediately while others deferred implementation until the 2009-2010 academic year, the data about implementation remains incomplete at the time this report was prepared. Participants are, without a doubt, enthusiastic about implementing what they learned and making the student-centered instructional practices a part of their teaching. As one participant pointed out when asked if he/she intended to continue using the activities learned at the workshop, *"Yes, for sure* [I will continue to use this activity]. *Not only did I use this for my students, but I also presented it to my colleagues at* [Name of institution] *and I will continue to do that."*

This evaluation report is organized around the following questions:

[1]An additional questionnaire (Post-Workshop Questionnaire) was developed by the external evaluator and administered by the project staff at the conclusion of each workshop.
[2]The Post-Workshop Questionnaire was administered on paper and the Implementation Plans Questionnaire and Post-Implementation Questionnaire were delivered electronically.

Project Activities and Implementation (Section Two)

1. *Did the ATE/PPF workshops attract physics faculty interested in strengthening their capacity to better prepare students for a technology-driven workforce?*

2. *In what ways did the ATE/PPF workshops meet the criteria for high quality physics workshops?*

3. *In what ways did the ATE/PPF workshops promote understanding of technician education and workforce development?*

4. *Did the workshops address the professional development needs of the physics faculty?*

Plans for Implementing Workshop Content (Section Three)

1. *How many participants, upon closure of the workshop, indicated that they plan to implement materials/activities/teaching strategies from the workshop?*

2. *After participants returned to their classrooms, how many confirmed their plans to implement workshop content in their classrooms? How many students and courses are influenced by these changes?*

3. *What problems might be encountered?*

4. *Will reform-based assessments be adopted?*

Implementation of Workshop Content (Section Four)

1. *What activities/resources were implemented in the participants' classrooms or teaching situations in AY 2007-2008?*

2. *To what extent were the implementations successful?*

3. *Is there evidence that participants' maintained their motivation to change classroom practices?*

Section Five of the report is a compilation of participant comments and overall rating of the program they attended, and Section Six contains summary comments from the external evaluator.

About the Evaluator

Karen L. Johnston, PhD Momentum Group, Fort Worth, TX, offers services to individuals and institutions engaged in improving physics education. She has over twenty-five years experience in physics teaching before retiring as a professor in the Department of Physics at North Carolina State University and over fifteen years experience as an evaluation consultant.

Section Two
Project Activities and Implementation

The goal of the ATE/PPF workshops is to engage physics faculty from high schools and two-year colleges in intensive, high quality workshops that focus on physics instruction for technology students. All of the ATE/PPF workshops are designed to engage the participants in using the activities/materials in ways that would promote adaptation and implementation in their own classrooms. The workshop content is relevant in a wide array of introductory physics courses and intended to be of value to instructors in high school or two-year colleges.

The workshop content and materials were identified and selected by the PIs based on their knowledge of physics curricular materials. The workshop leaders were selected based on their demonstrated track record in developing and implementing exemplary curricular materials for teaching physics using technology tools with student-centered instructional practices. As noted in previous evaluation reports for this project, both PIs are well informed about materials/resources appropriate for preparing a technical workforce, and both understand how these materials/resources can and should be integrated into physics courses. Their background, experience, and collegial connections placed them in a position to select a group of workshop leaders able to deliver a very high quality professional development experience.

For the 2008-2009 academic year and Summer 2008 workshops, O'Kuma and Desbien selected workshop leaders who were: (1) skilled in modeling instructional practices that focus on student learning; (2) capable of organizing and conducting a series of activities aimed at producing maximum participation by the workshop participants; (3) enthusiastic about physics and physics teaching; (4) able to model instructional practices that engage students in learning; and (5) capable of explaining fundamental physics using a wide array of technology tools, including tools for computation and visualization, for all student audiences, including students in technician programs.

<u>Recruitment Plan</u>

Question: Did the ATE/PPF workshops attract physics faculty interested in strengthening their capacity to better prepare students for a technology-driven workforce?

Participants were recruited to the workshops using a variety of methods including direct mailings to individuals, two-year colleges and schools. Membership lists from the American Association of Physics Teachers and other sources were used to identify potential participants. The recruitment efforts were successful in providing a good mix of high school and two-year college faculty at all of the workshops, even though some topics in workshops like PBP and VICS, might prove more challenging to implement to teachers in high schools.

In addition to the usual information requested on an application, participants were asked specific questions about students in technical programs in the applicant's physics courses and at the institution. Applicants were expected to provide a statement of interest and expected impact of the workshop. The application required a statement of institutional support for the applicant's attendance and partial support for travel. The signatory administrator provided additional information about the institution's technical programs that include a physics component. Thus, the application requested the kind of information that allowed the project staff to select participants where there was evidence of their interest in using physics instructional tools to provide more effective instruction for all physics students, including students in technical programs. The recruitment and selection process was well aligned with the goals of the NSF ATE program.

The ratio of high school affiliated participants to two-year college participants at the various workshops was: PBP—7 HS / 13 TYC; VICS—7 HS / 11 TYC; TIP—10 HS/ 14 TYC; and ISIP—14 HS / 9 TYC.

Including participants as teams from the same school is a well-accepted practice in many professional development initiatives, particularly those programs whose goal is to influence changes in teaching practices and the classroom environment. The ATE/PPF selection process encouraged and favored teams from the same school or same district since this was a likely indication that the participants would be better able to initiate change at their institutions and be more motivated to sustain the changes. In Year Three, the ATE/PPF program had: 3 teams at the PBP workshop—one with three members; 2 teams at the VICS workshop, 2teams at the TIP workshop and 1 team at the ISIP workshop.

The application process was designed to make it easy for participants to apply for more than one workshop at the same time. The reason for this is to encourage applicants to consider a more substantial commitment to professional development in a short (6 month-18 month) time frame. Since the goal of the ATE/PPF workshops is to foster change, this feature of the application process is considered to be a way to work more extensively with faculty who, for whatever reason, are not as skilled in using technology tools or interactive engagement in their classrooms and who are highly motivated to implement change in their classroom. Some participants applied for and were accepted at more than one workshop, and this opportunity to attend more than one workshop appears to strengthen the participant's commitment to change. Several of the teachers who attended more than one workshop remarked about the importance of having these opportunities to continue to learn. Some expressed their hope that funding would continue to be available to support their growth as teachers so that they, in turn, can prepare students for the technologically-intensive 21st century world of work.

The website for the project, www.physicsworkshops.org provides overviews of all workshops and contains essential information for participants regarding workshop logistics. This appears to work well as a communication vehicle between the project staff and the workshop participants. Once selected to attend a workshop, participants are able to find all of the essential information about the workshop.

Written information was mailed to the participants prior to the workshop. When queried on the Final Day Workshop Evaluation (FDWE) on the value of the pre-workshop mailings with the following question: *"Did the workshop pre-materials help prepare you for the workshop*", the participants provided ratings of 3.67 (PBP), 4.21 (VICS), 4.54 (TIP), and 4.29 (ISIP) on a 5-point scale where "5" indicates "excellent".

When asked about the value of workshop pre-materials, some of the participants commented that the materials did a good job of preparing them for the workshop. For example:

"They were good pre-reading prior to attending the workshop. It gave a good sense of what the workshop would be all about." [VICS participant, FDWE]

"The pre-materials were very helpful in my preparation of this workshop." [TIP participant, FDWE]

"The information about logistics and schedule were good." [TIP participant, FDWE]

"I was glad that the study information on effectiveness was contained in pre-materials and not so much during the conference…thanks." [ISIP participant, FDWE]

"They were informative and gave me some idea of what was ahead. It also allowed me sometime to do research on my own and have something valuable to bring to the workshop." [ISIP participant, FDWE]

A few participants commented that some of the pre-workshop materials were too lengthy, that the preparation time they had for the workshop was limited—meaning they did not have time to read all of the materials, and that the pre-workshop materials are not addressed within the workshop itself—with the implication that the materials should be referenced in the workshop activities to reinforce what they learn from the readings.

"Wish I had spent more time with it. It is good material." [ISIP participant, FDWE]

"…the reading material was never discussed and most of it wasn't useful anyway." [TIP participant, FDWE]

"Surprised that we didn't discuss in workshop any of these materials." [PBP participant, FDWE]

One participant's [ISIP workshop] comment regarding the pre-workshop materials was particularly glowing, *"100% useful, worth a million dollars."*

Workshop Quality

Question: In what ways did the ATE/PPF workshops meet the criteria for high quality physics workshops?

Professional development workshops are intended to provide participants with experiences and resources that are meaningful for their teaching situation. To be high quality and effective workshops should provide: 1) content that reflects current and accurate scientific knowledge; 2) content that is presented at a level appropriate to the participants; 3) content that is presented using sound pedagogical practices; 4) content that has an intended purpose for the participants' classroom or teaching situation; and 5) sufficient time allocated to present the content. The evidence suggests that the ATE/PPF workshops in all three years have met (and often exceeded) the expectations of the participants. Participants in all three years have commented on the challenges posed for them by intensive nature of the workshops—large amount of material and long workshop days. However, it is the intensive nature of the workshops that seems to contribute to the collegiality that develops among participants and between participants and workshop leaders.

The topics addressed in these workshops represent a broad overview of many research-based curricular resources in physics, all of which could be integrated into any general physics course and any physics course in technician education programs. All of the workshops provided ample opportunity for participants to learn more about using technology tools in teaching, particularly in ways that allow students to develop their own understanding about a physics concept. The table below offers a thumbnail sketch of the workshop content.

Table 1: Workshop Descriptions

	Workshop Descriptions[3]
Project-Based Physics (PBP) June 12-14, 2008 Mt. San Antonio College, Walnut, CA	Problem-based learning serves as the intellectual framework for this workshop where participants learn to use Very Large Contexts (VLC) to engage students in designing a project that describes a real-world problem/device. The group project requires students to model a complex system using computational and visualization tools, and the workshop activities are organized to instruct participants in each element of project-based learning in physics. Participants will learn to use VPython programming language that will ready their students for learning elements of computation to solve physics problems.
Virtual Instruments and Control Systems (VICS) September 25-27,2008 Southeast Community College, Lincoln, NE	Specially designed for instructors teaching students intending to become engineers, the VICS workshop provides participants with an intensive experience in using various microcomputer-based laboratory tools and software such as SensorDAQ, LabPro, LabQuest and LabVIEW. With LabVIEW, participants will learn to create and work with Virtual Instruments (VIs). Coupled with activity-based instructional practices, these technology tools are effective in engaging technology, engineering, and physics students with appropriately sophisticated computer tools for learning

[3] Data source: http://www.physicsworkshops.org

	physics.
Tools for Introductory Physics (TIP) November 13-15, 2008 Lee College, Baytown, TX	Hands-on experience in using simulations that provide students with an interactive and conceptual approach in developing their understanding of physics concepts. Participants will study various simulations such as the PhET simulations that are ready for use in the classroom. They will have the opportunity to develop skills to modify, adapt, and construct new materials. The suite of resources presented in this workshop addresses the spectrum of technological sophistication to allow participants to identify materials that align well with their classroom environment. Participants will work with various research-based assessment tools.
Instructional Strategies for Introductory Physics (ISIP)* April 23-25, 2009 Estrella Mtn. Community College, Avondale, AZ	Overview research-based instructional strategies that promote the development of problem solving skills, including modeling as a process of science. Participants will work with modeling tools like equations, free-body diagrams, and motion diagrams and will develop new materials to use with their students using these modeling tools. Participants will learn about modeling discourse management.
Workshops in the Year Two cycle of the project:	
New Faculty Training Conference (NFTC)* March 6-8, 2008 Delta College, University Center, MI	The NFTC offers an intensive overview of active learning strategies and how to integrate technology tools in physics classrooms and labs to promote more effective instruction. Activities conducted in a workshop environment are buttressed by the findings of physics education research, i.e. developing student understanding of physics. Thorough introduction to ICP/21, MBL, Discourse Management and assessment tools. Designed for new physics faculty members at two-year colleges.
Tools for Introductory Physics (TIP)* April 17-19, 2008 Estrella Mtn. Community College, Avondale, AZ	Hands-on experience in video-based motion analysis in a wide range of applications. Overview of Spiral Physics, Digital Video Analysis, and a video analysis based laboratory program. Participants will use Logger Pro 3.5 software to analyze video clips.

*Some evaluation results from this workshop are not included in this report, i.e. Post-Implementation Questionnaire not yet administered to these participants. The Post-Implementation Questionnaire results for the NFTC and the TIP workshop (April 2008) are included in this report since the questionnaire was not administered to these participants until Spring 2009.

When asked on the Final Day Workshop Evaluation [FDWE] to identify **"the best thing about this workshop,"** participants cited numerous items. Some of the citations include:

Regarding the **workshop leaders**:

"The interaction between instructors (leaders) and high school/college leaders was excellent." [ISIP participant, FDWE]

"Practical, organized and knowledgeable presenters." [TIP participant, FDWE]

"Wealth of free-flowing knowledge." [TIP participant, FDWE]

"Excellent instructors and context." [TIP participant, FDWE]

"…the presenters were very enthusiastic and experienced." [ISIP participant, FDWE]

"Outstanding instructors and facilitators. Excellent colleagues."
[PBP participant, FDWE]

Regarding the **topics** selected for the workshops:

"The LabView programming and the SDAQ use in the classroom to perform different experiments. This is high-end technology that can successfully replace the old material in many classrooms." [VICS participant, FDWE]

"PhET simulations and clickers…really awesome and practical."
[TIP participant, FDWE]

"I found the Vpython model more enjoyable than I had anticipated."
[PBP participant, FDWE]

"The opportunity to play with PhETs. The modeling of Modeling Discourse Management." [ISIP participant, FDWE]

Opportunities for small group work were integrated throughout workshop activities. Each workshop provided an opportunity for the participants to work individually or in small groups to prepare an activity to use in their own classroom. For example, participants generally had opportunities to: (1) design experiments—some of which were similar to design problems in engineering technology; (2) conduct guided investigations or explorations aimed at concept development; (3) engage in problem solving with specific emphasis on multiple representations, graphing solutions, symbolic tasks, etc.; (4) prepare materials or review assessments that they can use with their students; and/or (5) engage in group discussions to model discourse management. White boards and PowerPoint slides were two of the primary mechanisms that participants used when reporting out from the group's work. The workshop instructors modeled student-centered teaching practices in all of the workshops, including group work, and thus by their actions reinforced how group work would be integrated into teaching. The participants offered some comments about their opportunities for **group work** on the FDWE.

"I enjoyed the friendly small group atmosphere. It made it easy to meet the other participants and network." [ISIP participant, FDWE]

"Working in groups solving and writing problems." [TIP participant, FDWE]

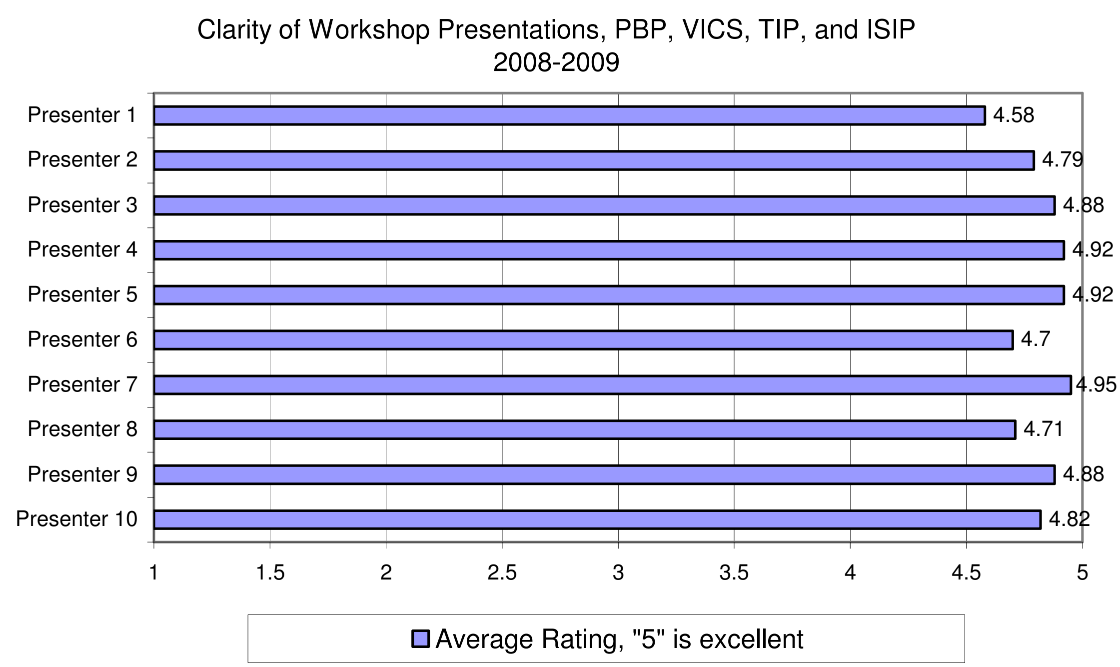
"The group work especially on nTipers was very challenging but extremely beneficial." [TIP participant, FDWE]

Even when participants offered a comment that reflected a sense of an unmet expectation with the workshop content, the comment was couched with a sense of understanding the challenges in conducting such an intensive workshop. For example, in response to the question of what he/she "**liked least about the workshop**" one participant offered the following comment:

"I understand the time constraints but would love more projects involving something like TIPERS." [ISIP participant, FDWE]

The Final Day Workshop Evaluation Form queried the participants about many aspects of the workshops including specific questions about each presenter: *"Were you able to understand and follow (Presenter's Name) presentation?"* Using a rating scale of 1 - 5, where "1" represents "poor" and "5" represents "excellent", the participants rated each presentation. Each workshop presenter received exceptionally high marks as illustrated in Chart 1.

Chart 1: Clarity of Workshop Presentations



Both O'Kuma and Desbien made presentations at all four workshops. As noted in previous evaluation reports, both receive "excellent" marks from almost all of the participants. For these four workshops, their composite ratings on the *"understand and follow"* question were 4.87 and 4.84, respectively. Eighty-eight percent (88%) of the participants in these four workshops rate O'Kuma's presentations as "excellent," and eighty-seven percent (87%) do so for Desbien.

At each workshop participants were informed about ATE/PPF project funds that could be used for special projects. They were encouraged to develop ideas for more extensive projects and to apply for these funds. Since the funds for special projects provide an additional support structure for the participants beyond those received in the workshops, it is predicted that the special projects are likely to be a strong motivator for sustaining change in the participant's classroom. Examples from Year Three include:

PBP Workshop	Luka Kapiai	Adaptation of Micro-Based Computer Labs and Incorporation of Project Based Physics and Video Analysis in Physics Courses (Major Project)
TIP Workshop	Ravi Sharma	Study of Coastal Waves Using Digital Video Analysis Techniques from an Introductory Physics Student's Perspective (Major Project)
	Tiberiu Dragoiu-Luca	Development of Modern Physics TIPER-like Questions (Major Project)

Over the three years of the project, almost forty (40) implementation projects have been developed and completed by the ATE/PPF participants with the aid of small project stipends.

The ATE/PPF project continues to receive very high marks for the planning and arrangements, contributing to the overall comfort of the workshop participants. (See Charts 2A and 2B, pages 15-16.) As mentioned earlier in this report, the ATE/PPF workshops are intensive in two ways: time and content. Typically, the workshops start at ~8:30 AM and end at ~9:30 PM, including breaks and meals that were appropriately timed and adequate. As noted in the evaluation reports for Year One and Year Two, the single aspect of the workshop commented on most frequently regarding what the participants *"liked least"* about the workshop was the schedule, i.e. the length of the workshop day was mentioned frequently and the over-packed schedule mentioned occasionally.

A few other participants mentioned that the schedule included too much material. For example:

"Long days were difficult. Please add a day, spread out the workshop." [PBP participant, FDWE]

"The long hours (can get brain dead)." [PBP participant, FDWE]

"..eventually you begin to feel like you were run over by a bus. Exhausting." [TIP participant, FDWE]

Charts 2A and 2B illustrates the positive regard expressed by the participants for the planning and accoutrements of the workshops to the following questions:

- Did you like the hands-on workshop format?
- How do you feel about the workshop organization?
- How were the (Name of site) facilities for this workshop?
- How do you rate the food?
- How do you rate your lodging?
- Did you enjoy the post-workshop evening interactions?

Chart 2A: Ratings of Workshop Logistics and Environment

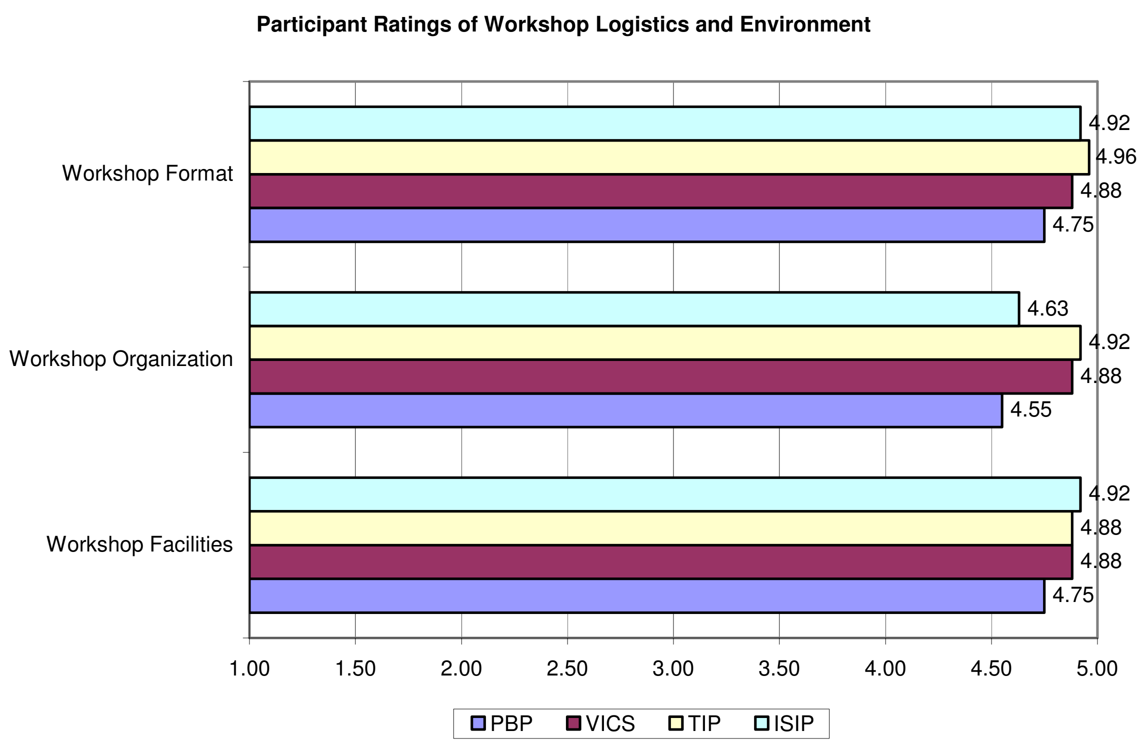
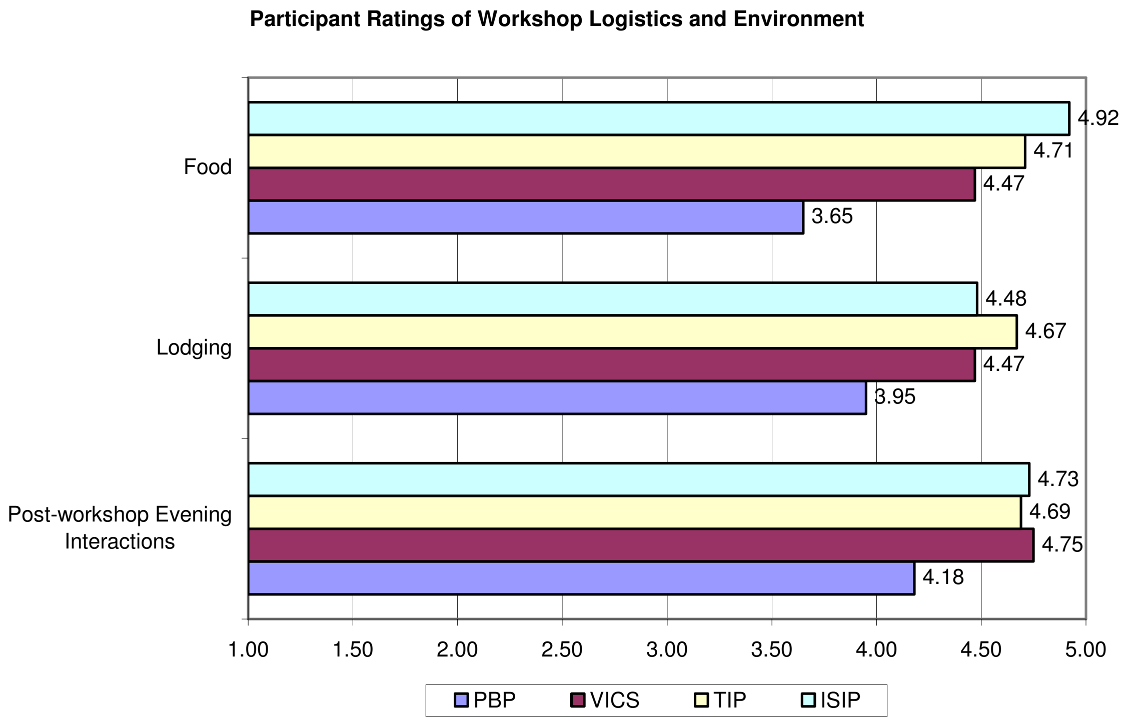


Chart 2B: Ratings of Workshop Logistics and Environment



In general, the workshops receive high marks on each indicator for what constitutes a high quality workshop. The time issue is one that the workshop leaders have considered and decided in favor of getting the most out of each hour. Participants often comment on how well they are treated at the ATE/PPF workshops. The PBP workshop is the only one where a few participants commented negatively on the lack of choice for evening meals and the hotel. With so few negative comments, it is clear that the PIs and workshop leaders do everything they can to make the workshop experience a positive one for all participants. The excellent workshop facilities, lodging, and food coupled with the extraordinarily talented workshop leaders and exemplary materials provide an exceptionally high quality professional development experience for the physics teachers.

Technician Education

Question: In what ways did the ATE/PPF workshops promote understanding of technician education and workforce development?

Specialized technician education programs that emphasize physics are offered at each of the four community colleges where the workshops were conducted. The specific topics, etc. for these technician education sessions are illustrated below.

Table 2: Focus on Technician Education

	Description	Time
PBP	Technology Education	1 hr
VICS	Technician Education/Winds of Change	1 hr
TIP	Technology Education	1.25 hr
ISIP	Technology and its Uses in Physics: Introduction to Clickers and TIPERS and Technology Education	3.25 hr

On the Final Day Workshop Evaluation Form Workshop participants were asked to rate the extent to which their knowledge of technology and its use in physics education was increased. At each workshop, the participants gave high marks to this component of the workshop, with PBP receiving a 4.65 rating, VICS a rating of 4.82, TIP a rating of 4.78, and ISIP a rating of 4.70 on a "1" to "5" scale where "1" is "poor" and "5" is "excellent."

When participants were asked rate the value or usefulness of the workshop sessions, they responded with the following composite ratings to the technician education sessions: [Note: Once again the rating scale was "1" to "5" with "1" being "poor" and "5" noting "excellent."]

Table 3: Ratings of Technician Education Sessions

How valuable or useful were each of the following sessions?		
PBP	Technology and its use in Physics	4.11
VICS	Technology and its use in Physics	4.69
TIP	Technology and its use in Physics	4.57
ISIP	Technology and its use in Physics	4.43

<u>Workshop Value</u>

Question: Did the workshops address the professional development needs of the physics faculty?

Instructors who take time away from their classes and time away from their private life to attend professional development workshops are usually highly motivated. The high marks that the ATE/PPF workshops receives across all measures on the Final Day Workshop Evaluation Form indicate that workshop content and pedagogy match the needs and expectations of the participants. The high marks also suggest that the PIs and the workshop instructors know exactly what challenges and motivates the participants and how to provide that mix of intellectual stimulation and practical advice on instruction.

At the end of the workshop, the participants completed a short questionnaire[4] prepared by the external evaluator. The participants were asked to indicate the extent to which the workshop was successful in *"targeting their needs in their current teaching situation."* Participants were given four choices: "very successful"; "moderately successful"; "slightly successful"; or "not at all successful." Table 4 illustrates the results.

Table 4: Value of Workshops to Participants' Teaching Situation

	Percentage of participants indicating that the workshop was "very successful" in meeting professional development needs				
	PBP N=20	VICS N=17	TIP N=22	ISIP N=22	All Workshops N=81
Taught at a level appropriate to my knowledge, skills, and interest (Item 2b)	80.0%	58.8%	81.8%	86.4%	77.8%
Content meaningful to my current teaching situation (Item 2c)	60.0%	58.8%	95.5%	77.3%	74.1%
Content, instructional strategies, and laboratory work adaptable to my current teaching situation (Item 2d)	60.0%	64.7%	90.9%	90.9%	77.8%
Responsive to my professional development needs (Item 2a)	70.0%	58.8%	95.5%	100.0%	82.7%

All of the participants (100%) in the TIP workshop indicated that the workshop was "very successful" or "moderately successful" on the four measures noted in Table 4. And, all of the participants in the ISIP workshop indicated that the workshop was "very successful" or "moderately successful" on three of the measures, 2a, 2b, and 2c. The ratings on the PBP and VICS workshops are slightly lower than the ratings received on these measures than for the other workshops. The content of these two workshops included topics that would require a different kind of intellectual engagement of students, i.e. computational modeling, etc. The participants acknowledged that implementing these topics posed challenges for them and for their students.

The underlying intent of content-driven professional development workshops like the ATE/PPF workshops is to encourage participants to adapt and implement new content and more effective instructional strategies in their own classrooms. One thread of the

[4] The Post-Workshop Questionnaire (external evaluation) was administered in addition to the Final Day Workshop Evaluation Form (internal evaluation).

ATE/PPF project evaluation is to monitor and assess the success participants have in implementing change and then sustaining that change. It is expected that if the workshops are of sufficiently high quality and if the content and pedagogical strategies are aligned with what the participants perceive as useful, within their skill level, and doable with current resources they have, then the likelihood of implementing and sustaining the changes they introduce is increased.

On the Post-Workshop Evaluation questionnaire, participants from the four workshops conducted from Summer 2008 - Spring 2009 and participants from the workshop and conference conducted in the Spring 2008 (NFTC and TIP)[5] were queried about the likelihood they would implement what workshop content in their own classrooms or teaching situations. Chart 3 illustrates the responses on four measures related to the participants' implementation plans. The specific questions were:

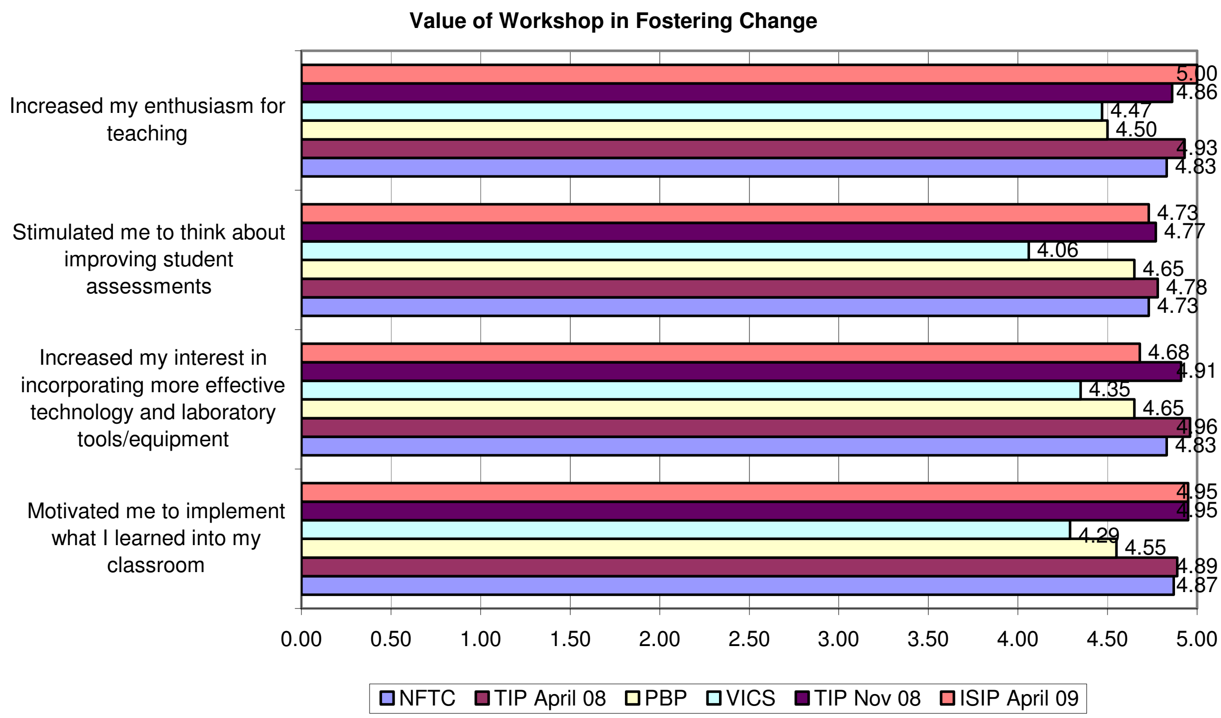
To what extent do you agree or disagree with each of the following statements concerning the impact of the [Name] workshop on you professionally,

1. *The workshop has motivated me to implement the ideas I learned into my own classroom.*
2. *The workshop has increased my interest to incorporate more effective technology and laboratory tools/equipment in my courses.*
3. *The workshop stimulated me to think about ways I can improve student assessments.*
4. *The workshop increased my enthusiasm for teaching.*

The rating scale for these measures was a "1" to "5" scale, where "1" indicated "Strongly Disagree" and "5" indicated "Strongly Agree."

[5] The responses from participants at the NFTC and the ISIP workshop are illustrated in this report. These results were reported in the Year Two Interim Evaluation report and the notation on the legend was inadvertently switched for these two initiatives.

Chart 3: Value of Workshop in Fostering Change



When asked to respond to the statement "*My students would benefit from an appropriate adaptation of the workshop content into my classroom or laboratory"* slightly over eighty percent (80.2%) of the participants in these responded that the workshops were "very successful"[6] on this measure. Almost ninety-eight percent (97.5%) indicated that the workshops were "very successful" or "slightly successful" on this measure, suggesting that by implementing workshop content, the teachers' believe their students receive a secondary benefit from the ATE/PPF workshops.

Every indicator suggests that all participants exit the workshops with a strong motivation to bring what they have learned to their students, even with workshops like PBP and VICS that push the envelope of implementation for participants. Not only do participants report an intent to immediately implement new strategies into their teaching, particularly the use of alternative assessments such as Ranking Tasks and tools for student engagement such as the White Boards, but most are committed to more major changes in how they teach fundamental concepts using various technology tools.

[6] This was the highest rating that participants could select.

Section Three
Participants' Plans for Implementing Workshop Content

The PIs have addressed the intent of the NSF ATE program by integrating technology appropriate for the physics or technical physics classrooms in every workshop that has been conducted in this project. The workshop activities intended to expand the use of technology tools, where appropriate for the task and supportive of student learning, into physics and technical physics courses in high schools and two-year colleges. The PIs' ambitious goal was to encourage implementation of the reform-based activities/materials and effective pedagogical practices in the classrooms for **every** participant. However, their experience with professional development workshops over many years tempered their exceedingly high expectations, and they acknowledged that:

- *if 90% of the participants exit the workshops with plans to implement activities/materials or teaching strategies from the workshop, and*
- *if 60% of the participants attempt a significant implementation plan and follow-through with their plans for implementation, and*
- *if 30% of the participants sustain that implementation after the project's completion,*

then the ATE/PFF workshops would meet their personal goals for a successful project. Feedback from the participants confirms that the PIs' goals are being met across all of the workshops.

Description of Implementation Plans

Question: How many participants, upon closure of the workshop, indicated that they plan to implement materials/activities/teaching strategies from the workshops?

When teachers have a positive experience in a professional development workshop, it is expected that they will be motivated to integrate what they have learned into their teaching situation. To determine if this premise held true for the ATE/PPF program, a post-workshop assessment immediately following the workshop queried participants about their motivation to make changes. On a short Post-Workshop Questionnaire, participants were asked to respond to the following: *"The workshop motivated me to implement the ideas I learned into my own classroom."* The average rating by the participants for each workshop was: 4.55 for PBP, 4.29 for VICS, 4.95 for TIP and 4.95 for ISIP. These ratings were on a 5-point scale, where "5" indicated "Strongly Agree" for four of the five workshops[7], [see Chart 3, page 20].

Participants were asked whether they planned to implement workshop activities in their classes or other instructional settings, and almost two-thirds (~65%) of the PBP and VICS participants and ninety-six percent (96%) of the TIP and ISIP participants

[7] DVTS, DVTS-MBL, NFTC, and TIP. Results for ACIP were reported in Year One.

confirmed that they would do so. None of the participants at any of the workshops indicated that they did not intend to implement the activities/materials. Thirty-five percent (35%) of the participants at the PBP and VICS workshops indicated a "maybe" regarding implementation. The content in these two workshops was, indeed, more challenging to implement. For example, unless a physics course is designed to develop computational skills along with analytical problem solving skills, the implementation of VPython might prove difficult, i.e. it might not address the specific needs of the students at the participant's institution.

Table 5 illustrates the list of workshop activities/materials that participants intend to implement in their classes when they exited the workshop.

Table 5: Workshop Activities/Resources Identified for Adaptation and Implementation

	Number Planning to Implement	**Type of Material/Activity, etc.**	**Frequency Counts for specific activities/materials**
PBP	65% or 13 out of 20	Project-based tasks	10
		VPython	6
		Design and measure projects	2
		Videoanalysis	1
		Whiteboards	1
		Pre-/Post-assessments with students	1
		Pre-labs	1
VICS	65% or 11 out of 17	LabVIEW	5
		Sensors with labs	4
		No specific information	3
TIP	96% or 23 out of 24	PhET	17
		TIPERs	9
		Personal Response System ("clickers")	9
		nTIPERs	8
		Simulations (not specific)	5
		Formative student assessments	2

	Number Planning to Implement	Type of Material/Activity, etc.	Frequency Counts for specific activities/materials
ISIP	96% 22 out of 23	PhET	15
		TIPERs	7
		Modeling Discourse Management	5
		Modeling	4
		Personal Response System ("clickers")	3
		Whiteboards	3
		Graphing methods	2
		Student assessments, such as FCI	2
		Circle time	2
		ILD's	1
		Physlets	1
		Ranking Tasks	1
		Modeling schema	1
		MIT TEAL	1
		Group work	1
		Simulations	1

<u>Courses and Students</u>

Question: After the participants returned to their classrooms, how many confirmed their plans to implement workshop content in their classrooms? How many students and courses are influenced by these changes?

Following the workshop, the participants were queried again[8] via electronic mail about their plans to implement the workshop content into their classrooms. Participants were asked to: (1) list the courses in which workshop content would be implemented; (2) estimate the number of students in the courses; (3) indicate when the implementation would occur; (4) describe the barriers for implementing workshop content; and (5) identify any assessment tools that would likely be a part of their implementation plan.

Table 6 illustrates the range of courses in which the workshop content is or will be implemented along with estimates of the students to be affected by this implementation.

[8] Implementation Plans and Actions Questionnaire

Table 6: Implementation Plans—Courses and Students

	Participants/ Respondents	Courses in which Workshop Content will be implemented	Number of Students in these Courses
PBP	$N_p = 20$ $N_r = 11$	**Courses for high school students:**	
		Conceptual physics	90
		General physics (algebra based)	146
		AP Physics B	18
		Courses for college students:	
		Introductory/conceptual physics	-
		College (algebra based) physics	253
		University (calculus based) physics	480
		Astronomy	-
		Courses for teachers:	
		Pre-service courses	-
		Professional development courses	-
VICS	$N_p = 17$ $N_r = 12$	**Courses for high school students:**	
		Conceptual physics	15
		General physics (algebra based)	95
		AP Physics B	35
		Courses for college students:	
		Introductory/conceptual physics	-
		College (algebra based) physics	142
		University (calculus based) physics	214
		Other: (intro to engineering, MatLab)	38
		Courses for teachers:	
		Pre-service courses	-
		Professional development courses	-

	Participants/ Respondents	Courses in which Workshop Content will be implemented	Number of Students in these Courses
TIP	$N_p = 22$ $N_r = 12$	**Courses for high school students:**	
		Conceptual physics	68
		General physics (algebra based)/honors	207
		AP Physics B	30
		Other: chemistry	68
		Courses for college students:	
		Introductory/conceptual physics	53
		College (algebra based) physics	137
		University (calculus based) physics	53
		Physical Science	53
		Applied physics	39
		Others: Chemistry, physical geography	65
		Other: Astronomy	107
		Courses for teachers:	
		Pre-service courses	-
		Professional development courses	19
ISIP	$N_p = 24$ $N_r = 11$	**Courses for high school students:**	
		Conceptual physics	190
		General physics (algebra based)	233
		AP Physics B	20
		AP Physics C	-
		Other: chemistry, IB	130
		Courses for college students:	
		Conceptual physics	-
		College (algebra based) physics	311
		University (calculus based) physics	70
		Physical Science	12
		Courses for teachers:	
		Pre-service courses	-
		Professional development courses	-

Table 7 illustrates the total number of students in the participants' classes for the conventional physics courses taught in high school and college for these four workshops.

Since all participants did not respond to this second query about implementation plans, even after a follow-up request, it is likely that the number of students influenced by their instructor's participation in the ATE/PPF workshops illustrated in Table 7 is lower than the true value.

Table 7: Student Impact Numbers by Level and Courses (Estimate)[9]

Courses for High School Students	
Conceptual physics course	363
General physics (algebra based) course	681
AP Physics B and C courses	103
Courses for College Students	
Physical Science*	65
Introductory/conceptual physics course	53
College (algebra based) physics course	843
University (calculus based) physics course	817
Courses for teachers	
Pre-service courses	-
Professional development courses*	19
Total for Typical Physics Courses *Not included in total	2860

Implementation Challenges

Question: What problems might be encountered?

Participants at the PBP workshop, in general, cited very few problems in implementing project-based activities in their classes. Of the eleven participants who responded to the Implementation Plans and Actions questionnaire, only two mentioned constraints that prohibited them from implementing project-based activities. One cited a temporary situation, i.e. by having a student teacher, the participant was required to conduct specific curriculum activities, and the other participant's teaching situation—teaching problem sessions at a large university—prohibited implementation of group work.

A few PBP participants mentioned the limited resources available to their program and a typical constraint—time. One was concerned about student assessments for projects, while another was concerned about managing groups so that all students contributed. In terms of additional assistance that the project staff could offer, one participant mentioned

[9] Ibid.

that he/she had not received the CD of resources promised at the workshop, while another said a consulting visit by the presenters would be helpful.

Only two participants from the VICS workshop, out of the twelve respondents, indicated that they did not anticipate any problems implementing activities/materials. The other participants cited lack of resources (computers, software—LabVIEW and Vernier products) as impediments to implementation. Two participants commented explicitly on their personal limitations in programming, with one saying that he/she would need more training in order to use LabVIEW. According to one of these participants, *"I am a bad programmer and I had difficulty learning the programming structure. … I will just use the Vernier equipment in the way that I do already, without the control systems."*

The participants recognize that some problems they may encounter in implementing what they learned at the workshop are beyond the scope of what the workshop staff can provide. For the VICS participants, the limitations on equipment and the old equipment (e.g. ~20 years old) were serious concerns. They expressed the need for more time, as well, to work with implementation. One participant commented that he/she needed a Mac version of LabVIEW. Another participant mentioned that he/she had asked for and received useful help via email from one of the presenters (S. Swartley). In general, the workshop staff members seem do a good job of communicating what they are able to do beyond the workshop period to help participants implement activities/materials. Participants at VICS and the other workshops comment frequently on the wealth of resources that have been made available to them through their participation in the ATE/PPF workshops.

Seventy-five percent (75% or 9 out of the 12 respondents) from the TIP workshop indicated that they had or anticipated no problems in implementing materials/activities from the TIP workshop. Of the few problems that were cited, most were issues that the workshop staff could not address, as the participants rightly acknowledge. These problems were: (1) more time to develop lesson plans to accompany simulations; (2) convincing colleagues to uses the activities/materials in their labs; (3) gauging time it takes students to use TIPERs; and (4) funding for computers in the classrooms. A few participants wished for more funding for their physics program specifically to purchase Personal Response Systems. Another participant wondered if the workshop staff could provide a list of vendors that supplied "good clickers." Once again, one of the participants cited that he/she would find it most beneficial for the PIs to visit his/her campus to offer advice and support for change. With the TIP workshop, the participants seem comfortable with how they will implement what they have learned. One participant stated that he/she would have no difficulty implementing materials/activities from the workshop because: *"the workshops are designed to learn and practice new techniques. I would have had difficulty if I would not have been given time to learn new techniques and skills. Technology is difficult for me to grasp. The workshop was great because I had time to practice and become proficient in utilizing the new skills."*

Two of the eleven respondents on the Implementation Plans and Actions Questionnaire from the ISIP workshop did not have or anticipate any difficulty in implementation materials/activities in their classrooms. Two mentioned the need for funding to support the purchase of Personal Response Systems or computers for the classrooms. Two others anticipated resistance from students or their colleagues if they tried to implement new activities or instructional strategies. Several others cited time to prepare or plan implementation as their major challenge. A couple of participants noted that it would be helpful to have more information on and time to practice the discourse management, with one suggesting that Co-PI Desbien write an instruction book on discourse management and another recommending a video that captured just how he [Desbien] "did it." Several of the participants were highly complimentary of Desbien's efforts.

In summary, about one-third of the participants in these four workshops did not anticipate any barriers to implementing the workshop content in their classrooms. While this number is not as large as the previous year (~50%), this measure, along with the similar measure on the post-workshop evaluation, suggests that the participants leave the workshop enthusiastic about implementing new materials into their courses and confident that they can do so. It is significant that the participants maintain that commitment to implement what they learned in the workshop weeks or months, in some cases, later.

Student Assessments

Question: Will reform-based assessments be adopted?

A large fraction of the participants who responded to the query about implementation plans were already engaged in using or planning to use research-based assessments in physics. The Force Concept Inventory was the most frequently cited assessment instrument that the respondents planned to use. Table 8 below illustrates the number of respondents indicating a plan to use specific assessments. Note: Some respondents indicated plans to use multiple assessments. Two assessments, which the evaluator is unfamiliar with—FRT and ECCE—were listed by one participant as ones that he/she would use.

Table 8: Plans for Using Research-based and Other Assessments

		PBP	VICS	TIP	ISIP
Research-based assessments	FCI	3	5	6	7
	FCME	-	-	1	-
	TUG-K	-	-	-	1
	MBT	-	1	-	1
	CSEM/E&M	1	1	2	1
	DIRECT	-	-	-	1
	Energy Concept Inventory	-	-	1	-
	Ranking Tasks	2	4	6	9
	TIPERs	3	1	2	1
	Unspecified inventory/assessment	1	-	1	1
National Exams	AP Exams	-	-	-	-
	IB curriculum	-	-	-	1
Other	"Clicker" questions	-	-	2	1
	Physlets	-	1	-	-
	Lawson test	-	1	-	-
	No plans to use special assessments	5	4	-	-

After a second follow-up request, the response rate on the Implementation Plans and Actions Questionnaire was a disappointing fifty-five percent (55%). A third follow-up by regular mail to the PBP participants did not improve the yield and was not continued with the participants in the workshops that followed. One or two participants from each workshop did not have a valid email address at the time of the administration of this questionnaire. The response rate is similar to that of the participants in Year Two and better than that of participants attending workshops in Year One.

As noted in last year's evaluation report, the less than desirable response rate is likely due to several factors, the primary one being the participants' busy teaching schedules. Timing the delivery of the evaluation questionnaires is a challenge for the external evaluation given that once faculty return to their classrooms, the demands of teaching and home life are rightfully their highest priorities.

Section Four
Implementation of Workshop Content

Classroom Implementation AY 2008-2009

Question: What activities/resources were implemented in the participants' classrooms or teaching situations in AY 2008-2009?

Participants who attended the following ATE workshops were queried about their implementation efforts that occurred during the current academic year: New Faculty Training Conference (NFTC, March 2008); Tools for Introductory Physics (TIP, April 2008); Project-Based Physics (PBP, June 2008); Virtual Instruments and Control Systems (VICS, September 2008); and Tools for Introductory Physics (TIP, November 2008). The post-implementation questionnaire was not administered to the participants who attended the Instructional Strategies for Introductory Physics (ISIP, April 2009) since their implementation would likely not begin until the beginning of the 2009-2010 academic year.

The participants were asked the following questions:

1. *Describe or list one of the activities/materials from the [name of workshop] that you introduced to your students.*
2. *Did you encounter any particular challenges? How did you handle the challenge?*
3. *What did you learn from observing your students?*

Tables 9-13 illustrate the responses from the participants in these five workshops. Following each table participant additional participant comments about implementation are presented.

Table 9: Classroom Implementation—NFTC (March 2008)

Participant	Activities/materials implemented to date (May 2009)	What challenges did you encounter? What did you learn from observing your students?
1*	TIPERS	Challenge:" Some of the questions needed to be explained in better detail when I was doing the lecture." The questions were challenging for the students, and they were not comfortable at first until problem was solved and material was re-taught as much as possible. Made the students think twice before answering a problem and gave them more practice in problem solving.
2*	Activity-based teaching, computer-based labs, ranking tasks, motion diagrams, discourse management.	The challenge was having too many chapters to cover in a given semester. To overcome the challenge I carefully selected contents and applied activities and materials from the NFTC to this chapter and the topics. "I observed the student become more motivated and excited in student centered and activity based learning. Students also enjoy computer-aided labs. As a result, their understanding of the

		basic physics is better when I implement the activities and materials from NFTC. "
3*	White boards.	No challenge identified.
4*	Discourse management. Expanded on conference project on Introduction to Motion. TIPERS, and created some new TIPERS	By implementing a new way of interacting with students during the middle of a semester, there was some unfamiliarity with it. Implementing from the beginning helps students get used to it. It seems that students learn to do well in this type of discussion while others see it as an opportunity to discuss extracurricular activities.
5*	Exploratory labs, team work/whiteboard concepts, student misconceptions, lab journal and redesigned lab write-ups.	Students resisted the exploratory labs; they wanted to be told what to do. Addressed this challenge by using labs with less specific instructions for "stronger" groups. Allow "weaker" groups to do more explicit verification style labs until they are ready to make the transition. With teamwork/whiteboard, there are too many students and too many groups. To address this, I assign well-chosen problems and treat like a lab with 3 sessions per semester. We go more slowly, covering less. The lab journal was too cumbersome but included the idea of writing what was learned in both class and lab, required students to "stump the professor" with questions. Questions answered at the beginning of the next class. Regarding misconceptions, I am more keyed in on student misconceptions, particularly when I'm in a one-on-one dialogue. On the lab write-ups I allow students to rewrite the lab write-up to include more explicit instructions or tips. I learned that some students have weak math backgrounds, and they want to hide what they do not know. I need to mix strong and weak students in a group and control the groups. Students can confuse a measured quantity with a mathematical value. Students like to complain about a lab in a report. By switching the papers on questions and confusions, students get stronger at expressing themselves, and by letting students grade each other, they tend to be harsher than I would.
6*	Video analysis of projectile motion.	Challenge: getting file set up and finding a movie to use. Getting it all into the lab computers was challenging. To address this, I used the movie that came with LoggerPro and put it on each computer by hand. The students seemed to understand the independence of the horizontal and vertical motion more clearly than classes have in the past.
7*	PhET simulations. White Board activities (lab summaries and reviews). Ranking Tasks (gears, energy, impulse, momentum, fluids, electricity and magnetism). MBL labs: graphing, projectiles, Newton's 2nd, simple machines, impulse/momentum, calorimetry, ohms, magnetism, sound. Made a philosophy shift: "If they can DO IT, have them DO IT." Java applets: color, sandiot science, and optics. IP player and Interactive Physics.	Some students do not like working with computers. To address this, I often just talk with them and make sure they are comfortable using the software. When using a conceptual approach to teaching, students cannot just "glide", and they find this discomforting at first, but gentle persuasion and "willingness to do whatever it takes to make them feel comfortable" usually solves the problem. Learned a lot from observing students: they sometimes misinterpret situations for reasons I had not anticipated; students extend the activity often in creative ways, and open ended discussions can provide valuable feedback to their thought processes.
8*	Ranking Tasks.	There is a learning curve for students in how to approach the Ranking Tasks. Students usually don't think conceptually at all most of the time. They just try to make the numbers fit. By the end of the semester, they get better at it.
9*	"Dwain Desbien" style lab—students discover the concepts the lab covers with minimal guidance from instructor.	Challenge: Doing more rather than letting students discover the concept themselves. "Now I can usually sense when the students need a little guidance. I no longer feel like stepping in all the time. The students do find the right way, and I only need to help a little."
10*	MBL	No challenges. Realized that students enjoy doing these labs more than traditional labs.
11*	Motion graphs in lieu of kinematic equations.	No challenges. Most students don't appreciate the change because they don't know anything else, but students who have seen the kinematic equations find the technique easier and more revealing.
12*	MBL	It took some time to get used to the software. Noticed that students enjoyed doing computer labs.
13*	MBL labs, FCI-pre/post-test, CSEM pre/post-test,	Making the transition from a lecture format to an activity-

	TIPERS and Ranking Tasks, student projects from ICP21.	based format has been a challenge. Students get more engaged through active teaching and learning. "However, there is a population of students who seems to need more than activity-based teaching. I think it has to do with weak or none previous math and science education. I still have not figured out how to handle this student population, other than providing additional study materials, but I do not feel happy with this patch."
14*	MBL for projectile motion.	No challenges. "Unsurprisingly, students were enthusiastic about the lab. Surprisingly (to me), students were not fazed by the semi-improvised nature of the lab, nor did they slack off the analysis at the end of what was an unusually long lab. Their understanding of projectile motion seemed better than in previous years (though I didn't measure it rigorously)."
15*	Inspired by the ideas of active and peer learning, I designed activities to engage my students. Examples: activities on magnetic flux, induced current and induced emf.[10]	Challenging to convey what is meant by a physical model. Guided students by providing tangible examples of modeling and development of empirical formulas.
16*	MBL	Challenge: students just following lab procedure and not thinking about the physics. Addressed this by adding more questions. Students who do the lab reports more conscientiously seem to understand the physics better.

The sixteen (16) respondents (shown with *) indicated they would continue to use these activities with their students.

"I am likely to use more and more of these materials and activities in my future teaching career." [NFTC, March 2008]

One participant (#4) from the NFTC implemented a number of activities/material offered the following comments:

Discourse Management- "*I began to incorporate more opportunities for students to work together in small groups and then allowed them to come together in a larger, but still student-centered group. Previously, I would give some time for students to discuss something in pairs, but then come together for an instructor-led discussion. After attending the conference, I see the value in allowing students to be allowed to lead the discussion, and to question each other. I implemented this in my physical science (PHS 100) laboratory class during the Spring 2008 semester and also used it in my physical science 'lecture' class during the 2008-09 academic year. Side note: Perhaps someday, we will have integrated lecture and lab!*

I summarized and expanded work started at the March 2008 conference on 'Introduction to Motion.' This was a group project, with input from [Names of two participants]. *I put our work into electronic form and expanded, modified, and clarified it after the conference. I have not taught a physics course since my return from the conference (only physical science), I have not had a chance to implement this method in its entirety. However, I will be using the TIPERs and parts of the worksheets in my physical science classes this semester.*

[10] Participant #15 indicated that the activities he/she developed had the following objectives: (1) determine conditions under which a current can be induced in a coil not connected to a battery; (2) determine physical quantities that affect magnitude of the current; (3) use current sensor to explore the behavior of magnetic fields through solenoids; (4) develop physical model to describe interaction of magnetic field through a solenoid; (5) develop physical model to describe relationship between magnetic field and voltage; and (6) develop formula to describe relationship between voltage and magnetic fields.

I created a series of 8 TIPERs, specifically designed for my physical science course that will be implemented this semester. I included Qualitative Reasoning (QRT), What if anything is Wrong (WWT), Ranking (RT), and Comparison (CT) so that I could gain experience writing different forms of TIPERs. I will share these with all appropriate faculty in my department so that they can either use them as is or use them as a model for creating relevant tasks for their classes." [NFTC, March 2008]

For participant #7 on philosophy shift: *"I evaluate every learning opportunity and actively seek activities that students can DO, rather than listen. I still utilize conceptual questions within lectures via clickers. I anticipate the clicker questions remaining, but lectures replaced by activities."* [NFTC, March 2008]

"Still plan to use CASTLE kits and ICP 21, but not sure when I can buy." [NFTC, March 2008]

"College management puts too many students in labs and classroom. Major problem. Also need more help from lab techs." [NFTC, March 2008]

"I hope to develop a course that is entirely interactive (hands on activities, java applets, labs with LoggerPro equipment, etc. This would take me quite awhile, but at least I have a vision of where I want to go. There are still materials/approaches that we utilized in this project that I want to extend/utilize, etc. I have enough materials/resources to do what I want—just need time to develop and refine. I seek to implement 6-8 new activities each quarter." [NFTC, March 2008]

"I will not go back to the much-less effective lecture mode teaching." [NFTC, March 2008]

Table 10: Classroom Implementation—TIP Workshop (April 2008)

Participant	Activities/materials implemented to date (May 2009)	What challenges did you encounter? What did you learn from observing your students?
1	None. Plan to implement in future.	
2*	Video analyzes. Students brought their cameras to take video (flying bird, throwing a ball, bouncing ball) and analyzed using LoggerPro.	Trouble converting video to jpeg mode with this year's video; so used last year's video. Observed that my students thought learning can be fun. Will continue to use, but cannot make new videos with each new group of students each year.
3*	ICP 21, ranking tasks, and E&M Tipers	Difficulties with students using TIPERS. Students needed to realize that conceptual understanding was as important as plugging numbers into a formula. Students seemed to be more aware of their learning.
4*	Used modeling of the throw of an object as a second degree equation using digital video analysis in a calculus class. Used digital video analysis of projectile motion and homework based on PHET simulation in physics classes.	Challenges encountered: acquiring a digital video camera/web cameras and LoggerPro. Wrote a local grant to acquire them. Observed that students increased their understanding of topics and also learnt (sic) to use Microsoft Excel as a tool to model and graph math and physics concepts.
.5*	Video labs	Some students were reluctant to use the video camera and a quick survey of students allowed me to organize the groups where they could help one another. Once students had a good grasp of the technology, they had fun while learning. They were able to repeat the activity

		several times to improve their understanding.
6*	Microcomputer based labs.	It took some time to get used to the software. Students enjoyed using the computer to do physics labs.
7*	Ranking tasks.	The only challenge was finding ranking tasks that fit well with my curriculum. The task was a different type from what the students were used to. The ranking tasks promote conceptual understanding compared to plugging numbers into a formula and doing math.
8*	Ranking tasks. Video analysis in the college prep and AP physics courses.	With the ranking tasks there were no challenges. With the video analysis there were a few technical issues, capturing the video, getting students to think the right way, and having students make decisions about what graphs they needed to develop. We will continue to use these since they are very strong learning tools.
9*	Purchased cameras for students to use to create videos and use video analysis and LoggerPro. Implemented several ideas from Spiral Physics.	A college-wide IT department manages lab computers, and we encountered a few challenges (time and effort) to get them to do what we need. The students were excited and challenged by creating their own videos. Their understanding of physics increases when analyzing videos using LoggerPro. Using the Spiral Physics approach creates a deeper understanding of physics phenomena. Planning to expand and adapt these activities in an online physics class.
10*	PhET simulation building circuits—utilized with website with teaching complex circuits. Students built circuits, worked the math and validated answers with ammeter and voltmeter. They were able to practice placing meters into the circuit.	No challenges. Students were totally engaged. Utilizing multiple teaching strategies increases student engagement. Students were building circuits through CASTLE curriculum. Their enthusiasm had decreased. Excitement was rekindled through this approach. Increasing student engagement increases student learning which is what teaching is all about.
11*	Video motion studies. Introduced to teachers who are now using this in their classrooms.	No challenges. Observed that students adapt very well.
12	No. Plan to implement in the future.	
13	No. Plan to implement in the future.	
14*	Video analysis using web cameras and LoggerPro—one and two dimensional motion.	Learning the limitations of the camera is still a challenge. Used the web camera for slower motions and a better digital video camera for faster motions. Students were helpful with the technology. "They think it is cool to help the teacher." It inspires them to suggest different types of motion to use for the analysis.
15*	Some of the activities using LoggerPro.	Time was a challenge in implementing some of the activities. Also, could not implement some of the activities but I didn't understand them myself because there was too much material covered in the workshop and there was no solution provided. Biggest challenge was that my college didn't have all of the supplies. I observed students doing collaborative learning—they came up with their own experiments. Will continue to implement, but I need more workshops to get more comfortable with the material.

The twelve (12) respondents (shown with *) indicated they would continue to use these activities with their students. One participant commented as follows:

> *"My students have a better understanding of physics."* [TIP, April 2008]

Table 11: Classroom Implementation—PBP Workshop (June 2008)

Participant	Activities/materials implemented to date (May 2009)	What challenges did you encounter? What did you learn from observing your students?
1*	Using the Digital Video Analysis	No challenges. It was very straightforward because I incorporated the Logger program and Vernier equipment. Students were engaged and appeared happy.
2	None. Plan to implement in future.	
3	None. Plan to implement in future.	
4*	Using digital analysis with Vernier LabPro.	Time factor, and have not come to terms with that. Injury prevented instructor from doing more. The students were fascinated at the data we generated.
5*	Implemented the use of MBL.	No particular challenges. Realized the students enjoyed doing these activities better than traditional labs.

6*	Use of VPython in AP Physics.	Students' programming ability is lacking. I gave them enough time in class to get familiar with the program. Do not recall anything specific from the students.
7		
8*	Introduced mousetrap car project in an algebra-based physics lab.	The lab was taught by adjunct faculty who had little excitement for the project. Needed to insure that the focus on physics was maintained and that the effort didn't deteriorate into a crafts project. Was not totally successful on this matter-- with one adjunct who failed to require any kind of lab report. Students did peer assessment, but no substantive formal assessment. One adjunct faculty member observed that male students were aggressive initially with the female student initially "sat back." However, as time progressed, the female students became more active and in many cases steered the group to a good solution. In spite of the difficulty with assessment, the cars were successful and the goals of the project were met. On student mentioned, unprompted, that the project was fun, but there was not enough emphasis on the physics. Will return to teaching lab next semester and resolve the problem of proper assessment.
9*	VPython	Students were given initial instruction about how to use VPython, but were "lazy" about completing project. Some groups respond more readily to "figure-it-out-yourself" projects. Last year's students had more fun with this type project.
10*	Students constructed a simple electric guitar using lab materials.	Biggest challenge was with original concept of project—originally plan required too much fabrications. Once simplified, easy to implement. I was surprised by how challenged the students were by the activity.

The seven (7) respondents (shown with *) indicated they would continue to use these activities with their students.

Table 12: Classroom Implementation—VICS Workshop (September 2008)

Participant	Activities/materials implemented to date (May 2009)	What challenges did you encounter? What did you learn from observing your students?
1*	Ranking tasks.	Initial challenge: Students didn't like that I was grading the Ranking Tasks and it was difficult for them to get a perfect score. Addressed by giving more examples of how to do the tasks and grading more leniently. As time progressed, they began to appreciate them. I observed that students like to be challenged, but they need practice in order to respond positively. "If they don't know how to swim, you cannot just throw them into the water and learn from themselves. (sic) You still have to teach them various techniques on how to swim properly."
2	Plan to implement in the future.	
3	Do not plan to implement activities/materials from the workshop.	"In order to implement what I learned requires first a big investment to purchase the equipment and the software. If I will have the money to purchase the probes, the software, etc. I will consider using it with the students."
4	Plan to implement in the future.	"For me implantation was difficult because I was teaching 21 content hours during the spring. I still have plans to create a couple of labs directly related to what I saw at VICS.
5	Plan to implement in the future.	With colleague, applied for and received local funds to refurbish labs.
6	Do not plan to implement activities/materials from the workshop.	Although LabView is good software, it is unlikely that we will ever use it. Vernier is sufficient for our needs.
7*	SDAQ and DCU	Problems with the SDAQ and will not continue to use this. I liked it, but I could not run it properly. Using Lab Pro and DCU to do VICS.

The two (2) respondents (shown with *) indicated they would continue to use these activities with their students.

Table 13: Classroom Implementation—TIP Workshop (November 2008)

Participant	Activities/materials implemented to date (May 2009)	What challenges did you encounter? What did you learn from observing your students?
1*	PHET Simulations.	Initially we had mobile laptops for students to use. These stopped working; so I show simulations on my laptop and LCD projector. It will work better if students are able to work on the simulations themselves when (if) the laptops are fixed. Students enjoy learning using technology. The PHET simulation is something they look forward to doing in class. Every time they come to class, they would ask me if we're doing a PHET simulation. For my students, this is one of the highlights of physics.
2*	PhET simulations. White Board activities (lab summaries and reviews). Ranking Tasks (gears, energy, impulse, momentum, fluids, electricity and magnetism). MBL labs: graphing, projectiles, Newton's 2^{nd}, simple machines, impulse/momentum, calorimetry, ohms, magnetism, sound. Made a philosophy shift: "If they can DO IT, have them DO IT." Java applets: color, sandiot science, and optics. IP player and Interactive Physics.	Some students do not like working with computers. To address this, I often just talk with them and make sure they are comfortable using the software. When using a conceptual approach to teaching, students cannot just "glide", and they find this discomforting at first, but gentle persuasion and "willingness to do whatever it takes to make them feel comfortable" usually solves the problem. Learned a lot from observing students: they sometimes misinterpret situations for reasons I had not anticipated; students extend the activity often in creative ways, and open ended discussions can provide valuable feedback to their thought processes.
3*	TIPERS and PhET simulations. TIPER questions are posted and students work on the question in groups and using White Boards. Use on-line worksheets for the PhET simulations, and students work in groups.	No real challenges. TIPERS are straightforward and the PhET simulations are free on-line with worksheets. Observed that when students work in groups on the TIPERS, they are engaged and talking with one another towards solving the problem. Student mention that they like the PhET simulations and "play" at home with these as well.
4*	TIPERS.	No particular challenges. Initially, students needed some coaching with TIPERS, but by the second time, they needed very little help. While I used them as review items, initially, I will begin to incorporate them throughout the unit.
5*	PhET simulation—used website with teaching complex circuits.	No challenges. Students were totally engaged. Using the multiple teaching strategies keeps students engaged. They were able to build circuits through the CASTLE curriculum. The students enthusiasm had decreased, but excitement was rekindled through this approach.
6*	Clickers used with almost every lecture. Used PhET simulations for circuits lab and in lectures. Plan to implement TIPERS in Fall 2009.	No challenges. Both clickers and simulations improved student involvement in class.
7*	TIPERS	More of a challenge with my conceptual physics classes, but not with the advanced classes. Students are motivated to complete the activities accurately and are actively engaged in the discussions.
8*	Modeling using digital video analysis, PhET simulations.	Wrote a proposal for local funds to purchase video camera and LoggerPro software.
9*	Use I-clickers with ranking tasks.	No challenges. Students were very enthusiastic. They love to use the I-clickers with review.
10*	PhETs.	Challenges: Some students could manipulate the activity faster than others. Assigned students to small groups, making sure each group had one student who could use the software. Students interacted more with one another.
11*	PhET simulations and NTIPERS.	Challenge: Student resistance. In response to an NTIPER exercise, "one student moaned, 'these (NTIPERS) make us think and we don't like to think!'" I observed that students found the NTIPERS very difficult and they had trouble transferring what they learned from one activity/exercise to the next. The NTIPERS were not popular, but were highly effective in forcing some real thought and discussion as well as challenging students' preconceptions.

12*	PhET circuit construction, electric field hockey. Faraday's EM Lab, Newton's Laws Ranking Tasks, EM Ranking Tasks.	The real challenge was coaching students to the correct deduction. "I would like help with that." I learned that they had misconceptions that I really had no idea they possessed.

The twelve (12) respondents (shown with *) indicated they would continue to use these activities with their students. Examples of the participants' comments include:

"Increasing student engagement increases student learning which is what teaching is all about." [TIP, November 2008]

From participant #10: *"I would have used more of these activities in the physics classes this past semester if it were not for the class-time I lost from the ice storm. Our college was closed for almost two weeks because of the storm's damage. The way classes were made up made it difficult to implement the several TIP exercises that I prepared and intended to use."* [TIP, November 2008]

Measuring Success

Question: To what extent were the implementations successful?

When students are active as opposed to passive learners, the likelihood that they will improve their understanding of a particular concept is increased. The ATE/PPF workshops are designed to give participants a wide array of resources and experiences that, if implemented in their own classrooms, would result in students becoming more actively engaged in learning. The external evaluation queries participants about their observations of students' behavior when the new activities were implemented.

Questionnaire Item: *When I implemented activities/materials from the workshop into my classes, my students were more engaged in learning.* [Item 1d]

Participants responded as follows:

	Strongly Agree	Agree	Not Sure	Not Applicable
NFTC March 2008 N=16	5	7	4	-
TIP April 2008 N=15	7	6	-	2
PBP June 2008 N=10	4	1	1	4
VICS September 2008 N=7	1	2	1	3
TIP November 2008 N=12	8	3	1	-

To secure a slightly different view of how the participants regarded their implementation efforts, they were asked to directly rate the extent to which they thought the implementation was successful. The results are illustrated in Table 14.

Table 14: Level of Success in Implementing Workshop Content

	Percentage of respondents indicating that the implementation of the new activity was "very successful"					
	NFTC N=16	TIP April 2008 N=11	PBP N=7	VICS N=2	TIP Nov 2008 N=12	All Workshops N=48
New activity encouraged students to be more engaged than previous activity [Item 7a]	37.5%	81.8%	28.6%	0%	91.7%	58.3%
New activity addressed physics content at a level appropriate to students' background, knowledge and skills [Item 7b]	56.3%	90.9%	42.9%	0%	66.7%	62.5%

Student Assessments

Each workshop allocated time to discuss the wide array of assessments that can be used for securing information about student learning. Participants were also asked about the value of the student assessments they used to evaluate the effectiveness of the activity they implemented. Table 15 illustrates how the respondents regarded the value of the student assessment(s) that they used.

Table 15: Profile of Responses on Value of Student Assessments

	Very Successful	Moderately Successful	Slightly Successful	Not at all Successful
Student assessment that was used provided the formative feedback I needed (N=21) [Item 7c]	53.3%	46.7%	0%	0%
Student assessment that was used suggests that this new activity helps students learn the specific concept better than previous activity (N=21) [Item 7d]	72.4%	27.6%	0%	0%

Approximately half of the participants gave "no response" or "not applicable" as their response to this question indicating that many of them did not use the research-based assessments to secure information on student performance.

Participants were asked about the extent to which they agreed with the following statement.

"When I implemented formative student assessments with a particular learning activity, the assessment provided me with valuable information about my students' learning prior to major tests." [Item 1f]

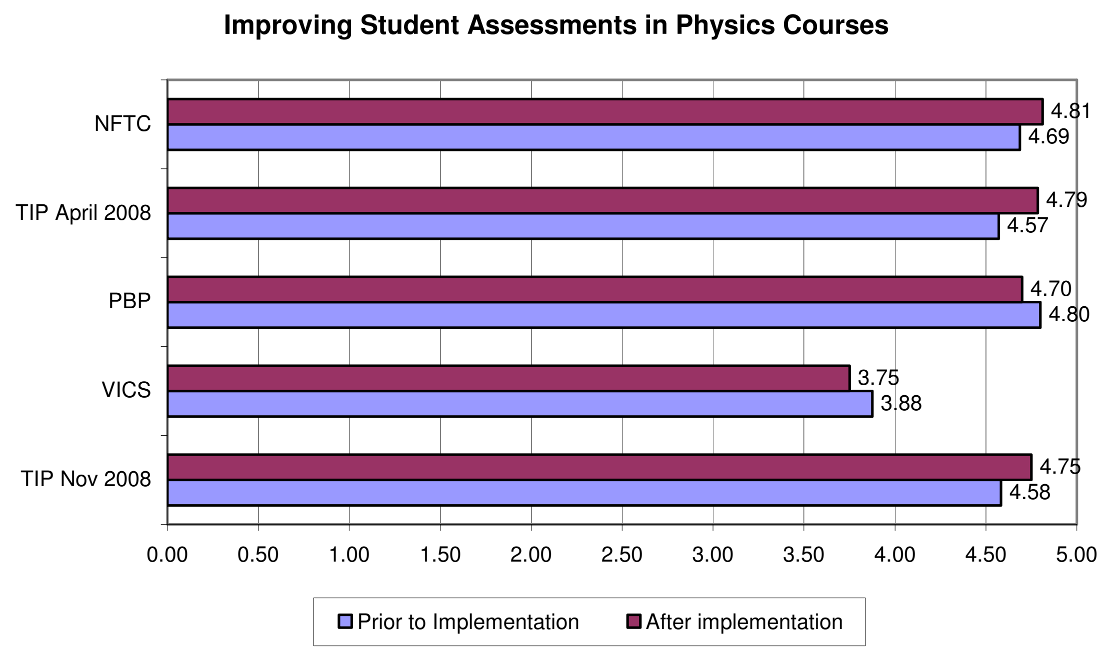
Participants responded as follows:

	Strongly Agree	Agree	Not Sure	Disagree	Strongly Disagree	Not Applicable/ No Response
NFTC	5	3	3	0	0	5
TIP (Apr 2008)	5	1	1	1	0	7
PBP	2	0	0	1	0	7
VICS	1	1	2	0	0	3
TIP (Nov 2008)	8	2	0	0	0	2

Participants were asked on two occasions to rate the extent to which the workshops stimulated them to improve the student assessments that they use in their courses. Specifically, they were asked to rate on a 5-point scale, where "5" indicated "Strongly Agree," the extent to which they agreed with the following statement:

The workshop stimulated me to think about ways I can improve student assessments that I use in my physics courses.

Chart 4: Effect of Workshops on Encouraging Changes in Student Assessments



Note: Chart illustrates results from paired samples of respondents on post-workshop and post-implementation questionnaires. N =16, NFTC; N=14, TIP April 2008; N=10, PBP; N=8, VICS; and N=12, TIP Nov 2008. .

Ranking Tasks and TIPERs are the most frequently cited assessment that participants use or plan to use in their classes. The ease with which these can be integrated into classes is the likely reason for their popularity.

The FCI, as a research-based assessment, is cited as the most frequently used. The queries about what participants learned from using student assessments were not sufficiently refined to establish a clear sense of how the research-based assessments such as the FCI are used or the details of what the instructor learned from the assessment.

Maintaining a Commitment to Change

Question: Is there evidence that participants maintained their motivation to change classroom practices?

The ATE/PPF workshops, from all indications, appear to have an extremely positive influence on the participants. On two occasions[11] participants were asked about the workshop's effect on their enthusiasm for teaching.

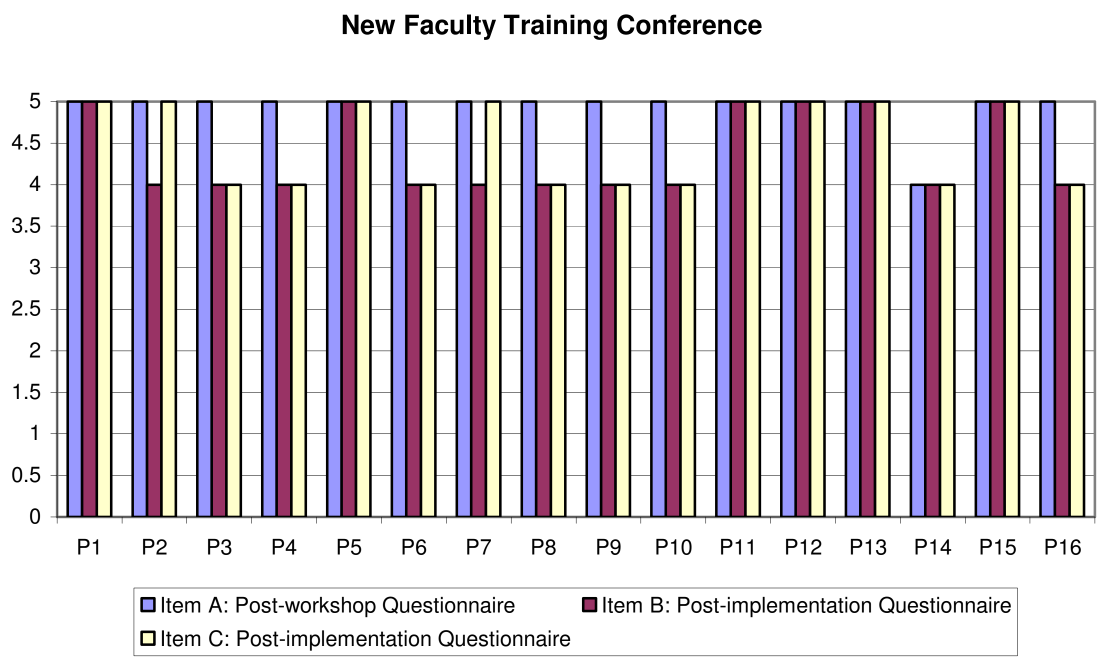
Specifically, the teachers were asked to rate the extent to which they agree or disagree with the following statements:

Post-Workshop Questionnaire (at the workshop's closure)	*The workshop increased my enthusiasm for teaching.* [Item 1a]
Post-Implementation Questionnaire	*Attending the workshop increased my enthusiasm for teaching.* [Item 1a]
Post-Implementation Questionnaire (May 2009)	*Implementing activities/materials from the workshop increased my enthusiasm for teaching.* [Item 1c]

Chart 5A-D illustrates the strength of the ratings[12] when teachers (paired sample) were asked these questions. Both attending the workshop and the act of implementing workshop content into classes seem to have a positive effect on the participants' enthusiasm for teaching.

[11] Post-Workshop Questionnaire and Post-Implementation Questionnaire.
[12] Once again this was a 5-point rating scale, where "1" indicated "Strongly Disagree" and "5" indicated "Strongly Agree."

Chart 5A: Effect of Workshops and Follow-up Implementation on Participants' Enthusiasm for Teaching



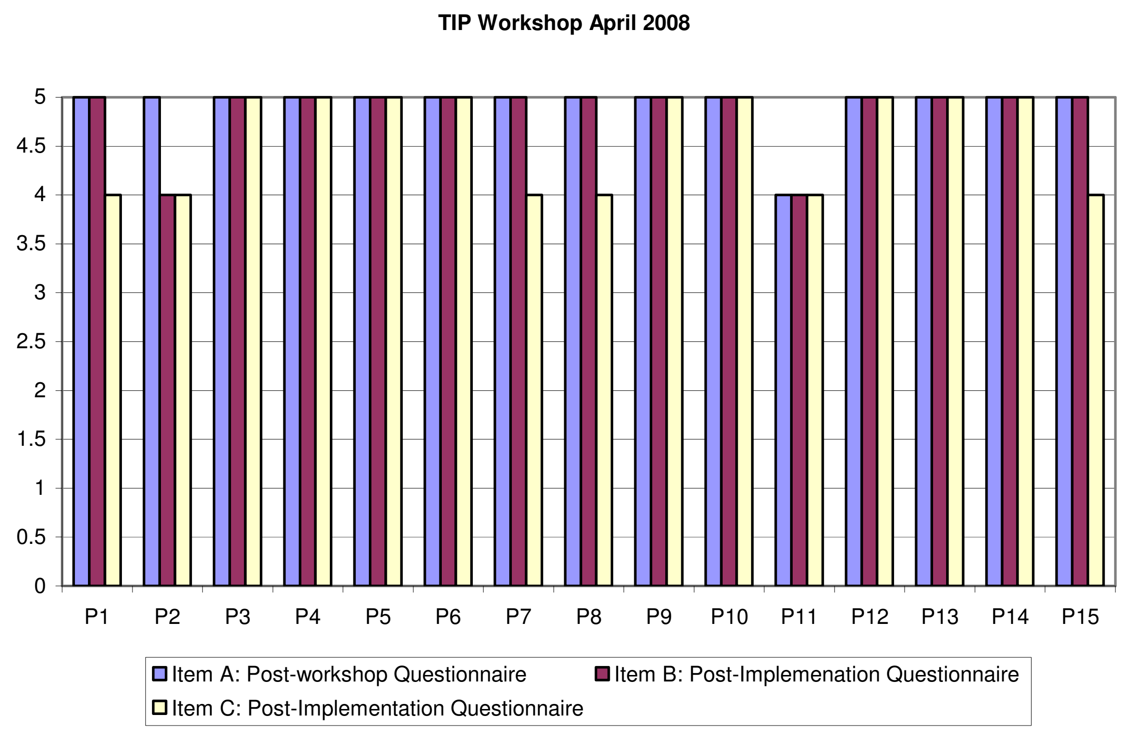
Key:

Item A: The workshop increased my enthusiasm for teaching. (Post-workshop Questionnaire

Item B: Attending the workshop increased my enthusiasm for teaching. (Post-implementation Questionnaire)

Item C: Implementing activities/materials form the workshop increased my enthusiasm for teaching. (Post-implementation Questionnaire)

Chart 5B: Effect of Workshops and Follow-up Implementation on Participants' Enthusiasm for Teaching



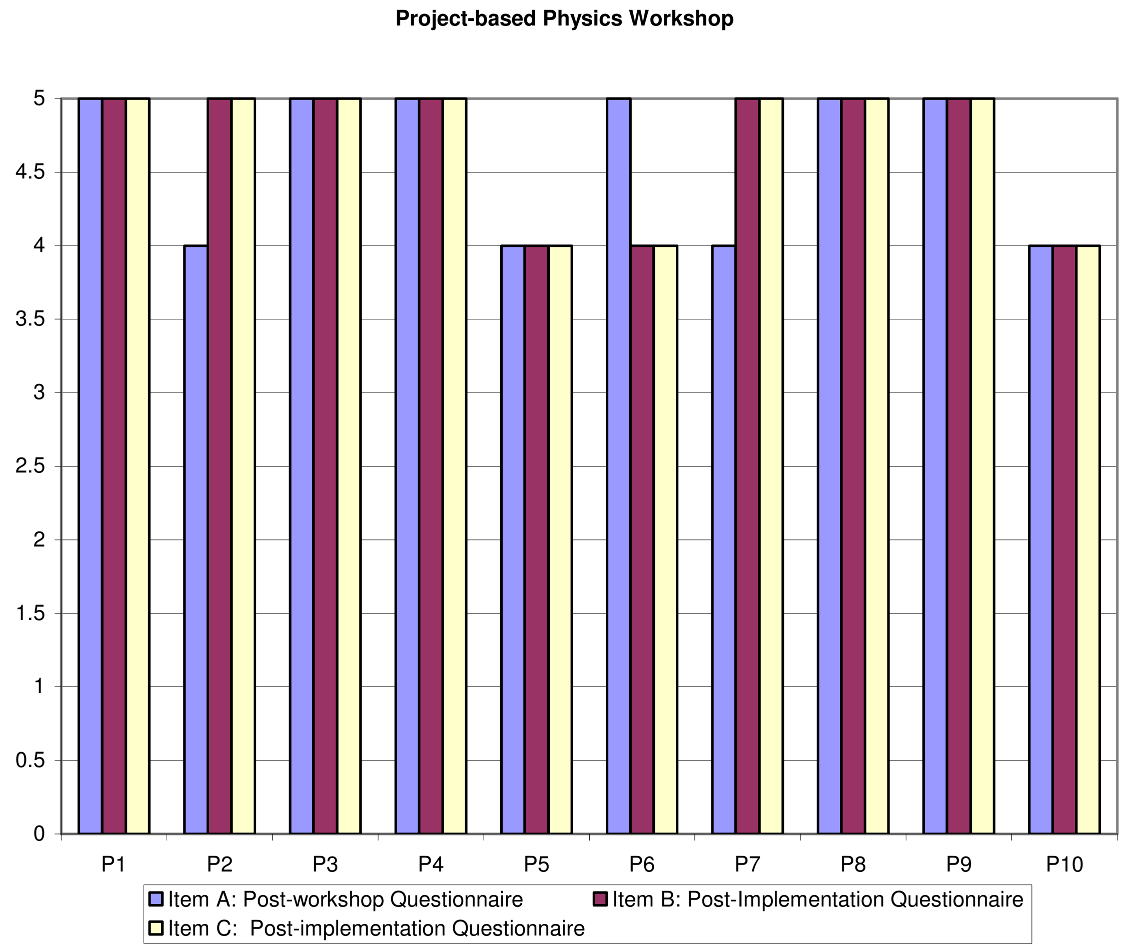
Key:

Item A: The workshop increased my enthusiasm for teaching. (Post-workshop Questionnaire

Item B: Attending the workshop increased my enthusiasm for teaching. (Post-implementation Questionnaire)

Item C: Implementing activities/materials form the workshop increased my enthusiasm for teaching. (Post-implementation Questionnaire)

Chart 5C: Effect of Workshops and Follow-up Implementation on Participants' Enthusiasm for Teaching



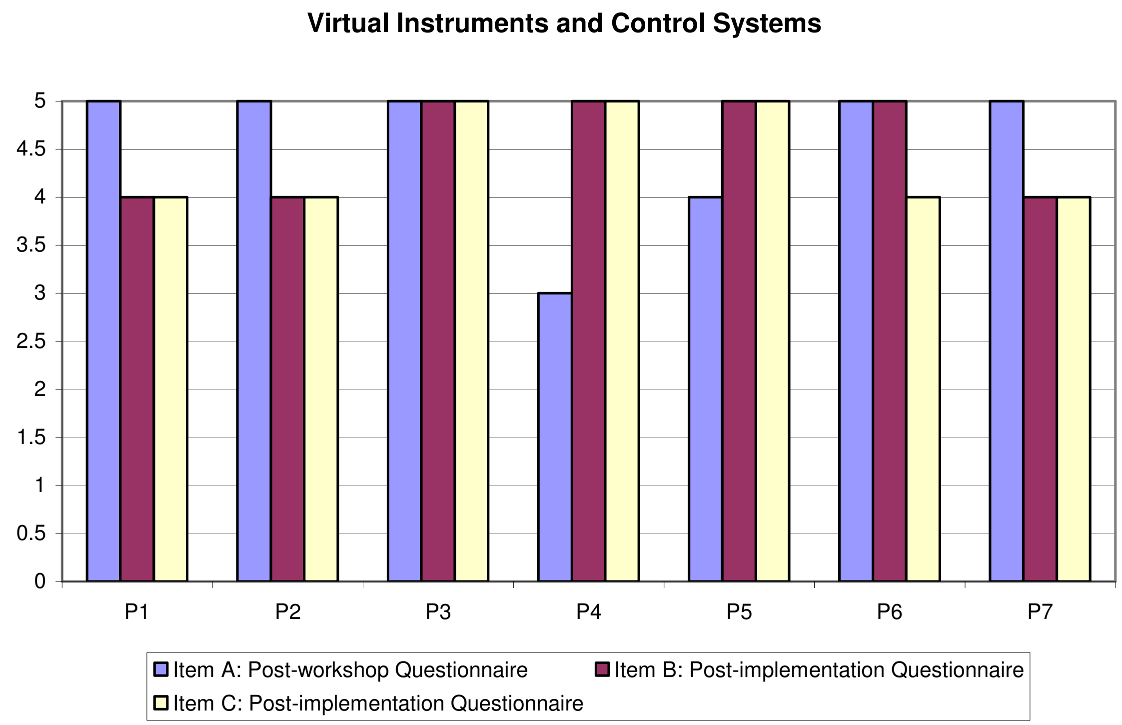
Key:

Item A: The workshop increased my enthusiasm for teaching. (Post-workshop Questionnaire

Item B: Attending the workshop increased my enthusiasm for teaching. (Post-implementation Questionnaire)

Item C: Implementing activities/materials form the workshop increased my enthusiasm for teaching. (Post-implementation Questionnaire)

Chart 5D: Effect of Workshops and Follow-up Implementation on Participants' Enthusiasm for Teaching



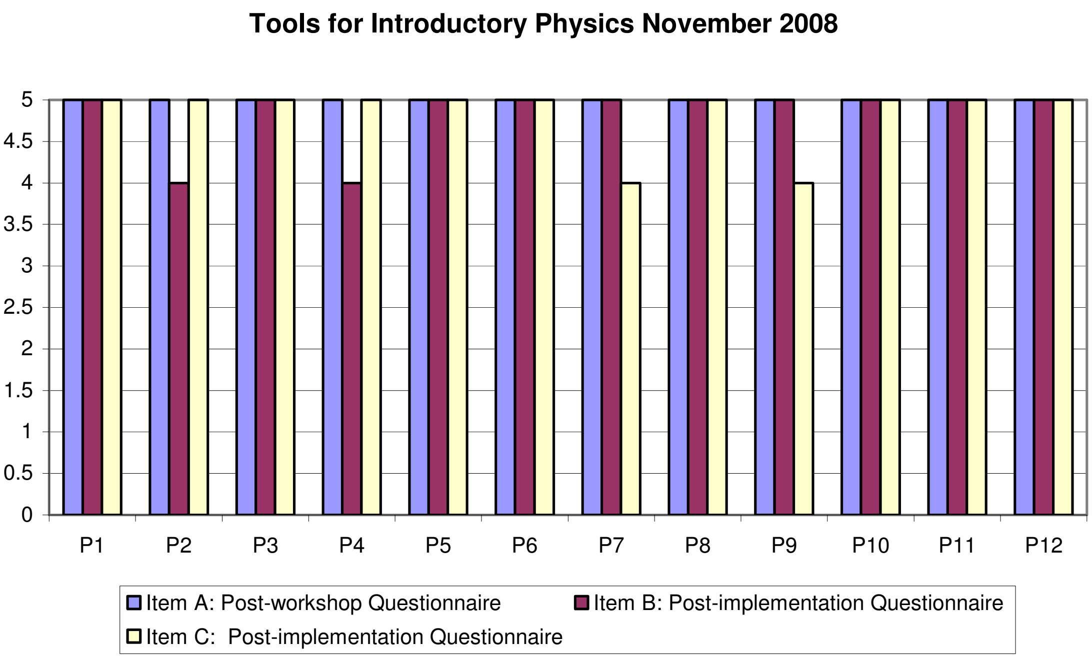
Key:

Item A: The workshop increased my enthusiasm for teaching. (Post-workshop Questionnaire

Item B: Attending the workshop increased my enthusiasm for teaching. (Post-implementation Questionnaire)

Item C: Implementing activities/materials form the workshop increased my enthusiasm for teaching. (Post-implementation Questionnaire)

Chart 5E: Effect of Workshops and Follow-up Implementation on Participants' Enthusiasm for Teaching



Key:

Item A: The workshop increased my enthusiasm for teaching. (Post-workshop Questionnaire

Item B: Attending the workshop increased my enthusiasm for teaching. (Post-implementation Questionnaire)

Item C: Implementing activities/materials form the workshop increased my enthusiasm for teaching. (Post-implementation Questionnaire)

On the same two occasions participants were asked about the influence the ATE/PPF workshops had on their continued interest in attending professional development workshops. In their responses on the Post-workshop Questionnaire, immediately following the workshop, participants from each workshop were left with a favorable impression about *continuing to seek out professional development opportunities*. Seventy percent (70%) of the NFTC participants (N=30), over eighty-eight percent per cent (88.9%) of the TIP-April 2008 participants (N=27), seventy per cent (70%) of the PBP participants (N=20), over eighty percent (81.3%) of the VICS participants (N=16), and over ninety-five per cent (95.5%) of the TIP-November 2008 participants (N=22) "Strongly Agreed" that they planned to continue active involvement in professional development workshops.

Some months later on the Post-Implementation Questionnaire, participants were asked to rate the extent to which they agreed with the following statement: *"Attending the workshop and implementing new activities/materials in my classes has increased my interest to continue participating in professional development workshops."*

Respondents continue to give good marks to the workshops along this measure with ratings of over:

- eighty per cent of the participants (81.3%) for NFTC (N=16);
- ninety per cent of the participants (92.3%) for TIP-April 2008 (N=13);
- seventy-five percent of the participants (77.8%) for PBP (N=9);
- sixty-five percent of the participants (66.7%) for VICS (N=6); and
- ninety per cent of the participants (91.7%) for TIP-November 2008

indicating that they "Strongly Agree" with the statement.

Section V
Participant Comments

As with workshops reported in previous years, the participants in the 2008-2009 workshops offer glowing comments and thoughtful commentary about their experiences in the ATE/PPF workshops.

New Faculty Training Conference

"Again, the time factor was problematic for me. Either the days needed to be longer for the workshop or some of the material needed to be lessened." [NFTC, March 2008]

"Thanks." [NFTC, March 2008]

"The students are definitely more engaged than in conventional lecture classes. The best students do well regardless of an activity. I think what happens with more average students is that some benefit from activity A while others benefit from activity B. I think there is created a better "espirit de corps" within the class. I plan to continue these activities as I have done – a little bit of this and a little bit of that. Keeps the class more interesting. The NFTC was very invigorating. Very dense in information, no wasted time, very relevant, fun, high concentration of Physics profs and their views in a very short time. Keeps everyone on their toes without getting bored and before controversies can arise." [NFTC, March 2008]

"The only improvement I would like to see is for conferences to be scheduled on semester breaks, so that I don't have to cancel classes to attend. This usually isn't too much of a problem, though." [NFTC, March 2008]

"I enjoyed the enthusiasm shown by our facilitators for promoting active learning in the classroom. I feel that their demonstrations gave me a better sense of how achieve the goals of my activities." (sic) [NFTC, March 2008]

"The conference has changed the way I look at teaching physics. I have not been able to implement all of the ideas I have. Some of the problems of implementation have been due to finances, but the others are just going to take time to figure out how everything will work for me. I am certain my classes 5 years from now will be quite different than those from 5 years ago." [NFTC, March 2008]

"I think NFTC and Project Based workshops were very helpful as they introduced me to other active learning techniques for teaching physics." [NFTC, March 2008]

"I learned a lot at this workshop, I think it is very worthwhile for anyone interested in physics education. As an instructor I always want to be applying the best and most modern techniques in education and this conference is designed just for that." [NFTC, March 2008]

"Tom, Dwain and Collaborators: keep up the good work!!" [NFTC, March 2008]

"The workshop was extremely beneficial in allowing me to develop as a teacher. It made me aware of effective teaching techniques that I now incorporate as often as possible." [NFTC, March 2008]

"The workshop increased my enthusiasm for teaching. The results of the new activity also depend on the motivation of the students to study physics." [NFTC, March 2008]

<u>Tools in Introductory Physics</u>

"The workshop and its content is very humbling because of the lack of physics skills and knowledge or should I say understanding of the subject matter. I rate it a 4 because of the interactions I observed from all participants. Also, as an "outsider" I feel that the participants knew my weakness and they accommodated me by making me feel encouraged to stay and absorb more. I feel smarter than the next non-physics science person in my own school community, yet I will not hesitate to give a presentation with a certain amount of uncertainty, realizing that it is alright to make a mistake. The formative assessment of "How do you know?" is a very rewarding tool to have as a teacher." [TIP, April 2008]

"Excellent workshops, excellent staff." [TIP, April 2008]

"The two workshops I attended have benefited not only me as an instructor, but also other adjunct faculty in my department. These workshops have helped me to become a better physics teacher and in the process increased my reputation in the college." [TIP, April 2008]

"I encourage all instructors to talk to, to take the opportunity to participate in these workshops." [TIP, April 2008]

"I learned a lot at this workshop. I think it is very worthwhile for anyone interested in physics education. As an instructor I always want to be applying the best and most modern techniques in education and this conference is designed just for that." [TIP, April 2008]

"From the workshop I got lots of new ideas that I was able to implement in my classroom. Also the opportunity to interact with other physics teachers was extremely motivating for me." [TIP, April 2008]

"This was one of the best professional workshops I've ever attended. I would like to go to more, so I hope they continue. The biggest question is if our district would help finance

the trip. I tell all my physics colleagues about this workshop and all the others they do." [TIP, April 2008]

"This is the one of the best workshops I ever attended. It was extremely well organized, highly informative, hard working and fun at the same time. Keep it up." [TIP, April 2008]

"The workshop added innovate instructional strategies to my teaching resource bag. Thanks for providing this opportunity." [TIP, April 2008]

"I broke my kneecap shortly after the course so was not able to plan any activity during the summer using the projects. In fact, although I recovered during the school year, my mobility and energy were limited. However, I intend to use the material and ideas I received next year. These courses really sharpen my interest in teaching physics. Thank you, Dwain and Tom and also Lee." [TIP, April 2008]

"I always enjoy the workshops put on by Dr. Okuma. This one in particular was most helpful because I learned many new things, not just one. The questions above only ask for feedback from one activity. I have actually implemented spiral physics some also. Dr. Desbien was very inspirational also. Their enthusiasm is contagious." [TIP, April 2008]

"I would love to attend more of these workshops. Please send me all the necessary information. Thanks to all of you for your effort and please continue with your valuable work providing these tools for us, because not only do new teachers need these new interventions, but all the instructors need to be updated as well." [TIP, April 2008]

Project-Based Physics

"I believe we need more of these workshop, not only like this one but like the other ones being offered. They give me new tool, new ways, and new strategies to learn and apply. But just, pleased, the timeframe needs to be extended or the material covered lessened." (sic) [PBP, June 2008]

"I received the materials from the PBP workshop very late, after the beginning of 2009 school year and at the high school is relatively difficult to implement major changes during the school year. Also my supervisor is stirring the science teachers more and more towards common tests/quizzes and common midterm/finals. This issue kind of takes away the freedom I had to do and implement different non-traditional pedagogical instructional techniques that I learn about, like PBP. I have to do similar to what my colleagues are doing. I really liked the workshop and the idea overall, maybe I'll try implementing PBP at the college level." [PBP, June 2008]

"I have been unable to implement activities due to lack of students. Since attending these workshops, an honors physics class has been approved at my institution, I was supposed

to teach it using the materials from the workshops, however, only two students signed up for the class. I intend to suggest offering the class again either spring or fall 2010. Due to shortage of faculty, it is not possible to offer this fall." [PBP, June 2008]

"I find these workshops really stretch me and enable me to come away with new material." [PBP, June 2008]

"I think NFTC and Project Based workshops were very helpful as they introduced me to other active learning techniques for teaching physics." [PBP, June 2008]

"The workshop kept me the busiest I have ever been. As a result, I learned a lot. I came away with several ideas. My implementation of what I learned was limited. Partly because I was waiting on the resource CD for the workshop materials. The other reason is I did feel like I knew enough about project based physics." (sic) [PBP, June 2008]

"The two workshops that I attended [June 2008 & September 2008] were absolutely the best run and conformed to the published agenda I have ever attended. Even the attendees were fun, excited about physics, and just good companions. I highly approve of how the budget was dispersed—the accommodations and food were adequate, safe, fun, and locally owned. The workshop leaders were there with us all the time and even sponsored an after hours get-together, which allowed some time to chat. This time provided the nexus between the education and the implementation. My institution is no different in general from the others.

The physics information was also fully applicable to our institution to make a major readjustment in our physics department on what is needed now and in the future. Reinforcement that our physics department is headed in the appropriate didactic direction was what I personally needed. Due to this workshop I applied for a NSF sponsored position to attend the APS meeting in Pittsburgh in March 2009 for women in physics special day. Steps in the VIC program were being used at well known institutions of the women attendees. The process of getting on another airplane to camp out at a hotel, even fully funded, is not my idea of fun. However, the information gained and the positive reinforcement of my professional life at STCC made the travel misery a minor issue.

Positive from the college--Our transportation cost and release from classes for the fall workshop were not a problem. As a result my colleague Beth & I applied for a national computer purchase grant to refurbish our labs and some local college funds. The modest college funds [~$2k was appropriated]; the major national grant, denied. Wait until next time! The college supported those endeavors. We two plus the other woman from Engineering Transfer Department [Name] will continue to apply for funding to upgrade our labs.

A problem to overcome at our institution--one problem for implementation is that the administration does not want to change fundamentals of advertising. We cannot even adjust our course descriptions to fit modern ones. It is the course description that is the *contract between the student and the faculty member. The competence of the adjuncts is spotty. The good ones are not a problem; the poor ones who do not follow protocol are difficult to replace, for various reasons. Our institution is reimbursed by the Commonwealth of Massachusetts on a capitation basis. Removal of non-qualified students through our Continuing Education Division is impossible at this moment. That issue of poor adjuncts is being addressed by us, the two faculty members. Some of the workshop information cannot be implemented due to the inertia of our system. I have asked three times in writing to present the workshop material in an abbreviated format to MSET. Each time my request is denied. I plan to present it next fall at a STCC professional development day.*

If a comparison is to be made between the two workshops—the June workshop introduced me to the MAC, which I did not like as I was unfamiliar with it. My lab partner did the computer part while I did the instructional component. My partner Beth McGinnis-Cavanaugh introduced that material [the cart] into her mechanics course work. The fact that I was witness to the project made it ever clear that our mechanics courses both trig based and calculus based should incorporate the project based learning. The cart project was an easy step. You will need to see her evaluation. Maybe next time we'll send the Dean.

The second workshop was more applicable to my skills in circuitry and E&M courses, a personal differential not a reflection of the instruction. That part was really fun and productive. To implement this material, we need computers in the lab and a link up with the Engineering Transfer Department in MSET and the Electronics Department in the School of Technology.

The one outstanding highlight of attending these two workshops is that an elder, tenured, grouchy, PhD can rethink the direction of the physics department and begin to have fun with the labs again.

I thank the NSF for funding this project." [PBP, June 2008 and VICS, September 2008]

"I am pushing for a complete revamping of our introductory physics course, both in structure and in content, with the goal of going to a problem- and/or project-based course. This would mean a complete integration of what I've learned in both workshops that I've attended thru this grant project (this workshop and the Lee College workshop, November 2008) and would entail using materials such as nTipers and simulations, as well as projects like the mousetrap car. Strategies learned elsewhere would also be incorporated, and a true compilation of approaches will have to be tested, sorted, and assessed to see what fosters a deep learning and understanding of the concepts being taught. All of this is very challenging, exciting, and extremely necessary, as it is clear to me now that the lecture/lab method of teaching is not serving our students well." [PBP, June 2008]

"The workshop was certainly beneficial. Getting to the "physics" with VPython requires lots of time." [PBP, June 2008]

Virtual Instruments and Control Systems

"I fell that although the workshop was excellent, it was to compacted and busy for the participants to grasp all the material presented. I wish that next time either the timeframe will be expanded or the materials will be shortened." [VICS, September 2008]

"The workshop was technological very narrow. …It seems more feasible to get accomplished at the college level because of the knowledge and maturity of students. Also, at the college, usually there is a lab technician that maintains the equipment and offer support to students. Overall the workshop was really great; it enriched my knowledge of what and how you can use modern technology in performing physics experiments." [VICS, September 2008]

"It was a great workshop and I have passed a lot of the information on to our Wind Energy Tech guy who was familiar with the program that we learned. He and I haven't had time to get together to work on some data acquisition based labs but we are thinking about it during this summer. I already use a number of the "physics education" techniques so their implementation wasn't really new." [VICS, September 2008]

"This was a very good workshop. Ken, Tom, Dwain, and Dave did an EXCELLENT JOB with the workshop. I learned a lot. I will continue to attend ATE workshops. They are the most useful workshops that I have ever attended." [VICS, September 2008]

Tools for Introductory Physics

"This is one workshop where I learned so much activities which I can employ in my classes. (sic) The activities are applicable to both TYC and HS physics teachers. The country should support workshops like these." [TIP, November 2008]

"The workshop overall was very prolific in terms of knowledge gained, materials provided, discussions and sharing with other participants. Looking forward attending more like this. think how to integrate simulations into lesson plans needs work. (sic) I would like to hear much more about using TIPERS to do all the teaching, including the introduction of new units." [TIP, November 2008]

"The workshop added innovate instructional strategies to my teaching resource bag. (sic) Thanks for providing this opportunity." [TIP, November 2008]

"The TIP workshop stands as one of the most useful workshops I have attended to date! The two workshops I attended have benefited not only me as an instructor, but also other adjunct faculty in my department. These workshops have helped me to become a better physics teacher and in the process increased my reputation in the college." [TIP, November 2008]

"This was an excellent workshop. It has helped me so much. I'm planning to implement more from this and other workshops in upcoming semesters." [TIP, November 2008]

"Loved this workshop, and found it extremely challenging to the point of being a "confidence buster", but that really served me well in two ways. First, it made me feel like a student again, which makes me a bit more sensitive to my own students on a number of levels; second, it made me rethink and relearn some physics on which I obviously needed some brushing up. The workshop was, quite frankly, a humbling experience in that regard, but that made it a true learning experience, which, certainly, was the goal of all involved." [TIP, November 2008]

"I really enjoy learning new ideas and practicing them in the workshop so using them when I get home is MUCH easier. I found this workshop extremely pertinent and readily applicable." [TIP, November 2008]

Section Six
Evaluator Commentary

In the third year of the ATE/PPF project, the evidence suggests that the exemplary work of the PIs and workshop leaders continued. Participants, in both their qualitative and quantitative assessments, regard the workshops as excellent in content and pedagogy. Most of the participants also rate the overall professional development experience as excellent. While the content from two of this year's workshops proved to be more challenging to implement in some high school and college classrooms, participants in all of the workshops acknowledge that they learn a lot at these intensive workshops.

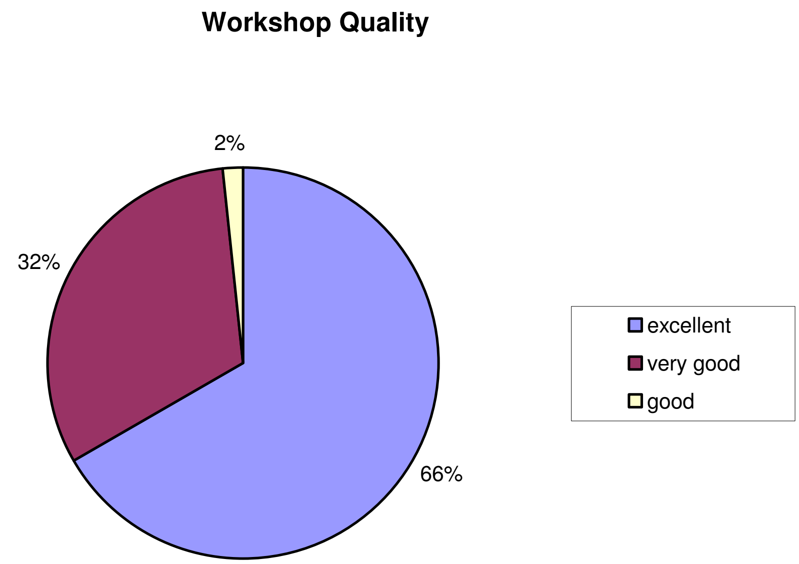
The evaluator concurs with the participants' judgment and commends the PIs and the workshop leaders on the standard of excellence they have established for physics workshops.

By focusing each workshop on integrating technology and by modeling instructional practices that are regarded as effective in promoting student learning, the PIs and workshop leaders have not only met but exceeded the intent of discipline-based workshops for ATE projects.

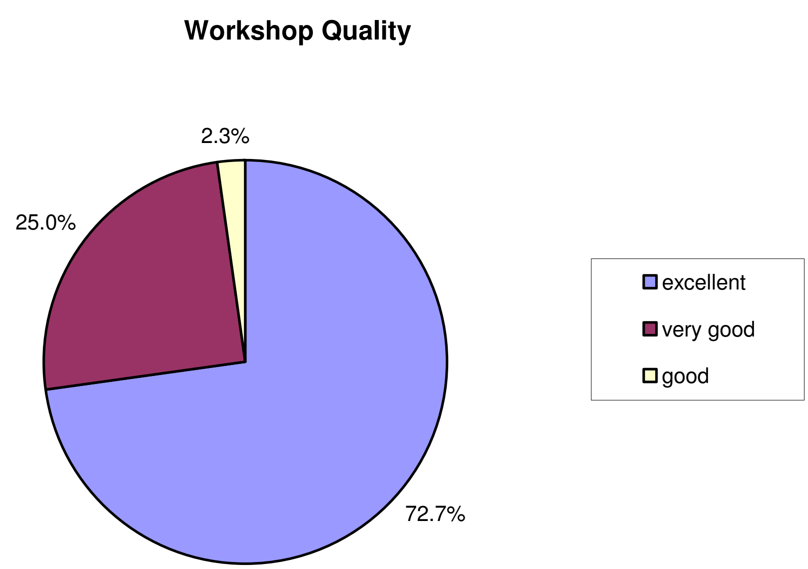
The NFTC, TIP (April 2008), PBP, VICS, and TIP (November 2008) participants were asked to rate the quality of the workshop they attended on the Post-Implementation Questionnaire. While the response rate was modest (N=60), two-thirds of these participants regarded the workshops as "excellent." The fraction of participants offering this rating is lower than the number for the workshops in Year Two, which was almost three-fourths of the participants (73.5%).

However, note that first graphic includes the participants from the NFTC, which differed in its intent, but was similar in its organization for the on-site work. The NFTC participants were all relatively new faculty members at two-year colleges, while at the other ATE/PPF workshops participants were a mix of experienced and relatively new instructors from both high schools and two-year colleges. When the NFTC participants' ratings are removed from the data set, the rating of the overall quality of the workshops is essentially the same as the rating given by the participants at the workshops in Year Two. (See second graphic)

Rating of Overall Workshop Quality from Participants in NFTC,
TIP (April 2008), PBP, VICS, and TIP (November 2008) N=60



Rating of Overall Workshop Quality from Participants in TIP (April 2008),
PBP, VICS, and TIP (November 2008) N=44



At the time of the writing of this evaluation report, most of the work of the project has been accomplished, with the exception of the work for the NFTC participants, who will meet for a commencement conference workshop for two days at the 2009 Summer Meeting of the American Association of Physics Teachers. Six of the NFTC participants are presenting papers at this meeting about their experiences in implementing what they learned at the conference into their classes. One of these papers focuses exclusively on teaching students in technical classes.

In summary, the ATE/PPF workshops are an excellent model of what can be accomplished in professional development workshops when you have the right people working with motivated and dedicated teachers engaging in content-rich and technology-driven physics experiences. Participants in these workshops have commented about their continuing need for high quality workshops from experienced physics faculty members periodically. The ATE/PPF workshops not only met the desired outcomes of the NSF ATE program, they also measured up to the participants standards of excellence. No recommendations need to be offered as this project draws to a close.