ATE/PPE Project Evaluation
Report on 2012 Workshops

NSF Award 0603271

Submitted
April 2013

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Table of Contents

Background

The Advanced Technological Education Program for Physics Education (ATE/PPE) is a program for two-year colleges and is supported by the National Science Foundation. The program focuses on the education of technicians for the high-technology fields that drive our nation's economy and involves partnerships between academic institutions and employers to promote improvement in the education of science and engineering technicians at the undergraduate and secondary school levels.[1] The goal of the project is to help high school and two-year college students develop a stronger understanding of science, with an emphasis on physics and its applications in industry.[2] Participants were offered graduate credit in physics at a reduced cost of $60 for the workshop through the University of Dallas. The ATE/PPE program is directed by Thomas O'Kuma and Dwain Desbien and supports professional development of college faculty and secondary school teachers by providing workshops focused on integrating technology into the classroom.

Participants for the 2012 workshops were recruited using a variety of methods including mailings, list serves, and word of mouth from previous attendees. Applicants were expected to provide statements indicating their interest in the workshop and the expected impact on their classroom teaching practice. Participants were encouraged to bring more than one member from their school or institution to extend the influence/impact of the program. However, individuals were not excluded from participating if they did not have a team attending. Participants were also encouraged to apply for more than one content workshop allowing them to experience multiple areas of technological applications for their classroom. Information for the workshops was posted on the website http://physicsworkshops.org/.

The purpose of this report is to summarize findings of the ATE/PPE project in 2012. During this time period there were three workshops conducted at sites across the nation including Mt. San

[1] Program Solicitation NSF 07-530, National Science Foundation, Directorate for Education & Human Resources, Division of Undergraduate Education, Research on Learning in Formal and Informal Settings

[2] Workshop Information, ATE Project for Physics Faculty. http://physicsworkshops.org/.

Antonio College in Walnut, CA, Bismarck State College in Bismarck, ND, Lee College in Baytown, TX

Each workshop focused on different aspects of technology tools appropriate for a classroom and was led by experts in physics education including members of the business community. Experts included: Tom O'Kuma (Lee College, Baytown TX), Dwain Desbien (Estrella Mountain Community College, Avondale, AZ), Tony Musumba-Mwene (Bismarck State College, Bismarck, ND), Mario Belloni (Davidson College, Davidson, NC), and Martin Mason (Mt. San Antonio College, Walnut, CA). The workshop instructors are active in Physics Education Research (PER) as well as national professional organizations. The instructors are well known in the physics community and have vast experience in working with teachers and presenting for diverse audiences. In addition, they use the materials presented as a regular part of their own physics course or class and therefore they can model how the materials can be effectively used in the classroom.

Workshops Conducted

- Computational and Modeling Tools for Introductory Physics (CMTIP), March 29-31, 2012 at Mt. San Antonio College in Walnut, CA
- Computational and Modeling Tools for Introductory Physics (CMTIP), May 31-June 2, 2012 at Bismarck State College in Bismarck, ND.
- Laboratory Tools for Introductory Physics (LTIP), November 15-17, 2012, at Lee College in Baytown, TX

Workshop Descriptions

The workshops targeted different technology tools and therefore allowed participants to attend more than one if desired to get professional development in multiple areas. The workshops used tools available for both Mac and Windows computers and included extensive discussions on how to use the tools and tactics once they returned to their classrooms. A detailed description of the workshops is included in the appendix. All workshops addressed assessment of physics learning and application of research findings in Physics Education Research (PER) as applied to students' learning of introductory physics.

The workshops are intensive over a 3 day period starting around 8:30 A.M. and ending around 9:30 P.M. Breaks and meals are dispersed over the period and participants are encouraged to take other breaks as necessary. The long hours are due to the project leadership's efforts to minimize the time teachers are out of their classes as well as minimize expenses associated with substitutes, travel, and accommodations.

Project Objectives

The ATE Program for Physics Faculty was created to provide a series of three-day, intensive, focused, hands-on professional and curriculum development workshops/conferences and follow-up activities over a period of three years to physics teachers in two year colleges (TYC) and high schools (HS) who serve students involved in technology-based or technical careers.[3] The workshops were to provide approximately 30 contact hours over a three-day period to limit the time participants would miss class and other duties. The workshops addressed topics, implementation strategies, workforce-related issues and education. Follow up activities included networking via list serve, electronic newsletter, and website interaction.

The activities of the project were designed to help high school and two-year college teachers in the following ways:

- Build and enhance their understanding and appreciate of the needs of students, educational programs, business and industry, and the workforce in areas dealing with physics and technology
- Provide them with knowledge of and experience with recent advances and appropriate computer technology, ATE supported centers and projects, assessment in student learning, and relevant curriculum materials and activities
- Allow them the opportunity to identify and evaluate the appropriateness of the ideas in meeting the needs of their students and programs
- Provide them with the background and incentive to develop, adapt, adopt, and implement workshop activities and materials into their physics course and programs

[3] ATE Program for Physics Faculty proposal as submitted to the National Science Foundation via Fastlane, provided by Tom O'Kuma project director.

- Impact student learning in physics and workforce related applications
- Provide them ways and ideas for building bridges and developing working relationships between TYC and HS physics and technology programs, and local or regional business and industries[4]

Evaluator and Evaluation Methodology

The proposed evaluation plan for the project focused on several key elements: workshop quality, classroom implementation and sustainability and impact of the instructional changes. The internal evaluation plan included three components: post workshop evaluation, follow-up evaluation, and case studies. These components were solicited and compiled by the project leadership. The external evaluation plan included solicitation and documentation of information from participants regarding the impact of the specific workshops on their teaching and their students using on-line surveys and questionnaires.

The leadership team assisted in the collection of data by having the participants complete surveys before they left the institute. The intent of the paper survey was to determine immediate feedback on how participants felt about the facilities, presenters, and the overall workshop. Results of this survey were collected by the leadership team, tallied, and then forwarded to the external evaluator and are included as part of this report.

Several months after the conclusion of the institute, the external evaluator (EAT, Inc.) contacted all the participants via email and asked them to complete an online survey regarding plans for implementing what they had learned. The survey queried the participants as to how they implemented the knowledge gained from the workshops, problems encountered, and feedback on the usefulness of the sessions. Results of the survey are the main component of this report.

Since some participants attended multiple institutes dealing with different skill sets it is likely they did not respond to all the surveys. This may be due in part to the integration of the material in the classroom, making it difficult to discern which practice was the result of a specific

[4] ATE Program for Physics Faculty proposal as submitted to the National Science Foundation via Fastlane, provided by Tom O'Kuma project director.

workshop. This type of integration is actually a desired result of the workshops, but it is difficult to distinguish where the overlap occurs and may lead to a lower percentage of responses for one workshop when the reality is they responded through another venue.

Although the participants were not asked to give their names, they were asked for their code on all surveys. If there were duplicate codes and responses on any of the surveys, the duplicate entries were removed before responses were tabulated and summarized.

The leadership team acknowledges that the expectations for the workshops are fairly rigorous. The expectations are:

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

On-line Survey Participation

The on-line surveys were anonymous and only viewed by EAT, Inc. to allow participants to freely discuss any issues or problems they encountered. Participants were reminded several times to respond to the surveys, but due to anonymity there was no way to determine who did or did not respond unless the participants chose to give their contact information. There were a few participants who contacted the evaluator and indicated they had responded to the survey twice and in those cases the duplicate entry was removed. The surveys were closed at the end of March 2013 and the response rates were as follows:

Survey Response Rates

	Number of Participants	*Number Responding to On-line Survey*	*Percentage Responding*
CMTIP @ MSAC (March 2012)	21	15	71.4%
CMTIP @ BSC (June 2012)	14	6	42.8%
LTIP @ Lee College (November 2012)	22	22	100%

Participant Demographics

The information below was collected from the on-line surveys, therefore is incomplete since all of the participants did not complete the surveys except for the LTIP workshop in November 2012. The information is considered useful and a good indicator of the participant demographics for all except the CMTIP workshop, which had fewer than half (42.8%) of the participants respond. It is unclear as to why the CMTIP workshop had so few participants respond since similar methods were employed in contacting all participants.

Participant Gender and Attendance

	Males	*Females*	*First Time Attendees*	*Repeat Attendees**	*Actual Attendees*
CMTIP @ MSAC (March 2012)	7	3	1	8	21
CMTIP @ BSC (June 2012)	2	2	1	3	14
LTIP @ Lee College (November 2012)	16	6	6	12	22

**Note: Attendees did not attend two sessions of the same workshop, but could attend another workshop or one in another year*

Participants' teaching positions were varied and covered almost all the different types of physics course offerings at both the high school and college level. Participants were categorized based on their level of teaching (i.e., high school vs. college), however, some participants did not fill out the survey correctly making it difficult to determine if they were teaching high school physics or college physics. If the evaluator could not determine the level of teaching, it was not included in this report. Levels that could be identified were:

- High School = General Physics, Honors Physics, AP Physics B, AP Physics C, Conceptual Physics
- College = College of Physics, Survey of Physics, General Physics, Trig Based Physics, Introductory Physics, Calc. Based Physics, Algebra Based Physics

The number of students directly impacted by implementation of workshop skills is an estimate based on responses to the on-line survey and is reported in Evidence of Results. It is understood that all of the participants did not respond to the survey, therefore the numbers indicated would be lower than the actual impact.

Research Questions

The questions addressed in this report are organized around the original questions developed by Momentum Group and include:

1. Did the workshop attract physics faculty interested in strengthening their capacity to better prepare students for a technology-driven workforce?
2. Did the workshops address the professional development needs of the physics faculty? In what ways did the workshops meet the criteria for high quality physics workshops?
3. After participants returned to their classrooms, how many implemented what they learned from the workshop in their classrooms? How many students and courses are influenced by these changes?
4. What activities were implemented in the participants' classrooms and to what extent were the implementations successful? How successful did they feel implementing what they learned? What problems were encountered during implementation?

Evidence of Results

Question 1*: Did the workshop attract physics faculty interested in strengthening their capacity to better prepare students for a technology-driven workforce?*

Faculty members who attend workshops during the school year are typically self motivated to enrich and enhance their classroom environment. The ATE/PPE workshops solicited participants using various recruitment methods and the result was a collection of participants from high schools, universities, and two-year colleges. Many participants brought colleagues with them from their institution, thereby increasing the probability of being able to implement the information on a larger scale than what would be done by a single person on a campus. The institutions listed by the participants included:

Alabama State
Arapahoe Community College
Bismarck High School
Bismarck State College
Cardinal Gibbons High School
Centennial High School
Central Arizona College
Century High School
Chaffey College
Chaparral High School

Coastal Carolina Community College
College of the Mainland
Collegiate High School
Cypress Creek High School
Gainesville High School
Granada Hills Charter High School
Hartnell College
Hebron Public School
Hinds Community College
Houston Community College-Southwest
Incarnate Word Academy
Irondale High School
Isothermal Community College
Kaua'I Community College
Langdon Area High School
Luna Community College
Magic City Campus
Manchester Township High School
Miami Dade College North
Middle Georgia College
New Mexico Junior College
Northeast Iowa Community College
Northwest Vista College
Ottawa Sr. High School
Palomar College
Parkway Central High School
Rosary High School
Santa Rosa Jr. College
South Florida Community College
St. Johnsbury Academy
Suitland High School
UC-Blue Ash College
Valley City State University
Vista del Lago High School
West Hall High School
West Shore Community College

Question 2*: Did the workshops address the professional development needs of the physics faculty? In what ways did the workshops meet the criteria for high quality physics workshops?*

There are several indicators that are useful in determining if a workshop addresses the professional development needs of the participants and can be considered a high quality workshop. Questionnaires administered at the conclusion of a workshop will indicate the overall attitude of the participant upon leaving. Did the participant feel the experience was worthwhile?

Did the participant feel the time was well spent? Does the participant value the information learned during the workshop to the extent that they are willing to try to implement components upon return to their classroom?

The leadership team administered two short surveys at the conclusion of the workshop in an effort to gauge how well the sessions met the needs of the participants, gain insight as to what areas they could improve on, and what areas were most likely to be implemented. The scores in the tables below are averages from the three workshops. A Likert scale was used to determine the level of satisfaction, with 5 being the highest rating for the first 5 items and 4 being the highest for the last 5 items.

Summary of Surveys Administered at Conclusion of Workshops (Average Response)

	CMTIP (March) N= 21	**CMTIP (June)** N= 14	**LTIP (Nov)** N=22
The workshop has increased my enthusiasm for teaching.	4.95	4.86	4.73
The workshop stimulated me to think about ways I can improve student assessments.	4.86	4.86	4.91
The workshop has motivated me to implement the ideas I learned into my classroom.	4.81	4.71	4.95
The workshop has increased my interest to incorporate more effective technology and laboratory tools/equipment in my courses.	4.95	4.71	4.82
I plan to continue active professional involvement in workshops like this one and other similar professional opportunities.	5.00	4.93	4.82
The workshop was responsive to my professional development needs.	3.95	3.86	4.00
The workshop was conducted at a level appropriate to my knowledge, skills and interests.	3.90	3.71	3.91
The workshop content was meaningful for my current teaching situation.	3.90	3.79	3.95
The workshop content, instructional strategies, and laboratory work are adaptable to my current teaching situation.	3.76	3.79	3.91
My students would benefit from an appropriate adaption of the workshop content in my classroom/laboratory.	3.95	3.86	4.00

Average Ratings for Workshops
Surveys administered by leadership team

	CMTIP (March) N=21	**CMTIP (June)** N=14	**LTIP (Nov)** N=22
Dwain Desbien's Presentations	5.00	4.86	4.95
Tom O'Kuma's Presentations	4.95	4.93	5.00
Martin Mason's Presentation	4.86	4.71	4.82
Workshop Format	4.95	4.86	5.00
Useful Ideas	4.86	4.93	4.95
Site Facilities	4.76	4.86	4.95
Food	4.43	4.93	4.95
Lodging	4.55	4.92	4.64
Workshop Organization	4.81	4.86	4.95
Workshop Worthwhile	5.00	4.93	4.95
Rate the whole workshop	4.95	4.86	4.95
Did pre-workshop materials help prepare you for the workshop?	4.10	4.27	4.67
Sessions on Computational Physics	4.62	4.57	N/A
Sessions on Modeling Discourse Management	4.81	4.79	N/A
Session on Technology Education	4.43	4.43	N/A
Project work sessions to create own materials	4.71	4.50	4.82
Session on Assessments and Implementation	4.43	4.57	4.82
Workshop increased your knowledge of technician and physics education	4.71	4.71	4.64
Enjoy post-workshop evening interaction	4.84	4.77	4.81
Sessions on MBL Activities	N/A	N/A	5.00
Sessions on Astronomy Activities	N/A	N/A	4.64
Session on Digital Video Analysis	N/A	N/A	4.86

In addition to Likert scales, the participants were queried after the workshop as to whether they felt the information was appropriate to be implemented in their classrooms and if so how they planned to execute the implementation effectively. Below are responses for each site to specific questions. Comparison of their plans to implement (post survey) and their actual implementation

(online survey) indicates most of them have followed through with their plan and are actively using the information learned at the workshop.

Do you plan to implement some of the workshop content in your classes or in other instructional settings? If yes, briefly describe one or two features of the workshop that you plan to implement in the near term (I.e. next 3-6 months). Will the activity you implement replace an existing activity or be a new addition to the current classroom or laboratory student work?

CMTIP @ Mt. San Antonio College (March 2012)

Vpython, changes to my version of modeling discourse
This week- implementing Tipers. This fall- implement "modeling" instruction and discourse management
Whiteboards, ranking tasks, graphing motion
I love the whiteboarding and discussion groups. I also want to use Dwain's vector approach to motion problems.
Circling up during whiteboards and not being part of the circle- will replace presentation of WB
Computational physics. This will be a new addition
Vectors-whiteboarding-new addition-this semester in Eng. Phys. Tipers- in my E-M class this semester (college physics)
I believe the ideas will lead to a more efficient learning environment. The workshop will influence the way I teach and Vpython is a unique computational tool.
Vpython in labs\activities (will be drastic modification rather than addition or replacement). More whiteboarding and large group discussions
Vector approach to kinematics. Computational programming as illustrative examples and\or discrepant events.
Part of the computational model and the modeling on a modular form
Vpython programming
Vpython projects. Whiteboard\discourse management
Use Vpython to help visualize fields (G,E,B). Use Dwain's method of vector addition to solve kinematic problems.
There is currently no useful curriculum available at my college. I have to start from scratch and the workshops helps me to get started and inspires me\gives me ideas.
Discourse MGMT-Now, Vpython programming- in fall, Dwain's 1st week- In fall Whiteboarding, Tippers
I will continue to use modeling discourse management and will experiment w/ getting "out of the circle". I will also use Vpython.
The combination of Dwain's material and Vpython will be integrated into all new course deliveries
Tipers this semester. Discourse management and whiteboards next fall

CMTIP @ Bismarck (June 2012)

Vpython for comp. modeling, graphs to solve equations
Introductory 1D motion using V-python
I'd like to try the discourse management in presenting mechanics.
1. I will use Vphython to show 3 dimensional mathematics and physics.
2. My college has hired a full time institutional data person. I hope to be better able to show that students are actually learning.
I plan on implementing Vpython labs. I also use modeling discourse management and am improving in this pedagogy.
I plan to use Dwain's modeling discourse management information to continue to improve my classroom environment. I also plan to revise and significantly increase my use of Vpython in my jr/sr physics class and as demos on soph.physics
I liked the use of white boards and small and large group discussion\class participation.
Vpython labs + blogs will replace lab reports, replace +new addition old activity
The Vpython modeling seems like a very powerful tool. More importantly I will be looking at changing assessment and teaching style.
Using vector addition in kinematics instead of equations
Model 3 classroom Vpython based labs and activities replace and supplement respectively.
Vector solution different instructional methods possibly some vpython
Implement vector analyzation of graphing. This will replace kinematics equations.

LTIP @ Lee College, November 2012

Tracker, Logger Pro, Experimental Exercises, Astronomy
I plan on utilizing Tracker to help with on existing momentum curriculum
I intend to introduce video tracking and analysis into my mechanics labs. I will also aim to increase student activities during the semester and decrease lecture time.
Video Analysis in support of existing visual observations in lab, addition
B field in a coil, Lens Law
Activities using Tracker and others on the compadres site
Possibly add video capture and/or Tracker labs or projects
tracker use and real time physics lab activities
Tracker in Astronomy and physics labs. Some lab activities obtained from the workshop in physics courses. Revise lab manuals.
Video analysis and use of logger pro/tracker
supplement more MBL, New addition B field of solenoid, B Flux
Some of the MBL stuff on kinematics
I will start using tracker to analyze data and take advantage of students' ability to take video to develop a series of reality physics.
I will use the force plate lab I learned about at this workshop. The rotating pendulum that my "lab partner" and I developed during this lab.

I hope to use those, which I can immediately "grab and go". For example, physlets for nuclear chem, Mario's astronomy stuff. Tracker if I can figure it out.
Assessment. Need to get laptops so I can operate the vernier hardware I already have.
The video analysis. The tracker software
Magnetic Field and eddy current of magnet falling into slinky lab. Using Tracker software for image analysis
I use Tracker and Logger Pro but I improved my knowledge and will be able to apply that to class immediately on return.
I definitely plan to use video analysis in logger pro and Tracker!! One of the applications might be too late to use this year, but next year yes!
I want to do the electromagnetic induction lab. It was ready interesting.
Exploratory lab experiments. So when questions arise, experiment can be adjusted to seek answers

Respondents to the on-line survey indicated they felt the workshop increased their enthusiasm for teaching and inspired them to implement new activities in the classroom. One of the objectives of the workshops was to facilitate classroom change, which has to begin by motivating the educator. It is recognized that most of the participants were likely attending these workshops due to their desire to be better educators, however even the most dedicated teacher can be uninspired after a workshop. Therefore, it is important to note that the respondents felt the workshop met their needs even though they had attended the workshop several months, or even a year, prior to the administration of the survey. The following table summarizes the online responses from the workshops regarding the question: "To what extent do you agree or disagree with each of the following statements concerning the value of the workshop regarding your efforts to implement changes in your classroom?" The response choices for the surveys were: Strongly disagree (1), Disagree (2), Agree (3), and Strongly Agree (4).

Summary of Online Responses and Overall Average

To what extent do you agree or disagree with each of the following statements concerning the value of the workshop regarding your efforts to implement changes in your classroom?	**CMTIP @ MSAC (March)** N=15	**CMTIP @ BSC (June)** N=6	**LTIP @ Lee College (Nov)** N=22
Attending the workshop increased my enthusiasm for teaching.	3.88	3.25	3.50
Attending the workshop supported my efforts to implement teaching strategies that have been demonstrated as effective into my classes.	4.00	3.25	3.53
Implementing activities/materials from the workshop increased my enthusiasm for teaching.	3.63	3.25	3.50
When I implemented activities/materials from the workshop into my classes, my students were more engaged in learning.	3.75	3.00	3.50
The workshop stimulated me to think about ways I can improve student assessments that I use in my physics courses.	3.75	3.00	3.56
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.	3.50	3.00	3.17
Attending the workshop and implementing new activities/materials in my classes has increased my interest to continue participating in professional development workshops.	4.00	3.25	3.72
Implementing new activities/materials in my classes has increased my interest to continue participating in professional development workshops.	3.88	3.00	3.65

Question 3: *After participants returned to their classrooms, how many implemented what they had learned from the workshop in their classrooms? How many students and courses are influenced by these changes?*

The participants were asked if they intended to implement something they learned at the workshop upon return to their classes. All participants from all three workshops indicated they had already implemented the materials and/or strategies from the workshop at the time the survey was given. This is highly unusual and a strong indicator that the information, regardless

of the format, was valued by the participants and therefore implemented in a timely fashion. Comments from the participants included:

- I was able to implement this in all my classes because it was readily available for me. (CMTIP June)
- They worked well and I continue working with the teachers in their schools (CMTIP June)
- After purchasing cameras and tripods, I have included at least 3 labs involving video tracking. (LTIP Nov)
- Moderate success; one challenge is access to software at my high school; this has been addressed. (LTIP Nov)
- I modified what I created during the workshop for use during the constant acceleration unit. (LTIP Nov)
- The students have been and are in the process of completing a large project involving what was learned at this workshop as well as a few others. (LTIP Nov)
- I was able to work with the lab tech to get the labs implemented. (LTIP Nov)
- I was able to apply some of the ideas I learned, but I got too busy to implement them as thoroughly as I had intended. (LTIP Nov)
- I am using portions of the Real-time Physics modules for activities in mechanics and electricity/magnetism. I have also used video analysis to assist with lessons on two-dimensional motion. I prefer to use LoggerPro over Tracker as it seems to be a bit more user friendly. I was able to implement these methods quickly as we already have a site license to LoggerPro and several other pieces of equipment to MBL (carts, track, motion detector, force probes). If we didn't have these materials, it would have been much more difficult to implement MBL on my campus, as funds are not readily available. (LTIP Nov)

Question 4: *What activities were implemented in the participants' classrooms and to what extent were the implementations successful? How successful did they feel implementing what they learned? What problems were encountered during implementation?*

One of the strategies addressed at the workshops was the proper use of assessment tools such as Tipers, Ranking Tasks, and Force Concept Inventory (FCI).

The following responses are from the online survey respondents when queried as to whether they had used any of these tools. (Note: Numbers indicate number of respondents indicating they used the assessments as instructed and they could choose more than one)

Assessment Tools Implemented in the Classroom

	CMTIP March	**CMTIP June**	**LTIP Nov**
Ranking Tasks	8	4	11
TIPERS	8	2	9
FCI	5	3	9

Participants were asked to share ways that they implemented what they learned at the workshop as well as how successful they felt those implementations were. Some of the activities implemented included: whiteboarding, VPython, geometric approach to problem solving, discourse management, energy graphs, physics projects, MBL, launching tube, video analysis, watermelon explosions, standing waves, momentum conservation, Tracker, student group discussions, and exploratory group learning. Since most participants only shared one particular component of the workshop, results are tabulated below regarding the first activity they implemented.

How successful overall did you feel implementing what you learned at the workshop? (Note: percentages are percent of survey respondents)

	CMTIP March	CMTIP June	LTIP Nov
Very successful	55.6%	75.0%	63.2%
Moderately successful	33.3%	25.0%	31.6%
OK	11.1%	0.0%	5.3%
Less than I hoped for	0.0%	0.0%	0.0%
Very disappointed	0.0%	0.0%	0.0%
Have not used it yet	0.0%	0.0%	0.0%

To what extent, if any, was your experience with the implementation of this new activity successful? (Note: numbers indicate number of survey responses for each category, totals are combined for all workshops)

	Not at all successful	Slightly successful	Moderately successful	Highly successful
The new activity encouraged students to be more actively engaged than other activities I have used in the past in learning the physics concepts addressed by the activity.	0	0	11	17
The activity addressed the physics content at a level appropriate to my students' background knowledge and skills.	0	1	7	20
The student assessment of learning that I used for this activity provided the formative feedback I need as a teacher.	0	3	12	13
The student assessment of learning that I used for this activity suggests that this activity as is or with slight modifications helps students learn the specific physics content addressed by the activity better than a more conventional way of teaching the concept	0	1	13	13

Participants were asked to elaborate on any challenges they encountered and how they handled the challenges. They were also queried as to whether they would be likely to continue using the

activities and all of them responded “yes” although some indicated they would make modifications to increase student involvement and engagement. Some of the problems encountered include:

- Lack of computers
- Trouble with software
- Time management
- Working with TI to install software
- Students needing more oversight than expected
- Cameras were too slow for analysis
- Space limitations
- Resistance to using graphs instead of formulas

Although there were issues with implementation, as mentioned, there were also many benefits gained from using what they learned at the workshops. When asked what they learned from observing their students during the use of the technology, the teachers responded:

- They were actually engaged and seem very interested.
- The students take ownership of their lab data and share it without fear.
- They were very self-sufficient when they were in charge of their learning.
- I learned that, as a teacher, it is often less important to cover EVERYTHING in the textbook. Less breadth and more depth.
- That they liked challenges.
- This completely changed the dynamics of my class. My students were so much more engaged with learning and experimenting. They also did better as a group on their FCI this year - not sure if that was the reason but I know it helped increase their interest in physics.
- I learned that I need to write very detailed directions for the beginning activities.
- Some weak students had a very strong fixed mindset (Dweck, 2006) and felt there was only right and wrong - and they were always "wrong".
- Students are interacting much more and many of them greatly appreciate the exercise.

When asked if there were any other comments regarding the implementation of this material, the following comments were made:

- I need to do a better job of using assessments that better reflect what I think is important. If I'm doing ranking tasks in class, I better be sure to put ranking tasks on the exam. This is something I have failed to do in the past, but I'm working on it. Until I start doing this, I think that my assessments are not doing as much as they could to tell me about what my students are learning and how effective the changes I've made to my classroom have been. (CMTIP March)
- I found that the successful implementation depended on the # of students in the class. (CMTIP March)
- I noticed the most amazing thing - one student who did poorly on exams did the most outstanding job on his project. He clearly demonstrated he had mastered kinematic equations of motions through his project which he developed using the scientific method - something I barely touched upon! It was amazing to see his level of interest and effort at doing a superior project on his own. (CMTIP March)
- I think that I need to write a better set of activities to get the students comfortable with writing VPython code before I give this task to them. (CMTIP March)
- Practice and continued feedback with coaching helps my teachers try new strategies. (CMTIP June)
- I agree with the ideas offered in the workshop and that it is difficult to implement them in a course already under its own power. Better to wait to start new and train them up right. (LTIP Nov)
- As I mentioned before, I find it difficult to find time to implement new ideas during the school year when I am so busy. (LTIP Nov)

According to the participants who responded to the on-line survey, the participants attending serve a wide array of student levels of interest and achievement. The number of students impacted by program was determined by calculating how many students were in the classes of those that said they implemented the materials and responded to the survey. The table below indicates the impact on students based on the survey results of the participants that implemented materials from the workshop(s).

Student Impact Numbers by Level and Courses (Based on Survey Results)

	Participants/ Respondents	Courses Impacted by Workshop	Approx. Number of Students in these Courses
CMTIP @ MSAC (March 2012)	$N_p = 21$ $N_r = 10$	**Courses for high school students:**	
		Conceptual physics	75
		General physics (algebra based)	280
		General physics (calculus based)/honors	150
		AP physics	25
		Courses for college students:	
		Introductory/Survey of Physics	50
		College (algebra based) physics	225
CMTIP @ BSC (June 2012)	$N_p = 14$ $N_r = 4$	**Courses for high school students:**	
		General physics (algebra based)	370
		AP Physics	27
		Courses for college students:	
		College (algebra based) physics	6
LTIP @ Lee College (Nov 2012)	$N_p = 22$ $N_r = 22$	**Courses for high school students:**	
		Conceptual physics	437
		General physics (algebra based)/honors	380
		AP Physics	71
		Courses for college students:	
		Introductory/conceptual physics	158
		College (algebra based) physics	120
		University (calculus based) physics	185

Summary and Suggestions

Overall, the participants seemed very pleased with the workshop experiences and were anxious to implement the things they learned. The workshops met the criteria for high quality workshops based on the Guskey Professional Development Model. They would be considered successful professional development experiences since the ratings are on the upper end of the scale between strongly agree and agree.

The participants felt the workshop stimulated them to think about ways to improve student assessments and increased their interest in incorporating more effective technology and laboratory tools/equipment in their courses.[5]

The workshops were well planned and followed the format as outlined in the grant and advertising materials. None of the participants expressed disappointment that this was not what was advertised or expected. Nearly all of the participants were extremely complimentary of the usefulness of the workshop. One participant suggested that the workshop leaders continue to update the website to include sample works of other physics teachers attending the workshops.

The participants felt the activities were appropriate and attending the workshop would benefit their students in due time. Participants felt the activities were productive and will continue adding new technology and activities to their curriculum.[6]

There were very few participants that felt they could not implement what they had learned at the workshop. Those commenting on their lack of implementation most often cited issues with their technology department or lack of funds to support the technology. One participant stated: "I implemented only few activities. The reason is funding. Our school system doesn't have money to buy the Vernier program."

[5] *Summary of Surveys Administered at Conclusion of Workshops*
[6] *Average Ratings for Workshops*

Appendix

Results from Leadership Post Workshop Surveys

Final Day Comments
CMTIP Workshop
Mt. San Antonio College
March 29-31, 2012

1. What did you like best about this workshop? (You may list more than one)
    a. I have started implementing modeling discourse and it was really good to hear Dwain present it again. I am leaving with many ideas for improvement. I love learning about how to use and implement V-python.
    b. Use of modeling, white boards, implementation of use in the circle.
    Integration of computational modeling into practical situations.
    No time was wasted. Assessment topics.
    c. The nontraditional (modeling) was of solving kinetics with graphs and vectors. The attempt to change how I view instruction The goals, the format, and student interaction.
    d. Discourse management subtleties. Alternative problem solving with vectors. Creating something to use in my classroom. Martin was extremely helpful in helping my group to create our project. Gaus's Law Activity (Dwain). 2nd laws activity (DD)
    e. The "thinking outside the box" ideas as well as computer (programming) applications.
    f. Hands on experiences that showed us how students perceive computational modeling and discourse management.
    g. The time taken to describe\ experience the different learning environments. Hands on aspects of this experience. Willingness of the presenters to share their hard work and information with us.
    h. Both computation and modeling were well presented.
    i. Hands on nature. Positive environment, application oriented, not a lot of theory.
    j. Introduction to V-python
    k. The white boarding and circle discussions were stimulating. The programming was scary but intriguing (sic). I want to investigate this further.
    l. The vector approach to kinematics the programming.
    m. Free sharing of ideas and resources. Focused nature of the workshop. Hands on activities
    n. Dwain's presentation regarding vector edition and kinematics. Intro to V-python. Micro computer based labs (Vernier)
    o. Learning to use V-python. Collaborating with other physics instructors all wanting to improve student learning.
    p. Combination of " being the student" and information for the instructor. Several practical ideas that could be implemented both immediately and for implementation "down the road"
    q. Learned new programming language got new inspiration
    r. V\python focused, topic specific times, interacting with others.
    s. The coordination of theory and practice.
    t. Everything

2. What did you like least about this workshop? (You may list more than one)

a. The amount of sleep I got ☺. Being in southern California for the first time and not being able to explore.
b. My own frustration and downloading the computational software. My own stupidity and being careless in coding. I thought by the end my husband gave me some tips at home. Now however I am going to persist doing this because I did see how useful it will be with my students.
c. The speed of the computational session. Although I want to use this down the road, its not appropriate for my Alg\Trig coarse. I would have preferred going through a few sections well instead of being left struggling without a fountain in V-python
d. Enjoyed all. I regret that my admin did not allow Pat to go it would have helped him!
e. Nothing.
f. Some of the presentations on Saturday. Hard to stay engaged after long hours.
g. No response
h. Too much material in a short period of time
i. Too far from me! (Geographically) Tom don't talk! (Doesn't)
j. Time schedule\ 8 am\ 9:30 pm Too much a little bit
k. Late hours were tough but doable. The programming initially was not enjoyable.
l. I honestly can't think of anything that falls on that side of the "like" spectrum.
m. Too short a time (but don't think I could take much more at one workshop!)
n. Felt like I didn't have enough time to get a good grasp on programming but plan on spending more time in future on my own.
o. I really don't have anything negative to say I even enjoyed the long days because they were full of useful activities.
p. Days got to be long…. But in understand (I would not cut anything out!)
q. N\A
r. No response
s. N\A
t. Nothing

3. What suggestions do you have to improve this workshop? (You may list more than one)

a. Be sure not to skip breaks. They are needed to stretch legs and maintain focus.
b. I never really have any suggestions, you think of anything.
c. I would help to have a few breaks in the back to back sessions.
d. If it were on the beach????? J\K. Actually, I think it would be helpful to go into student mode a little more since we are so often in teacher mode. I realize though, that time is an issue for workshop leaders to consider as well.
e. These workshops are always good and packed with "enlightenment"
f. Break up Saturday a bit so it has more active engagement
g. No response
h. Relax, time constraint
i. Tom talks! More reference to articles.
j. More on addressing conceptual physics, labs.
k. Slow Dwain's talking down.

l. A couple pre-made computational physics example to draw inspiration from that have no flaws, that way I can " see" the code a bit easier.
m. Nothing. This was the most engaging workshop I have attended in a long time. So much packed into a short time. This was outstanding! Thank you so much!
n. Send more preliminary information regarding V-python, especially syntax. Would have been nice to see this ahead of time.
o. N/A
p. Can't think of anything now. I really think that I have never attended a more valuable workshop!
q. N\A
r. No response
s. N\A
t. Short on the time, 9:30 pm too long.

4. Are there any other workshops that we should consider offering in the future?
   a. I would like to hear more about how Dwain does system schema.
   b. I would like to go on the spiraling workshop if possible.
   c. I am interested in continued support "implementing" instruction into my courses. I Think I can make changes in the beginning topics, but want to know more about techniques and other topics\ energy and second semester topics.
   d. CASTLE! E&M! WAVES(2nd semester material) A workshop for the "conceptual physics" student would help high school teachers at my school the most
   e. Yes, I can't think of particular topics, but anything that's news.
   f. Labs and lab practicals
   g. No response
   h. No response
   i. No response
   j. I would to see a workshop on how to help differentiate the work for the students. I would also love to learn more on discourse management.
   k. Yes, more discourse management.
   l. A workshop dealing with circuits, thermodynamics, and quantum mechanics would be welcomed.
   m. How about have participants share the areas\ concepts they are having the most trouble getting their students to understand and then at the workshop work on activities focused on those problems. Video analysis
   n. Instructional resources (PIRA) online physics classes.
   o. I am interested in the video analysis that Martin does. I would also be interested in more discussions of assessment and how to create reliable tasks
   p. Yes!
   q. No answer
   r. No response
   s. Advanced topics such as optics, modern physics, etc…
   t. Motivational techniques

5 General comments about the workshop pre-materials.

a. They were interesting reading. These workshops give the best professional development I have ever had. Thank you so much for your commitment and hard work.
b. I liked the projects. The flexibility of the organizer allowed me to work on a ranking task I can use for expertise development I my class soon. I love to be taken out of my comfort zone.
c. I really appreciate all the hard work you all put into this workshop and your continued support. The details are extremely well planned and executed. Thank you for everything!
d. Very grateful to be here even though the waves are pumping right now. Bye! ☺
e. Very good for getting a pre-view and giving an opportunity to think about the topics.
f. Not sure they were needed
g. Even though I have attended two other ATE physics workshops, I still learned a completely new set of information at this one. Impressive facilities and presenters\organizers! Many thanks!
h. Well done keep up.
i. Seemed very optional.
j. Some information on V\ python. In really liked this workshop and I want to thank all you guys for organizing this, your time and friendliness
k. I did not get the materials until I arrived.
l. The shorter papers were much better. The longest one had some good stuff, but it just seemed to never end.
m. Good, but could have used more! More background on python programming.
n. Same as # 3
o. Very appropriate
p. I had spring break when material arrived…. So it was very near my departure date for the workshop when I received materials. Overall though… I do appreciate some background to read before workshops.
q. No answer
r. Good articles but I thought the computational modeling article was the least useful.
s. I had already read them in the past.
t. None

Final Day Comments
CMTIP Workshop
Bismarck State College
May 31- June 2, 2012

1. What did you like best about this workshop? (You may list more than one)
    a. I liked the modeling discourse concept and the introduction to vpython programming. The way things are organized and implemented and exceptional.
    b. Instruction was very direct and relevant to what I do in my classroom. Using graph to solve 1\2 dimensional motion—V python.
    c. Knowledgeable instructors w/ lots of classroom experiences. Excellent host.
    d. 1) Learning another computer language and how to use it. 2) "" classroom management techniques. 3) I spent a week before the workshop thinking about "what is science" and "what is physics" so that these were relevant. 4) Interacting with other physics teachers.
    e. I've been wanting to learn V python. I will definitely implement Vpython now – I have enough comfort and materials to hit the ground running.
    f. Idea sharing.
    g. Interaction with other teachers, hands on and final presentation.
    h. I liked the relaxed atmosphere and how people shared. I think everyone felt very comfortable risking saying things because no one put you down for what was said.
    i. I have attended a V python workshop before with ATE PROJECT and this was great- Martin has done a good job of adding video links (content) in and making the sessions manageable yet still challenging.
    j. I think the immediate hands-on work to implement ideas presented in the wksp is an excellent way to make the lessons more concrete.
    k. The people- Including instructors because they are people too. The information.
    l. Energetic, organized, quality instruction and modeling of MODEL 3 CLASSROOM. V python intro excellent, great materials.
    m. Interacting and networking in groups
    n. The different ideas, but it fits my style of teaching.

2. What did you like least about this workshop? (You may list more than one)

    a. nothing I liked everything about it.
    b. Martin moved too fast. I got frustrated when I got lost.
    c. No Response
    d. the amount of time to do everything. It is really condensed. Unfortunately increasing the length might not be useful.
    e. Would have been nice to have a few more TYC instructors present.
    f. Long, intense days left me drained by the end of the day.
    g. No response
    h. I am not sure. I think all parts were helpful.

i. I liked almost everything. We did not work with equipment which I must confess I always look forward to in the Physics Workshops.
j. N/A
k. So fast I felt way overwhelmed.
l. Too short, Too far away from VT.
m. Computational V python was covered too quickly- more time was needed to understand the how to's of the program.
n. The fast pace of it V python

3. What suggestions do you have to improve this workshop? (You may list more than one)
a. Keep up the great work you have been doing. You're doing and excellent job of inspiring physics educators to be the best that they can be.
b. No Response
c. No Response
d. Maybe marketing. There must be many other teachers who would have benefited.
e. No Response
f. pre-workshop materials could have been included more with V-python. Would have been nice to see Prof. Mason's website before the workshop.
g. No response
h. The time was cramped. It might be nice to have the workshop last a little longer. I know this would be difficult during the school year.
i. ARRIVING IN EARLY TO SEE THE WORKSHOP AREA (SIGHTS AND SOUNDS SMELLS TOO)
j. N/A
k. I understand constraints on schedules but more time.
l. I'll think of something, but cant now.
m. Same as above
n. More time.

4. Are there any other workshops that we should consider offering in the future?
a. Content based physics for non physics majors.
b. No Response
c. Robotics, CMTIP Part II
d. No Response
e. No Response
f. No Response
g. How to organize and lead PD, what do HS teachers need.
h. ? Any would be good.
i. LABORATORY METHODS\TECHNIQUES
j. Perhaps a workshop on assessment/evaluation and developing assessments in the style of the fcl/MBT/etc.
k. Modeling and lab work.
l. Country side) – one in VT or NY (Great golfing, restaurants), - how to budget for and prioritize equipment in lab.
m. More-more-physics workshops like this one.
n. V python more teaching in models methods.

o. General comments about the workshop pre-materials.
a. They are very helpful to participants' frame of mind. They become ready for the workshops.
b. Great workshop. I look forward to doing more of these in the future.
c. No Response
d. They were good. I spent some time looking at them, but perhaps not enough.
e. I found the materials totally relevant and helpful to participating in the workshop. They will be referenced post-workshop as well. Thanks!
f. The short articles were effective, but the longer ones were boring. Need more pre-info with V-python.
g. Finally got "it" after several times; Great sharing and interactions.
h. This was an excellent use of my time. The whole experience was great. Thank you all.
i. The materials came in a little late and I am not sure how well we read the computational ARTICLE.
j. They were very thought-provoking and helpful in setting the mind set for the workshop.
k. I am unsure how valuable they were to me.
l. A little V python pre-code might be good.
m. Excellent but needed to receive them earlier.
n. No Response

Final Day Comments
LTIP Workshop
Lee College
Nov. 15-17, 2012

1. What did you like best about this workshop? (You may list more than one)
    a. The workshop had a nice flow generated by excellent fore planning and a great mixing individuals from different levels of teaching. It is hands on and relevant. You feel welcome. The presenters are considerate and show a genuine sincerity about your learning and achievement. They truly love what they do and it shows.
    b. Meeting people. Using MBL's and video analysis
    c. –Material Presented, the technology, the software
    d. Its is very well organized. I liked the presentations of both Dwain and Tom
    e. Interaction with other physics instructors, getting ideas for new labs, learning about new equipment, methods,.. for lecture\lab
    f. Sharing ideas and observations with colleagues. Learning new materials and tools and practicing with MBL.
    g. The presenters were available for help and advice
    h. The uses for some of the equipment we have in our lab that ive never used before. I'll now go back and implement some of this equip.
    i. Learning new software and having time to practice it. Gathering new ideas and technologies from others
    j. Networking, Scaffolding, building on previous experiences
    k. Contact with other pros, development of MLB skills, transportable ideas I can bring into the classroom.
    l. Interaction with fellow faculty. Discussions of ways to increase student understanding. Learning new lab techniques
    m. Lab tools and ideas that can be implemented mid semester
    n. Interactions between colleagues. Innovates ideas to apply in the MBL. The ability of facilitations to support your ideas
    o. Applications and usefulness
    p. MBL, tracker/video analysis
    q. Student centered activity
    r. Activities using logger program
    s. The interactions with others. Tracker and the other stuff presented by Mario Belloni
    t. Hands-on. Excellent presenters. Good into on assessment. Professional dev and college credit
    u. Tracker, Free goodies, free food
    v. The time to create a great project that I've wanted to do for years.

2. What did you like least about this workshop? (You may list more than one)

a. The discussion on the difference between assessment and evaluation. I see its importance in the long run but I feel that time could have been used for something else.
b. Too damn long each day
c. The variation of technology being used in this workshop along with the material provided.
d. The Astronomy presentations
e. Just a bit "too long" day!!
f. The pace and length of day are (?) to me; I have a med condition which is reducing my energy and it is a bit hard to keep up. (however, I understand why it is packed full the way it is.)
g. No response
h. Many topics that I'd like to spend more time one. (i.e too short)
i. Very long hours but this is completely understandable
j. At first, that it was only 3 days. But I got over that.
k. Texas is really not so bad
l. No Response
m. Lab evy. I'd love to have computers and other equipment in my classroom to be able to do more of what we did these three days.
n. The length of the working day
o. Not a whole lot
p. Sound activities (Whistle, microphones, whirl tubes)
q. No Response
r. None
s. The hours were too long. I think more learning and meaningful interaction could occur if the evening sessions were informal and optional
t. No Response
u. Good
v. When working with Real Time Physics the group I worked with did not work well together. (not workshop fault)

3. What suggestions do you have to improve this workshop? (You may list more than one)

a. as a whole the workshop was excellent! There is nothing that I would change. The time of (?) and being on task was well distributed.
b. sometimes technology gets in the way of understanding. Try to have Low tech but elegant solutions to some lab problems
c. Keep up the great work!
d. They have to conduct more & more workshop so that a lot of teachers can participate and improve their content knowledge as well as the lab skills.
e. I cant think of any at the moment.
f. Perhaps more opportunity/ encouragement to work with different partners/groups on subsequent topics.

g. At times it was hard to follow something's shown on the screen (steps)- a quick outline of steps would help. Some URL's and procedures could be given to us during some technical demostrations. It was hard to follow some steps
h. It's tough to cover many topics in just 3 days. This workshop was great. Thank you!
i. Softer chairs ☺ all in all and excellent workshop and experience I always learn a lot of useful things to take home. Maybe start a Googledocs group for the workshop materials instead of memory sticks.
j. I have tried to think of ways, but really you folks are the masters. But if I do think of something, I'll let you know.
k. Nothing comes to mind
l. No Response
m. No Response
n. Create follow-up workshops to de(?) our understanding of new techniques
o. Fewer hour a day and more than 3 days.
p. More from real time physics curriculum
q. No Response
r. Keep repeating this type of workshop
s. See above
t. No Response
u. Good cant think of any
v. No Response

4. Are there any other workshops that we should consider offering in the future?
   a. More MBL labs on electricity and magnetisim
   b. Daytime Astronomy experiments (Not computer simulations) that can be done during the daylight that are on task for AST 1 &2
   c. More hands on activities, labs, software and new technologies
   d. Yes. They have to conduct some workshops to so some experiments or labs in modern physics especially the photo electric effect and cathode ramp.
   e. Modeling Workshop (physlet, Java, python..)
   f. I would like to see a workshop on instrumentation and use of microcontrollers (e.g. Ardnino, Basic stamp) in physics and related technical subjects (robotics, remote data collection). Would be nice to see something related to the new next-gen science stds. When they are finalized.
   g. More Astronomy
   h. Workshops concentrating on one area of interest. (more in depth)
   i. Perhaps workshops concerning teaching strategies to help teachers who are strong in content but maybe weak in implementation.
   j. I would love to explore about developing high school level assessment tools that are both reliable and valid.
   k. How to teach physics on a very limited budget.
   l. I wouldn't mind something more focused on assessment and evaluation.
   m. No Response
   n. A workshop on how to develop raking tasks, more appropriate tools to assess our students
   o. A workshop on how to approach administration

p. Thermodynamics
q. No Response
r. No Response
s. No Response
t. More lab-oriented workshop
u. No Response
v. We always touch on modeling and I have become a member of the association but am having issues with technique

5. General comments about the workshop pre-materials.
   a. Very good
   b. No Response
   c. None! Thanks!
   d. It was really useful
   e. One of the best I have ever attended
   f. Didn't see them.
   g. No Response
   h. No Response
   i. I did not receive the pre-materials till late so I did not get a chance to review them as I should.
   j. I always appreciate being able to read ahead of time about the work we will be doing or learning about so I can shift from everyday mode into all about what I want to learn mode.
   k. No Response
   l. They were helpful and let me know a little more about what to expect.
   m. No Response
   n. No Response
   o. No Response
   p. Include some astronomy stuff
   q. No Response
   r. Some sample data to come w/
   s. No Response
   t. Excellent
   u. Good
   v. I would love to assess to them prior to applying to help me sell it to my administration.