ATE/PPE Project Evaluation
Report on 2013 Workshops

NSF Award 0603271

Submitted
April 2014

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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 (faculty and teachers) 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 2013 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 2013. During this time period there were three workshops conducted at sites across the nation including Mt. San Antonio College in Walnut in California, Estrella Mountain Community College in Arizona, and Fox Valley Technical College in Wisconsin.

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[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/.

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), Martin Mason (Mt. San Antonio College, Walnut, CA) Ann Cox (Eckerd College, St. Petersburg, FL), David Weaver (Chandler-Gilbert Community College, Mesa, AZ), and Bradley Staats, (Fox Valley Technical College, Appleton, WI). 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

- Instructional Strategies for Introductory Physics, ISIP, April 11-13, 2013, at Fox Valley Technical College in Appleton, WI.
- Laboratory Tools for Introductory Physics, LTIP, June 20-22, 2013, at Mt. San Antonio College, Walnut CA.
- Advanced Laboratory Tools for Introductory Physics, aLTIP, November 13-15, 2013, at Estrella Mountain Community College, Avondale, AZ.

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.

Advanced Laboratory Tools for Introductory Physics (aLTIP)

The emphasis of this workshop was on how to use MBL (microcomputer-based laboratory) tools (available for both Mac and Windows computers) to teach physics more effectively to two-year college (TYC) and high school (HS) students. There were extensive discussions on how to use these tools in TYC and HS courses, and tactics to overcome problems at TYCs and HSs. In addition, this workshop dealt with the assessment of physics learning in these areas and the application of the research findings in cognitive science and PER as applied to students' learning of introductory physics, particularly in the context of the use of the microcomputers at TYCs and HSs. Discussion and information on the needs of the technological workforce and its connection with the activities of this workshop was presented.[3]

Instructional Strategies for Introductory Physics (ISIP)

During this hands-on workshop, participants were familiarized with various TIPERs. TIPERs Tasks have been Inspired by Physics Education Research. These tasks are not like traditional physics textbook problems, but rather, require the students to think conceptually about a particular physical situation. They include ranking tasks, working backwards tasks, conflicting contentions tasks, linked multiple choice tasks and others. In this workshop, participants worked with different kinds of tasks, discussed how they might be effectively used in the physics classroom, and learned how to write some of their own tasks. There was an emphasis on the new Sense Making TIPERs although nTIPERs (Newtonian TIPERs) and EM TIPERs were also discussed. Participants also experienced a classroom management technique called modeling discourse management. While this classroom management style was created for a modeling curriculum, it can also be used with most PER based activities or curriculum. Modeling discourse management is an attempt to improve student-student interactions, student-teacher interactions, and classroom discussions.[4]

Laboratory Tools for Introductory Physics (LTIP)

[3] http://physicsworkshops.org/Fall%202013/Workshop_Description_F13.pdf

[4] http://physicsworkshops.org/Fall%202013/Workshop_Description_F13.pdf

The emphasis of this workshop was using microcomputer-based laboratory tools (available for both Mac and Windows computers) to teach physics more effectively to two-year college (TYC) and high school (HS) students. Participants worked in areas involving force and motion, energy, waves, electricity and magnetism. They explored approaches and curriculum materials from *Real Time Physics* (and leader developed labs) as well as hardware, software, and sensors from Vernier Software (LabPro/LabQuest Interface and Logger Pro software), PASCO Scientific, and *Tracker* software. These curriculum materials are often used with sensors and interfaces from other vendors as well. There were discussions on how to use these tools in TYC and HS courses, and tactics to overcome problems at TYCs and HSs. In addition, this workshop addressed the assessment of physics learning in these areas and the application of the research findings in cognitive science and PER as applied to students' learning of introductory physics, particularly in the context of the use of the microcomputers at TYCs and HSs. [5]

Project Objectives

The ATE Program for Physics Faculty was created to provide a series of 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.[6] 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 participant understanding and appreciate of the needs of students, educational programs, business and industry, and the workforce in areas dealing with physics and technology

[5] http://physicsworkshops.org/past.htm

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

- 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
- Impact student learning in physics and workforce related applications
- Provide participants 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[7]

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 workshop on their classroom teaching and the perceived impact on their students. Online surveys were used to obtain the information for the external evaluation.

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.

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

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.

Participants were asked to give their names in order to determine match respondents with the attendee list. Once duplicate responses were deleted, participant identity was removed.

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 only viewed by EAT, Inc. to allow participants to freely discuss any issues or problems they encountered. Response rates to the surveys were as follows:

Survey Response Rates

	Number of Participants	*Number Responding to On-line Survey*	*Percentage Responding*
ISIP @ Fox Valley Technical College (April 2013)	16	13	81.25%
LTIP @ Mt. San Antonio College (June 2013)	23	10	43.47%
aLTIP @ Estrella Mt. Community College (November 2013)	23	21	91.3%

Participant Demographics

The information below was collected from the online surveys, therefore is incomplete since all the participants did not complete the surveys. The information is considered useful and a good indicator of the participant demographics for all except the LTIP workshop, which had fewer than half (43.4%) of the participants respond.

Participant Gender and Attendance

	Males	*Females*	*First Time Attendees*	*Repeat Attendees**	*Actual Attendees*
ISIP @ Fox Valley Technical College (April 2013)	8	5	1	12	16
LTIP @ Mt. San Antonio College (June 2013)	7	3	4	6	23
aLTIP @ Estrella Mt. Community College (November 2013)	15	7	5	16	23

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

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 resulted in a collection of participants from high schools and colleges. A few participants brought colleagues with them from their institution or sent colleagues to different workshops, 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.

There were 24 states (see table below) represented at the workshops. Few of the participants attended more than one institute this year, however the majority of the participants had attended a workshop from a prior year. The fact that the participants were "repeaters" is an indicator of the value of the workshop and the high regard for its impact on the professional growth of the participants. The table indicates how many from a particular college or school attended the workshops and which workshop they attended. In some cases, less than five, the same person attended multiple workshops.

Universities and Schools Represented at the Workshops

College or School	State	Workshop
Alabama State	AL	ISIP
Arlington H.S	MA	aLTIP
Arlington ISD	TX	LTIP
Bismarck High School	ND	aLTIP
Cardinal Gibbons High School	FL	ISIP
Chaffey College	CA	LTIP
Champion High School	OH	LTIP
City College of San Francisco	CA	aLTIP
Cochise College	AZ	aLTIP
Cochise College	AZ	aLTIP
College of Coastal Georgia	GA	LTIP
Community College at Beaver County	PA	aLTIP
Community College of Denver	CO	aLTIP
Craven Community College	NC	ISIP
Cuyahoga Community College	OH	ISIP

Deep Run HS	VA	aLTIP
Estrella Mountain Community College	AZ	LTIP, ISIP
Evergreen Valley College	CA	aLTIP
Forest Lake Area High School	MN	LTIP
Gainesville High School	GA	ISIP
Grafton High School	WI	ISIP
Granada Hills Charter High School	CA	ISIP, LTIP
Henry M. Gunn High School	CA	LTIP
Irondale High School	MN	LTIP
Ivy Tech Community College-North Central	IN	LTIP
Kaua'I Community College	HI	LTIP
Lakeshore Technical College	WI	ISIP
Lee College	TX	LTIP, ISIP, aLTIP
Madisonville Community College	KY	LTIP
Madisonville Community College	KY	aLTIP
Malcolm X College	IL	LTIP, aLTIP
Manchester Community College	CT	ISIP, aLTIP
Manchester Twp.H.S	NJ	aLTIP
Marion Military Institute	AL	LTIP
Mesa Community College	AZ	aLTIP
Miami Dade College- North	FL	aLTIP
Middle Georgia College	GA	aLTIP, ISIP
Nebraska Indian Community College	NE	ISIP
North Lake Community College	TX	LTIP
Ottawa High School	KS	aLTIP
Rosary High School	CA	LTIP
San Diego Miramar College	CA	LTIP
Shenandoah High School	IN	ISIP, aLTIP
Show Low High School	AZ	LTIP
St. Johnsbury Academy	VT	LTIP, ISIP, aLTIP
West Hall High School	GA	LTIP
West Kentucky Community and Technical College	KY	ISIP

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 multiple indicators useful in determining the quality of a professional development sessions and how it met the needs of the participants. Questionnaires administered at the conclusion of a workshop indicated 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)

	aLTIP (November) N= 23	**ISIP (April)** N= 16	**LTIP (June)** N=23
The workshop has increased my enthusiasm for teaching.	4.57	4.75	4.83
The workshop stimulated me to think about ways I can improve student assessments.	4.70	4.75	4.74
The workshop has motivated me to implement the ideas I learned into my classroom.	4.91	4.88	5.00
The workshop has increased my interest to incorporate more effective technology and laboratory tools/equipment in my courses.	4.83	4.94	4.96
I plan to continue active professional involvement in workshops like this one and other similar professional opportunities.	4.83	4.69	4.87
The workshop was responsive to my professional development needs.	3.91	3.94	3.96
The workshop was conducted at a level appropriate to my knowledge, skills and interests.	3.74	3.88	3.96
The workshop content was meaningful for my current teaching situation.	3.87	3.88	3.96
The workshop content, instructional strategies, and laboratory work are adaptable to my current teaching situation.	3.91	3.94	3.96
My students would benefit from an appropriate adaption of the workshop content in my classroom/laboratory.	3.83	4.00	4.00

Average Ratings for Workshops
Surveys administered by leadership team

	aLTIP (November) N= 23	**ISIP (April)** N= 16	**LTIP (June)** N=23
Dwain Desbien's Presentations	4.96	4.81	4.91
Tom O'Kuma's Presentations	4.91	4.93	4.96
Martin Mason's Presentation	NA	4.75	4.91
Anne Cox's Presentations	4.83	4.88	NA
David Weaver's Presentations	NA	4.75	NA
Workshop Format	4.91	4.88	4.96
Useful Ideas	4.96	4.69	4.91
Site Facilities	4.87	4.88	4.96
Food	4.74	4.75	4.65
Lodging	4.62	4.88	4.45
Workshop Organization	4.78	4.94	4.96
Workshop Worthwhile	5.00	4.94	4.96
Rate the whole workshop	4.91	4.53	4.96
Did pre-workshop materials help prepare you for the workshop?	4.26	4.75	4.18
Sessions on MBL Activities	4.61	NA	4.78
Sessions on Video Analysis Activities	4.91	NA	4.77
Sessions on Open Sources/Physlets/EJS Activities		4.63	NA
Session on Computational Modeling Analysis	4.30	NA	4.78
Session on Technology Education and its Use in Physics	4.59	4.67	4.71
Sessions on Project Based	NA	4.75	NA
Project work sessions to create own materials	4.59	4.63	4.70
Session on Assessments and Implementation	4.68	4.63	4.39
Increased knowledge of technical and physics education	4.71	4.81	4.78
Post-workshop evening interactions	4.47	4.75	4.86

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 determine if the participants 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). Unfortunately, there were no responses to this question from the ISIP participants and very few responses for the other two workshops. It is unclear if the participants just skipped the question or if there was a glitch in the online survey.

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?	**LTIP (June)** N= 1	**aLTIP (November)** N= 2
Attending the workshop increased my enthusiasm for teaching.	4.00	4.00
Attending the workshop supported my efforts to implement teaching strategies that have been demonstrated as effective into my classes.	4.00	4.00
Implementing activities/materials from the workshop increased my enthusiasm for teaching.	4.00	4.00
When I implemented activities/materials from the workshop into my classes, my students were more engaged in learning.	4.00	3.00
The workshop stimulated me to think about ways I can improve student assessments that I use in my physics courses.	4.00	4.00
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.	4.00	3.00
Attending the workshop and implementing new activities/materials in my classes has increased my interest to continue participating in professional development workshops.	4.00	4.00
Implementing new activities/materials in my classes has increased my interest to continue participating in professional development workshops.	4.00	4.00

Question 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?

The first workshop and the last workshop had the same number of responses for activities that had been implemented. A question might be asked if this is due to the fact that the workshop was during the actual school year where they could go back and immediately try some of the activities while they were fresh on their mind instead of the summer workshop, which was followed by two more months of summer vacation. It would seem reasonable that the longer break would allow one to anticipate and plan for implementation, but perhaps it had the opposite affect and participants forgot what the activities were or how to use them because they did not immediately apply that knowledge in the classroom.

The table below gives the workshop and the semester participants indicated they were going to implement at least one activity they had learned.

Semester Materials/Activities Were Implemented

	Spring 2013	**Fall 2013**	**Spring 2014**
ISIP @ Fox Valley Technical College (April 2013)	4	10	5
LTIP @ Mt. San Antonio College (June 2013)	3	4	2
aLTIP @ Estrella Mt. Community College (November 2013)	NA	10	9

One item of interest to the project leadership was to estimate the number of students directly by the workshop. The number impacted by implementation of workshop skills is an estimate based on responses to the on-line survey and is reported below. 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.

Approximate Number of Students in Courses Where Activities Were Implemented

	Number of Students
ISIP @ Fox Valley Technical College	932
LTIP @ Mt. San Antonio College	3465
aLTIP @ Estrella Mt. Community College	772

Since participants came from different states and different levels of teaching (high school, college, etc), the course identifiers were grouped according to classroom, laboratory or integrated settomg. In the past the information was gathered for specific courses, but the results proved to be of little value since the names of courses and levels were very diverse. The table below indicates that there is a fairly even scattering of the settings and there is not one setting that is more predominant than another.

Courses Where Materials/Activities Have Been Implemented

	Classroom (lecture discussion)	**Laboratory Setting**	**Integrated Lab/Lecture**
ISIP @ Fox Valley Technical College (April 2013)	6	6	7
LTIP @ Mt. San Antonio College (June 2013)	3	2	2
aLTIP @ Estrella Mt. Community College (November 2013)	6	7	8

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?

Participants identified specific activities from the workshops they implemented into the classroom environment. The table below summarizes the activities mentioned by the participants. Overwhelming favorites include the Video Analysis program developed by Vernier Software and the free Tracker software. Other activities mentioned include MBL, motion sensors, MRI lab, force plate, resistance of human body circuitry, and Jing.

Activities Implemented (Number of Responses)

	Tipers/Ranking Tasks	**Group Projects, whiteboards**	**PhET, OPS**	**Video Analysis, Tracker**
ISIP @ Fox Valley Technical College	2	2	3	3
LTIP @ Mt. San Antonio College	2	1		2
aLTIP @ Estrella Mt. Community College	0	0	1	6

The online survey was used to determine how successful they felt implementing the activities identified. They were asked: "*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)

ISIP (N=11)

	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.	1	0	4	6
The activity addressed the physics content at a level appropriate to my students' background knowledge and skills.	1	0	4	6
The student assessment of learning that I used for this activity provided the formative feedback I need as a teacher.	1	2	4	3
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	1	0	7	3

the concept				

aLTIP (N=12)

	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	2	4	6
The activity addressed the physics content at a level appropriate to my students' background knowledge and skills.	0	1	2	9
The student assessment of learning that I used for this activity provided the formative feedback I need as a teacher.	0	2	7	3
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	7	4

LTIP (N= 4)

	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	1	3
The activity addressed the physics content at a level appropriate to my students' background knowledge and skills.	0	0	0	4
The student assessment of learning that I used for this activity provided the formative feedback I need as a teacher.	0	0	1	3
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	0	1	3

One of the strategies addressed at each workshop 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

	ISIP (April)	**LTIP (June)**	**aLTIP (November)**
Ranking Tasks	10	8	15
TIPERS	7	5	9
FCI	7	6	12

Challenges

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 overwhelmingly they indicated they would although some indicated they would make modifications to increase student involvement and engagement.

Listed below are some of the problems participants encountered (based according to the workshop they attended).

ISIP

- They were difficult for my students but it improved somewhat as they continued using them.
- Some students were inclined to let others do the work. I gave the responsibility to the other members of the team. The value of their effort was respective of all their work.

- iPad constraints, but I overcome it by using the MacBooks as needed.
- Fall semester was the first time I implemented project based learning. It was a bit rough at first telling students what was expected, how they would be graded with a rubric, etc. etc. It was more of a trial run to work out the kinks. This semester it is going more efficiently.
- It is always a challenge to try something new. The advantage of these workshops is that we actually plan and develop materials for immediate use in the classroom. So I tend to do projects on topics that I need to develop in the classroom.
- Mostly, technology problems with Tracker, but tech department at my school and some of my students helped solve them. Java sims have worked fine.
- I have needed to create more and more boundaries to limit the options available to the students. Last year, one of the students launched a softball and put a hole in the wall. Now we use hacky sacks.

LTIP

- I found them easy to implement if I ran through them once on my own first before giving them to my students.
- The newness of the approach was difficult to get students to buy in. I started with small activities and grew them.
- Problems were with school equipment malfunctioning. Computers didn't boot up properly

aLTIP

- Our students have been issued iPads and I find it difficult to use some of the interactive software with iPads, but some are becoming more friendly (i.e. PhET)
- Installing Tracker on school computers. Having students take and transfer videos to their PCs.
- Tracker doesn't always download and work properly, which is a struggle to deal with on the fly in class and is a bit time consuming.

- Student frustration with the programming. Talking them through the frustration and logical thinking
- I do not have high-speed cameras, so identifying good constant-acceleration problems that can be tracked in Tracker Video Analysis is a challenge. I was able to create some sample videos, and I was also able to help students analyze videos taken with digital cameras and phone cameras.

Things Learned from Trying New Activities

Although there were often issues with implementation, as mentioned before, participants also felt there were also many benefits gained from using what they learned at the workshops. Below are some of the responses regarding what they learned during the use of the activities.

ISIP

- I need to explain how the questions work in a way they can understand - they're not used to these types of questions so are resistant at first.
- Students are able to control situations better than if the instructor took on the active role of monitor.
- That some students will rise to the occasion and others sit to wait for the occasion to come to them.
- The students need more practice with graph reading.
- Every student enjoyed using the technology and the ones that went farther, enjoyed the creativity.
- Engaged = Asking more questions, retention = Excited
- It was generally well-received but I need to ensure that all students in a group are participating equally.
- Demonstrations or simulations are good for teaching; they have helped in the past with concept communication
- I learn mainly from listening to my students and the Tipers often provide a good opportunity to see what they are really thinking. This allows me to better design activities that help them (students) to correct their thinking. One of Dwane's suggestions that I have

found really useful is to often ask students why they think that I had them do a particular activity. This is now one of my favorite questions.

- Good engagement on both the video analysis with tracker and the java sims. They enjoy the competitive nature of the assignment and look forward to the day of the competition.
- It was well-received by my students and it went well. I am improving on my organization in the fall to make it smoother. Additionally, I am making use of some of the physlets but the question asked us to focus on one activity.
- If I were to teach physical science again, I would definitely use the resources about which I learned at the workshop
- I will continue to use what I learned from the workshops and to integrate it with my own style of teaching
- Some students don't care for it due to their sense that it is a time consuming activity, but most enjoy the atmosphere it creates and the creativity it promotes. Most also think it's just fun.

aLTIP

- Students were surprised by the results and how stubborn preconceptions are. The believe the scale reads their weight is
- That some will always tackle a "problem" with a desire to solve it and learn something new. They will have fun in my class! Others will always sit back and whine that "this is hard" because the answer is not filled in on the blank for them to regurgitate. They will be disappointed daily in my class. =(
- Has potential, but need to more tightly integrate recording of labs with lab reports: majority chose to grind out modeling in excel.
- Students seem more engaged with each other and the material.
- Students are quick with technology
- They all have different levels at which they understand what is going on. They learned a great deal from the activity.
- They are enjoying the Challenge of these Activities and the Concepts beyond them....

- While students are somewhat overwhelmed by the technical aspects of using the software, they are motivated and interested in the outcome, and they like using videos they have produced in/out of the classroom.
- Projects are more difficult for students who are working full time and have a family.

LTIP

- The circuit lab helped students to apply parallel and series circuits in combination, it was rigorous for 101 students but do-able. The momentum was applied with both 101 and 111 but needed to be adjusted for the 101 course.
- They were more engaged in the learning cycle
- Students are willing to try something new. Video is a great way for students to visualize motion.
- Students learned to modify their misconceptions about motion.
- This workshop helped me to markedly improve the student experience in labs. The students appreciated finally having labs that worked!
- Without these workshops it would be difficult to find quality professional development and collaboration opportunities for physics instructors.

Summary and Suggestions

1. Overall, the participants seemed very pleased with the workshop experiences and were anxious to implement the things they learned. The workshops meet the criteria for high quality workshops based on the Guskey Professional Development Model since the participants felt good about the workshops and implemented what they learned. Those that had not implemented an activity indicated they would do so in the near future.

2. 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.

3. 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.[8]

4. 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. Participants were positive about the support they have received from the leadership team when they tried to implement activities and had questions or technical difficulties.

5. Overall the participants had very few suggestions regarding changes for the workshops. One participant commented: "These workshops are perfectly planned. I appreciate very much being allowed to participate."The most common suggestion referenced the lack of support or equipment or the amount of material that was covered during the short time frame. Suggestions from participants are listed below:

- I thought the mouse trap car thing was a little drawn out. Taking all that time to physically build the stuff seemed unnecessary especially given the time constraints of the conference. It was fun, but I didn't get much out of it for time spent. 3 hours was overkill.
- Not to improve this particular workshop but to have more workshops year round so faculty have more options to work with in their schedules.
- Maybe offering a beginners course and an advance course.
- Implement labs that are not the "follow the instruction" type lab.
- If possible, ensure that teachers could have equipment that works the first time that would be great. The biggest problem is introducing a task and then having only half the school computers boot up properly.
- I would have liked to work with vPython. Many of my honors students would have had an easier time with their projects had I had training on this system.
- The workshop is excellent. I would like to see more activities related to Electricity and Magnetism.

[8] *Average Ratings for Workshops and Online Surveys*

- The workshop are excellent, just spread them over maybe four days, by the end of the day we were pretty tired.
- I would like to see a workshop offered for female only attendance. I would be curious to see if we could fill one. Then to see how the participants would work and what they would accomplish without the often domineering attitude of some of the male participants. This male attitude also affects the pursuit of physics education by female students. But that is a conversation for another day.
- Perhaps a pre-workshop video of some tasks
- I would love to see is an active lecture demo with clicker questions

Appendix
Results from Leadership Post Workshop Surveys
and
Workshop Descriptions

Results from Leadership Post Workshop Surveys

Final Day Comments
aLTIP Workshop
Avondale, AZ
November 14-16, 2013

1. What did you like best about this workshop? (You may list more than one)
    a. Interaction with colleagues. Exposure to new technologies. Introduction to educational software.
    b. Being introduced to and working with the tracker software.
    c. Getting lots of practice with logger pro. I learned a lot of new features to use in my classroom
    d. 1. Very good environment, friendly, open. 2. Liked topics
    e. The instructional activities that involved the use of "tracker" software. The activities that involved the use of "logger-pro" software. The force plate activity and the circuit mode of the human body.
    f. Time to learn about the technology- loved getting more time w/ logger pro, especially 2D models
    g. Playing with new toys and physics tools
    h. Being able to learn/relearn video analysis and the resources available for it.
    i. I got a lot of ideas for things I can do in my own classes
    j. I liked the organization + logical use of time and facilities. Time and opportunity to collaborate with peers from around the country is also valuable
    k. Excellent presentations by instructors and participants teaching ability of the instructors
    l. The introduction to various techniques in both software and hardware that are needed!
    m. I liked the use of multiple data taking and data analysis tools as well as how to integrate them with the curriculum
    n. Lots of hands on activities- the sessions on video analysis
    o. Being able to discuss issues I've had in class. Learning modeling in tracker and working with tracker more.
    p. Sharing and developing ideas + projects with many colleagues
    q. 1. Interaction with peers 2. Seeing facilities at another institution 3. Traveling to Phoenix
    r. The collaboration with other colleagues. The movie analysis software. The time given for project preparation presentation
    s. Comments from a lot of participants inputs were welcomed and encouraged
    t. Content, presentations, I honestly can't say anything bad
    u. No Response
    v. Instructors, MBL, Video analysis, Modeling
    w. Hands on nature

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

    a. All good
    b. None!

c. I did not like the tracker sessions probably b/c it was my 1st exposure to tracker and I found it overwhelming. When we worked with the models
d. Very long day, hard to focus after dinner
e. Nothing! I found every aspect of the workshop to be informative and instructive
f. The higher level of Tracker (computational) I'll need more time to really "get it". Interesting stuff, just deeper than my abilities
g. 8am-930pm is too long for me to be productive with new material
h. The attitudes of some of the male participants of superior intellect, "let me explain it to you" (even though they were wrong), and let me do everything.
i. Probably needs to be about 1 hour shorter each day- 13 hours is too much to 2 consecutive days. I thoroughly enjoyed workshop mat'l but did not benefit from sessions in late evening.
j. That I was too tired for the post-workshop evening interactions
k. I can't think of anything I really disliked
l. The introduction Video analysis as well as the Tracker with the use of MBL
m. N/A
n. Liked the MBL materials but I was already familiar with it would have liked a lot more info assessment- the food was good, but too much of it!
o. Nothing
p. The pace/hours are taxing, though I would not trade this for more days. It is difficult but doable
q. 1. Limited time for the entire workshop
r. N/A
s. No complaint
t. see above
u. No Response
v. Modeling, but I need to get higher up the learning curve to appreciate.
w. Too much down time. Participants should have been partnered as teams of 2

3. What suggestions do you have to improve this workshop? (You may list more than one)
a. No Response
b. I think the workshop has achieved its goals
c. No Response
d. I would like to see less topics covered, but dipper
e. I would keep doing the workshops the same way. I am very impressed with the activities that the workshop leaders give us with so few resources available to them.
f. No Response
g. Shorter days
h. All female workshop or be more selective with the groups so that(similar) individuals are in their own group
i. No Response
j. No Response
k. It would be nice to be a little longer but that is very difficult if not impossible for teachers to attend
l. Keep up the great work that you've always done!

m. Teach how to use vPython into curriculum
n. Healthier snack options
o. Nothing
p. No Response
q. No Response
r. No Response
s. No Response
t. more frequent coordinate with local org
u. No Response
v. None, excellent job
w. The after dinner sessions were not productive – order dinner in and leave for hotel earlier

4. Are there any other workshops that we should consider offering in the future?
   a. No Response
   b. It would be helpful, if possible, to include more electricity and magnetism activities.
   c. Laboratory tools as they apply to one physics topic I attended a workshop in which the instructor did 6-7 labs all about momentum. Cheap ones, vernier, air tracks, regular tracks, balloons, etc.
   d. No Response
   e. I would like to see you offer another workshop similar to this one that would include more activities in MBL, logger-pro and tracker
   f. No Response
   g. ?
   h. I am so new to the teaching of physics that any at this point would be extremely useful!
   i. No Response
   j. I would love the opportunity for female only workshop(s). The chance to collaborate with other female faculty in the absence of some of the gender interaction issues inherent in the sciences would be welcomed
   k. ?
   l. More on Video Analysis and modeling
   m. A multiple assessment workshop –use, how to analyze assessments, how to use assessments to alter curriculum
   n. Assessment techniques and student learning outcomes
   o. Dwain's discourse management. More Vpython
   p. Microcontroller (Ardwino, TI, etc) apps in physics. Use of 3D printing in physics teaching software/design, hardware, production
   q. Working together through the internet
   r. No Response
   s. No Response
   t. Review of mbl show an tell
   u. No Response
   v. Hands-on of any Type. Simplified modeling for concept physics and alg/trig

w. Workshops that focus on different areas say, just on E and M or mechanics or waves

5 General comments about the workshop pre-materials.
   a. NA
   b. They were very useful
   c. No Response
   d. I got materials just day before flight. Want to see them earlier
   e. I read the workshop pre-materials and these help prepare me for the activities in the workshop
   f. Good reading, helped prepare us
   g. It was really helpful to get a heads-up on the content, since this was my first ever ATE/ aLTIP workshop
   h. The articles were relatively old-informative- but made me wonder about the current research in the field.
   i. I liked the paper showing the effect of inquiry based instruction compared to traditional instruction
   j. The above suggestion should not be viewed as a complaint in any way. It is an idea that I just had during these workshops based on the idea of female only workshops provided in other fields not traditionally populated by women.
   k. I had read most of them before, but got me in the frame of mind to be at the workshop
   l. Excellent work and a job well done!
   m. N/A
   n. N/A
   o. No Response
   p. Good resources
   q. No Response
   r. No Response
   s. I'm glad I came
   t. No Response
   u. No Response
   v. N/A
   w. Thanks for all the stuff

Final Day Comments
ISIP Workshop
Fox Valley Technical College
April 11-13, 2013

1. What did you like best about this workshop? (You may list more than one)
    a. The introduction to various Technological of Either software or hardware. The introduction among the rest of the group's members and the leaders and organizers.
    b. I like the collegial aspect that exist in the supportive community surrounding this workshops activites.
    c. I loved Mr. David's presentation about project based physics.
    d. Very educative
    e. To get together and share ideas with colleagues and peers new techniques for teaching difficult subjects that are easy to do and easy to follow. Immediately able to implement them to the students
    f. The OSP/EJS session by Anne was top notch. Will definitely use in classroom
    g. Time to interact and use tools we were introduced to
    h. Project based learning by Mr. Weaver, E J's
    i. Introduction of web based resources
    j. I learned about many resources I was unaware of before now. I also learned more modern methods of teaching to improve engagement and retention
    k. Excellent
    l. Practical tools and sharing that were provided
    m. Anne's
    n. Learned to use physlets. Belief I can now do project based physics
    o. Doing a project specific to me timeline required to get us on task
    p. The tune to create activities that can be implemented immediately

2. What did you like least about this workshop? (You may list more than one)
    a. Too much information in regards to physlets, open source and EJS. That needs more time and energy to work on.
    b. I did not dislike anything that could be controlled. Weather is weather
    c. Some simulation work because I am not really familiar with Java and V-python. Too many simulation problem within a span of time so I am bit confused.
    d. The time span for each day was a little too long for me.
    e. Too much time for some presentations-set time limits and stick with them. Also do not call time and then extend time.
    f. Evenings got a little long. Also the PBL session was about twice as long as it should be. Having us make presentations for that was kind of silly
    g. Nothing
    h. No Response
    i. Lack of time to see the surroundings
    j. I wish there were more time for developing our own activites
    k. None
    l. No Response

m. time limits v.s. project
n. Nothing it was great
o. No Response
p. Not enough breaks

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

a. Keep up the great work and please keep these workshops coming.
b. I don't think I can offer anything helpful. Any problems were not intentional and will be corrected prior to the next one.
c. My suggestion is to focus on two or three simulations problems and spent more time to work with.
d. Cut down a little on the time window for each day
e. Too much time for some presentations-set time limits and stick with them. Also do not call time and then extend time.
f. More V-python. I want to learn it and there was little of it
g. Workshop closer to the ocean so that surfing can be integrated
h. No Response
i. No Response
j. No Response
k. None
l. It goes a little late. Should wrap up a little earlier.
m. ? none
n. No Response
o. No Response
p. Very little. It was fantastic

4 Are there any other workshops that we should consider offering in the future?

a. No Response
b. How about a mini course management course? How to create our own version of your successful classrooms? More time on really creating the implementation possibilities?
c. I would prefer some workshop mainly focused on Electricity and magnetism and modern physics.
d. Yes
e. No Response
f. I would attend one on tipers or on V-python of offered
g. Use of I- pads and I-pad apps and or I- phones and I-phone apps
h. No Response
i. No Response
j. No Response
k. No Response
l. No Response
m. ?
n. Using engineering concepts
o. Using engineering process NGSS highlights engineering
p. No Response

5 General comments about the workshop pre-materials.
   a. Excellent work guys! Please keep up the great work!
   b. Thank you for setting the scene.
   c. In general it is very good.
   d. Very good workshop nice people good food.
   e. I did not receive them via mail in time. Could they please be sent via email.
   f. Not all that useful. If you were signed up for this workshop it was basically preaching to the choir.
   g. Amazing workshop that really improve physics instruction Thank you
   h. No Response
   i. No Response
   j. No Response
   k. No Response
   l. No Response
   m. Always good! And appropriate
   n. Very helpful
   o. No Response
   p. Loved it thank you for all the time you put into the workshops

Final Day Comments
LTIP Workshop
Walnut, CA
June 20-22, 2013

1. What did you like best about this workshop? (You may list more than one)
    a. The presentations by the workshop leaders were excellent. The workshop were remarkably patient and helpful with any technical question on the computer programming as well as the "logger pro"
    b. I really liked the way we jumped right into the content and the way we worked on labs and activities that we could use in our teaching.
    c. Survey of Laboratory Tools using data collection technology, and V-python programming
    d. I like the easy attitudes that allow for free discussion and sounding boards. People who attend these workshops are perpetual learners and gracefully encourage co-participants to accompany each other on the journey.
    e. The workshop kept moving, it was very well organized (no wasted time at all)
    f. Equipment supplied; I did not need to bring anything. Shuttle from hotel. Food Plenty of opportunities to do labs
    g. V-python and computational analysis. Video analysis with logger pro
    h. The ability to work with others on the lab project working on the V-python modeling I felt I understood this much better. Use of whiteboards for explanation. The helpfulness and friendliness of organization
    i. The hands on nature of this workshop is exceptional I also thought discussion time with other physics faculty was extreme importance
    j. Interaction with peers, Intro. To V-python
    k. Useful, practical hands on experimentation with tools that will enhance classroom interactions among students and myself. These are by far the best workshops I know for physics teachers
    l. Computational Modeling and Video capture programs.
    m. Python,… gosh everything
    n. Covered material I cover in my courses
    o. V-python, labs, presentations, the list goes on
    p. I love walking away with materials I can use immediately
    q. No Response
    r. Use of magnetic field probe and constant current probe. Practice with video analysis. V-python isn't as complicated as I thought. Work time on projects
    s. Working with other teachers. Asking(and getting answers) from facilitators
    t. Meeting fellow teachers and getting new ideas for running my labs. Having new resources for lab development
    u. Knowledgeable workshop leaders, excellent logistic organization, prompt following of schedule.
    v. Computational modeling physics, Video analysis activities, MBL
    w. V-python, group projects

2. What did you like least about this workshop? (You may list more than one)
    a. I liked everything about the workshop
    b. Some people in my team were not very interested in really doing hands on stuff on trouble shooting when things did not work.
    c. Choice of food was limited and hotel had no gym
    d. I always hate when they end, but it is time to go home
    e. Only that the days were long. I like to have a little more "me" time. However I also appreciate that we covered so much in 3 days.
    f. some activities were too advanced for me; but I do not count this as a bad point
    g. I liked everything
    h. nothing really
    i. Didn't have a lot of time to discuss implementation aspects/ assessments
    j. Inability to visit the surroundings
    k. No Response
    l. No Response
    m. N/A
    n. N/A
    o. No complaints
    p. Not a lot of time to chat w/ fellow participants
    q. No Response
    r. Long days too much sitting too cool in the room
    s. The after dinner sessions
    t. Long trip!
    u. None
    v. No Response
    w. No Response

3. What suggestions do you have to improve this workshop? (You may list more than one)
    a. I would like another workshop dealing with these same topics. Computation with Vpython, logger pro, and the quantitative analysis of videos.
    b. No response
    c. NSF should provide more fund for this innovative event
    d. I have not EVER attended a comparable professional development opportunity and it is not for lack of participation. There are few or no glitches in the planning or execution and that is invaluable
    e. No Response
    f. Individual project. Although this is an option
    g. More time would be good although I realize there is only so much time available
    h. I haven't got any suggestions I just enjoy coming to your workshops
    i. More time for discussion of assessment and implementation
    j. No Response
    k. I do not have any because they are already so good
    l. Try to bring in Pasco interfaces as well. The labs and ideas are translatable but sometimes time is taken up learning new interfaces.
    m. Use any spare time for python skill development
    n. No Response

o. More processing time
p. it was great! Thank your for all of it!
q. No Response
r. ? Loved it
s. have more in the north east, discussions about Grants/ Funding, more info about local area
t. Nothing really
u. none
v. No Response
w. No Response

4. Are there any other workshops that we should consider offering in the future?
    a. I would very much like to attend a workshop precisely dealing with these same topics in the future.
    b. No response
    c. Possibly equipment trouble shooting
    d. Expand your expertise into more chemical realms by training your co-workers to embrace what is working in PER and encourage workshops like these are cross-curricular
    e. Perhaps same style just different topics I really could use help with particle physics, photoelectric effect and some of the modern physics concepts. Also possibly something with heat concepts
    f. NA
    g. Yes, modern Physics
    h. No Response
    i. I could certainly use more workshops on the same topics here. So many more great ideas out there to share.
    j. No Response
    k. As technology changes I believe the excellent workshop leaders will adapt. The same workshop topics will need to evolve and adapt. They are current now. More of the same please.
    l. No Response
    m. Python
    n. Should consider more advanced lab. Include modern physics
    o. V-python
    p. No Response
    q. No Response
    r. Applications to heat or light concepts
    s. Setting up Lab Environments
    t. Something on quiz/exam/ test design
    u. Robotics, Teaching online physics
    v. I wish I knew there was a computational modeling physics workshop last year. I could easily enjoy doing that for 2 ½ days.
    w. If you can teach fundamentals of robotics or a quick starting guide to robotics, that might be nice.

5 General comments about the workshop pre-materials.
   a. It way my fault that I failed to read all of the workshop pre-materials. What I did read proved to be an excellent introduction to the material covered in it.
   b. N/A Did not get them
   c. Pre-materials provided a quick refresher to ideas to expect in workshop
   d. When offered they are relevant and useful
   e. The pre-materials and handouts were great. I would highly recommend this workshop to other teachers.
   f. No Response
   g. Good-very helpful
   h. Many thanks for putting on these workshops I always learn so much
   i. Provided nice background
   j. Interesting but some were less than current
   k. Excellent and inspiring articles
   l. No Response
   m. Awesome!
   n. The pre-material were very informative
   o. No Response
   p. Loved it ☺
   q. No Response
   r. Felt like I had very little idea of what to expect
   s. No Response
   t. They pointed me in the right direction concerning topics covered
   u. No Response
   v. I briefly read them, didn't really get a lot from them I will read again.
   w. No response

Workshop Descriptions

Laboratory Tools for Introductory Physics
June 20-22, 2013 at Mt. San Antonio College, Walnut, CA

Workshop Leaders:
Martin Mason, Mt. San Antonio College, Walnut, CA
Dwain Desbien, Estrella Mountain Community College, Avondale, AZ
Tom O'Kuma, Lee College, Baytown, TX

Recent physics education research (PER) data indicates microcomputer-based laboratory (MBL) tools coupled with an activity-based physics approach provides a better method of teaching physics by enabling the teaching/learning process to build on students' direct experiences in the physics classroom/laboratory or studio. These MBL tools give students immediate feedback by presenting data graphically in a manner that can be easily and quickly understood. The ease of data collection and presentation afforded by these tools invites students to ask, discuss, and answer their own questions. Thus, students acquire an increased competence in the use and interpretation of graphs as well as a better understanding of the physical relationships, principles, and concepts that underlie their experiences. In this hands-on workshop, participants will work in areas involving force and motion, energy, waves, electricity and magnetism. They will explore approaches and curriculum materials from *Real Time Physics* (and leader developed labs) as well as hardware, software, and sensors from Vernier Software (LabPro/LabQuest Interface and Logger Pro software), PASCO Scientific, and *Tracker* software. These curriculum materials are often used with sensors and interfaces from other vendors as well.

Recent versions of MBL tools allow the inclusion of movies for some interesting activities. The movies can be synchronized with the sensor data taken at the same time and replayed. Video analysis, frame-by-frame, can provide distance, velocity, and acceleration data in situations where sensors are not workable. A number of physics applications will be explored.

The emphasis of this workshop will be on using these tools (available for both Mac and Windows computers) to teach physics more effectively to two-year college (TYC) and high school (HS) students. There will be extensive discussions on how to use these tools in TYC and HS courses, and tactics to overcome problems at TYCs and HSs. In addition, this workshop will be concerned with the assessment of physics learning in these areas and the application of the research findings in cognitive science and PER as applied to students' learning of introductory physics, particularly in the context of the use of the microcomputers at TYCs and HSs. Discussion and information on the needs of the technological workforce and its connection with the activities of this workshop will also be presented.

The workshop leaders have many years of experience in developing and refining curriculum for introductory physics students. In addition, and more importantly, the workshop leaders have had extensive experience with the implementation and adaptation of curriculum in a variety of institutions and for many types of introductory physics students along with the training of faculty in using and developing their own curricula for their technology-oriented students. This workshop is designed for TYC and HS teachers who are interested in using technology in lab and their courses to improve teaching and learning in introductory physics courses.

There will also be an opportunity to share and discuss issues relating to teaching physics more effectively (particularly for students enrolled in technician/technology education programs), and how to use various strategies, tools, and tactics to overcome problems and barriers to learning at TYCs and HSs. Important issues such as standards, assessment, diversity, and technology utilization will be addressed at various points during the workshop. Discussion and information on the needs of the technological workforce and its connection with the activities of this workshop will also be presented.

The local host will be Martin Mason who has provided strong leadership for an outstanding physics program in a suburban campus in a major city. Recently, the physics program at Mt. San Antonio College was selected as one of the ten outstanding TYC physics programs visited during the SPIN-UP/TYC project.

Advanced Laboratory Tools for Introductory Physics

November 14-16, 2013 at Estrella Mountain Community College, Avondale, AZ

Workshop Leaders:
Anne Cox, Eckerd College, St. Petersburg, FL
Dwain Desbien, Estrella Mountain Community College, Avondale, AZ
Tom O'Kuma, Lee College, Baytown, TX

Recent physics education research (PER) data indicates microcomputer-based laboratory (MBL) tools coupled with an activity-based physics approach provides a better method of teaching physics by enabling the teaching/learning process to build on students' direct experiences in the physics classroom/laboratory or studio. These MBL tools give students immediate feedback by presenting data graphically in a manner that can be easily and quickly understood. The ease of data collection and presentation afforded by these tools invites students to ask, discuss, and answer their own questions. **Selected participants for this workshop are expected to have MBL type experience**. They will explore approaches and curriculum materials from commercial vendors (and leader developed labs) as well as hardware, software, and sensors from Vernier Software (LabPro/LabQuest Interface and Logger Pro software), PASCO Scientific, and *Tracker* software. These curriculum materials are often used with sensors and interfaces from other vendors as well.

Recent versions of MBL tools allow the inclusion of movies for some interesting activities. The movies can be synchronized with the sensor data taken at the same time and replayed. Video analysis, frame-by-frame, can provide distance, velocity, and acceleration data in situations where sensors are not workable. Coupling video analysis with video modeling brings computational modeling into the laboratory—opening up the analysis to include friction, air-resistance and damping (without requiring a numerical analysis or programming course!). A number of physics applications will be explored.

The emphasis of this workshop will be on using these tools (available for both Mac and Windows computers) to teach physics more effectively to two-year college (TYC) and high school (HS) students. There will be extensive discussions on how to use these tools in TYC and HS courses, and tactics to overcome problems at TYCs and HSs. In addition, this workshop will be concerned with the assessment of physics learning in these areas and the application of the research findings in cognitive science and PER as applied to students' learning of introductory physics, particularly in the context of the use of the microcomputers at TYCs and HSs. Discussion and information on the needs of the technological workforce and its connection with the activities of this workshop will also be presented.

The workshop leaders have many years of experience in developing and refining curriculum for introductory physics students. In addition, and more importantly, the workshop leaders have had extensive experience with the implementation and adaptation of curriculum in a variety of institutions and for many types of introductory physics students along with the training of faculty in using and developing their own curricula for their technology-oriented students. This workshop is designed for TYC and HS teachers who are interested in using technology in lab and their courses to improve teaching and learning in introductory physics courses.

There will also be an opportunity to share and discuss issues relating to teaching physics more effectively (particularly for students enrolled in technician/technology education programs), and how to use various strategies, tools, and tactics to overcome problems and barriers to learning at TYCs and HSs. Important issues such as standards, assessment, diversity, and technology utilization will be addressed at various points during the workshop. Discussion and information on the needs of the technological workforce and its connection with the activities of this workshop will also be presented.

The local host will be Dwain Desbien who has provided strong leadership for an outstanding physics program in a suburban campus in a major city. Recently, the physics program at Estrella Mountain Community College was selected as one of the ten outstanding TYC physics programs visited during the SPIN-UP/TYC project.

Instructional Strategies for Introductory Physics (ISIP) Workshop
April 11 – 13, 2013 – Fox Valley Technical College, Appleton, WI

Workshop Leaders:
Anne Cox, Eckerd College, St. Petersburg, FL
David Weaver, Chandler-Gilbert Community College, Mesa, AZ
Bradley Staats, Fox Valley Technical College, Appleton, WI
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Physics students enter our classrooms with important skills and knowledge (along with a few alternative conceptions). Furthermore, they also bring expectations about the ways they will (or won't) use physics in their careers or in other aspects of their life outside the classroom. There are many highly laudable efforts that have been made to address the impedance mismatch between students' background as well as the needed exit knowledge and skills for physics courses. We believe a problem-based learning (PBL) format is another effective tool in this mission. This workshop is designed for teachers who are interested in using and developing new authentic learning tasks in introductory physics.

"How can I get my students to think?" is a question asked by many faculty, regardless of their disciplines. Problem-based learning (PBL) is an instructional method that challenges students to "learn to learn," working cooperatively in groups to seek solutions to real world problems. These problems are used to engage students' curiosity and initiate learning the subject matter. PBL prepares students to think critically and analytically, and to find and use appropriate learning resources (by Barbara Duch on website: http://www.udel.edu/pbl/.)

This workshop will feature the use of one form of PBL, Very Large Contexts (VLC), in which student teams have 4-5 weeks to construct a project, collect pertinent data, create a technical instruction manual for their device and develop a multimedia presentation about their efforts. Participants will work in small groups on specific VLCs projects.

Computer simulations, for example, can provide an interactive and conceptual mode for student understanding. Simulations alone, however, are not necessarily the answer for increasing student understanding. They must be informed by good pedagogical practices and must be adaptable to a variety of educational environments. Thus, this STIP workshop will allow participants to explore how these simulations can be used most effectively in the classroom. This often means coupling simulations with various teaching strategies.

During this workshop, participants will become familiar with the variety of simulations available. Participants will work with Physlets© (physics applets) and Open Source Physics resources (www.opensourcephysics.org). Included in this set of resources are tools for authoring simulations (Easy Java Simulations) and video analysis (Tracker). Participants will also become familiar with other simulations, e.g., the PhET simulations (http://phet.colorado.edu/new/index.php) which are research-based, interactive physics simulations. Participants will also develop the ability and skills to modify, adapt, and construct new materials. One of the goals of this workshop is to provide a flexible suite of resources appropriate to different levels of instruction as well as different levels of technological sophistication (from low to high) so that participants can choose what will be most successful in their home environment.

The workshop leaders have many years of experience in developing and refining curriculum for introductory physics students. In addition, and more importantly, the workshop leaders have had extensive experience with the implementation and adaptation of curriculum in a variety of institutions and for many types of introductory physics students along with the training of faculty in using and developing their own curricula for their technology-oriented students. This workshop is designed for TYC and HS teachers who are interested in using technology in lab and their courses to improve teaching and learning in introductory physics courses.

There will also be an opportunity to share and discuss issues relating to teaching physics more effectively (particularly for students enrolled in technician/technology education programs), and how to use various strategies, tools, and tactics to overcome problems and barriers to learning at TYCs and HSs. Important issues such as standards, assessment, diversity, and technology utilization will be addressed at various points during the workshop. Discussion and information on the needs of the technological workforce and its connection with the activities of this workshop will also be presented.

The local host will be Bradley Staats who is a chemistry and physics professor at Fox Valley Technical College (FVTC). His college serves approximately 50,000 students annually. Last year, the college, which offers more than 200 associate degrees, technical diplomas and certificate programs, had the highest enrollment of all 16 colleges in the Wisconsin Technical College System.