ATE/WPF Project Evaluation
Report on 2011 Workshops

NSF Award 1003633

Submitted
May 6, 2012

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Background

The Advanced Technological Education Workshop for Physics Faculty (ATE/WPF) 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] The ATE/WFE 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 2011 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. 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 four workshops conducted for the ATE/WFE project between February 2011 and December 2011. During this time period there were workshops conducted at the following sites: Estrella Mountain Community College, Mt. San Antonio College, Manchester Community College, and

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1 Program Solicitation NSF 07-530, National Science Foundation, Directorate for Education & Human Resources, Division of Undergraduate Education, Advanced Technological Education Program

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

Austin Community College. Each workshop focused on different aspects of technology tools appropriate for a classroom and was led by experts in physics education. Experts included: Tom O'Kuma (Lee College, Baytown TX), Dwain Desbien (Estrella Mountain Community College, Avondale, AZ), Paul Williams (Austin Community College, Austin, TX), Anne Cox (Eckerd College, St. Petersburg, FL), Martin Mason (Mt. San Antonio College, Walnut, CA), Paul D'Alessandris (Monroe Community College, Rochester, NY), and David Weaver (Chandler-Gilbert Community College – Williams Campus, Chandler, AZ).

Workshops Conducted

- Stimulations Tools for Introductory Physics (STIP) Workshop, February 3-5, 2011 at Estrella Mountain Community College in Avondale, AZ
- Instructional Strategies for Introductory Physics (ISIP) Workshop – April 7-9, 2011 at Mt. San Antonio College in Walnut, CA.
- Instructional Strategies for Introductory Physics (aISIP) Workshop – June 2-4, 2011 at Manchester Community College in Manchester, CT.
- Instructional Strategies in Introductory Physics (ISIP) Workshop—Nov. 3-5, 2011 Austin Community College, Austin, 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. In addition to the advertised descriptions below[3], 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.

- STIP: 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

3 Complete workshop descriptions are included in the appendix

analysis (Tracker). Participants will also become familiar with other simulations, such as 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.

- ISIP (MSAC): This workshop will provide hands-on experience with the use of video-based motion analysis in a wide range of applications, including the teaching laboratory, projects, and homework. Video analysis can be done in the classroom with inexpensive web cameras, digital cameras or traditional video cameras. Participants will learn how to make digital video clips for analysis, as well as how to use video analysis for homework problems and in the classroom. For example, participants will create a number of movies of one-dimensional and two-dimensional phenomena and make center-of-mass analysis of pre-recorded movies.
- aISIP: This workshop will introduce and provide participants with experience in using several different curricular approaches to teaching general physics, algebra/trigonometry-based, and calculus-based physics courses. Two approaches in particular will be extensively used during the workshop: a modular approach known as Introductory College Physics/Twenty First Century (ICP/21); and a "supplemental" approach using readily available resources, known as Modeling Discourse Management.
- ISIP (ACC): This workshop will feature the use of one form of Project Based Learning, 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. Another alternative curriculum is Spiral Physics, designed for use in both the algebra-based and calculus-based courses. Spiral Physics rearranges the traditional topic sequence so that students receive repeated exposure to concepts throughout the semester, each time with an incremental increase in complexity. Designed to facilitate active

learning, it makes use of numerous alternative problem types including goal-less problem statements, ranking tasks, and an emphasis on graphing and other non-quantitative representations.

The workshop instructors have excellent credentials, and are active in Physics Education Research (PER) implementation 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. More information about the workshops and presenters can be found at the project website, www.physicsworkshops.org.

The workshops are intensive over a three 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. The rigor and contact hours set forth for the workshop meet the criteria set forth for a graduate level course by the University of Dallas. Therefore, participants were offered graduate credit in physics at a reduced cost of $60 for the workshop through the University of Dallas.

Project Objectives

The ATE Workshops for Physics Faculty (ATE/WPF) 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.[4] The workshops were to provide approximately 33.5 contact hours over a three-day period to limit the time participants would miss class

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

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
- 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[5]

Evaluator and Evaluation Methodology

The proposed evaluation plan for the project focused on several key elements: 1) workshop quality, 2) classroom implementation and 3) 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. The external evaluation instruments were

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

designed to collect self-reported data regarding plans of implementation and action taken to fulfill the plans as well as the level of perceived success of the activities with students.

The leadership team assisted in the collection of data by having the participants complete post workshop surveys before they left the institute. This 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 given to the external evaluator and are included in the appendix of this report.

A few weeks 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. Most participants did not have the opportunity to implement the materials immediately, so the survey was left open to allow them to submit throughout the year. However, as is true of most projects, participants were hesitant to complete the surveys and therefore it was necessary to periodically remind them and request feedback.

Some participants attended multiple institutes dealing with different skill sets and therefore 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 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. Another factor also complicated the issue of overlapping responses. In order to prepare for the project summary report (2009-2011), a survey was designed to collect information related to the implementation of activities as a result of training at any of the sessions. 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. Again, this may have reduced the overall response rate for some of the sessions. The project summary survey did contain information useful for this report and so some of the information for this report was extracted from the summary surveys.

In addition to email solicitation, EAT, Inc. mailed (via United States Parcel Service) letters and surveys to encourage the participants to submit feedback. Several participants submitted lesson plans to document their implementation. The lessons were shared with the project leadership and some are attached to this report in the appendix.

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.

In January 2012, a short implementation survey was posted in an effort to target those who had implemented activities from the workshops, but had not responded to prior surveys. The survey link was sent to all prior participants (since 2006) and resulted in more participants providing feedback. Unfortunately, some of the participants misunderstood the instructions and only responded to the short survey, which meant we were unable to collect a complete profile of their participation since the implementation survey only had 8 questions and the others had 31. As a result, the data had to be carefully disaggregated in order to ensure that there were no duplicate entries. The addition entries obtained from the implementation survey are embedded in the data where appropriate and properly noted as "additional responses". All surveys were closed April 10, 2012 and the response rates were as follows:

Survey Response Rates

	Number of Participants	*Number Responding to Original Online Survey*	*Additional Responses to Summative*	*Percentage Responding*
STIP @ EMCC (Feb. 2011)	23	17	1	78.2%
ISIP @ MSAC (Apr. 2011)	24	20	4	100%
aISIP @ MCC (June 2011)	22	12	5	77.3%
ISIP @ ACC (Nov. 2011)	25	13	5	72.0%

Participant Demographics

The information below was collected from the online surveys, therefore is incomplete since all of the participants did not complete the surveys. The information is considered useful and a good indicator of the participant demographics since over half of the participants submitted the information.

Participant Gender and Attendance

	Males	*Females*
STIP @ EMCC (Feb. 2011)	10	7
ISIP @ MSAC (Apr. 2011)	10	10
aISIP @ MCC (June 2011)	9	3
ISIP @ ACC (Nov. 2011)	9	4

According to the participant list provided by the leadership team, both high school and college faculty were well represented at the workshops. Teaching positions were varied, ranging from middle school through university faculty. Participants indicating affiliation with a magnet school, charter, preparatory, or academy were tallied as high school teachers, but are also tallied separately in the table below to highlight the number of technology teachers/faculty attending the ATE/WPF workshops.

Educational Affiliation of Participants

	High School/ Middle School	College/University	*Academy, Charter, Preparatory, or Magnet School*	*Technical College*
STIP @EMCC (Feb. 2011)	19	3/1	*7*	*0*
ISIP @ MSAC (Apr. 2011)	14/1	7/2	*3*	*2*
aISIP @ MCC (June 2011)	11	10/1	*2*	*2*
ISIP @ ACC (Nov. 2011)	10	12	*1*	*2*

The table below indicates the anticipated impact of the ATE/WPF workshops according to the estimated number of students in courses currently being taught by workshop attendees. As stated earlier, this data is self reported by attendees and is a low estimate of the yearly impact since not all participants responded (number of total attendees = N_p, number of respondents = N_r and N_r includes additional responses from additional responses to summative survey).

Participants were encouraged to attend more than one workshop in order to hone their skills as well as learn new activities since the workshops focused on different aspects of technology integration. Eleven participants attended more than one workshop in 2011. The table below contains information provided by the leadership team indicating the distribution of workshops attended by participants.

Participants who Attended More than 1 Workshop in 2011

Primary Workshop	*Number of Participants*	*2nd workshop STIP@EMCC*	*2nd workshop ISIP@MSAC*	*2nd workshop aISIP@MCC*	*2nd workshop ISIP @ACC*
STIP@EMCC	23		2	1	2
ISIP@MSAC	24			1	4
aISIP@MCC	22				1

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

	Participants/ Respondents	Courses in which Workshop Content will be implemented	Estimated Number of Students in these Courses
STIP @ EMCC	$N_p = 23$ $N_r = 16$ 2 Skipped question	**Courses for high school students:**	
		Conceptual physics (9th grade)	194
		General physics (algebra based)	522
		AP Physics A (algebra based)	23
		AP Physics B (calculus based)	169
		Courses for college students:	
		Introductory/conceptual physics	100
		Algebra based physics	303
		Calculus based physics	35
		Courses for teachers:	
		Professional development courses	25
ISIP @ MSAC	$N_p = 24$ $N_r = 20$ 4 Skipped Question	**Courses for high school students:**	
		Conceptual physics (9th grade)	90
		General physics (algebra based)	284
		AP Physics	170
		Honors Physics	25
		Courses for college students:	
		Algebra based physics	259
		Calculus based physics	107
		Engineering	32
		Other:	
		6th grade science	140
		Advanced math and science	15
aISIP @ MCC	$N_p = 22$ $N_r = 14$ 3 Skipped Question	**Courses for high school students:**	
		General physics (algebra based)	129
		Honors Physics/Regular	36
		AP B / Regents (algebra)	215
		AP C (calculus)	88
		IB Physics	15
		Courses for college students:	
		Algebra based physics	70
		Engineering	54
		Astronomy	40

	Participants/ Respondents	Courses in which Workshop Content will be implemented	Estimated Number of Students in these Courses
ISIP @ ACC	$N_p = 25$ $N_r = 14$ 5 Skipped Question	**Courses for high school students:**	
		General physics (algebra based)	236
		AP C (calculus)	36
		Teacher professional development:	
		General Physics (curriculum coach)	40
		Courses for college students:	
		Algebra based physics	214
		Calculus based physics	32
		Survey of physics (algebra based)	25
		Astronomy	8
		Conceptual physics	35

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. How many participants indicated that they plan to implement materials/activities/teaching strategies from the workshop?
4. After participants returned to their classrooms, how many confirmed their plans to implement workshop content in their classrooms? How many students and courses are influenced by these changes?
5. What activities were implemented in the participants' classrooms and to what extent were the implementations successful? What problems were encountered during implementation?
6. Is there evidence of the participants' continued motivation to change?[6]

[6] Interim Evaluation Report, Year One, July 2007. Prepared by Karen Johnston, Momentum Group

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?*

The ATE/WPF workshops solicited participants using a wide variety of resources and the result was a wide variety of participants. As seen earlier in the table *Educational Affiliation of Participants*, the participants were from public high schools, charter high school, academies, technical colleges, two-year colleges, and universities. Students of these educators typically embrace technological challenges and would be well served by the strengthening of their courses with the technology, simulations, and challenging projects presented in these workshops. .

Faculty members who teach at these institutions and attend workshops during the school year are typically self-motivated to enrich and enhance the classroom experiences. However, casual observers do not take into account the rigor of workshops given in the short time frame such as the ones provided by ATE/WPF. The fact that the workshop participants are allowed graduate credit with the University of Dallas lends credibility to the rigor and quality of the sessions. Therefore, participants attending these workshops know they are going to be working long hours and the productivity expectations are high both during and after the workshop.

It is often assumed that participation in workshops of this nature infers that the participants are going to take the experiences back to the classroom, particularly when they have the option of receiving graduate credit. One measure of interest in strengthening their capacity to prepare students for a technology-driven workforce is determined by how and when they implemented the materials learned at the workshop, a difficult measure to quantify. At the end of the workshops, nearly 100% of the participants indicated they were eager to implement activities learned into their curriculum. [7]

Implementation of the activities learned in the workshop can directly impact students in the classroom if used effectively. Research indicates time and exposure to concepts is

[7] Refer to research question #3

important for the implementation phase. Since technology is involved in the ATE/WPF workshops, it is understandable that the faculty may not be able to implement the materials immediately. However, according to the survey, many had already implemented the activities/materials or had plans in place to implement in the near future.

Based on the types of participants attending the workshops and their eager anticipation to implement what they had learned, this evaluator concludes that the workshops did attract faculty interested in using the knowledge gained from the workshop to enhance the use of technology in the classroom. The responses of the teachers indicate they were excited and willing to take these experiences back to the classroom to help students realize the importance of technology in the work force.

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?*

Respondents to the online 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 survey results given below. The following table summarizes the 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 responses and overall average for the various workshops

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?	**EMCC STIP (N=17)**	**ISIP MSAC (N=18)**	**aISIP MCC (N= 9)**	**ISIP ACC (N= 12)**	**Weighted Average**
Attending the workshop increased my enthusiasm for teaching.	3.08	3.11	3.33	3.83	3.29
Attending the workshop supported my efforts to implement teaching strategies that have been demonstrated as effective into my classes.	3.17	3.28	3.44	3.83	3.39
Implementing activities/materials from the workshop increased my enthusiasm for teaching.	3.08	3.06	3.44	3.83	3.29
When I implemented activities/materials from the workshop into my classes, my students were more engaged in learning.	3.25	3.11	3.33	3.92	3.36
The workshop stimulated me to think about ways I can improve student assessments that I use in my physics courses.	3.08	3.39	3.22	3.83	3.36
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.	2.91	2.83	3.22	3.58	3.08
Attending the workshop and implementing new activities/materials in my classes has increased my interest to continue participating in professional development workshops.	3.17	3.11	3.67	3.92	3.39
Implementing new activities/materials in my classes has increased my interest to continue participating in professional development workshops.	3.08	3.17	3.44	3.92	3.35

There were two participants for the EMCC STIP workshop that strongly disagreed on all of the above questions and there were two that disagreed with the statements regarding implementation of formative student assessments and that attending the workshops increased their interest to continue participating in professional development workshops. These contributed to the lower scores for the EMCC workshop.

The average score on the question: "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" was noticeably lower than the other scores. It is unclear as to whether this is from the assessment itself not being useful or if it is a situation where the participants did not know how to use the information gained from the formative assessment. It is also noted that this category was lowest on the session at EMCC, which had the highest number of high school teachers. Prior experiences of this evaluator would support the second explanation, a lack of training by the teachers on how to use formative assessments. Teachers typically have not had a supportive environment for testing, formative or summative. They are told when, what, and how to give a summative, but little or no training in how to use formative assessment to address student needs and misconceptions. The leadership team may want to consider spending time on formative assessments and how to analyze and take action on data gathered from those assessments. This information would be useful to the participants and would help them understand how to use these assessments to increase student understanding and achievement.

The workshops meet the criteria for high quality workshops based on the Thomas Guskey Professional Development Model and would be considered successful professional development experiences since the ratings are on the upper end of the scale, mostly between strongly agree and agree.

Question 3: *How many participants indicated that they plan to implement materials/activities/teaching strategies from the workshop?*

At the conclusion of the workshops, participants were queried as to their plans to implement materials/activities from the workshop. As shown in the table below, the percentages were over 85% for all of the workshops, which is clearly significant.

Indicators of Intent to Implement (Paper Evaluation)

	Yes	*Maybe*	*% Yes*
STIP @ EMCC (Feb. 2011)	23	0	100%
ISIP @ MSAC (Apr. 2011)	22	0	92%
aISIP @ MCC (June 2011)	19	1	86%
ISIP @ ACC (Nov. 2011)	24	1	96%

In order to try to determine a timeline for implementation, the online survey, administered several months after the workshop, queried the participants as to when they were planning on implementing what they learned. The initial question was to ask if they had already implemented what they learned (see prior table). If they had not implemented an activity, the survey took them to a section where they were asked them: "*When do you plan on implementing what you learned in the classroom*?" The responses of the second question are below (note these are only the ones that answered the survey and had not already implemented their plan. A follow up on these responses would likely increase the percentages of implementation.

Future Implementation Plans

	STIP EMCC (2/11)	**ISIP MSAC (4/11)**	**aISIP MCC (6/11)**	**ISIP ACC (11/11)**
Next week	0	0	0	0
In about a month	3	0	1	0
In about 3 months	1	0	0	0
Not sure	0	0	1	0

Question 4*: After participants returned to their classrooms, how many confirmed their plans to implement workshop content in their classrooms? How many students and courses are influenced by these changes?*

Participants were asked to submit what they implemented via an online survey and give feedback as to their perception of success for the activity that was used. Although the data was self reported data and not all participants responded, it does provide useful information as to what participants used and what they felt was successful. A Likert scale was used to rank their responses on a scale of 1-4, with the following categories: 1= not successful at all, 2 = slightly successful, 3= moderately successful, and 4=highly successful. Therefore an average score between 3 and 4 would be considered successful. Below are questions and the average score of responses from the self reported data.

Question: To what extent, if any, was your experience with the implementation of this new activity successful?

	STIP EMCC (2/11)	ISIP MSAC (4/11)	aISIP MCC (6/11)	ISIP ACC (11/11)	Weighted Avg.
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.	3.50	3.39	3.50	3.83	3.54
The activity addressed the physics content at a level appropriate to my students' background knowledge and skills.	3.67	3.33	3.63	3.75	3.56
The student assessment of learning that I used for this activity provided the formative feedback I need as a teacher.	3.17	3.33	3.43	3.50	3.35
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.	3.42	3.33	3.63	3.92	3.54
	N=12	N=18	N=8	N=12	

As mentioned earlier in this report, the number of students potentially impacted from these workshops is very diverse and spans from middle school to AP physics in high school to engineering and physics courses in colleges and universities. Participants were asked to estimate the number of students they have per year that would be impacted by the ATE/WPF grant. The estimated number for the 64 teachers (who responded to the survey) is 3766 students or an average of 50 students per teacher. This number does not include the participants who indicated they would be working with 40 teachers. If each teacher attending the professional development impacts of 50 students per year, the total impact will be between 5,000 and 6,000 students per year.

The online surveys specifically asked the participants to share their plans for implementation of the materials. Most of the responding participants indicated it was difficult to sort out the exact lab or method of implementation because they integrated the knowledge and activities they gained from the workshops with previously used labs to enhance them and make them more rigorous. Many built lessons around the PhET simulations and video analysis. Others indicated they do more simulations and hands on experiences and fewer power points and lecture. Some samples of those plans are listed below:

STIP EMCC (2/11)

- Mostly as prelab to help students explore & understand relationships between variables. In some cases, when time & resources make doing the lab impractical, simulations were used instead of an actual lab experience using equipment.
- We use them mostly prelab. Very helpful allowing students to visualize and play with fundamental relationships between variables.
- Use Tipers as formative assessments and discussion builders, and use simulations as discovery activities and labs when appropriate.
- I have used a simulation in the lab portion of the course and incorporated Ranking tasks and nTIPER questions into lecture and homework
- To implement the PHET simulations for my Calculus classes.
- Simulations have already been implemented Physlets were very helpful. Use them mostly in Physics of sound for beats etc

MSAC ISIP (4/11)

- Using some spiral and several ranking tasks for student understanding planning to integrate more spiral next year
- This is a new course beginning in spring 2013. My plan is to implement some of the spiral curriculum strategies.
- Video analysis, white boarding, construction for projects
- During the workshop I learned about using video analysis. My plan was to use it in class using the videos available form the digital library. And to ask student to record short clips and analyze the phenomena using video analysis.
- Redelivery to physical science teachers (400 students)
- My main goal would be less focus on answers and more on physics through discussion oriented discourse.

- To add a new video based lab to each Kinematics unit.
- I have installed video analysis software on all lab computers and am in the process of selecting cameras.
- Quantitative fluid dynamics from footage of water flow in different situations.

MCC aISIP (6/11)

- Introducing collaborative learning
- Implement interactive use of clickers
- Project based lesson on building wind generators
- Critical Thinking exercises
- I plan to use the materials to help my General Physics students gain a more conceptual understanding so that they will have a better understanding of the material before going on to AP, and in AP Physics to help them catch up on conceptual things they might have missed out on in General Physics.

ACC ISIP (11/11)

- I am using spiral physics to instruct my PHY 152 course and I am using it as a supplement or my PHY 151 course. I used a project based learning problem that I developed with Jim Deane in my PHY 151 course as well. I am also using a "science fair project" in my PHY 110/PHY 110A course that borrows ideas from the project based learning strategies.
- Less lecturing. One thing I took away from David Weaver's presentation was that I spend WAY too much time talking and need to give the students more opportunity for hands-on activities (whether it be doing homework or working on labs). I don't envision myself ever going to 100% project-based class (ala David) but I like the idea of having a classroom where students are working on different projects (h.w./lab) and I only spend the first 20-25 minutes talking. I spend the rest of the time walking around and helping students on whatever it it is they're working on. I started doing this at the beginning of the spring semester and I am having good results so far.
- Expansion of project-based learning with VPython

- Introducing project based learning ideas along with spiraling concepts to the teachers in my district and help support those who attended the workshop in implementing these concepts.
- Use of Ranking tasks. Project based learning using projects to reinforce and teach material.

The online surveys were open until April 2012 with the intent that participants would go online and submit their activities as soon as they completed implementation of an activity. However, most participants did not respond until the final request for reflections making it impossible to tell exactly when then activities were completed. Although this information may have been useful, ultimately the leadership team wanted to know if they had implemented any of the activities and if they were successful. The table below correlates the number of online responses regarding completed implementation plans to the total number of attendees. There is a significant difference in the first two workshops and the last two, which is likely due to the fact that the last two only had one semester or less to implement the activities or materials learned at the workshop. Research[8] indicates teachers need over 45 hours of training or professional development on a particular topic before they gain enough confidence to use it in their classroom. The time spent in the workshops is slightly less, therefore it is understandable that the level of implementation would not be 100%. However, it is significant that those implementing activities felt the activities helped their students have a better understanding of physics concepts and integration of technology. Also, it was determined through data collected in the surveys that the teachers who had proceeded with implementing activities, implemented multiple activities thereby actually raising the level of implementation overall, even if the number of teachers was less than desired.

Another factor influencing the response rate, particularly for the last two workshops, was the summative survey. Comparison of unique identification codes indicates some of the participants thought the summative survey replaced the original post workshop survey and they did not complete both. There were 14 respondents to the ACC ISIP survey, 11 to the

[8] Horizon Research, Inc.

MCC aISIP, 12 to the MSAC ISIP, and 5 to the EMCC STIP[9]. In fact, 12 of the 14 participants who had attended the ACC ISIP workshop indicated they were using the summative survey for their reporting of implementation

*Have you already implemented things you learned in the classroom? **

	STIP (2/11)	ISIP (4/11)	MCC aISIP (6/11)	ACC ISIP (11/11)
Number of positive responses	13	19	11	13
Total attendees	23	24	22	25
Percent	56.5%	79.1%	50%	52%

**Includes additional responses from summative survey*

The assessment tools (Ranking Tasks, Tipers, etc) used in the workshop appeared to be the most valued (i.e. used) resource, but this may be due to the fact that these materials are pre-prepared, research based, and therefore easily implemented. When the survey results were tallied, the participants indicated they used the assessment materials as shown in the table below. Participants were asked: "*Identify assessment tools learned from the workshops that you have already used in the classroom*." As is evident by the number of respondents, many of the participants used multiple assessment tools.

Implemented Assessment Tools

	STIP EMCC (2/11)	ISIP MSAC (4/11)	aISIP MCC (6/11)	ISIP ACC (11/11)
Ranking Tasks	10	14	9	10
Tipers	13	11	5	9
Force Concept Inventory	6	5	6	6
(N)	15	15	10	11

Based on the comments and data from the online surveys, this evaluator concludes that the overall sustainable implementation is well above the 30% targeted by the leadership team[10] and is in fact more than 50%, which is an excellent percentage.

9 Responses that were not duplicated in the original survey were added to the totals in the table above.
10 In background section of this report

Question 5*: What activities were implemented in the participants' classrooms and to what extent were the implementations successful? What problems were encountered during implementation?*

Respondents to the on-line survey were asked to rate the overall success in implementing what they learned at the workshop. The majority felt it was very successful with very few problems. The participants were asked, "How successful did you feel implementing what you learned at the workshop?" All of the respondents, as shown in the table below, indicate they felt very successful or moderately successful at implementing the activities from the workshop.

Level of Success for Implementation

	STIP (2/11)	**ISIP (4/11)**	**aISIP MCC (6/11)**	**ISIP ACC (11/11)**
Very successful	6	8	5	8
Moderately successful	6	8	4	4
OK	0	2	0	0
Less than I hoped for	0	0	0	0
Very disappointed	0	0	0	0
Have not used it yet	0	0	0	0
(N)	12	18	9	12
Skipped question	5	2	3	1

The activities below were reported by the participants to be easy to implement, very successful, few problems and indicated they would be used on a regular basis or they have already used them several times. The tally indicates how many mentioned the activity/strategy as one they specifically used. The appendix includes lessons submitted by some of the participants that they designed as a result of the ATE/WPF workshop. All lessons are not submitted due to space and formatting issues.

Activities Successfully Implemented

	STIP EMCC (2/11)	ISIP MSAC (4/11)	aISIP MCC (6/11)	ISIP ACC (11/11)
Phet/Java Applets	10			
Tipers	6	1	1	1
Ranking Tasks	2	1	1	1
Reactants, products and leftovers lab	1			
Video Analysis		6	2	1
Momentum and collisions		1		
Catapult marshmallow launcher		1		
Building coil gun from disposable camera		1		
Linear Track—Newton's second law		1		
Motion of a pendulum and spring		1		
Water flow dynamics to simulate event horizons		1		
Clicker questions	1		1	
Whiteboards			1	2
Kinect gaming technology			1	
Motion Diagrams			1	
Spiral Physics				1
Project Based Learning				4
VPython				1

Participants were also asked to give comments regarding the implementation. Some of the responses submitted with the above questions include:

- I am currently changing it so that it fits better in the High school classroom. (ACC ISIP)
- It takes a few tries to get the problem right. I have made slight revisions for the next time I give this problem. (ACC ISIP)

- Without the workshop I would not have been exposed to adding other elements such as more time on the students presenting their data and conclusions. (ACC ISIP)
- The reformed teaching activities require some modification/adaptation when implemented in courses culminating in state-mandated standardized assessments or national (e.g. AP) exams since typically the pace needs to be too fast for student feedback in these courses. (MCC aISIP)
- Students were actively engaged manipulating variables utilizing the scientific method (EMCC STIP)
- Some students thought this was a game to be played not understood, then we had to repeat the process. (EMCC STIP)
- It is very good for students to use that have not grasped the material. (EMCC STIP)
- It was my first time teaching physics so I try the activities without modification since I wanted to see how they work, but hopefully in fall 2012 I can provide more feedback!! (MSAC ISIP)

Question 6*: Is there evidence of the participants' continued motivation to change?*

Responses to the previous question are some indication of the participants' continued motivation to change and implement new technology in their classroom, but there is quantitative data that suggests the participants wanted to continue to change their classroom practice. The quantitative data was observed when reviewing the number of participants that attended more than one workshop through the summative survey. Although the percentage of responses from the survey was low, there were a large number of participants who attended multiple workshops.

Workshops Attended Previously by Participants

	2/11	4/11	6/11	11/11
Adaptable Simulations for Introductory Physics (ASIP) Workshop, Nov. 16-28, 2006, Lee College in Baytown TX.	0	0	0	1
Instructional Strategies in Introductory Physics (ISIP) Workshop - February 8-10, 2007 at Estrella Mountain Community College in Avondale, AZ	0	0	2	0
Adaptable Curriculums for Introductory Physics (ACIP) Workshop - April 12-14, 2007 at Florence - Darlington Technical College in Florence, SC	0	1	1	2
Data Visualization Techniques and Strategies (DVTS) Workshop - June 28-30, 2007 at Mt. San Antonio College in Walnut, CA	0	1	0	0
Data Visualization Techniques and Strategies (DVTS-MBL) - October 25-27, 2007 at Howard Community College in Columbia, MD	0	0	0	0

Instructional Strategies in Introductory Physics (ISIP) Workshop - November 8-10, 2007 at Lee College in Baytown, TX	0	1	0	1
New Faculty Training Conference (NFTC) for Two-Year College Physics Faculty – March 6-8, 2008 at Delta College in University Center, MI	0	0	0	1
Tools for Introductory Physics (TIP) - April 17-19, 2008 at Estrella Mountain Community College in Avondale, AZ	0	3	1	3
Project Based Physics (PBP) Workshop - June 12-14, 2008 at Mt. San Antonio College in Walnut, CA	0	1	0	0
Virtual Instruments and Control Systems (VICS) Workshop - September 25-27, 2008 at Southeast Community College in Lincoln, NE	0	0	0	1
Tools for Introductory Physics (TIP) Workshop – November 13-15, 2008 at Lee College in Baytown, TX	0	0	1	3
Instructional Strategies for Introductory Physics (ISIP) Workshop – April 23-25, 2009 at Estrella Mountain Community College in Avondale, AZ	0	3	2	1
New Faculty Training Conference – Commencement Conference (NFTC-CC) for Two-Year College Physics Faculty – July 25-26, 2009 at the University of Michigan (AAPT Meeting) in Ann Arbor, MI	0	2	0	0
Data Visualization Techniques and Strategies – Microcomputer Based Laboratory, (DVTS-MBL) Workshop, October 29-31, 2009 at Springfield Technical Community College in Springfield, MA	0	0	1	0
Data Visualization Techniques and Strategies – Microcomputer Based Laboratory (DVTS-MBL) Workshop, December 3-5, 2009 at Lee College in Baytown, TX	3	2	1	5
Programming Tools for Introductory Physics (PTIP) Workshop – September 30-October 2, 2010 at Southeast Community College in Lincoln, NE	0	1	0	2
Stimulations Tools for Introductory Physics (STIP) Workshop – November 4-6, 2010 at Lee College in Baytown, TX	0	0	0	6
Stimulations Tools for Introductory Physics (STIP) Workshop – February 3-5, 2011 at Estrella Mountain Community College in Avondale, AZ	0	3	0	2
Instructional Strategies for Introductory Physics (ISIP) Workshop – April 7-9, 2011 at Mt. San Antonio College in Walnut, CA.	0	8	1	2
Tools for Introductory Physics (TIP) Workshop – June 2-4, 2011 at Manchester Community College in Manchester, CT.	0	2	6	1
Instructional Strategies in Introductory Physics (ISIP) Workshop—Nov. 3-5, 2011 Austin Community College, Austin, TX	0	4	0	10

The rigor and duration of the workshop was considerably higher than most daily workshops, so to have so many participants want to return for another session is quite remarkable. In addition to the quantitative data supporting the continued motivation to change and implement new activities into their curriculum, there is a considerable amount of qualitative data in the participants comments, particularly the comments collected by the leadership team at the conclusion of the workshop. Those comments are in the appendix, but a few that are indicative of the desire to continue to learn include:

- Many thanks for providing this invaluable experience for us. To be aware of better techniques for teaching is fine, but this workshop focuses on the details of implementing these ideas which is extremely helpful!

- I learned a lot – which is why I keep coming back. I felt I got valuable info to use in my new class. I liked using the high speed cameras. I have got valuable information to help me in my chem. classes as well.
- Implementation: phase 2…I need to go to a workshop twice before I truly apply it in class. After today I will "dabble" with simulations in class but could use a follow-up 6 months from now

Conclusions, summary, and additional participant comments

Overall, the participants seemed very pleased with the workshop experiences and were anxious to implement the things they learned. 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. The participants felt the activities were appropriate and attending the workshop would benefit their students in due time. Participants indicated the workshops were useful and many attended multiple sessions. Based on the online surveys (to which all did not respond), the number of repeat attendees were: STIP @ EMCC 13%, ISIP @ MSAC 41%, aISIP @MCC 27%, and ISIP @ ACC 41.6%.

Summary of the research questions:

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

The workshops attracted educators from various school environments including middle school, high school, academies, charter schools, colleges (including technical colleges) and universities. The courses taught ranged from conceptual physics to college calculus and even professional development courses for in-service teachers.[11] Students of these educators typically embrace technological challenges and would be well served by the strengthening of their courses with the technology, simulations, and challenging projects presented in these workshops.

[11] refer to p. 10 of the report

Based on the types of participants attending the workshops, their eager anticipation to implement what they had learned, and the number (11) of returning participants, this evaluator concludes that the workshops did attract faculty interested in using the knowledge gained from the workshop to enhance the use of technology in the classroom. The responses of the teachers indicate they were excited and willing to take these experiences back to the classroom to help students realize the importance of technology in the work force.

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?

The workshop addressed the professional development needs of the attendees.[12] The weighted average response was always above 3 (agree) and was typically closer to 3.3 where 4.0 indicated the participants strongly agreed. The lowest average score was on implementation of formative assessments. This may be due to a lack of understanding and/or practice by the teachers in how to use formative assessments to enhance the learning process. It was suggested that the leadership team consider spending more time on the research and methodology of using formative assessments.

As mentioned in the previous question, eleven participants attended multiple institutes which also indicates the workshops met the criteria for high quality physics workshops.

3. How many participants indicated that they plan to implement materials/activities/teaching strategies from the workshop?

At the end of the workshops, a high percentage of the participants indicated they were eager to implement activities learned into their curriculum. Only one site had less than 90% (aISIP @ MCC, 86%).

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[12] refer to p. 16

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

The project leadership set 30% as the number of participants they hoped would sustain implementation after the project's completion. Over 50% of the attendees for each workshop indicated they had already implemented things they learned from the workshop into their classroom curriculum, which is a significant increase.

Data collected from the online surveys indicates the yearly student impact to be between 5,000 and 6,000. However, since all participants had not implemented the materials at the time of data collections, this is considered to be a conservative number.

5. What activities were implemented in the participants' classrooms and to what extent were the implementations successful? What problems were encountered during implementation?

The participants felt the activities they implemented were successful to highly successful.[13] The online survey results indicated the participants felt the least amount of success (3.35 out of 4) on formative feedback. As previously mentioned, this is likely due to the fact that teachers are unfamiliar with how to be successful using/implementing formative evaluations.

The assessment tools (Ranking Tasks, Tipers, Force Concept Inventory) were cited as the most used activities. However, this is likely due to the fact that these tools were specifically listed in the survey bringing them to the forefront of the participant's memory. Participants were asked to list specific activities that were implemented in their classrooms and those are listed on p. 25 in the report.

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[13] refer to pages 19 and 24

The problems mentioned were typically either related to how the materials had to be modified/adapted due to mandated assessments or how the participant needed more confidence in using the materials. The first problem is not one that can be remediated by the leadership team. The confidence levels typically take time and repeated success of implementation in order to change significantly. With continued use, this will increase significantly over a period of 1-3 years.

6. Is there evidence of the participants' continued motivation to change?
Several of participants attended more than one workshop indicating their continued motivation to change.

Suggestions and comments from participants:

EMCC (2/11)

This workshop was a lot of sitting and programming. Normally I enjoy the intensity of these workshops, but this one had a bit much seat work on the computers. I loved the content though and got a lot from it.

- Drop the part about modifying physlets. It's too tough to learn well enough to implement on our own.
- !@hrs+ days are too long for a workshop. It is hard to focus on the worlshop in the evenings. To much material covered in short time.
- It might have been better to have had one of the evenings free. I think many participants might have worked more productively if the sessions had provided for optional evening sessions. I understand the reason for the design and knew going in what the expectations were but some participants did not.
- Probably dump Ann's section on how to reprogram the physlets, due to time restraints, I probably will never do that with students
- It was very intense, but I don't know what your can do to change that, given the short amount of time.
- There were a couple of sessions that were slight repeats of the previous workshop I attended (i.e. clickers). Maybe give the option to work on something else during that time.

- A few hours to get out and move around. The long first day was fine, but the second day had me zoned out!

MSAC (4/11)

- The workshop was very exciting I have to say that the best part was working with groups and getting ideas from each other! Although the project part at the end was fun, it seemed to be a bit too much, I rather work on small activities such as actually doing a section of one of the modules to see how to use those modules.
- Use an LMS (like Moodle) to place teaching resources and allow teacher to collaborate
- I would like a workshop on co-operative learning.
- More hands-on project seminars
- I would like to see three days of either "demo's" and/or "hands -on" experiments for students without using expensive materials.
- The workshop was great and leaves me with many questions mostly about modeling discourse management.
- The workshop was intense, like drinking from a fire hose. I would enjoy a follow up session to expand on the projects and work on implementing more

MCC (6/11)

- I think the workshop was great...the only suggestion I have is to allow more time to process the information presented. I often felt rushed.
- Too fast/long long days
- More hands-on workshops and use of gaming/data visualization technology, GPS and GIS-based physics
- I would like to see more of the lessons modeled by the presenters and less by the participants

ACC (11/11)

- More detailing and practicing discourse management

- The workshop was already well-organized and packed with ideas and activities. I have nothing else to say except to congratulate the organizer for the job well done.
- How to implement student centered physics.
- How do you do physics labs online? Is this even possible?

Appendix

Final Day Comments

Final Day Comments
STIP Workshop
Estrella Mountain Community College
February 3-5, 2011

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

- The PhET & clicker/TIPER infor
- This workshop was extremely useful - so much packed into 3 days. I am very grateful that I was able to attend. It will take me many days to process all the information. It was wonderful to connect to so many intelligent and helpful physics teachers. Thank you!
- Interaction w/fellow physics teachers. Organization of materials given to me.
- Time to interact with great physics teachers and pick their brains.
- Ranking system, CCTs etc. Many simulations explored, even the programming. The good humor of colleagues and leaders. The resources – books, binders, etc.
- Supplementary materials, information about many useful online resources.
- "Stuff" I could take back & immediately use.
- All the simulations and practicing to create ones own content using our links.
- The wealth of materials provided was wonderful. High school teachers rarely get this in workshops. There was ample time to build connections with other teachers and share ideas and resources. I think the examples of using technology to enhance instruction was "cutting edge" especially for high school teachers.
- Hands on programming/manipulation of applets. Interacting & discussing with other teachers about how they do things and plan to change how they do it.
- I liked learning how to modify the physlets …however I also learned that there was enough out on the web that I didn't need to do it myself.
- Enjoyed time to delve into this topic and use technology. Plenty of time to work through things. Dwain's discussion of assessment was really good and helpful.
- Atmosphere of collegiality – useful resources & materials & ideas to implement.
- All the resources, especially the tipers the way of using simulations instead of just Demos.
- PhET discussions & our project.
- Physlets & Tipers
- Getting to know the instructors & other students
- How to implement EJS, Physlets, PhET sims/tasks.
- Time to develop ejs. Anne's step by step instructions. Anne's (hand out) instructions with step-by-step instructions for home use.
- Access to new material & the exchange of ideas.
- Good instructors, great facilities & food, Good-Great teaching tips & tools.
- Organization. Friendliness of organizers & participants. Resources supplied (Flash drive, books, email contacts…). Applicable, innovative teaching strategies. Flexibility.

Final Day Comments
ISIP Workshop
Mt. San Antonio College
April 7-9, 2011

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

- As far as the organization of this workshop is concerned all of them did an awesome job. I was very impressed by the presentations delivered by Dwain
- It opened a lot opportunities to make teaching physics more enjoyable. The use of alternative methods to teach kinematics (without equations). The use of simple materials and be able to produce a video that provides the opportunity to analyze every side of the motion of the object.
- Video analysis projects. White board and sharing-circle. Great camaraderie among participants.
- Supplemental materials & thumb drive. The innovative (to me) ideas to improve physics understanding modeling.
- The organization which had a variety of mixed activities so nothing dragged. The activities and interactions. Projects with other participants.
- Organization of workshop. Content & its appropriateness to classrooms. The atmosphere of the workshop. It's very obvious all presenters work well together & enjoy each others company. This makes for a very relaxed, yet professional time.
- Being able to work on our own projects. "Modeling" the classroom discourse (i.e., whiteboard/circle activities).
- Modeling approach is a great alternative and very challenging.
- Definitely intrigued with Dwain's classroom model. I also am ery int5rigued and found the Hi Speed Video & video analysis. I will definitely use this in my classes.
- Getting practice in making and analyzing videos.
- Modeling Discourse & Digital Video Analysis.
- Actually making videos. The technical expertise of presenters. Modeling.
- Opportunities to practice with various video equipment. Open dialogue among participants I both formal and informal settings.
- Digital Video Analysis.
- Interaction with presenters & participants. Innovative approaches to teaching of Physics.
- Interactions with other teachers & facilitators.
- Having a lot of time to test out the process of using motion capture software in the classroom. The new spin on kinematics and motion.
- The hands-on experiments & instructors ability to interact with participants.
- Hands-on activities.
- Intense knowledge, new ideas, different perspectives.
- Great content.
- Video analysis, kinematics using vectors.

Final Day Comments
aISIP Workshop
Manchester Community College
June 2-4, 2011

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

- Interaction between the presenters was great!
- The fact that there where tons of hands-on activities per models. Discussions/question time. Changing the groups for each activity.
- The hands-on, brains-on approach. And the simulation of real classroom environment. Developing and writing up the project (group work).
- The interpersonal communications during and outside the workshops allowed for questions and furthering understanding.
- It was Great.
- Explanations of collaborative teaching theory, methods & processes. Hands-on, collaborative learning of collaborative teaching methods.
- The free sharing of experience, knowledge, ideas, & useful implementation tips. One of the most helpful workshops I've ever attended. Lots of hands-on chances to learn/absorb.
- The topic, ICP/21. Hands-on applications of ICP/21 modules.
- Right to the point.
- Facilities, presenters, style of instruction mirroring implementation style.
- Collaboration of smart minds.
- 1. Useful. 2. Interesting. 3. Well organized.
- Modeling of the classroom style even in teaching us.
- The interaction between presenter and student. It was very open and it was easy to exchange ideas and facilitate feedback.
- Doing class simulation sessions let by presenters.
- The opportunity to interact with and learn from other physics educators.
- Interaction. Materials, both electronic and hard copies.
- The food (as always), modeling discourse management.
- 1) Experienced instructors, 2) excellent organization, 2) excellent host.
- New ideas to implement in classroom.
- I've heard things about teaching & teaching strategies that I've never heard before. Lots of great ideas were presented. I'm encouraged & motivated to experiment with new teaching methods.
- Martin's experimental exercises gave me excellent about some physics that I will try introduce into my physics lab course. Dwain thought provoking lectures. He inspired me to look at certain concepts in physics in ways that I did not previously consider.
- New ideas for teaching physics better. New connections with other physics instructors. New methods for learning assessments.

Final Day Comments
ISIP Workshop
Austin Community College
November 3-5, 2011

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

- Working and laughing simultaneously. Leaving with many new ideas and plans. Meeting new folks with similar ideas.
- The variety of materials and the cohesiveness of the programs and materials presented.
- Wonderful presenters. Chances to try out new ideas/projects/techniques. All material available online. Additional resources mentioned (Physlets, VPython, Logger Pro). Time to talk to people/meet teachers..
- Hearing about how spiral physics creates a reformed classroom.
- I liked how it was hands-on and given to us in a way that enables us to use the CASE method.
- The friendly atmosphere among the presenters & the teachers (faculty attending the workshop). The two workshops about spiral physics and Project physics.
- Meeting new people. Knowing there are others out there in a situation similar to my own.
- Projects. Interacting with other physics teachers. Collaborating
- I loved the idea of spiral physics. Mainly seeing how it is supposed to work in a live environment. Meeting individuals w/ideas that are so amazing and interest while also being quite simple to implement.
- I liked having material already to use 1st day back. I also liked adding to items I already do in class.
- The new idea about spiral approach to teaching physics is very promising. The way Paul presented is very convincing. The project-based learning is also a bit to high school and college students,
- The project-based experience. Meeting other physics instructors.
- Many new ideas and strategies were introduced. Great atmosphere, where everyone participated a great deal.
- Learning about spiral & project physics – yes, that is much of the workshop, but both are important physics ed. topics.
- Spiral physics concept and introducing B right after E.
- Food, leaders, projects, presentations.
- The cross pollination from the pros.
- Spiral Physics, chance to share ideas, excellent group leaders, great experience.
- The time to develop a lesson for my classroom – implementation.
- The numerous hands-on activities.
- The opportunity to network with my physics faculty colleagues. The incredible content imparted by Paul & David.

Lessons and Plans Submitted by Participants

Objective: To evaluate the relationship between the dropped height and the rebound height of dropped bouncy balls.

Materials and Equipment:

- video camera
- meter stick
- bouncy balls
- Logger pro

Experimental Procedure:

1. Tape a meter stick to a wall.
2. Drop a ball in front of the meter stick while recording the event with the camera.
3. Using Logger Pro to analyze the video and determine the drop height and rebound heights.
4. Drop the ball from each drop height three times to obtain an average rebound height.
5. Record your results in the data table.
6. Repeat steps 2-4 with the ball at a different height.

Data:

Drop Height (cm)	Trial 1 Rebound Height (cm)	Trial 2 Rebound Height (cm)	Trial 3 Rebound Height (cm)	Average of the Rebound Heights (cm)

Analyzing Your Data:

1. For each drop height, calculate the average of the rebound heights and record your calculations in the data table.
2. Open a new file in Logger Pro and enter the data from your table.
3. Determine the slope of your line.
4. Use this slope to make an equation for your ball.
5. Give your ball to your instructor. Your instructor will give you a new drop height to test your equation.
6. Plug your new drop height into your equation and calculate your rebound height.
7. Inform your instructor that you are ready to test your equation.

Course: <u>Physics</u> Day: <u>21-25</u>

Objective: Describe motion in terms of frame of reference, displacement, time, and velocity. Calculate the displacement of an object traveling at a known velocity for a specific time interval. Construct and interpret graphs of position v. time. **Activities:** Check HW BW – *SSR;* Demo – pg 42-Displacement CW – VS pg 41 fig 2 *What would the displ of the gecko be if the 0 end of the meterstick had been lined up w the gecko's first position?* (the same-the position of the meterstick does not affect d moved.) HW – Conceptual Challenge pg 41, pg 44, 1-6, pg 47,1-6 Journal A Days Learnings	**MATERIALS** Textbook Multimedia Projector Demo pg 42 Meterstick Toothpicksor paperclip 3 pcs Modeling clay Toy car	**ASSESSMENT** Warm-up Teacher Observation Class Participation Classwork Homework Journal
Objective: Describe motion in terms of changing velocity. Compare graphical representations of acceleration and non acceleration motions. Apply kinematic equations to calculate d, t or v under conditions of constant a. **Activities:** BW – *SSR;* Check HW CW – (use whiteboard) Conceptual Challenge pg 50; Ranking Task pg 9 practice: *A bicyclist accel from 5 m/s^2 to 16 m/s^2 in 8s. Assuming uniform a, what d does the bicyclist travel during this time interval?* (84 m) class practice pg 57; accel. H/O HW – pg 49, 1-5; 53,1-4; 55,1-4; 58, 1-6 Journal A Days Learnings	**MATERIALS** Textbook Multimedia projector Handout acceleration whiteboard	**ASSESSMENT** Warm-up Teacher Observation Class Participation Check HW Class Work Journal Homework
Objective: Review previous day's objectives and calculations. **Activities:** BW *SSR;* Check HW CW- pg 59, 1-6 Review CW Journal A Days Learnings	**MATERIALS** Textbook Multimedia projector Whiteboard	**ASSESSMENT** Warm-up Teacher Observation Class Participation Review Orally Check HW Journal
Objective: Relate the motion of a freely falling body to motion with constant a. Calculate displacement, velocity, time at various points in the motion of a freely falling object. Compare the motions of different objects in free fall. **Activities**: BW – *SSR;* CW- VS fig 15, [B/c the ball's a is constant, the ball's s is the same going up as it is going down at any pt in the ball's path] *If the v_i of the ball is 10.5 m/s when it is thrown from a h of 1.5 m, what is the v of the ball when it passes this point on the way down*? (-10.5 m/s) Class practice pg 63 (whiteboard) Ranking Task pg 22 Free Falling problems from H/O HW-pg 64, 1-4; 65, 1-6 Journal A Days Learnings	**MATERIALS** Textbook Multimedia projector Handout Whiteboard	**ASSESSMENT** Teacher Observation Class Participation Class Work Homework Journal
Objective: Students will set-up, demonstrate, observe and calculate a free falling object **Activities:** BW-none begin lab Check HW – review on next date LAB – ASIM Free-Fallin' Lab HW-complete lab report Journal A Days Learnings	**MATERIALS** Celebration Textbook ASIM Free-Fallin' Lab Lab notebook	**ASSESSMENT** Celebration Class Work Homework Journal

STIP Workshop Project
Lesson Plan

Abstract

This activity relates to the need in my class for a better conceptual understanding of forces. Students need the ability to visualize a situation but most standard labs do not allow them to try different scenarios and have the ability to easily see the relation between static and kinetic friction, normal force, coefficient of friction, etc. The PhET simulations from the University of Colorado suited my classroom needs perfectly. Preconceptions also need to be addressed before even beginning the topic so Ranking Tasks were done as a pre-assessment and then used again to see how well the students could correlate its questions with the PhET activities.

Summary Account

This was the student's first time to use Ranking Task. They were very hesitant about them at first and were worried that I was going to grade them. I explained how I wanted to use them and that seemed to help. I found that most of my students really tried to consider how to solve the problem and about one third got the correct answer in their preliminary work. When asked to explain their reasoning, these students did a good job while those who didn't get the answers correct only wrote one or two sentences and were very vague. They were then allowed to use the PhET's "Forces in Motion" simulation to help them better understand the Ranking Task. Only two students didn't get the correct answers at this point but they did do a better job in their explaining.

The students then used another simulation, the "Forces and Ramps" to take their learning one step farther by forces on hills. I wrote a lab handout to help guide them in their work on this simulation. The students thought the handout helped them understand how this concept. I have found in the past that many of the labs I've done with forces on hills still don't seem to help get the students past the usual difficulties of understanding the two components of weight. After our discussion when this activity was finished, I do think all these activities helped them better visualize what was happening.

Day One

1. Students will take the Ranking Task – (p. 34) "Forces on Objects on Smooth Surfaces – Velocity Changes" as a pre-assessment for the topic
2. The following assignment is put on the whiteboard:
    a. Discover as many aspects of the simulation as possible – each student will present one thing they found interesting and there can be no duplicates! (10 minutes)

    b. Which object is easiest to push, which is hardest, and why?

    c. Look at the various graphs and consider how you can use the information found in them. What are some physical quantities you can explore with this simulation? Watch the graph for forces, seeing what happens when the object just begins moving.

    d. **Use the simulation to rethink the Ranking Task and answer the one on the back as well ("Forces on Objects on Rough Surfaces – Velocity Changes")**

Day Two

Students will run the simulation "Forces on Ramps" and use the worksheet to guide them through the preliminary learning about forces on hills.

Lab-Atwood's Machine

Background: A classic experiment in physics is the *Atwood's machine*: Two masses on either side of a pulley connected by a light string. When released, the heavier mass will accelerate downward while the lighter one accelerates upward at the same rate. The acceleration depends on the difference in the two masses as well as the total mass.

Special Note: Write up this lab carefully recording data and experimental results. Later in the semester we will return to the calculation and add the moment of inertia of the pulley into the calculations.

Purpose: To compare the experimental acceleration of the masses with the theoretical.

Materials: low friction pulley with clamp, set of masses, string, meter stick, foam rubber to protect the floor, video camera, computer with LoggerPro.

Procedure: Remember you will be video taping the movement of your masses. You will want to arrange the background accordingly and remember a meter stick must appear in your film.

1. Clamp a low friction pulley to the side of the lab table. Choose some masses so that there is a difference between the total mass on each side of the pulley. There are several considerations you should take into account in choosing your masses. For example, the larger the difference the greater the acceleration, and the larger the total mass the greater friction will be in the pulley. Try to optimize your set up for at least two different sets of masses that you will videotape.

   You will do the theoretical calculations while you are waiting for the camera, but be ready to run the experiment as soon as you get the camera.

2. Attach the predetermined masses to each side of the pulley. Record video as you let go. When you have a good record of the motion on the camera, attach the firewire to the computer and put the camera in "play mode". Launch LoggerPro, and from the "Insert" menu, choose "Video Capture". After you have captured your video, analyze the motion to obtain the acceleration.

3. Do the theoretical calculation of the "ideal" acceleration for each of your set of masses. Compare the experimental and theoretical accelerations by finding the percent difference.

Conclusions: Write a conclusion to the lab referring to the purpose and giving improvements/extensions to the lab.

Lab- ROCKET LAUNCH

Purpose: To determine the vertical acceleration of your rocket when it is in projectile motion, the horizontal component of the velocity and the time of flight.
We will be sharing a video camera to capture your rocket launch. We will need to use a 2-meter stick in each film in order to set the scale for the analysis.
We will be firing the rockets at the field and recording the motion on video. Note that you want the camera to be perpendicular to the plane of the motion. Then we will return to the lab to do the analysis.
Every group needs-
Rocket launcher
Rocket
2-Meter stick
Soda bottle
stopwatch

You might want a large protractor which is optional.
SAFETY!!! Safety must be your number one concern. The rocket will take off and return at a high speed. You do not want it to hit anyone. Therefore your group must find a spot away from the other groups. Everyone must be aware of when you are launching and where it is coming back down. Also, be careful not to lean over the rocket launcher when you are launching the rocket. Everyone must wear goggles whenever a rocket is being launched anywhere on the field.

Procedure:

1. Try off a couple shots of your rocket, choosing a speed and angle where you can get a significant amount of the shot in the video screen.
2. Use the video camera to record a shot, making sure your two meter stick is clearly visible in the shot and that you are perpendicular to the plane of motion. Time the flight and record this.
3. Upon return to the lab, connect the camera to the computer using the firewire. (The plug in the computer has a "Y" icon. Put the camera on "play" and launch LoggerPro. Choose "Video Analysis" from the "Insert" menu.
4. The camera should be detected, and you are asked to choose the type of video. Choose DV video.
5. Now there should be a box on the computer screen that shows what is playing on the camera. You will have ten seconds of video capture so advance the film to your segment. When it reaches the start of your shot, click on "Start Video Capture". When the shot is over, click "Stop Video Capture". Play it back to make sure you like what you captured, before passing the camera on to the next group. (Any captures that you don't like, simply delete.)
6. Click on the icon with the red dots to enable video analysis. Icons now appear to the right of the picture.
7. Choose the icon that looks like a coordinate axis, and choose the point to set your origin.
8. Choose the icon that looks like a ruler and drag across your two meter sticks in the video to set the scale.
9. Click on the icon with the one red dot to choose points. After you click on your rocket, the video will go forward by a frame. Continue choosing points until you have plenty to analyze. As you have chosen positions, they are recorded and graphed for your x and y coordinates.
10. Shrink the video until you can see the graph. Using your graphs determine the horizontal velocity of the rocket and the vertical acceleration of the rocket.

Lab Write -up: This lab will not require a formal lab write-up. But, it should be in your logbook and will be graded.
After *Title, Date, Partners*-
Data-You should have the time of flight recorded.
Analysis- Explain how you determined the horizontal velocity and the vertical acceleration.
Error analysis- Use your graphs to get an estimate of your errors and discuss the source of them.
Conclusions: Write a paragraph about what you can conclude from the experiment. Conclusions should always refer to the purpose/hypothesis of the lab and give ways to improve/extend the lab.

TOPIC: **Application of Newton's Laws**

TIME ALLOTMENT: 90 minutes

Objective:

At the end of the activities the students should be able to create paper product aircraft that is capable of long distance flight in order to apply Newton's three laws of motion.

Strategies:

1. **Warm-up** Activity: **Ranking Task** p 44 (Horizontal Arrows at Different Times – Force) - 8 min
2. View a **5-minute video** about aircraft flight. (reference "Force Course Nav Air Education Outreach" booklet) - 5 min
3. Ask them to bring out their paper plane design based on the modified version of the *"Fly the Friendly Skies"* activity. (This was assigned as a homework the previous class.) – 1 min
4. **Individual Work**: (with background music) Give the students time to create their own plane. – 10 min
5. **Collaborative Grouping**: Divide them into 8 groups of 3 and have them choose the best plane for the class competition. – 5 min
6. Do the **paper plane contest** in the hallway. (one group at a time) The winner will be declared as the plane which reached the farthest distance - 20 min
7. Ask them to complete a **group reflection**: (with background music) - 10 min
   a) Make a free-body diagram of the forces acting on the paper airplane after it has been flown.
   b) What factors affected the distance your plane achieved?
   c) What variations could you have done to change the outcome of your results?
8. **Closure** – Group presentation using a document camera. - 20 min

Homework:

In groups of four, design and build a freestanding, triggered water balloon launcher. (Show examples from the You Tube – squirrel launcher, trebuchet water balloon launcher. Students have two weeks to work on this project.)

Capacitor Simulation Lab – Charge vs. Voltage
Go to the website http://phet.colorado.edu/en/simulation/capacitor-lab
Click on the Run Now! Button.

Your task is to explore the relationship between charge and voltage for a capacitor. You should use the simulation to gather voltage and charge readings and make a graph in Logger-Pro of Charge vs. Voltage.

To change the voltage of the capacitor, slide the white bar on the battery up.

To measure voltage check the box on the right side of the screen that says Voltmeter and move the red and black leads to different plates of the capacitor to get a reading.

To measure the charge on the capacitor check the box on the right side of the screen that says Plate Charge. A meter will show up on the screen.

During the lab do not change the separation between the plates or the plate area. This lab depends on having a capacitor with a constant capacitance.

At the end of the lab check the box on the right side of the screen that says Capacitance.

You will need this reading for your percent error calculation.
Once you have made your graph answer the following questions:

1. What are the units of the slope?
2. What is the significance of the slope?
3. What is the percent error of the slope? Why did you get this percent error value?
4. Write a general physics equation that includes the two variables and the slope. This equation should be able to be used to solve many problems involving capacitors.
5. What does the area under the curve represent? Hint: Use the units to help you answer this question.
6. Write a general physics equation that includes the two variables and the equation for the area of a triangle. This equation should be able to be used to solve many problems involving capacitors.
7. What is capacitance?
8. Write your findings on a whiteboard.

Workshop Descriptions

Simulations Tools for Introductory Physics (STIP) Workshop
February 3 – 5, 2011 – Estrella Mountain Community College, Avondale, AZ

Anne Cox, Eckerd College, St. Petersburg, FL
Paul Williams, Austin Community College, Austin, TX
Dwain Desbien, Estrella Mountain Community College, Avondale, AZ
Tom O'Kuma, Lee College, Baytown, TX

Recent physics education research indicates that the "traditional" lecture-style, passive learning model does not substantially impact the learning and understanding of most students who take introductory physics. The research also indicates that most students enter introductory physics with alternative conceptions to many of the basic concepts that are taught in introductory physics. For most students, passive learning techniques generally do not replace these "misconceptions" with concepts that are more consistent with our understanding of nature. Results from physics education research have identified several different active learning techniques that have substantially increased student conceptual understanding in introductory physics.

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 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 7 – 9, 2011 – Mt. San Antonio College, Walnut, CA

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 indicates that the "traditional" lecture-style, passive learning model does not substantially impact the learning and understanding of most students who take introductory physics. The research also indicates that most students enter introductory physics with alternative conceptions to many of the basic concepts that are taught in introductory physics. For most students, passive learning techniques generally do not replace these "misconceptions" with concepts that are more consistent with our understanding of nature. Results from physics education research have identified several different active learning techniques that have substantially increased student conceptual understanding in introductory physics.

This workshop will provide hands-on experience with the use of video-based motion analysis in a wide range of applications, including the teaching laboratory, projects, and homework. Video analysis can be done in the classroom with inexpensive web cameras, digital cameras or traditional video cameras. Participants will learn how to make digital video clips for analysis, as well as how to use video analysis for homework problems and in the classroom. For example, participants will create a number of movies of one-dimensional and two-dimensional phenomena and make center-of-mass analysis of pre-recorded movies.

A complete first semester video analysis based laboratory curriculum will be presented which contains over thirty different video analysis labs based on the Minnesota problem solving labs. The workshop will use the new video feature of the Logger Pro 3.8 software from Vernier Software & Technology that allow video movie clips to be analyzed and synchronized and replayed side by side with MBL data. Evaluation copies of analysis software, selected digital video clips, and a CD with many video analysis labs that can be edited by the user will be provided to the participants for their use after the workshop. Participants will have the opportunity to take and analyze high speed video footage (up to 1000 fps) using the Casio Exilim series cameras which are now available commercially.

Another instructional strategy of the ISIP workshop will be Modeling Discourse Management. Participants will experience 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.

The modeling theory of physics focuses the introductory physics curriculum around a small set of models. Participants will learn these models and practice applying them to physical situations. Essential to creating a useful model is to have quality-modeling tools. This workshop will introduce new modeling tools and demonstrate how to use existing tools in more robust ways.

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.

Adaptable Instructional Strategies for Introductory Physics (aISIP) Workshop
June 2 – 4, 2011 at Manchester Community College, Manchester, CT

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

This workshop will introduce and provide participants with experience in using several different curricular approaches to teaching general physics, algebra/trigonometry-based, and calculus-based physics courses. Two approaches in particular will be extensively used during the workshop: a modular approach known as Introductory College Physics/Twenty First Century (ICP/21); and a "supplemental" approach using readily available resources.

The goal of this workshop is for the participants to become familiar with these curricular approaches, develop ways of using the approaches, and to continue working on these approaches after the workshop ends. Each participant will receive extensive ready-to-use curricula materials along with the rights to use them at their institution. In this workshop, participants will work in teams composed of two to four individuals under the guidance of the workshop leaders.

The ICP/21 modules were written with technical students in mind. Each participant will work through selected modules in this new curricula that was developed by a group of two-year college physics professors led by Alexander Dickison and Sherry Savrda of Seminole State College in Sanford, Florida; Marvin Nelson of Green River Community College in Auburn, Washington; and Pearly Cunningham of Community College of Alleghany County in West Mifflin, Pennsylvania.

Each ICP/21 module uses a learning cycles and incorporates many of the teaching techniques, developed by others, that are based on physics education research. Throughout the problem sets and examples in the modules, ICP/21 uses applications found in industry and medicine. The modular CD curriculum allows HS and TYC instructors the opportunity to choose several modules from the curricula that are particularly germane for their students and modify them to meet their particular needs. Each module is activity-based and utilizes a variety of tools to better motivate the student in the learning of key physics concepts. The ICP/21 modules were designed to allow a two year college or high school with limited resources to implement a fully featured activity based curriculum.

Results from Physics Education Research (PER) have indicated that active learning techniques have substantially increased student conceptual understanding, which provides a basis for problem solving with understanding in introductory physics. This workshop will discuss a number of supplemental approaches, including TIPERs (Tasks Inspired by Physics Education Research), ranking tasks, modeling discourse management, and others. This will include small group work on creating sample activities that employ these approaches. This work will be shared and critiqued by the group and workshop leaders. The advantages and weaknesses of these approaches will also be discussed.

The workshop leaders have many years of experience in developing and refining curriculum for introductory physics students. 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 technology-oriented students.

There will be ample opportunity to share and discuss issues relating to teaching physics more effectively (particularly for those 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 workshop's local host will be Negussie Tirfessa. Manchester Community College (MCC) is the largest of the 12 Connecticut community colleges; all of which are part of the state system of community technical colleges. MCC serves more than 15,000 students a year. It is located in Manchester, CT about 6 miles east of downtown Hartford.

Instructional Strategies for Introductory Physics (ISIP) Workshop
November 3 – 5, 2011 – Austin Community College, Austin, TX

Workshop Leaders:Paul D'Alessandris, Monroe Community College, Rochester, NY
David Weaver, Chandler-Gilbert Community College – Williams Campus, Chandler, AZ
Dwain Desbien, Estrella Mountain Community College, Avondale, AZ
Tom O'Kuma, Lee College, Baytown, TX

Recent physics education research indicates that the "traditional" lecture-style, passive learning model does not substantially impact the learning and understanding of most students who take introductory physics. The research also indicates that most students enter introductory physics with alternative conceptions to many of the basic concepts that are taught in introductory physics. For most students, passive learning techniques generally do not replace these "misconceptions" with concepts that are more consistent with our understanding of nature. Results from physics education research have identified several different active learning techniques that have substantially increased student conceptual understanding 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.

Another alternative curriculum is Spiral Physics, designed for use in both the algebra-based and calculus-based courses. Spiral Physics rearranges the traditional topic sequence so that students receive repeated exposure to concepts throughout the semester, each time with an incremental increase in complexity. Designed to facilitate active learning, it makes use of numerous alternative problem types including goal-less problem statements, ranking tasks, and an emphasis on graphing and other non-quantitative representations. The integrated text and workbook activities in Spiral Physics have been used at Monroe Community College since 1993, as well as at other institutions, and will be freely distributed at the workshop.

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 Paul Williams of Austin Community College (ACC). The workshop will be held at ACC's central administrative offices – the Highland Business Center. ACC, located in the heart of Central Texas, is an eight campus single college district with a service area spanning eight counties. It has an enrollment of over 45,000 credit students per semester with a Physics enrollment of approximately 1200 students per semester, ranking it among the largest TYC physics programs in Texas.