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Winter 96

Curriculum **a**nd **F**aculty **D**evelopment Newsletter for Two-Year College Physics Teachers

Part of a workshop project

Supported by

National Science Foundation

Joliet Junior College (IL)

Lee College (TX)

A Low-Tech Modeling-Centered/ Active Learning Curriculum: Part 1

Dennis Albers
Columbia College
Columbia, CA

I was hired in the Fall of 1985 to develop a physics program at Columbia College, a small rural community college in the foothills of the Sierra Nevadas in California. During 1986-88, journal entries of student responses to my questions and student-student dialog were making me suspicious that few of my students — including "A" students — understood key concepts, nor did they understand the modeling process. What particularly irked me was that my excellent lecture on modeling had zero impact. Convinced by my own assessments and by physics education research literature that traditional instruction doesn't produce the desired learning, I began in 1991 to seriously overhaul the introductory physics course.[1] My aim was to improve my students' conceptual knowledge and, influenced by Hestenes,[2] to make explicit the modeling procedures. The project seemed overwhelming.

In 1992, support came in the form of a CE/OCS workshop[3] whose mission was to inspire two-year college instructors to reinvent their introductory physics curricula based on recent physics education research. One of the workshop objectives was to bring the participants up to speed on cognitive science and physics education research findings:[4]

A. Lectures of any kind, whether by charismatic lecturers, by lecturers who do frequent demonstrations, by lecturers who meticulously develop theory, and with or without traditional labs attached to the lecture, have no significant impact on test scores.

Students learn better by doing than by watching and listening.

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Workshop Physics at Jamestown CC

Marie Plumb
Jamestown Community College
Jamestown, NY

At Jamestown Community College we have adopted the "workshop" physics model on both campuses for our calculus based and trig based physics. We meet three times a week for two hours each session. We use several different modes of instruction that include: Priscilla Laws "Workshop Physics", Real-Time Physics, Tools for Scientific Thinking, Alan Van Heuvelen's ALPS kits, several labs which we have traditionally used which have been rewritten to fit the new approach, group projects and reports and out of class required "study group" time. Much of what we use we learned at the TYC Workshops. In fact it was a TYC workshop which started us on the road to revision. To date (6/13/95), anyone at JCC who is teaching one of those two courses has attended at least one TYC workshop. A comment on a recent student evaluation of the class is worth repeating. The student had just successfully completed two semesters of our special rendition of "workshop physics." He said, " I can't imagine sitting in a physics lecture ."

Our retention has improved dramatically since we have adopted this approach. This spring fifteen students completed the second semester of our 4 semester sequence and to date we have fourteen students in the third semester E&M class for the fall. •

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B. Students show up with ready-made mental models associated with physical phenomena. Their mental models often conflict with the mental model that physics is asking them to construct.

If the context used in introducing a new concept is unfamiliar, the new concept will, at best, be learned with much more difficulty.

Most, if not all, concepts are learned via analogy.

C. Regarding physics problem solving: Experts follow a four-stage modeling procedure (expert modeling approach) deciding early-on, the relevant physics principle to use. Novices do not understand modeling. They pay little attention to principles and proceed via a busy means-end analysis that is so cognitvely taxing that little or nothing is learned from the exercise.

These findings have implications for teaching introductory physics:

A: As much as possible, replace traditional lectures with well designed, research-based, active learning sessions.

B: In planning concept development activities, understand and address preconceptions, familiarity of context, and "What do students already know that is like some aspect of the new concept?"

C: Design the curriculum so that (a) students perceive the expert approach to problem-solving as a useful skill, and learning it is necessary to their passing the course and; (b) students are given sufficient coaching and monitored practice time to learn the expert approach.

By Fall 1994, I had completely converted to a modeling-centered / active learning curriculum. The information and materials from the above-mentioned TYC Workshop and its follow-up in 1994 were of tremendous help in bringing my vision to fruition. Briefly, my own efforts so far in addressing A-C have gone like this —

Regarding A, rather than have my students passively listen to 60 hours of lecture in one semester and do 40 hours of traditional laboratory experiments, I've transformed this into 80 hours of active learning sessions with debriefings and 20 hours of mini-lectures and overviews. About 40% of the active learning sessions are hands-on exercises; during the next two years this will increase to 60% due mainly to added exploration experiments that make use of the Macintosh plus lab interface capacity to display (in real time) graphs of position, velocity, acceleration, and force simultaneously.

Regarding B, designing exploration experiments and interactive demonstrations is time consuming enough. Inventing and testing my own concept introduction and qualitative reasoning exercises for just one semester of the introductory physics sequence would be overwhelming. Instead, I use Alan Van Heuvelen's ALPS Kit. This set of pencil-and-paper exercises is so thoughtfully designed I doubt there will be anything equivalent that could hold a candle to it for some time.

To address C, I give my students reason to learn the expert approach to modeling by assessing on written exams all of the procedures in the expert approach, holding them accountable for all the procedures during every problem solving practice session, and requiring them to solve context-rich problems—problems for which the novice approach will likely fail or turn into a real pain. I give my students time in their collaborative problem-solving groups to practice each of the expert procedures with an expert present who will coach them and give them immediate feedback on their efforts.

Impact Of The New Curriculum

At the time of this writing, the Fall 1995 semester had just been completed. The new curriculum has been in place since the beginning of the Fall 1994 semester. To measure the impact of the new curriculum I will address student success rate, proficiency at newtonian modeling, and understanding of basic concepts.

Table 1 on the next page displays the student success rate (percentage of initially enrolled students who passed the course) from Fall 1986 through Fall 1995. The value tends to hover around 70% until 1994 at which time it jumps to 100% and remains 100% for Fall '95. Compared to the Fall '93 course, the Fall '94 course involved a major shift toward a higher percentage of active learning activities.

For example, I used significantly more exercises that show students and offer practice in the procedures expert modelers use. In addition, the course successfully made use of structured collaborative problem solving groups. In '94 and '95 I noticed an obvious jump in classroom morale. When I combine that with the observation that there were just as many ill prepared students as previ-

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Table 1: Success rate, proficiency at modeling, and conceptual understanding per curriculum type

Curriculum Type	Yr	Student Success	Modeling Proficient	Basic Concept Understanding			Passive/ Active
				Pretest	Post-test	Gain	
Traditional	86-90	70%	0.40 est.	x	x	x	90% Passive / 10% Active
Transitional	91	67%	0.54	x	x	x	80% Passive /
Transitional	92	73%	0.59	50%	74%	24%	70% Passive /
Transitional	93	67%	0.59	43%	69%	26%	60% Passive /
Active Learn	94	100%	0.88	43%	74%	31%	15% Passive /
Active Learn	95	100%	0.81	50%%	76%	26%	15% Passive /

ously, I am tempted to attribute the higher student success rate in '94 and '95 to the use of the collaborative problem solving groups.

The fourth column in Table 1 displays a measure of the class's proficiency at modeling. Since 1991, when I first attempted to explicity address the expert approach to modeling, I have assigned a 0, 0.25, 0.50, 0.75, or 1.0 to each student near the end of the first semester of introductory physics, based on my assessment of the student's proficiency at doing modeling.

My criteria for assigning these numbers have been uniform through to the present. The assessment process involved one-on-one debriefings of selected homework assignments, exam problems, and formal laboratory tasks involving modeling. The value of 0.40 for 1986 through 1990 is an average made in 1993 based on a review of the exams and homework given, each student's coursework scores, and journal notes I had made on these former students. Each student's proficiency number was assigned with far less confidence and hence the computed average for '86-'90 is to be considered only an estimate. The jump from 0.59 in '92 and '93 to 0.88 in '94 is dramatic. In my opinion, what is mainly responsible for the jump is that in '94 the students practiced modeling in the classroom and in collaborative groups rather than at home alone. It is infinitely less frustrating for the student in the early stages of learning modeling to have the instructor or a peer immediately available when the student hits a snag.

The instrument used to obtain the data in columns 5-7 of Table 1, the Force Concept Inventory (FCI)[5], is widely used as a measure of understanding of basic newtonian concepts. I give this test at the second class meeting and again near the end of the semester. Column 7 is a measure of the gain in conceptual understanding as a result of participating in the course activities.

Research has shown that traditional curricula never cause gains of more than 10%. The higher gains at Columbia College in '92 through '95 are due to the use of active learning conceptual exercises. About 85% of these exercises are taken from Van Heuvelen's ALPS kits and the remainder are of my own invention typically motivated by a perceived gap in my own students' understanding. The FCI data (not shown) indicates that my students have consistently missed the 3rd law questions over the past three years. (I could use some help here.)

The key features of the new Columbia College introductory physics curriculum are: Active Learning, Modeling (Motivate expert approach; explicitly address procedural knowledge), Collaborative Learning, and Spiral Structure.

In Part 2 of this article I will focus on the active learning feature and three of the six types of activities of which the new curriculum is composed.

[1] A. Van Heuvelen, “Learning to Think Like a Physicist,” American Journal of Physics **59**, 891-897 (1991), and references therein: L.C. McDermott, “Millikan Lecture 1990: What we teach and what is learned—Closing the gap,” Am. J. Phys **59**, 301-315 (1991)

[2] I.A. Halloun and D. Hestenes, “Modeling instruction in mechanics,” Am. J Phys **55**, 455-462 (1987); D. Hestenes, “Toward a modeling theory of physics instruction,” Am. J. Phys. **55**, 440-454.

[3] Developing Research-Based Community College Curriculum, a Joliet Junior College, Lee College, National Science Foundation project also known as TYC Physics Workshops. This was a Conceptual Exercises / Overview Case Study workshop led by A. Van Heuvelen and David Maloney held at Lee College, Baytown, Texas.

[4] E.F. Redish, “Implications of cognitive studies for teaching physics,” Am. J. Phy. **62**, 796-803 (1994) and references therein.

[5] D. Hestenes, M. Wells, H. Swackhammer, “Force concept inventory,” Phys. Teach. **30**, (3), 159-166 (1992). •

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The Development of B.E.T.T.E.R.

*(Basic Educational Tools for Technical Employee Retraining)**

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***partially supported by NSF Grant #DUE-9254184**

(Editors Note: This project is not related to any of the workshops that we have sponsored nor is it apparently based on the results of physics education research. It does, however, represent a major reform effort related to technical training and physics. I consider it to be a novel approach which is worthy of bringing to your attention.)

I teach in and am head of the Mathematics, Physical and Computer Science Department at Dutchess Community College (DCC). For the past ten years the school has been involved with retraining technical employees at IBM. Therefore, I have found myself confronted with the problems associated with providing education to a large corporation, both as teacher and as director and provider of the basic math and science courses.

The most significant problem that I have confronted was the difference between the students coming into the classroom from the corporation and the students who found their way to us on their own. DCC has always had technical programs and workers have been up-grading their education or changing career paths with our help from the very beginning of the college. Therefore, my department has always provided the general education component in math and science to students in all of the technologies. Moreover, we had always been successful. Students were pleased with the courses and instructors; they performed well both in the courses and later in the classes which required the knowledge that they had learned. In short, we were all happy!

That is, we were happy until we were confronted with IBM's major initiative to upgrade the educational level of its production line workers. The students who were coming to us through IBM were pleased with the technical courses and displeased with the general education courses. The general education courses are all traditional, college level courses — physics, chemistry and mathematics from my department along with English and reading. All of these courses had years of success with the traditional DCC students in the technical programs. However, these new students saw the general education courses as nothing more than "make work projects" and "hoops to jump through." These perceptions astounded me and my department and, since they persisted with each new class that enrolled, I knew I had to find out what was wrong.

In order to determine the source of dissatisfaction, I began a systematic effort to compare our new students to the traditional DCC students in the technical programs. I conducted extensive interviews with students and faculty. I administered various questionnaires. I had a suggestions and comments box mounted outside my office in an attempt to gather responses spontaneously from the students. I compared student evaluations of the courses and faculty. I compared tests and test scores. I compared assignments and the resulting student work. Moreover, as I gathered information, I attempted to respond. I changed textbooks, syllabi, faculty, class schedules, etc. all in an attempt to address the students concerns and, with every change, I gathered more data.

However, after analyzing all the data, it became apparent that the problems could not be solved by simple fixes such as a change of textbook or course sequence. The difficulties arose from the students inability or unwillingness to make connections between the subject matter and its uses in the world at large, and connections between the various academic disciplines themselves. The traditional students were making the connections; the students in the retraining program were not. The students in the retraining program saw the academic disciplines as a collection of separate, disjointed facts that they could not assimilate or interrelate.

The only other difference between the traditional students and the new students that I could find was why each group was in school. The students in the traditional courses had decided themselves to go back to school. The students in the retraining program had been sent to school by their employer. This is not to say that they were not grateful for the opportunity to retrain and keep their jobs. However, they had never intended to go back to school. In fact, most of them stated that when they graduated from high school, they were relieved that they

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would not ever have to be in a school classroom again. Thus, they saw the technical courses as job training and the general education courses as just "being in a classroom again."

I combed the literature in an attempt to find a way to address the needs of the new student group. I discovered that there is very little about students who are required to engage in general education through their place of employment. There is some work on up-grading basic educational skills of workers, but there is virtually none about doing this through a college and while maintaining the standards of traditional college courses. Therefore, I decided to keep doing my own research. I assigned myself to teach in the retraining program and also to teach a series of courses for traditional DCC students enrolled in technical programs. I was thus able to pilot and assess a variety of teaching techniques, learning strategies and ways to integrate material. The B.E.T.T.E.R. (Basic Educational Tools for Technical Employee Retraining) curriculum is a result of this work.

The B.E.T.T.E.R. curriculum is founded on the principle that life-long learning is essential for living. Learning is more than simply going to school. It is fundamental to everything that we do in life. If you buy a new car, you have to learn how to use it in order to get the most from it. If you take up a new sport, you have to practice or learn how to do it in order to enjoy doing it. When you have a baby, you have to learn how to care for him / her and the care needed is constantly changing, truly requiring life-long learning. We take all of these examples of learning for granted. We know we have to do them. But we also know that some of us accomplish these tasks particularly well. It is my contention, based on my research, that those who do them better have learned how to learn. They have practiced the art of learning so that they can tackle anything and achieve at least a reasonable level of success with everything.

People, who learn successfully under a wide range of circumstances throughout their lives, effectively use what they have learned in school even if they do not realize it. What they do has several important features: they are consciously engaged, they are aware of what is to be learned, they are aware of what they already know in order to build on it, and they are aware of the role of practice and experimentation in learning. In short, the people who learn successfully are active learners. It is those features of active learning that B.E.T.T.E.R. focuses on. Although the basic principles that underlie B.E.T.T.E.R. are applicable to everybody, they are particularly essential for today's workforce since workers are constantly being challenged by new technologies, new products and new manufacturing methods.

Although B.E.T.T.E.R is new in its emphasis on active learning, the content of B.E.T.T.E.R. is fundamentally standard and encompasses the subject matter from the following academic courses which comprise a 32 credit certificate program.

- 6 credits of technical mathematics
- 8 credits of chemistry: introductory chemistry and introductory industrial organic chemistry
- 8 credits of technical physics
- 3 credits of English, literature and composition
- 3 credits of content reading
- 3 credits of basic economic issues
- 1 credit of computer skills including basics of word-processing and spreadsheets

What makes B.E.T.T.E.R. novel is the integration which is accomplished by organizing the material around themes, skill- building and problem solving. The course progresses from basic tools for thinking and learning to apply those tools to analyze complex industrial processes. Thus, new material is introduced as a problem or application when it is required rather than when some normally accepted disciplinary or pedagogical sequence calls for it. Moreover, the material and the students relationship to it is addressed from a multidisciplinary point of view.

Scientific and mathematical topics are discussed in terms of their economic impact. Throughout the course, the English and reading portion focuses not only on developing clear technical writing and an ability to tackle technical reading, but also on the students reaction to learning and an exploration of their educational and job experiences. Thus, when they explore a new technology such as semiconductors scientifically, historically, and economically, they also focus on what it means to them in their jobs and lives. This personalization of the course has been invaluable in allowing the students to express their concerns with the educational process and their relationship to it. In doing so, the students develop a more conscious approach to learning. In addition, continuity and personalization of the course material is also provided for by a year-long research project. The students pick any topic that has a scientific / mathematical component and which is of interest to them. They then do research on that topic throughout the year, thereby developing an expertise in that topic which culminates in their presenting a paper at the end of the year.

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Furthermore, to offset the perceived irrelevance of standard introductory non-technical courses, the material is taught in a manner that reflects on-the-job practice as well as current pedagogical research. Thus the students work in groups with the focus on the mastery of learning and teaching students to help and teach each other. The course guides the students in building up the skills needed to tackle large, complex problems. This is accomplished by teaching skills of broad applicability and consistently encouraging the students to use new tools and methods. These new skills are in contrast to traditional academic approaches that reduce education to disconnected simple disciplinary components. The students develop skills that fit well within each discipline but whose generality and portability are not intuitively obvious to the students.

In order to accomplish these overarching goals, B.E.T.T.E.R. is taught four hours per day, five days a week, for 30 weeks by a team of faculty who are chosen for their interest in interdisciplinary and multidisciplinary studies. Although for scheduling purposes, faculty must be assigned to specific times, all faculty are encouraged to attend as much as possible and all faculty know what each class is teaching and what the students have learned. The year is broken down into seven four-week units bracketed by an introductory week and a wrap-up week. The general progression of B.E.T.T.E.R. is as follows:

- Introductory Week: building confidence and fundamental study skills
- Unit 1: building fundamental skills of measurement and data analysis
- Unit 2: building an understanding of functional relationships
- Unit 3: building an understanding of equilibrium
- Unit 4: building an understanding of dynamics
- Unit 5: building an understanding of remote sensing and control mechanisms
- Unit 6: building an understanding of computer integrated machine tools
- Unit 7: building an understanding of large scale industrial systems
- Wrap-up Week

Each Unit in B.E.T.T.E.R. is four weeks long. The first week is an introduction to the units' material in which connections are explicitly made to what has gone on before and how the new material will build on it. The second week is simple applications of the material. The third week is more complex applications. Finally, the last week is a review and wrap-up of the material. Between each unit there is a reading period for which there are no scheduled classes and which allows the students to do the literature reading and pursue the research topic of their choice. That way during the unit the students are not burdened with overwhelming reading assignments, but can use the English and reading time to discuss and write about what they have already read.

The schedule of each class week is regularized in order to allow for scheduling of faculty and rooms.

MONDAY: laboratory work in order to introduce new material through hands on exploration (Time at the beginning of the four hour block is used for a quiz on weeks 2-4)

TUESDAY: thinking, writing and developing a theoretical understanding about what has been observed the previous day. This includes mathematical instruction and time for the students to reflect on their experiences.

WEDNESDAY: laboratory work extending the material and broadening the students ability to work with it.

THURSDAY: continue the work on thinking, writing and developing a theoretical understanding. This includes instruction in mathematics and in economics in order to show how the concepts fit into the broad business/industrial setting.

FRIDAY: laboratory work to finish exploration of the material and wrapping up the week's work. In addition, two hours are spent working on computing and library skills according to the students' needs.

This format has proved successful. B.E.T.T.E.R is in the second year of implementation and I am happy to report that it is doing very well. The satisfaction of the students is high and so is their performance.

Now it is time to look to the future. The project has worked well in this prototype phase. Now, I need others to get involved in order to proceed further. If you are involved in this kind of a retraining program I urge to get in touch with me for more particulars about the course. I am in the process of completing the teachers' guide for the course and am working on the actual text materials for the students. Right now, we use conventional texts and this is undoubtedly the weakest link in the course. What I hope to put together is a team of writers from across the country who are interested in this program and would like to work on the integrated text material. If what I have written here hits home, please do get in touch. We could have a lot in common and our combined efforts could give the students what they need. •

Graphing Data Using Excel 5.0a

K. W. Nicholson
Central Alabama CC
Alexander City, AL 35010

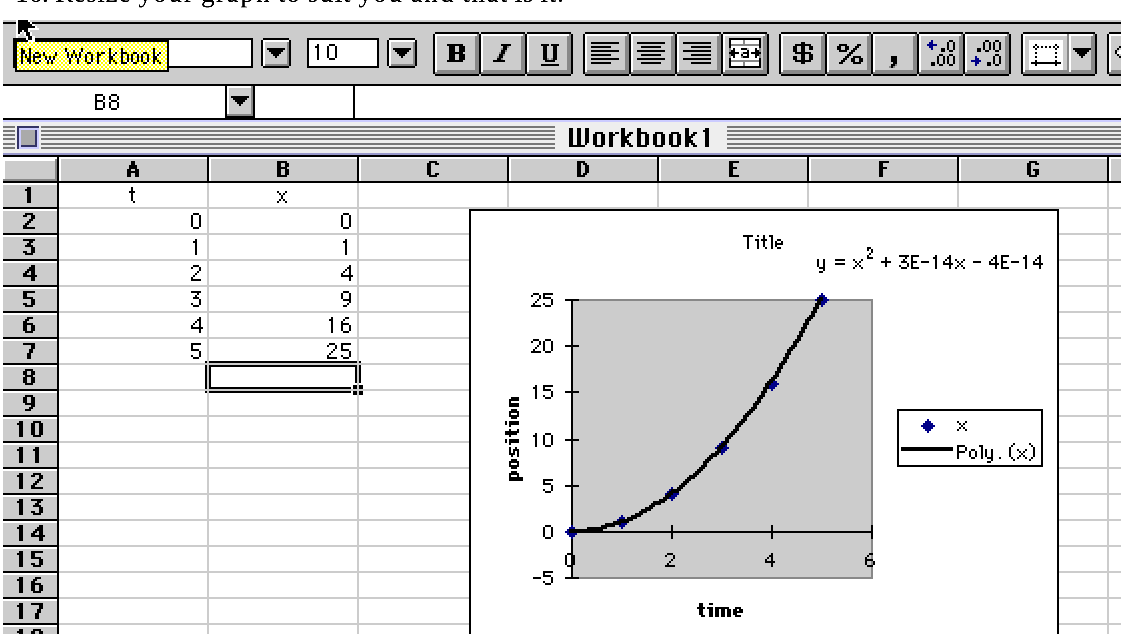
I am definitely the new kid on the block when it comes to using Excel in Physics classes, so most folks probably already know this and consider it too mundane to mention. But if you happen to be one of those rare few who are using Power Macs and have noticed that Excel 4.0 seems to be prejudiced against Power Macs, (it is real slow and if one uses the WP Excel Tools developed at Dickinson it really gets slow), and if you are frustrated by the fact that you don't know anything at all about Excel 5.0a, and are intimidated by the statement right on the box that recommends 16 MB of RAM to use Excel 5.0a on Power Macs, well, I have news.

I have a 10-pack of Excel 4.0 and the other day I received a free upgrade to Excel 5.0a. In frustration I loaded up Excel 5.0a on my Power Mac 6100/60 with 8 MB of RAM and tried it out. WOW! Compared to Excel 4.0, it is lightning fast, and runs just fine.

So, I called up Excel Tech Support and me and some guy named Jeff wrestled with the thing for about an hour and a half and Double WOW!! It is great and really much easier than Excel 4.0 even with WP Excel Tools. Here are the steps to graph data (any kind imaginable), get a best fit curve and its equation on the graph all at the same time. There are 16 steps, but give it a try before you judge it. Once you have gone through it a couple of times I swear you'll be able to do the whole thing in less than a minute.

Steps to graph data on Excel 5.0a:

1. Highlight the two columns of data, (the left hand column contains the horizontal axis data).
2. Click on Chart Wizard Icon at the top of the page.
3. Hold down the mouse on your spreadsheet and drag a nice sized box for your graph. (Don't worry about the size, you can resize it easily later.)
4. Click on NEXT.
5. Select the XY Scatter plot and click NEXT.
6. Select the appropriate Format and click NEXT.
7. Make sure you have "Use first 1 columns for x data" and click NEXT.
8. Put in the Titles and click FINISH.
9. Look at the graph and estimate the graph type (Linear, polynomial, log , etc.).
10. Double click on the graph (it gets a feathered edge around it).
11. Click on one of the data points to make them all light up.
12. Go to the INSERT Menu and select "TRENDLINE ".
13. Select the appropriate type of graph.
14. Click on the OPTIONS Folder that is just behind the TYPE folder.
15. Click the "Display equation on Chart" box on, and the "Display R-Squared Value on Chart" box on too if desired, then click OK.
16. Resize your graph to suit you and that is it! •



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TYC Innovations

John Anthony Splett
Erie Community College- City Campus
Buffalo, NY

As a result of attending the CE/OCS TYC workshops, I have introduced various innovations into my classroom teaching.

The most pronounced is the use of ranking task problems. I have used them in both mechanics and electricity and magnetism. My colleagues have been using them at all levels — from conceptual to calculus based. Some of the students appeared to enjoy them. However, the plug-and-chug type students despised them. They also provided some difficulty for students whose first language was not English. They had a tendency to regard the whole exercise as one giant computation. I do not use ranking tasks as pretests because our student body is heavily nontraditional — they have few opinions or innate prejudices about physics.

I have also used conceptual exercises in calculus based courses — particularly when reviewing vector cross-products. The approach appears to be a good review of some of the more tedious elementary topics. I have also introduced miniature case studies in many of the physics courses, especially, mechanics. I'm fond of a problem which requires the student to decide whether a car traveling at a certain speed can make a stop sign. For technical students, this reviews the concepts of uniform and accelerated motion. For calc-based physics students, this becomes a quick exercise in accelerated motion.

I enjoyed the TYC workshop and am trying to further implement its concepts and instructional methods. •

Test Results

Mark Bunge
San Jose City College
San Jose, CA

These are scores for a calculus based course using a lot of CE/OCS with computer simulations and some MBL.

Fall '94 n=16 Force Concept Inventory:
pretest = 33% post-test = 72%
Mechanics Baseline: post-test: 67%

Sp '95 n=11 Force Concept Inventory:
pretest=45% posttest = 73%
Mechanics Baseline: post-test = 61% •

About the TYC Physics Workshop Project

K. W. Nicholson
Central Alabama CC
Alexander City, AL 35010

Much of what is learned at a TYC workshop can be used in one form or another immediately without additional equipment. If extra equipment is required, they even teach us how to obtain the needed materials.

After my first TYC Physics Workshop, following Curt and Tom's instructions to the letter, I wrote a grant that was funded the next year for computers and lab equipment.

I began to use the ideas learned immediately, even their workshop techniques. Copying their style, I have hosted two mini-workshops on conceptual and MBL teaching techniques

Materials I received at TYC Physics Workshops, as well as some of my equipment, are now being used in Calculus, Trig, Physics, Physical Science, Chemistry and Psychology courses here at CACC by at least 4 teachers.

All but the first two TYC Physics Workshops have essentially been re-runs, (follow-ups of the original two). Amazingly, I seem to learn more from each workshop than I did at the last. In fact, I'd say this series of workshops is in its infancy. Many of the veterans of these workshops are gaining such skills with these methods that participants are now beginning to learn nearly as much from each other as they do from the workshop leaders.

The quality and usefulness of the TYC Physics Workshops really cannot be over emphasized. Personally, I'll continue to attend them as long as I can get a foot in the door.

Before the TYC Physics Workshops, the general consensus about my physics classes was that I was a good teacher, it's just that physics is a really boring subject. Now the general comment is "Whew! It seems like we just get started and the class is over." •

1996 Two-Year College Physics Workshops

Building a Better Understanding of Physics and Developing More Effective Problem Solving Skills in Introductory Physics Courses using Conceptual Exercises and Overview Case-Studies (CE/OCS)
March 21-23, 1996
South Mountain Community College
Phoenix, Arizona

David Maloney, Indiana-Purdue University at Fort Wayne
Alan Van Heuvelen, Ohio State University
Curtis Hieggelke, Joliet Junior College
Tom O'Kuma, Lee College

Constructing and Implementing Effective Microcomputer Simulations in Introductory Physics Courses (PS)
April 25-27, 1996
Lee College
Baytown, Texas (near Houston)

Cindy Schwarz, Vassar College
David Winch, Kalamazoo College
Curtis Hieggelke, Joliet Junior College
Tom O'Kuma, Lee College

Implementing Modeling, Digital Video Analysis, and Microcomputer-Based Laboratories in Electricity, Magnetism, and Optics in Introductory Physics Courses (MBL II)
September 26-28, 1996
Jamestown Community College
Jamestown, NY (near Buffalo)

Priscilla Laws, Dickinson College
Ronald Thornton, Tufts University
David Sokoloff, University of Oregon
Curtis Hieggelke, Joliet Junior College
Tom O'Kuma, Lee College

Implementing Workshop Physics and Effective Microcomputer-Based Laboratories in Mechanics, Sound, and Heat in Introductory Physics Courses (MBL I)
November 14-16, 1996
Mira Costa Community College
Oceanside, CA (near San Diego)

Priscilla Laws, Dickinson College
Ronald Thornton, Tufts University
David Sokoloff, University of Oregon
Curtis Hieggelke, Joliet Junior College
Tom O'Kuma, Lee College

Apply early! For applications contact:
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(800) 728-1050 or (815) 729-9020 Ext. 2371
e-mail: curth@jjc.cc.il.us
http://ac4.jjc.cc.il.us/tyc/tyc.html

'95 TYC Physics Workshop Participants Colleges

Central Alabama Community College	Alexander City	AL
Mesa Community College	Mesa	AZ
South Mountain Community College	Phoenix	AZ
Antelope Valley College	Lancaster	CA
College of the Redwoods	Eureka	CA
College of the Sequoias	Visalia	CA
Columbia College	Columbia	CA
Diablo Valley College	Pleasant Hill	CA
Los Angeles Mission College	Sylmar	CA
Los Angeles Pierce College	Woodland Hills	CA
Los Angeles Valley College	Van Nuys	CA
Mira Costa College	Oceanside	CA
Orange Coast College	Costa Mesa	CA
Pasadena City College	Pasadena	CA
San Diego City College	San Diego	CA
San Jose City College	San Jose	CA
Ventura College	Ventura	CA
Yuba Community College	Marysville	CA
Daytona Beach Community College	Daytona Beach	FL
Indian River Community College	Fort Pierce	FL
Lake Sumter Community College	Leesburg	FL
Palm Beach Community College	Lake Worth	FL
Polk Community College	Winter Haven	FL
Seminole Community College	Sanford	FL
South Florida Community College	Avon Park	FL
Bainbridge College	Bainbridge	GA
Young Harris College	Young Harris	GA
Indian Hills Community College	Centerville	IA
Iowa Central Community College	Fort Dodge	IA
Blackhawk College	Moline	IL
College of Dupage	Glen Ellyn	IL
John A. Logan College	Carterville	IL
Joliet Junior College	Joliet	IL
Lincoln Land Community College	Springfield	IL
McHenry County College	Crystal Lake	IL
Moraine Valley Community College	Palos Hills	IL
Prairie State College	Chicago Heights	IL
Wilbur Wright College	Chicago	IL
Cloud County Community College	Concordia	KS
Highland Community College	Highland	KS
Independence Community College	Independence	KS
Central Maine Technical College	Auburn	ME
Henry Ford Community College	Dearborn	MI
Lansing Community College	Lansing	MI
Monroe County Community College	Monroe	MI
Wayne County Community College	Detroit	MI
Vermilion Community College	Ely	MN
Forsyth Technical Community College	Winson Salem	NC
Mitchell Community College	Statesville	NC
Wayne Community College	Goldsboro	NC
Western Piedmont Community College	Morganton	NC
Albuquerque Technical Vocational Institute	Albuquerque	NM
Jamestown Community College	Jamestown	NY
Monroe Community College	Rochester	NY
Sullivan County Community College	Loch Sheldrake	NY
SUNY College of Technology at Canton	Canton	NY
Central Ohio Technical College	Newark	OH

continued on the next page

CCD Grant

Mark Bunge
San Jose City, College
San Jose, CA

(Editors note: This was received via e-mail last summer on the BBS System at Joliet Junior College and I thought it might provide some insight in writing a successful NSF grant.)

I've attached the abstract of my $157,000 CCD grant. The budget provides a salary for me, 58% released time for Rufino (our full-time physics instructor), travel, a programmer, 4 evaluators (Alan is one), support for the electronics arts teacher at Lincoln High (San Jose) and stipends for the students to work on the project—edit and make videos, animation's with Macromedia Director.

Supporting factors cited by reviewers included our track record (I used 6 pages to review what we've done), our planned dissemination via CD-ROM, use of Interactive Physics for simulations, emphasis on educational research (5 pages), and participation in workshops and conferences.

I owe much of this to you and the workshops that you've developed and reference materials that you provided. •

Publications Available

We have available for the asking, limited quantities of the following items—

A Selection of Physics Ranking Tasks

Edited by T. O'Kuma, D. Maloney and C. Hieggelke

This book of over 130 ranking tasks was produced in conjunction with the Two-Year College Physics Workshop Projects sponsored by Joliet Junior College (IL), Lee College (TX), and the National Science Foundation, Division of Undergraduate Education.

Putting the Pieces Together— A Guide Book for Leaders of Coalitions of Two- and Four-Year Colleges and Universities

Edited by Patricia A. Cunniff, Curtis Hieggelke and Barbara Leigh Smith

This published set of notes is a result of the Faculty Coalition Workshop that was held October 14-15, 1993 in Arlington, VA.

If you wish to have the above publications-sent to you, mail us a card with your name and address indicating which one(s) you would like to receive. •

'95 TYC Physics Workshop Participants Colleges continued from previous page

Cuyahoga Community College	Cleveland	OH
Firelands College-Bowling Green State University	Huron	OH
Kent State University-Stark Campus	Canton	OH
Lorain County Community College	Elyria	OH
Marion Technical College	Marion	OH
Stark Technical College	Canton	OH
Northern Oklahoma College	Tonkawa	OK
Community College of Beaver County	Monaca	PA
Pennsylvania State University-Beaver Campus	Monaca	PA
Pennsylvania State University-York Campus	York	PA
Colegio Regional De La Montana, UPR	Utuado	PR
Aiken Technical College	Aiken	SC
Northeast State Tech Comm. College	Blountville	TN
College of the Mainland	Texas City	TX
College of Eastern Utah	Price	UT
Richard Bland College	Petersburg	VA
Centralia College	Centralia	WA
Green River Community College	Auburn	WA
Blackhawk Technical College	Janesville	WI
Fox Valley Technical College	Appleton	WI
University Of Wisconsin Center-Barron County	Rice Lake	WI
Waukesha County Technical College	Pewaukee	WI
Casper College	Casper	WY

CaFD

Curriculum and Faculty Development Newsletter For Two-Year College Physics Educators

Winter 96

National Science Foundation

Joliet Junior College (IL)

Lee College (TX)

TYC Physics Workshop Project Update

As of January 1, the TYC Physics Workshop Project which is supported by Joliet Junior College, Lee College, and the National Science Foundation has held 22 workshops at 10 different community colleges in 8 states. There have been a total of 455 participants involving 246 different faculty members from 207 community colleges located in 39 states. There have been 12 Microcomputer Based Labs workshop including 3 MBL Follow-up workshops and 9 Conceptual Exercises and Overview Case Studies workshops including 3 CE/OCS Follow-up workshops and 1 Physics Simulations.

In 1995, there were 98 participants at the workshops from 82 different TYCs located in 25 states and 1 territory. The states which had the greatest representation at the '95 TYC Physics workshops were California (16), Illinois (9), Florida (7), and Ohio (7).

There are four workshops scheduled for 1996 (see page 9) plus a TYC Introductory Physics Conference (TYC IPC). The TYC IPC is open to past participants and will feature previous workshop leaders as well as several TYC physics faculty members. The schedule will be more relaxed with open work sessions allowing collaboration among participants and leaders. The special topic that will be focused on will be Heat and Thermodynamics. In addition, a discussion and review of the tests on Electrical Concepts and Magnetic Concepts may also be of interest. Apply early since we will only accept 24 applicants to this event. If you did not receive an application, let us know. •

CaFD is a component of the networking, follow-up, and dissemination process of a National Science Foundation supported Faculty Enhancement project (DUE 9353998). The opinions, statements, findings, recommendations, or conclusions expressed in this newsletter are those of the author(s) and do not necessarily reflect the views of the National Science Foundation, Joliet Junior College, or Lee College. Readers are encouraged to submit responses to articles. They should be sent to Curtis Hieggelke, Natural Science Department, 1215 Houbolt Road, Joliet Junior College, Joliet, IL 60431 or e-mailed to curth@jjc.cc.il.us

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