# FORUM ON EDUCATION

*of The American Physical Society*

*Fall 1995*

## Local Alliances: Exchanging Ideas for Better Physics Teaching

*Thomas Rossing*

Local alliances of high school teachers, college and university teachers, research physicists, and others interested in physics education serve as effective forums for the discussion and exchange of ideas for teaching physics. Some of these alliances, such as the DMAPT in Detroit and the ISPP in Chicago, have been active for more than 25 years; others owe their existence to the APS Local Physics Alliance project which began in 1987. Alliances have become an important part of the professional lives of many physics teachers.

This issue of the FEd newsletter includes several reports on local physics alliances. We hope that readers who have never attended a local alliance meeting will make an effort to do so. If no alliance exists in your area, we hope that some of you may consider starting one. There are three active alliances in the Chicago area (ISPP, Physics Northwest, and Physics West), and I try to attend their meetings whenever I can. I have never come away without renewed enthusiasm and at least one new idea for teaching physics.

*Local Alliances, contd. on pg. 6*

## IN THIS ISSUE



## Wheeler Directs NSTA

Gerald F. Wheeler, professor of physics at Montana State University and a member of the FEd Executive Committee, is the new Executive Director of the National Science Teachers Association. He succeeds Bill G. Aldridge, also a physicist, who served as executive director since 1980.

NSTA, with over 50,000 members, is the largest organization of science teachers in the world. It publishes four journals, including the *Journal of College Science Teaching*, and a regular newsletter. Over 20,000 teachers attend its national and area conventions each year. Its Scope, Sequence, and Coordination Project, funded by NSF, is attempting to develop a new structure for science teaching that will include some physical science during each of the high school and middle school years.

Gerry Wheeler, who has taught physics both at the high school and university levels, has been an active member of AAPT, APS, and AAAS, as well as NSTA. He has served as president of AAPT and as Director of the Public Understanding of Science and Technology Division at AAAS. He was a charter member of the FEd Executive Committee, and served as temporary editor of the FEd newsletter. He has served as director of NSTA's SS&C project site in Bozeman, Montana.

Gerry has received numerous recognitions for both his teaching and his mass media work. He received outstanding teaching awards at Temple University, the University of Hartford, and Montana State University. The Milliken Award from AAPT in 1983 recognized "outstanding innovative work in physics education," especially his work in television. He is a fellow of the W. K. Kellogg Foundation and the American Association for the Advancement of Science.

His friends in FEd wish him the best in this challenging new position, and we look forward to close cooperation between APS, AAPT, and NSTA in furthering physics education in the United States!

# The Chicago Alliance, ISPP: 26 Years Old and Going Strong

*Ann Brandon and Gerry Lietz*

The ISPP, a high school and college physics alliance in Chicago, was described in *The Physics Teacher* in December 1979. The guiding light behind the formation of our alliance in 1969 was Harald Jensen, Lake Forest College, who died last November at age 86. Before joining the Lake Forest faculty, Harald taught high school physics, and he never lost his ability to relate to both groups of students. Harald's words remind us, "Start with the phenomena" and "Let the phenomena do the teaching." We try to use these ideas every month at our meetings.

In 1967, the NSF funded an Illinois State Physics Project at five colleges in Illinois. In the Chicago area, Harald Jensen at Lake Forest and Ed Schillinger at DePaul, aided by a cadre of area high school teachers, organized summer in-service institutes. Others soon became interested, including Earl Zwicker at Illinois Institute of Technology.

As funding became more difficult, the project came to an end. Harald, however, suggested it not be allowed to die. "This is too good a thing to let die; we can continue without funding," Harald counseled. "We need to meet once a month during the school year, and if we can find 9 or 10 host schools, we can continue." Schools which had teachers involved were each asked to host a meeting. The host was to provide a useful giveaway, coffee, and some snack, such as cookies. Ten schools agreed, and our alliance was off the ground!

After Harald retired and moved to California, Earl Zwicker became our spiritual leader. He began writing a newsletter, originally dittoed, but now a monthly newsletter with a circulation of 400--500 all over the country and even overseas. Soon, we hope to distribute it by email. We include sketches and photographs. The newsletter reminds everyone of the next meeting and of the fun they may have missed. Sometimes it challenges them to explain something at the next meeting. For several years, these newsletters formed the basis of Earl Zwicker's column in *The Physics Teacher* entitled "Doing Physics."

We generally meet from 6:30 until about 8:30 on a week night from September to June. We vary the day of the week, so that those who have fixed activities such as evening classes can attend some meetings. We also vary the location around the city, within a radius of 50 miles. The ISPP has spawned two other physics alliances, Physics Northwest and Physics West, which serve the more distant Chicago suburbs. Once a year, all three alliances meet jointly.

It is important to feed people. The host school provides coffee, doughnuts, tea, and even ice cream (each has its own favorites). We do not have a speaker or formal presentations--these are left to the AAPT Chicago section meeting. Rather, teachers bring favorite demonstrations, puzzles, and questions. The host always prepares a few extra demos just in case things are slow. As the teachers come in, they sign up on the blackboard to announce their presentation, which helps the authors of the newsletter to identify the name of the teacher and to acknowledge the school of the presenter. We also have a sign-up sheet so that our mailing list can be kept up to date.

We always have a free giveaway for each attendee, something that a teacher can take back to her/his school to demonstrate, or better yet, have the students use. We try to make them very inexpensive, using surplus or scrap materials if possible, so that they can be duplicated if a classroom set is needed. At one meeting, the giveaway was a plastic bottle filled with water and having a plastic bulb floating in it. The following summary of the presentation will give the reader a little flavor of a typical ISPP meeting.

"I have a plastic bottle filled with water and a plastic bulb floating in it. When I squeeze the sides of the bottle, the bulb sinks. When I release it, the bulb floats. How many have seen this before? (Hands are raised; Earl Zwicker reminds us to always get the audience involved). When you ask a student how this works, someone often says "buoyancy," but I'm sure that you ask for a more complete answer. Talk to your neighbor now and give me one....(wait a while).

"Many of you know that this is called a Cartesian diver. This one is made from a 5-cc plastic micropipette, with the long stem shortened and a 10-32 steel nut (or nuts) forced on to the stem to add weight. I have partially filled the micropipette with water, and so it is slightly buoyant. I place it in a water-filled, liquid soap bottle and seal the bottle. When I press the sides of the bottle, the diver sinks. This costs only a few cents to make, so each student can make one and explore. Here is another variation: When I press the wide sides of this bottle, the bulb goes to the bottom and stays. If I press the narrow side, the bulb rises. Can you explain this one? I'll give you a hint: pressing on the sides of the oval bottle can cause the shape to become more cylindrical and decrease the pressure. It has to be carefully balanced. Warning: If the students make them at home, some will not work when they arrive at school. There are questions you can ask your student to research: for example, why does the carefully balanced diver sometimes not work after an hour or two? Is it temperature, or dissolved gases, or what?

"Here is your free giveaway: a bag containing materials to make two Cartesian divers; you provide the soap bottle. You can add wires to these so that one can be used as a "sunken-trapped diver" (with a loop), which the other (with a hook) dives to, hooks and "saves". We thank Elmhurst College for the micropipettes and the diver idea."

At the meetings, we encourage fun and involve everyone. **Do physics — don't just talk.** Have a lot of discussion (we encourage puns), and try people's suggestions, such as "Let's

do it again but this time make the following change--what will the result be?" There are many suggestions from the floor about things to try with the apparatus. It is fun to get the audience to predict the result of a demonstration experiment; often we vote on the outcome. Self-involvement is very important to keep everyone feeling they are contributing. After a demo is described, ask "How many of you have seen this before?"-- there are always some who have not. This encourages everyone to remind us of the "golden oldies" by bringing their favorites.

If a presenter says, "I don't know if I should do this--you've probably seen it before," we reply, "Go ahead; even if we have, we'd enjoy seeing how you do it." Many experienced teachers will have suggestions on the variations that they use and can tactfully introduce them without any show of "one-upmanship." Often there will be a new wrinkle on how to involve the students. Sometimes new teachers will bring items from their stockroom and challenge us with "What is this for?" "How do I use it?" "What is missing?" A leader who can encourage everyone to bring something and help them through their first few presentations is a valuable asset.

How many teachers do you need to have an alliance? We have meetings with as few as six to more than 70. New teachers, pre-service teachers, and even high schools students come to our meetings. We ask newcomers to identify themselves. Often teaching job openings are announced at the meetings.

What about leaders? Don't depend on one person; have five, even ten hosts who meet once a year and share the load. We have two chairs, a treasurer, database helper, three photographers and three newsletter authors. Illinois Institute of Technology provides secretarial help to print and mail the newsletter.

Our alliance continues to be strong because we have been able to blend ideas and experiences from the older members with the energy and enthusiasm of the younger teachers. We expect another 25 years of "Doing Physics."

*Ann Brandon, who teaches high school physics at Joliet West High School, has won several awards for teaching including the State Award for Excellence in Science Teaching. She has been active in AAPT, serving on several national committees and also as president of the Illinois section. Gerry Lietz has taught physics for 27 years at DePaul University, has served on several national AAPT committees, and he presently represents the Chicago section on the AAPT council. Ann and Gerry have made several presentations for the APS local alliance project.*

## MOPTO: The Local Physics Alliance in New Orleans

*Larry Blanchard*

Two PTRAs, Kathy Malone and Bill Gregg, with support from Jack Sullivan (University of New Orleans), led in the organization of Metro Orleans Physics Teachers Organization (MOPTO) in 1987. The young organization received a boost from an APS/AAPT Local Physics Alliance workshop in 1988, [I assume this is what you meant by "outreach at the 1988 meeting"] which included demonstrations of superconductivity and low temperature physics by Brian Schwartz for local high school students who were bussed to a centrally located school from all parts of the metropolitan area.

Meetings have continued with a stable core of long-time teachers and infusion of crossover teachers. A monthly MOPTO newsletter has been used to inform all of the local physics and physical science teachers about progress in new teaching methods as well as being the vehicle for sharing their own teaching strategies at the meetings. One member commutes regularly from Mississippi for meetings and workshops.

In response to discussions about local needs, especially in the realm of equipment, an attempt was made to secure an equipment library and support staff for teachers to help guide and introduce hands-on activities. Funding for this came through a 3-year grant from NSF (1991-1994) for workshops to train support personnel.

An intense 8-day hands-on workshop for 24 teachers during the Summer of 1991 used mainly simple materials, such as those described in *String and Sticky Tape Physics*. This workshop was led by Jack Sullivan, Bill Gregg, and Larry Blanchard.

Two local grants from Amoco and the Greater New Orleans Foundation made it possible to purchase a van. With the workshop group as a core, "in-classroom" support was given by Larry to over 70 teachers who were also supported with materials supplied by the University of New Orleans and fabricated in the University machine shop.

Although our local alliance is small, its impact is considerable.

*Larry Blanchard, a physics teacher at Warren Easton High School in New Orleans, has masters degrees in physics and in Latin American studies. He has been a teacher of science and mathematics for 33 years, and is a PTRA Plus '92.*

# The CHIC Thing to Do

*John J. Russell*

What do a high school physics and Latin teacher have in common? Many things, including precision and subtlety in describing the world they live in. They are also lonely! Only the largest schools in the country have more than one physics or Latin teacher, so both rarely have contact with a colleague who understands the subject they love — or even the handful of jokes and puns in their language.

A few intellectual giants have thrived in isolation, but the rest of us — especially teachers — need colleagues to sustain our professional vitality. And there are some ready examples at hand of how to reduce our isolation from one another, whether physics teachers, Latin teachers, doctors or lawyers.

For many generations, across the country, county bar and medical associations have served the majority of lawyers and doctors who practice their professions on their own by bringing them together to share common concerns of their professions. Physicians, for example, who see that obstetrical services in their region are underutilized or that their growing local elderly population needs different services can work together to bring about the necessary changes.

Why shouldn't teachers of Latin or physics, whether practicing in schools or colleges, have the benefit of exchange with their colleagues nearby? Just as tax lawyers in a region — members of large firms and individual practitioners together — may organize a seminar on new tax law, teachers of physics locally might put together a workshop on using computers to improve physics instruction, on including more contemporary physics in their introductory classes, or improving public support for good science instruction.

That's what the Local Physics Alliances Project is all about — people who teach physics in a variety of settings getting together regularly to keep one another current in their profession and to improve its practice locally. Teachers of physics from schools and colleagues who live within commuting distance of one another can meet late afternoons or Saturday mornings at a convenient location to share coffee and donuts or pizza, and most importantly — physics. (What "commuting distance" means varies enormously within the U.S., but that's another whole article!)

When Judy Franz, then a physics professor at WVU, formed the College-High School Interaction Committee (CHIC) in 1981 she brought together a handful of AAPT and APS members who believed that greater school-college collaboration could help ease the then emerging "crisis in high school physics". (The May 1981 *Physics Today* issue was devoted to the subject.) Within a year CHIC had recruited college and university physics faculty from 500 of the country's 800 physics departments to serve as CHIC liaisons to work with teachers of physics in local high schools. A newsletter, devoted to sharing examples of productive school-college physics collaborations, was begun by Dick Sands at Michigan State; now edited by Peter Lindenfeld of Rutgers, its circulation has grown to nearly 3,000.

I got recruited by AAPT stalwart John Layman to join CHIC about 1983. (Sound familiar to a few of you? John's very persuasive!) Having worked with high school physics teacher since the mid-60s in the Physics Advanced Placement Program, I needed no convincing of the value to both school and college teachers of talking together about physics and how to engage students in learning and enjoying it. College folks generally operate closer to the frontiers of research and can often share their excitement and knowledge of current developments with their school colleagues; they often have useful insights into the workings of classical physics as well. Reciprocally, most high school physics teachers have had more training in the profession of teaching (any training is more than most of us college faculty have had!), and are generally much more aware of pedagogy — what works and what doesn't in the classroom, and how to tell the difference.

Impressed by the collaborative models that Dick Sands gathered for the CHIC newsletter, I proposed that we take a smorgasbord of them around the country to regional workshops aimed at stimulating similar new local collaboratives. APS agreed in 1986 to sponsor an NSF proposal to do so, and the rest, as they say, is history. Between 1989 and 1995 Brian Schwartz and I put on 11 APS/AAPT Local Physics Alliances workshops across the U.S. which brought together 750 high school teachers and 500 college faculty. They formed about 150 local alliances, which we estimate now engage through local meetings, newsletters, and regional school reform projects nearly a quarter of the high school physics teachers in the U.S. AAPT support, especially that of the national network of Physics Teacher Resource Agent (PTRA) teachers, was vital to our successes.

A follow-up study of alliances formed in our 1989 workshops in Raleigh, NC, and Spencer, IN showed that more than two thirds of the participants are still engaged. (A significant additional finding: women participated initially and persisted at twice the percent they represent in the school and college teaching populations.) Local alliances and their leaders have played outstanding roles in science education reform, helping to bring the higher education community and its resources into productive engagement with schools in this vital effort.

After the state systemic initiatives — and their NSF funding — are history, local alliances may emerge as the most important vehicle for maintaining the reform process. In the late 60s. after NSF "declared the war won" with PSSC and other new curricula and stopped supporting science education, a number of local school-college alliances — like

# Detroit Metropolitan Area Physics Teachers

*Alan Gibson*

Why will 30 to 40 teachers drive as much as 1½ hours each way to attend a meeting after a long day at school? Three reasons are important: one is to learn more physics; another is to learn new ways of teaching physics and relating to students; and the third is to develop friendships with colleagues with similar interests. DMAPT's programs have included demonstration sessions, "make and takes" (where we make demonstration or lab equipment), discussion of topics in physics education, and tours that have included hospitals, industrial plants, and a nuclear power plant. In addition, we try to plan one public meeting each year with a lecture on a current topic in physics to which we invite our students and the general public.

In 1957 the excitement of the emerging American space program led Cecil Meyers and others to the form the Oakland County Science Teachers Association. Several of the teachers involved in teaching the PSSC course felt the need to concentrate more on physics and formed the Tri-county PSSC Teachers. In the 1960s, the introduction of Harvard Project Physics led to another name change, and the Detroit Metropolitan Area Physics Teachers (DMAPT) organization was born. Around 1962, Al Varone, Bernard Sharkey, and other high school teachers started inviting college physics teachers such as George Beard (Wayne State University), Robert Williamson and Paul Tipler (Oakland University) to join them. Since that time, a number of college and university teachers have been active members of DMAPT.

PSSC and Project Physics called for different ways of teaching. In many previous courses students were encouraged to memorize formulas and "plug and chug" to solve problems, placing few demands on the teacher. In the PSSC and Project Physics courses, on the other hand, thought and reasoning are much more important. We began to search for new ways to actively engage the students in physics. If we could no longer use the college lecture model, what was the new model to be? We began to realize that telling facts was not the same as teaching.

One of the major problems any organization faces is maintaining its vitality; DMAPT is no exception. For the first 20 years of our existence, our leaders were volunteers. The same person might act as president 10 years, but as that person became busy with other things or lost interest in DMAPT, our meetings became less frequent and less interesting. In the 80s, DMAPT adopted a constitution and defined the terms and responsibilities of officers, similar to local sections of AAPT.

To maintain an effective alliance, it is very important that both secondary and university teachers share responsibility for the organization. As physics teachers we probably have more in common than do teachers of the other sciences. The topics covered in our first-year courses are similar. A sense of shared mission is the key to our alliance. A university professor may be a particle physicist as well as a teacher. She/he may know more physics facts than a high school colleague, but as long as both value teaching, they have a great deal in common. What the high school teacher has learned about teaching physics may help the university professor to be a more effective teacher.

*Alan Gibson has taught physics at Adams High School in Rochester Hills, Michigan for 26 years, as well as in Okinawa and Germany. He won a Presidential Award for Excellence in Science Teaching in 1988. He has been very active in AAPT, and chaired the Committee on International Physics Education.*

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the Chicago ISPP and the Detroit MAPT groups — formed to maintain the momentum, support and camaraderie they found so rewarding; they have kept the professional juices flowing since for many of the best school and college physics teachers in their areas.

My former Congressman Tip O'Neill used to say that all politics is basically local. I'll bet that the science education reform that really "takes" will also be local and self-supporting. Collaboration among school and college physics teachers may be the best way to build the solid local platform strong enough to support the sustained professional growth for teachers and better physics education we need. It's also a lot of fun!

*John Russell has been professor of physics at the University of Massachusetts, Dartmouth for 26 years. He is chair of the CHIC committee and a former chair of the APS Education Committee. He was co-PI of the APS local physics alliance project, and was the first candidate for APS fellowship nominated by FEd.*

## Manual on Undergraduate Research Available from AIP

Ed Neuenschwander, AIP Education Director, has prepared a booklet entitled "How to Involve Undergraduates in Research: A Field Guide for Faculty." It is being distributed to all Society of Physics Students chapters, and others may obtain it for $5 by calling Ed Neuenschwander at (301) 209-3010 or email to den@aip.org.

# Comments From the Chair:

*Ruth Howes*

These days I read the *Muncie Star* with my morning coffee. It makes a change from the *Washington Post*. High school athletics dominate the sports section. The activities of parents and community groups in support of the teams fill the local news. Winning, of course, is critically important, but the league in which the team plays makes little apparent difference. The Star always gives lots of column space to football, volleyball and soccer, bands and band parents' spectacular fund-raising efforts.

When high school stars make game-winning touchdowns or spikes, they deserve the kudos they receive. But if star players want future trophies, it behooves them to remember that their triumphs rest on a pyramid of effort. They generally praise the members of their teams, their coaches and their parents. The smart ones also acknowledge their debts to the student body and the fans.

Physics could use the community support that high school athletics enjoys. Within physics, we find ourselves divided by subdiscipline and by type of employment. A commercial success based on new applications of fundamental physics receives few cheers from academic physicists. Physicists in industry often greet yet another *Phys Rev* letter from their academic colleagues with a heart-felt yawn. Physicists teaching in high school are probably too busy to pay attention to either achievement and, in their turn, get little recognition from their industrial and university colleagues.

We physicists should imitate high school student bodies and celebrate the victories of all our teams. Of course, that means that we must explain them to one another. It costs extra time and trouble for research physicists or industrial developers to take time to write popular articles for the physics community in general, but each of us must do so if we wish wholehearted community support. High school physics teachers must explain again and again how their innovations benefit the current crop of future physicists.

A second obvious area in which we can learn from the high school teams is community-wide fundraising. Obviously bake sales in support of research projects come up woefully inadequate. (It's too bad that many school systems must hold them to equip teaching labs.) Physicists must work together to persuade our elected officials to support funding both for education and research. We cannot afford to have big science feuding with little science and the pair of them sniping at science education funding. The APS leadership has mounted a Congressional Visitors program which stresses building long term relationships with senators and representatives, before we have to ask them for favors. Forum members should get involved and support science education as one of the activities about which physicists care greatly.

Finally physics superstars could take a leaf out of the books of the high school team stars. These physics leaders are generally fairly good at acknowledging the members of their teams and their coaches, but they all too often forget their academic parents and certainly fail to recognize the support they receive from the physics community. Their efforts along these lines would go a long way to make their breakthroughs victories for all of physics.

Working as a team, physicists can influence the thinking of our entire society. Separately, segments of the discipline may well interfere destructively. As our country works through the painful process of reevaluating national priorities in light of flat or decreasing fiscal resources, physicists must speak with one voice if we are to be heard at all. If all of us work together, we can boast a winning record in education, in research and even in fundraising.

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*Local Alliances, contd. from pg. 1*

In the lead article, Ann Brandon (Joliet West High School) and Gerry Lietz (DePaul University) report on the ISPP, the oldest Chicago area alliance, begun under the guidance of Harald Jensen (formerly of Lake Forest College) in 1969 and nurtured by Earl Zwicker (Illinois Institute of Technology) and others. The ISPP, which has served as a model for many other local alliances, publishes a regular newsletter, which is circulated all over the country. (If you wish to receive it, all you have to do is contact Ann or Gerry).

Local alliances in no way compete with state and local sections of AAPT but rather complement them. Many physics teachers, whose first professional interaction with other physicists was through a local alliance, have now become leaders on the national level through AAPT and through the PTRA (Physics Teaching Resource Agents) program. "I'm sure that I have learned about more good ideas from the high school teachers than they have learned from me," commented Robert Williamson, Oakland University, who has participated in the Detroit alliance for nearly 25 years.

For information about local alliances in your area, contact Ramon Lopez, Education Officer at APS or John Russell, Chair of the College-High School Interaction Committee (CHIC), author of another article in this issue.

# Three Cultures?

*Peter Lindenfeld*

Have you been to an AAPT meeting lately? What a difference from an APS meeting! The first two days of workshops have become an integral part of the schedule, as groups of members give others the opportunity to learn by direct participation about innovative programs and methods, and teachers and manufacturers' representatives get together to explore experiments made possible by the latest products. Then come the days of papers, awards, the apparatus competitions, some invited guests, open committee meetings, discussions, and a few social occasion. The members know how to communicate, and do so mostly on a lively and interesting level, but what especially distinguishes the proceedings is the eagerness to share, to include others, to maximize one's own as well as everyone else's effectiveness.

This contrasts with the almost overwhelming attention to the 'self' at APS meetings, and the scramble for the highest possible spot in a closely structured pecking order, that more often than not causes the excitement of science and discovery to take second place.

The worst talks that I heard at this summer's AAPT meeting in Spokane were by invited "experts" whose focus and perspective were narrow, and whose sensitivity to their audience was small. There was also another jarring note. It seemed sometimes as if there were two meetings, interpenetrating, but interacting to a surprisingly limited extent, one consisting of high school teachers, the other of people from the colleges and universities. I became aware of this state of affairs through conversations and at a meeting of the College-High School Interaction Committee.

"Why do we need the Forum on Education when we have AAPT?" "I have tried to make contact with the local colleges, but I don't think anyone there is interested in the schools." "The research physicists act as if they knew it all." "I am tired of being talked down to." These are some of the comments, to the extent that my memory can reproduce them.

It doesn't take much to put a high school teacher on the defensive. And some of our colleagues, exuding certainty and superiority don't make the interaction easier.

We are members of a privileged class. We have access to resources and rewards, including but beyond those in our paychecks, that are rarely available to teachers. We, and they, tend to be aware of the differences in our activities, experiences, and status accorded by society. Occasionally the establishment of a personal relationship can move us beyond differences, with mutual respect and understanding for each other's strengths.

When I was a student just about every faculty member and most graduate students were members of AAPT. Today's professor is an entrepreneur, who most often sees his or her allegiance elsewhere.

We are members of the Forum. We are missionaries for physics and for all that it represents, but if we think of ourselves as bringing the true word to the savages, we risk being boiled in oil, or, at least, being ineffective. On the other hand, if we invite some teachers to a meeting to exchange thoughts and plans, we can lay the groundwork for a different future. Perhaps relationships will develop, and they may go farther than guest lectures and field trips, as we find new colleagues with common goals and aspirations. (You may even want to join the AAPT...)

Are we three separate groups? The research physicists who find their home in the APS, the high school teachers, and those whose predominant activity is to teach at the post-secondary level? You may think of physics as the carrier of the seeds of technology, or as the search for the pure knowledge and poetry of the universe. We are all part of one community, each of us, in our way, preserving and expanding the language and culture of our subject.

More than ever, as our work is often valued less than we think it should be, we must find new ways to transcend the boundaries that separate us, to go outside the subculture within which we spend our working hours, to support each other, and to strengthen the bond between us.

*Peter Lindenfeld, professor of physics at Rutgers University, does research in superconductivity. He is active in both APS and AAPT, and is editor of the CHIC newsletter. He was awarded the Millikan medal by AAPT in 1989.*

## Nominations for APS Fellowship

FEd nominates for APS fellowship persons who have made noteworthy contributions to physics education. Suggestions for nominations should be sent to Ken Lyons, Chair of the Fellowship Committee.

# Letters

## Computer Monitored Homework

To the Editor:

Paul Cottle, in the Summer issue of the Forum newsletter, discusses his measurements of the out-of-class study habits of students in an Introductory Physics course. Only 30% or so of students attempted "most or all of the homework problems" before a recitation session. Cottle speculates that if the out-of-class study time could be increased and more broadly spread over the preceding week then student success could be improved. He further discusses approaches to force students to more frequently work on homework activities, including scheduling many problem sessions in a week. As he says, scheduling many such sessions would probably be considered inappropriate by many teachers. I would suggest another approach; have the students submit their homework through computer networks on a daily basis with the computer checking the results and monitoring compliance. My preliminary studies suggest that this can be quite successful.

The observations stem from a study of whether performance on tests can be improved by having the students practice with homework problems designed to enhance basic skills. The homework assignments are to perform a large number of simple, single concept, problems in a limited time. The criterion of success is a high rate of correct responding with the rate being critical. The technique is sometimes known as "Precision Teaching"; early results of the program are encouraging and have already been published [1].

A large class (150 students) of pre-engineering students in a calculus based Introductory E&M class were divided into three groups for recitation period purposes. One group was given the skills development homeworks via computer terminals. Students were required to perform one exercise per day. The computer monitored compliance, cut the student off after the allotted time period, graded the answers and kept records. Within this group the students are forced to work daily to obtain the portion of the grade assigned to homework. In a second group the students are given the same basic skills material, but on paper. While they are instructed to perform these daily there is no objective monitor of compliance and surveys indicated that 50 to 60 percent of students did not comply with this instruction; a similar figure to that of Cottle. A third group acted as control and undertook regular "back of the chapter" word problems to be handed in weekly for grading; for this control group there is no objective monitor of study habits.

We find that both groups undertaking the skills development routines exhibit superior performance on the final examinations to than of the control group who simply perform conventional "end of the chapter homeworks"; the difference is an approximately 20 percent higher grade on the final. This validates our earlier conclusion [1] that emphasis on development of basic skills appears to be more useful than just working complex word problems and examples. Within the skills development groups those forced to work daily by the computer system showed final exam scores as much as 30 percent higher than students undertaking the same work but not being required to perform exercises daily. These various differences in performance are a function of the incoming GPA of students. Those with a low incoming GPA, and therefore with the greatest risk of failing the class [1], show the greatest improvements through regular work. Those students with high incoming GPAs show little difference in performance when forced to work regularly. Full details of the study are to be published [2].

These studies validate Cottle's speculations. Regular work habits give rise to improved performance with the greatest impact being on those students whose past performance, measured by incoming GPA, is weakest. The study also demonstrate an effective manner for ensuring regular work habits which requires no additional class periods nor expenditures of faculty time. Let a computer keep track of the student's work habits.

Edward W. Thomas
Georgia Institute of Technology,
Atlanta, GA

[1] E.W. Thomas, Journal of Engineering Education, 82 152 (1993)
[2] Edward W. Thomas, Jack Marr, and Neff Walker. Proceedings of the Conference on Frontiers in Education (Atlanta, GA, 2 November 1995. Accepted for publication)

## A New Type of Quiz

To the Editor:

In his response to the letter by Paul Cottle in the Summer 1995 FEd Newsletter, Stan Jones suggests that a way of motivating out-of-classroom work is to collect and grade homework, allowing groups to hand in a single set. However, given the current extensive availability of worked-out solutions and examples, and of other people who will do most of your work for you, it is only too easy to turn in near-perfect homework without the kind of struggle that alone brings true understanding and mastery of the learning material.

Because of this, some of us here at Purdue have been experimenting with a new type of quiz, which would be taken before the instructor gives a complete explanation of how to work out the homework. The students are allowed to keep their worked-out homework in front of them during the quiz,

and are told beforehand that the quiz would be a deliberately-disguised version of one of the homework problems, with different numerical values and with modified wording, but with the same basic physics, diagrams and algebra (although the quiz may, e.g., require a calculation of A from B and C where the homework may involve a calculation of B from A and C). The result is that it is only by doing their homework with real understanding and preparation that they will be able to complete the quiz successfully in the deliberately short time allocated to it. In effect, it becomes an indirect way of properly "grading" true homework performance, and of motivating an optimal individual or group learning experience, particularly if the quiz is awarded substantial credit in the course.

Louis A. P. Balázs
Purdue University, W. Lafayette, IN

## Comprehensibility of Research Papers

To the Editor:

This letter to the editor of the Forum on Education newsletter is in response to Ruth Howes' front page article about communication in the Summer 1995 issue.

All of her observations and conclusions seem correct, but I think we can even add to her list of our communication problems. In particular, I wish to briefly discuss the comprehensibility of research papers appearing in our research journals.

It is rare that I pick up a scientific or engineering paper and relish an interesting and informative introduction that then launches into a main body that is reasonably easy to digest. Instead, it is my experience that most papers in the original technical literature (and not just physics!) are written for people who already have expertise in a narrow field.

A few years ago, I submitted a paper to the journal Biophysical Chemistry. I was proud of my submission because, although the method that I described was a novel one, I'd taken the time and trouble to thoroughly introduce the reader to the method with a logical exposition. The editor didn't like it though...said it was too chatty and much too long. Well, I fell in line by cutting out the pedagogically inspired introduction and resubmitting a lean, taut, economical, sparse, concise, and (in my view) much less comprehensible version. The referees accepted it right away, and it was published. I would have much preferred the publication of my original submission.

It doesn't gotta be this way! A glance at just about any science journal published prior to, say, 1950 will show that many of the older papers are more accessible to non-experts. And think of the mega-kudos that Richard Feynman has received for a style that made physics accessible to all (e.g. his book *QCD*).

I don't think its too far off the mark to state that we include, in graduate education, indoctrination in the virtues of appearing abstruse to our colleagues. To be hard to understand is to be sophisticated, advanced, and one-up to the next person.

So, in addition to Ruth Howes' exhortations that we should communicate better with the non-scientific world, I'd like to suggest that we have some in-house cleaning to do, too: Let's make it easier for us scientists to understand each other in our papers, talks, books, etc. We would do well to emulate Feynman's style of sculpting words that our readers can enjoy taking in. And I think many scientists would prefer enjoying papers and talks rather than having to wrestle with them.

Jeffrey Marque, Ph.D.
Beckman Instruments, Palo Alto, CA

## Neglect of Thermal Physics in the Introductory Course

To the Editor:

Prof. Knight struck a resonant chord with me in his review of Prof. Arons' book, A Guide to Introductory Physics Teaching (Education Forum, Summer 1995) when he said it lacked material on thermal physics. Indeed that is true of almost all recent introductory texts in physics, and the result is general ignorance of concepts which are of enormous fundamental scientific interest, and also impinge on the daily lives of everyone. I have encountered the problems of ignorance of basic concepts of thermal physics almost every day of my 20 years in educating the public on an important advance in firemaking that TIME, (December 22, 1975) called "The Physicist's Fire".

I now have a book in the hands of major publishers, Revolution and Counter-revolution in the Fireplace, with a chapter on Teaching and Learning about Fire that addresses issue of basic, everyday thermal physics that seem to have eluded the understanding of almost everyone from judges to journeyman, and including some physicists! Ignorance is rampant of such basic distinctions as that between radiant and convected heat, and their implications for thermal comfort. The result is widespread acceptance of absurdities such as that fireplaces are energy counter-productive (Anti-Fireplace Hoax).

Aside from practical issues, thermal physics is a feast of intellectual insights, starting with the beginning of time and

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and Wilson in the sixties, and one follows the arrow of time to its end in the Warmetodt (Heat Death). Along the way are the universal Laws of Thermodynamics, the Infra-red Catastrophe and the genesis of quantum mechanics, exotic phenomena at temperature extremes like superconductivity and superfluidity on the one hand and thermonuclear reactions at the other, the profound unities embodied in the electromagnetic character of blackbody radiation, etc.

I know of only one introductory text that illustrates the Hohlraum (hole space), the ideal blackbody. I know of no mention of Bruce Lindsay's philosophic application of entropy that ethical conduct is that which minimizes the increase of entropy in the universe. In the Two-Culture discussion, understanding the concept of Entropy was considered the hallmark of scientific literacy. If so we should give it more attention or opt for a more intuitive concept, such as Energy, properly understood, as a password into the ranks of the scientifically literate.

The problem of teaching thermal physics may be that it is so difficult to make a selection among its fascinating aspects, it is tempting to ignore it altogether. Yet it is as teachable or more teachable than the classical mechanics which is the backbone of the introductory course in physics.

Lawrence Cranberg
Texas Fireframe Co., Austin, TX

## An Effective Tool to Educate Individuals

To the Editor:

Improvement in the quality of education will be a major factor in determining our future as a nation. What are we willing to do in the U.S. to really improve education, and particularly science education? What are we failing that should be done? Various studies on education have indicated that America's children received a better education fifty years ago than they do today. If education did a better job in the past, what has caused the deterioration of education to its present condition? What are the real basics which play a part in becoming education? That which determines more than anything else whether or not an individual is going to succeed as a student depends on the individual's eagerness to learn and the individual's willingness to be completely involved in doing what needs to be done, and this is typically closely associated with strong family life and parental concern.

We need to keep in mind that gifted students who are truly motivated to learn will succeed no matter what type of support is given by the educational system. Therefore, evaluation of improvement in the educational process must be determined by the progress shown by average and below-average students. These are the students who need more motivation and more individual help.

I believe that one of the keys is that each student must be taught according to his her ability within the framework of what needs to be achieved in each grade level. Eagerness to learn is greatly enhanced when students have the opportunity to investigate and find out for themselves. Future success in any type of human endeavor depends mostly on what a student continues to do on his or her own time in addition to what is required at school. This effort is strengthened when there is an eagerness to learn. We need to eliminate the practice of equalization, the mass processing of all students according to a model of what has been determined as the level of the average student's capability. This method ignores the different abilities and interests of students and provides a mediocre and limited type of education for students.

Over the last three decades or so, students have become adept at memorizing and passing tests but haven't developed, as they should, their ability to think or to write. As a result, these students are not prepared to function at the college or university level and are also limited in terms of being able to function properly in society. In many cases, the memorization syndrome is continued and even enhanced in universities and colleges.

Many of my physical science colleagues at BYU have told me that in the last few years more and more of their students lack the ability to think and write properly, and they try to get by through *memorizing* what is needed to pass tests. The overemphasis in public schools, and in many instances in universities and colleges, on passing tests, usually accomplished by memorization, has had a debilitating effect in learning science, especially physics. Many professors have seen a need to reduce and simplify what they require of their students now because the students don't have the capability to do what has been done in the past. Emphasis must be placed on the need to educate *individuals* instead of educating by *group processing* so that each individual learns how to think and is able to report orally or in writing what he or she has learned.

I believe that physical science teachers at all levels of education have the opportunity to be primary catalysts in this process, because physical science courses, more than any other basic courses, provide numerous opportunities for students to investigate and learn for themselves. Physical science courses provide hands-on experience with the opportunity to express orally and in writing what has been observed and what it may mean. We must take full advantage of these opportunities to help our students think for themselves and optimize their individual potentials.

Alvin K. Benson
Dept. of Geophysics and Geology
Brigham Young University, Provo, UT

# Jefferson County Physics Alliance

*Vincent A. DiNoto, Jr.*

The Jefferson County Physics Alliance is located in Louisville, Kentucky. Jefferson County has the largest population of any county in the state of Kentucky and also has the largest public school system in the state. It has a very large number of non-public schools, with the majority of them being Catholic. One major research university (University of Louisville) and the largest community college (Jefferson Community College) in Kentucky are also located in the county as well as several private institutions of higher education. The alliance was formed about eight years ago after a Science and Math Teachers conference was held in Louisville. Educational leaders from across the state were invited to attend the two day conference. Several national leaders spoke about alliance building at the conference. During this conference a regional math/science alliance consortium was developed. Consortiums were developed at other locations across the state, these groups took many different directions in the development of alliance activities. The group in Jefferson County developed alliance groups in different subject areas such as physics, biology, chemistry, middle school science to name but a few. Those instrumental in the forming of the physics alliance were Dewey Beadle, Bruce Jones, Lester Evans, and myself.

The alliance has been blessed with good funding, which has varied throughout the years from about $2,000 to more than $4,000. The funding has allowed the alliance to do many projects that have directly benefited the teachers, without any worry of how to finance the projects. The funding sources have come from local and state Eisenhower funds. Part of the Eisenhower funds have come directly from the school corporation and other funds have come from a physics consortium grant and also regional math/science alliance consortium grants. Without the benefits of these funding levels it would have been difficult to keep the alliance functioning at the level it has enjoyed.

The member of the alliance come from all parts of the county both public and private schools, most of the members are high school physics teachers, a few of the teachers don't teach physics but instead teach physical science or general science. Several members of the higher education community attend the meeting some more regularly than others. The alliance has worked very hard to insure that all people feel welcomed and can share with other alliance members. The alliance meets four times during the academic year. The meetings occur after school usually at a central location, but the alliance has meet from time to time at a specific school or higher education institution depending on the active for that meeting. The meeting begin about one hour after school is over and lasts for about three hours with a light supper served to those present. At all of the meetings there is always time for the teachers to share new ideas or for demonstrations to the entire group. Usually either a guest speaker will be invited from a local company or a make and take session will be held. Guest speakers have come from many different companies, some of the recent speakers have been from General Electric, Microwave Oven Research area and a pilot from United Parcel Service, they have discussed how they use physics in their work. Items constructed have varied from Lasers to photogates to computer sensors, many teachers have learned to use a soldering iron and work on printed circuit boards during project construction. The alliance has taken one major trip several years ago to Argonne and Fermilab National Laboratories, near Chicago, IL.

The structure of the alliance has been kept very simple with no dues, officers, or rules to distract from discussions of physics. Most meetings are attended by 25 to 35 teachers. The teachers can receive in-service credit for attending the meetings if their local site based council approves it in their professional development plans. When many alliances across the country have begun to experience problems with keeping members, this alliance is growing and becoming a much stronger group. The success of this alliance can be directly attributed to the efforts of Dewey Beadle and Bruce Jones.

*Vincent Dinoto is professor of physics at Jefferson Community College (Southwest Campus) and a past president of the Kentucky Association of Physics Teachers. He edits the Kentucky Academy of Science newsletter and is director of the Kentucky science olympics.*

## Nominations for FEd Offices

Nominations for FEd offices, including members-at-large of the Executive Commitee should be sent to Rush Holt, Chair of the Nominating Committee.

## Database of Summer Job Opportunities

Thanks to Ken Lyons, the FEd database of summer job opportunities for undergraduates is now on the worldwide web. The address is: http://www.att.com/APS/SJB.html.

# U.S. Physics Team Wins Four Golds and a Silver

*Larry D. Kirkpatrick*

The U.S. Physics Team received four gold medals and a silver medal at the XXVI International Physics Olympiad held in Canberra, Australia, in July. This is the first time in its 10-year history that all five members of the U.S. Physics Team have won a medal. The Chinese team was the only team to win more gold medals, winning five for the second straight year. The Iranian team won two golds and three silvers while the teams from Germany and Russia each earned two golds, two silvers, and a bronze. Great Britain took home two golds and three bronzes. The remaining gold medals were earned by students from Hungary, Italy, the Netherlands, South Korea, Turkey, and Vietnam. Australia, the host country, won two silvers and three bronzes for its best medal count ever and the Canadians garnered two silvers and two honorable mentions.

In terms of the total points earned by the five members of a team, the U.S. students placed second among the 51 nations at the Olympiad. This was an improvement over their third place finish last year in Beijing, China.

The U.S. Physics Team was led by gold medal winner Rhiju Das, who attained the second highest score. Rhiju graduated from the Oklahoma School of Science and Mathematics in Oklahoma City, where he studied with Xifan Liu. Paul Lujan placed in the top 10 in the world and will be a senior at Lowell High School (Richard Shapiro) in San Francisco next year. Ben Rahn won a gold medal after graduating from Thomas Jefferson High School of Science and Technology in Alexandria, Virginia (John Dell). His schoolmate Jooh Pahk will return to Thomas Jefferson for his senior year and may compete for another gold medal next year. The silver medalist is Daniel Phillips, who graduated from Concord Carlisle High School Massachusetts (William Barnes). The three seniors are now attending Harvard University.

The success of this year's team can be attributed to four factors: 1) the group learning and friendly competition at the training camp held at the University of Maryland, 2) the very intense studying by the five members during the five weeks between the training camp and the Olympiad (they are asked to solve all of the problems from the previous 25 Olympiads), 3) the three-day training camp held at Cal-Poly-Pomona just before leaving the U.S., and 4) the intensity of the team members in their group study during the trip.

It is a 14-hour flight to Sydney from Los Angeles, one of the longest non-stop routes in the world. The team spent three days in Sydney adjusting to the time change and thoroughly enjoying an introduction to the "land down under." Upon arriving at 6 a.m. the team cleared customs, collected luggage, and traveled to the hotel to leave off luggage. A late breakfast and a two-hour walk around Darling Harbor got us back to the hotel in time to claim our rooms and take hot showers. Then it was off for a harbor cruise to the zoo, so that we didn't fall asleep and could use the sunshine to help reset our biological clocks. Shortly after dinner, it was off to bed and a very long night's sleep, solving most of the jet-lag problem. The next two days were occupied with some sightseeing mixed in with study sessions.

Then it was off to Canberra for the Olympiad. The Olympiad organizers consisted of Prof. Rod Jory (normally director of the Australian Physics Team) and approximately 90 of his students and former team members. Even the coaches of the Australian Team were former team members. The organization was very professional and the hospitality well beyond anything that could have been expected. The Australians made all of us feel very welcome and special. And it was very interesting experiencing the new flora and fauna. It was a strange experience having your noon-day shadow point south, seeing many new constellation in the night sky, and having winter in July.

*Larry Kirkpatrick is a Professor of Physics at Montana State University, Bozeman. He is Academic Director of the U.S. Physics Olympiad team, and he is Field Editor of Quantum magazine.*

## The Problems

The problems are the heart of the Olympiad competition and were very well prepared by teams of physicists from the major cities of Australia. Each student was given five hours to solve three very difficult theoretical problems. They were not allowed to use any references and could only use nonprogrammable calculators.

The first problem asked the students to calculate the radius and mass of a star by measuring the gravitational redshift of photons emitted from the decay of He+ ions on the surface of the star. The redshift was measured as a function of distance from the surface of the star by giving He+ ions in a spacecraft the velocity relative to the star required for resonant absorption. As a final part of this problem, student were required to show that the frequency shift due to the recoil of the ion was very small compared to the redshift.

The second problem was a study of sound propagation in the ocean when the speed of sound has a minimum at a depth midway between the surface and the floor of the ocean. Students were asked to prove that the sound rays follow arcs of circles when the speed gradient is linear with depth. They then derived an expression for the time it takes sound to travel from a source to a detector when both are at the depth of the minimum speed. It is interesting to note that the direct ray takes longer than one that travels along an arc.

# The North Central Indiana Physics Teachers Alliance

*Charles Emmert*

The North Central Indiana Physics Teachers Alliance was organized in 1987-88 by Jim Bogan (then at Lebanon HS) and myself as a follow-up to our PTRA activities and given another "push" by the APS meeting on alliances in 1989. Our alliance is an informal organization, currently having no fixed structure nor officers, which meets three times during the school year to share and to discuss ideas for the teaching of physics, as well as current concerns. Meetings have been at various high schools or at the Children's Museum of Indianapolis, which has been helpful in offering museum facilities and a contact person. The alliance maintains a mailing list of approximately 200 names, including high school and college physics and physical science teachers. Attendance at meetings varies from 7 to 35.

During high school textbook adoption review years, a meeting has been devoted to discussion of textbooks under consideration for adoption, with teachers sharing their thoughts, concerns, and experiences with past editions of these materials. This has served as a valuable resource for the sharing of physics teaching philosophies and approaches, as well as the specifics of curriculum materials. Meetings have also included sharing of information about computer software, hardware, and activities for physics teaching.

Our alliance subscribes to the motto of "fun, food, and fellowship," and we always have lots of each — especially chocolate-chip cookies — at our meetings. Most of our meetings times have been devoted to sharing classroom demonstrations and activities designed to help each other improve our instruction and our students' understanding of physics concepts and applications. Specific ideas have included: using a "hot wheels g-force track" to find how much energy the ball has when it leaves the track, shining a heat lamp through a round water-filled flask to focus IR onto a liquid crystal, "Bernoulli basketball" (blowing across the top of a coin so that it jumps into a cup), placing various color filters on top of a holographic diffraction grating on an overhead projector, etc.

*Charles Emmert has taught physics at Noblesville High School for 32 years. He is very active in the Indiana section of AAPT, and has served as a PTRA since 1985.*

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For the third theoretical problem, the students examined the motion of a cylindrical buoy floating in water when it was displaced from equilibrium by a small amount. The problem was complicated by a thin rod hanging down from the center of the buoy so that there was an angular oscillation as well as a vertical oscillation.

After a day of sightseeing and interacting with members of other teams, the students performed two experimental tasks, each in 2.5 hours. In the first problem the students dropped small metal cylinders in a graduated cylinder filled with glycerin. From the dependence of the terminal speed on the diameter and density of the cylinders the students were asked to determine the power of the radius dependence of the viscous drag and the density of the glycerin.

The other experimental problem was divided into two parts. In the first part, the wavelength of the light emitted by a laser diode was determined from the diffraction pattern produced from a metal ruler. In the second part, the students determined the attenuation coefficient for the scattering of light in a mixture of milk and water.

## The 1995 Team

The other members of the U.S. Physics Team (with their physics teachers and high schools) are: Matthew Ahart, North Hollywood CA (John Feulner, Harvard-Westlake School), James Belk, Endicott NY (Mitchell Johnson, Union-Endicott HS), Franz Boas, La Jolla CA (Martin Teachworth, La Jolla, HS), Chris Holleman, Durham NC (Hugh Haskill, NC School of Science and Mathematics), Yoon-Ho Lee, Wallingford CT (Lawrence Stowe, Choate Rosemary Hall), Chen Ling, Cleveland Heights OH (Robert Quail, Cleveland Heights HS), Edward Miller, New Orleans LA (Tony Asdourian, Isidore Newman School), Vivek Mohta, Northville MI (Robert Sharrar, Northville HS), Chris Norris, Andover MA (J. Peter Watt, Phillips Academy), Mark Oyama, Honolulu HI (Carey Inouye, Iolani School), Brian Patt, Birmingham MI (James Bedor, Seaholm HS), Casey Rothschild, Northfield, MA (Boris Korsunsky, Northfield Mt. Herman HS), Ari Turner, Los Alamos NM (Julia Wangler, Los Alamos HS) and Daniel Wesley, Rosemont PA (Robert Schwartz, Harriton HS).

The U.S. Physics Team is coached by Larry Kirkpatrick (academic director from Montana State University), Dwight Neuenschwander (senior coach from Southern Nazarene University, now with AIP), Ted Vittitoe (senior coach retired from Libertyville High School in Illinois), Hugh Haskill (coach from the North Carolina School of Science and Mathematics), and Mary Mogge (coach from Cal Poly-Pomona). The U.S. Physics Team is organized by AAPT under the direction of Bernard Khoury and with the invaluable assistance of Maria Elena Khoury and her staff. Financial support is organized by AIP with help from its member societies, including APS.

The next International Physics Olympiad with be held in Oslo, Norway, from 30 June to 5 July 1996. Application materials can be obtained from Maria Elena Khoury at AAPT (301-209-3344).

# Browsing Through the Journals

*Thomas Rossing*

• The design and development of a new method for high school physics instruction in which students construct and use scientific models to describe, explain, predict, and control physical phenomena, is described in a paper by Malcolm Wells, David Hestenes, and Gregg Swackhamer in *American J. Physics* (July 1995). The paper is especially noteworthy in that it is based on the doctoral dissertation of Malcolm Wells, who died from Lou Gehrig's disease, and two of his colleagues tell his story.

• "Top Federal Science Agencies Join Other Reformers to Focus on the Vital Undergraduate Years" is the title of an article in *J. College Science Teaching* (Sept/Oct 1995) which highlights the National Research Council-National Science Foundation convocation on undergraduate science, mathematics, engineering, and technology education held in Washington last April.

It was noted that most reform in science and technology education thus far has aimed at precollege and graduate support, whereas the undergraduate years have received less attention. Small children seem to take to good science like ducks to water, and improving their science education is a gratifying task. By the end of high school, however, young people's original enthusiasm for science has largely evaporated. Secretary of Health and Human Services Donna Shalala suggested that the dual curriculum in undergraduate science which often provides "tree hugging" courses for generalists and "sink or swim" courses for majors should be replaced by introductory courses that serve and interest all students.

• In another article in the same issue of JCST, Morris Shamos takes issue with the above report which, in his eyes, evokes a certain *déjà vu*. Clearly the pressure to become functionally literate in an industrialized society far outweighs the need for scientific literacy. Yet, if a large number of men and women cannot be persuaded of the value of functional literacy, what hope do we have of convincing them that going after a much more difficult goal, scientific literacy, is worth the effort? Shamos hopes that the next major convocation will focus on the *why* of science education rather than the usual *what* and *how*.

• "Vocational Science" is the focus of the July 1995 issue of *Physics Education*. Several articles address the topic of how physics fits into General National Vocational Qualifications (GNVQ) courses followed by students in schools and colleges in England. Along with being vocationally oriented, GNVQ promotes more student-centered approaches, with the teacher adopting the role of learning facilitator. Evidence from pilot centers suggests that the proportion of time which is teacher-centered has fallen to about one-third.

• The General Atomics education outreach program is playing a major role in enhancing pre-college science education in the San Diego area, according to an article in *MRS Bulletin* (July 1995). The education outreach program originated from a desire on the part of CEO Neal Blue, his wife Anne Blue, and Patricia Winter, GA's outreach coordinator to enrich K-12 science education. Teams of GA scientists and junior and senior high school science teachers have developed five teaching modules: An Exploration of Materials Science, Radioactivity in the Environment, Energy from the Atom, Fusion, and Recombinant DNA. Their workshops have been presented to over 300 teachers from junior and senior high schools in the local area, and recently the materials science module was presented as part of an American Chemical Society nationwide satellite television seminar for science teachers. Further information about the GA program can be obtained from Patricia Winter (619-455-4475; email winters@vaxd.gat.com).

• "Has the Computer Failed in Schools and Universities?" is the title of a thought-provoking editorial by Alfred Bork in *J. Sci. Ed. Tech.* 4(2), 97 (1995). Although computers have been used in education for over 30 years, there is little sign that the major problems of education are getting better. Bork discusses several possible causes for the failure, including: too much emphasis on hardware, too little focus on learning, too little focus on the students, too much attention to short pieces of software rather than complete courses based on computers. He suggests ten guidelines for developing such courses.

• Despite a recent wave of complaints from young scientists, the US system for educating graduate students is the best in world and is not in need of drastic repair, according to a report from the National Academy of Sciences (*Nature*, 27 April, 1995). The report suggest new block grants to support graduate students and more intensive career guidance, but if rejects any effort to limit the number of students embarking on PhDs or to restrict the number of foreigners amongst them. The academy's Committee on Science, Engineering and Public Policy found that most Ph.D.s who failed to find academic posts eventually prospered in other sectors, but the transition can be painful and nobody has been telling the students to expect it. The report calls for a more flexible Ph.D. structure to allow students who are not planning a career in academic research to take at least two alternative pathways: one would end with a master's degree, while the other would offer a full Ph.D., combining more courses with a shorter dissertation.

• Companies want to hire young scientists who understand the realities of working in a competitive business environment, according to Susan Partridge, industrial affairs manager of the Institute of Physics (UK) in an article entitled "The Need

for Business Awareness" in the June 1995 issue of *Physics World*. Candidates who have business awareness will end up getting job offers in preference to those with the greatest academic prowess. The Institute is producing a CD-ROM package "Scientists in Business" which will allow users to explore vital aspects of company operation and the role of scientists in business.

• In the same issue of *Physics World* is a report on the first 25 years of the Open University, entitled "Teaching Science the Open Way." The OU degree is essentially multidisciplinary; nevertheless, it is possible to obtain a mainly-physics BSc that is recognized by the Institute of Physics. The OU physics department, headed by Jocelyn Bell-Burnell, has 18 academic staff.

• "Whatever happened to the scientific generalist?" asks Laura Garwin in an editorial entitled "In Praise of Interdisciplinarity" in the 17 August 1995 issue of *Nature*. Since 1991 the Keystone (Colorado) Center has held an almost-annual series of interdisciplinary meetings known as Scientist to Scientist colloquia. Meetings of this type are great fun. Neuroscientists and astrophysicists alike seem to delight in the mutual discovery that there are about as many neurons in the human brain ($10^{11}$) as stars in our Galaxy--not a profound realization but one that gives each practitioner a better feeling for the other's work.

• "Teaching for Understanding" is the title of an editorial by Charles Hardy in the Spring 1995 *NSRC Newsletter* published by the Smithsonian Institution and the National Academy of Sciences. Teaching for understanding encourages student progress and performance because it begins with the child's needs and interests and encourages children to apply their knowledge both inside and outside the classroom.

• The October 6 issue of *Science* has a special section on "Careers '95: The Future of the Ph.D." with thought-provoking articles by guest writers as well as the AAAS editorial staff. Also in this issue is an announcement of an interactive forum on "Training Scientists for 21st Century Careers" on the World Wide Web.

# North Shore Physics Teachers Association and the Collaborative Project for Math and Science Education at Salem State College

*Thomas L. Maccarone*

The North Shore Physics Teachers Association (NSPTA) was founded in 1986 by three Massachusetts high school physics teachers: Joseph Clement (Beverly HS), Herb Fox (then at Winthrop HS), and Thomas Maccarone (Swampscott HS). Workshop meetings are held on school days from 3:30 to 5:30 at a host school four times a year. Since 1987, local PTRA (Physics Teaching Resource Agents) trainers have presented most of the workshops, which average 20 teachers. The Collaborative Project for Math and Science Education (CPMSE) at Salem State College supports these meetings by paying for refreshments and mailing costs.

Topics for these meetings have included: astronomy and astrophotography, interfacing equipment for the Apple IIe, under $1 demonstrations, the physics of forensics, waves and sound, nuclear physics at the Bates/MIT accelerator, electrostatics, fiber optics from NYNEX to you, understanding relativity, teaching relativity with The Mechanical Universe, making the oscilloscope friendly, the magic eye and 3-D stereograms. Tours have included Bell Laboratories and the GE Factory of the Future.

In 1990 the Collaborative added a newsletter and all-day workshops. The newsletter, called *The Synergist*, carries information about workshops and the teachers sharing groups. The sharing groups now cover chemistry, biology, physics, mathematics, middle school science, middle school mathematics, and elementary science. Some workshops in computer science are generally provided for the Collaborative members.

Initially, external support for the NSPTA was virtually nonexistent. The Collaborative helped by covering expenses for the afternoon meetings, and individual teachers covered many expenses through PTRA funding and local district aid. Early on, the Collaborative was supported by a generous grant from the Raytheon Corporation, but when Raytheon moved on to other educational projects, the Collaborative project formed an alliance with area school districts, which has now grown to include 19 public school districts and 8 private schools. Each member school district pays the Collaborative $0.80 per student per year. Several member districts have been subsidized by industry (Raytheon, GE, GTE). Salem State College furnishes the director of the program, secretarial help, and a building on campus for the teacher groups.

Project WISE (Women in Science and Engineering), an all-day workshop for middle school girls, has been a sellout each of the four years it has been presented. Conducted by the Collaborative, General Electric and North Shore Community College, it offers young girls an opportunity to meet and talk with successful young women in science, engineering and education.

*Thomas Maccarone is Curriculum Director for Science at Swampscott High School, Swampscott, MA 01907. He has taught physics for 27 years at the secondary level and has been an adjunct professor for 15 years at a local community college. Last year he was inducted into the Massachusetts Science Educators Hall of Fame.*

This Newsletter, a publication of **The American Physical Society, Forum on Education**, presents news of the Forum and articles on issues of physics education at all levels. Opinions expressed are those of the authors and do not necessarily reflect the views of the APS or of the Forum. Due to limitations of space, notices of events will be restricted to those considered by the editors to be national in scope. Contributed articles, commentary, and letters are subject to editing; notice will be given to the author if major editing is required. Contributions should be sent to any of the editors.

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**Fall Issue**
(deadline: Oct. 1)
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