The Preparation of Excellent Teachers at All Levels

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What is the status of teacher preparation in the United States today?

What makes an excellent teacher?

What is the most effective way to prepare future physics teachers?

How do we provide the very best science education for our students?

What should be the role of the physics teacher in today's schools?

Perhaps Christa McAuliffe, the NASA Teacher in Space,
who was killed in the Challenger tragedy, best summarizes
why these questions must be answered.
When asked why she wanted to be the first
teacher in space, she responded,
"Don't you understand?
Every day, through my students,
I touch the future."

To effectively touch the future, teachers must be well prepared
in content, methods, pedagogy and psychology.
AAPT has the tools, the skills and the manpower
to assure that America's physics teachers are second to none.
This white paper outlines the steps
necessary to produce excellent teachers at all levels.

The Preparation of Excellent Teachers at All Levels

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INTRODUCTION

The news is full of stories concerning the poor state of education in this country. State and national legislators are passing bills to improve the situation, all of which offer a quick fix, but no long term solutions to a major problem that has taken years to come about. Nowhere is the crisis in education more acute than in our major urban areas. To wit: faced with an under supply of teachers in certain critical-needs areas, some school districts are forced to look abroad for a solution. Last December, the Chicago Tribune reported that the Chicago Public Schools, under a special agreement with the U.S. Immigration and Naturalization Service, will receive 100 temporary work visas a year for the next five years to recruit teachers from abroad to fill critical shortages in science, mathematics and foreign languages.

The Thomas Fordham Foundation study, *State of the State Standards 2000*, indicates that in spite of a nationally accepted set of curriculum standards, many states are doing poorly on following the standards. Comparing the four major content areas, English, math, social studies and science, the study found that states are performing best in the area of science. However, overall the country receives a grade of C. Only 19 states are judged either to be following successfully the national science standards or have prepared an acceptable set of science standards of their own. Some states have no standards, and many simply have an encyclopedic list of topics with no suggested activities or laboratories. Furthermore, few state standards indicate strong relationships between math and science.

In the bigger picture, it is now clear that states cannot agree on what should be taught, how it should be taught or how teachers should be prepared to teach the material. Before any program dictating certification can be developed, there must be a clear understanding of the answers to these questions. In the Fordham study Finn and Petrilli ask: “How can we expect students to master a body of knowledge, if we fail to define what that body of knowledge is.”

Has America been playing catch-up since the days of Sputnik, or is this a new problem? Everyone has a criticism, but no one seems to have a solution. Many elementary students have no science instruction during the year. Middle school students spend only small amounts of time in the lab and are often taught by teachers who have little or no science training. High school students have science teachers who are teaching out of field and spend so much time preparing them for local, state and national tests, that they never seem to quite cover the curriculum. The *Third International Mathematics and Science Study* (TIMSS) report indicates that American students fall well behind students of other nations in science knowledge. Colleges are plagued with an ever decreasing number of physics majors, and prestigious graduate fellowships are going to foreign students, passing over American students.

What is the real problem? Is it the curriculum, the quality of the American student or the preparation of the science instructor? Although all three problems need to be addressed, this paper will deal only with the preparation of teachers in America.

The Problem

The recruitment and preparation of science teachers in general, and physics teachers in particular, has been, and will continue to be, a challenge. There is no reason to believe that this situation will soon abate. The growth in elementary and high school enrollments, the acceleration of teacher retirement, and the quest for smaller class size, portend a need for over 2.5 million new teachers in the next ten years (Hauser, 1999). Meanwhile, the demand for talented college graduates in the private sector continues to attract the best and brightest. Positions in the sciences and engineering with starting salaries exceeding $40,000 are commonplace (Chicago Tribune, June19, 2000).

Presently, wealthy suburban schools are finding enough qualified instructors to satisfy their science and math needs. However, both inner-city and rural schools that do not have the wherewithal to attract qualified staff are left wanting. To illustrate the severity of the problem, 70 percent of 7th through 12th graders in the high-poverty schools are being taught by unqualified teachers. According to the National Center for Education Statistics, the figure nationwide is an alarming 56 percent (NCES, 1996).

The need for qualified science and mathematics teachers is underscored by an announcement by the U.S. Labor Department declaring a critical teacher shortage in math, science, foreign languages and bilingual education. Equally compelling is the previously mentioned decision by the Chicago Board of Education to petition The Department of Labor and the U.S. Immigration and Naturalization Service to allow the Board to use six-year work visas to attract top teachers from abroad. Will Chicago's unprecedented "Global Educators Outreach" program be the salvation of other major cities experiencing a dearth of qualified teachers in critical need areas? And perhaps more importantly, is it the way we, as a nation, want to staff our schools?

The findings of National Center for Education Information (NCEI) paint a somewhat brighter picture. The NCEI research suggests that certain areas of the country may actually have a surplus of teachers. When polled, only nine states reported that it was very likely that a fully certified, recent education major could find a teaching job now. Three states responded, "not likely" and one said "not at all." While the NCEI feels that no widespread teacher shortage has occurred, nor need occur, they do concede that fully certified science, math, and special education teachers stand the best chance of finding teaching jobs now and in the future.

We sent a questionnaire to all state science supervisors requesting information on the training and certification of K-12 teachers of science and physics. The responses indicate a great variation in certification requirements from state to state. With such disparity in teacher preparation, a question naturally arises: If we are to be held to national standards regarding science curriculum, shouldn't we need to look at national standards for teacher preparation programs? The following range of certification requirements indicates the training deemed appropriate by both the states and the National Science Teachers Association (NSTA).

The results of the questionnaire reveal that elementary school teachers are required to have from zero science courses to one year maximum. Since the elementary emphasis is on math and reading, science is a low priority in many states, and with most elementary teachers. Often no money is allocated for science equipment, and classrooms have poor lab facilities with no water or gas lines. Since the learners are still at the concrete operational level, science classes need to be hands-on and relevant to their lives. With little or no formal training in the sciences or science teaching, elementary teachers are often unable to provide meaningful, activity-based instruction.

America's elementary teacher preparation in science falls short of the mark set by the NSTA. The NSTA recommends that elementary teachers have a minimum of one college course in each of the three science areas-biology, physical science and earth science and coursework in science education. Roughly half of the elementary teachers meet this standard. According to Roman Czujko, Director, Statistical Research Center, American Institute of Physics, on average, students majoring in elementary education take the least number of science courses. This includes students majoring in the performing arts.

Clearly the future of science in America begins with elementary teachers. As Howard Voss informed the U. S. House of Representatives Committee on Science, "Science in the schools is the other end of the pipeline that feeds scientists into professional societies. Elementary school science must be taught by people who have actually learned science by experience and inquiry and who have learned about pedagogy. Studying science is not the same as studying about science by reading books or watching computer monitors do cool things." Elementary education departments must be made to see the value of quality hands-on science courses for all elementary teachers.

Recipients of the Presidential Award for Excellence in Science Teaching at the elementary level are teachers who: 1) have attended college where elementary science is a priority or, 2) have dedicated their own time and money attending conferences or workshops to learn how to teach science to elementary children. If elementary science education is to improve, the voices of these excellent role models must be heard.

State science supervisors indicate in the questionnaire that middle/junior high school teachers are required to have from 12 to 24 semester hours of science, with more hours required for those who wish to specialize in science. The NSTA recommends that middle/junior high school teachers' backgrounds should include at least two courses in each of the three science areas as well as coursework in science education. A study done by Horizon Research indicates that the majority of grade 7 - 9 (junior high) science teachers (57 percent) meet the NSTA recommendations, compared to 42 percent of grade 5 - 8 (middle school) teachers.

In junior high, just as at other grade levels, students learn best by doing. In the words of Clifford Swartz: "All that is needed is to make sure that the students learn to do things besides sitting and watching." In his March 1991 editorial, he stresses the importance of hands-on activities and the futility of rote memorization of terms. The importance of competent middle and junior high school teachers capable of providing advanced measurement and observational laboratory activities cannot be overstated. Pen and paper activities do not satisfy the curiosity of these students. In the words of Dr. Swartz: "Puberty is a terrible thing to waste."

The science supervisor questionnaire reveals that, depending on locale, high school science teachers may be required to have from zero to 12 semester hours of physics for broad field certification and from 24 to 30 semester hours of physics for the physics endorsement. Many states only offer a broad field certificate, which allows all science teachers to teach all sciences.

In contrast to their colleagues in elementary school, high school teachers, on the whole, are quite qualified to teach science. The Horizon Research report indicates that 63 percent of high school science teachers have an undergraduate major in science and 72 percent have a major in either science or science education at the undergraduate or graduate level. However, in the area of physics teaching, finding qualified teachers can be a challenge. Based on The AIP report *Maintaining Momentum: High School Physics For A New Millennium* (AIP, 1999), over the years, around 40 percent of the principals looking to hire physics teachers reported having difficulty finding qualified candidates.

The same AIP report states that only 33 percent of high school physics teachers hold a degree in physics or physics education. The report emphasizes that this does not mean that the majority of physics teachers are unqualified, however. The AIP study found that less than 2 percent of high school physics teachers had themselves never taken a college physics course and that virtually all physics teachers have science or math as their field of specialization. Especially heartening is the finding that 67 percent of the physics teachers who had been teaching for more than 5 years had earned a master's degree.

This is good news, for the demands on the high school science teacher are many. In John Layman's book *Inquiry and Learning: Realizing Science Standards in the Classroom*, a list of teacher skills is provided. Teachers are expected to plan inquiry-based science programs, facilitate student learning, assess student learning, provide an appropriate learning environment and create a community of learners. Additionally they are expected to be masters of their subject, to understand all concepts and be able to work all the problems in the book.

College instructors, although knowledgeable in their subject matter, frequently have no formal training in pedagogy. As Howard Voss states, "With some notable exceptions, scientists and mathematicians are not all that famous for expertise in pedagogy. We science types need the education types, and they need us." With the exception of the colleges and universities with strong PER groups, most instructors teach as they were taught, which often involves only lecture and problem sets. Even less skilled in the art and science of teaching, graduate students are given lab, recitation and lecture assignments.

In general, college instruction is based on the premise that teaching is an intuitive act. Since the instructors understand the material, it is just assumed that they know how to effectively share what they know with others. To make matters worse, often there is no feedback to the instructor, because there is little interaction between instructors and students except in smaller colleges or in individual study sessions.

In Leonard Jossem's article "The Teaching of Physics" and his "Resource Letter EPGA-1: The Education of Physics Graduate Students" (AJP 68:6, June 2000), he expresses his concern for the lack of pedagogical training of college professors and teaching assistants. He feels that it is the responsibility of the older, more experienced professors, to teach the new instructors by "precept, example, and friendly council". It should be noted that the AAPT is blessed with numerous exceptional college and university professors, most of whom either developed their skills through trial and error or were fortunate to have a gifted mentor on the faculty.

As college enrollment has risen from 4.7 percent of the college age students in the 1920's to 50 percent of the college age students in the 1990's, the demands on the instructor are quite different. Instructors are expected to have a thorough understanding of the subject matter, be adept at providing interesting, relevant activities in the laboratory and deal with a rapidly changing ethnic and culturally diverse set of students. In addition, the instructor is expected to tailor the instruction to the school, the subject, and the students and prepare the graduates for the world of work. Consequently, many universities are examining the need for the study and practice of modern pedagogy by their faculty members.

Current Efforts to Improve Teacher Supply and Preparation

Innovative Teacher Preparation Programs

Realizing that "the quality of schooling in America is inadequate for the times," the American Council on Education, in collaboration with the American Association of Colleges for Teacher Education, appointed a President's Task Force on Teacher Education. The mission of the Task Force is "to place the education of teachers at the center of the professional and institutional agendas of college and university presidents and their institutions". In the words of Vanderbilt Chancellor Joe Wyatt: "Our nation's future depends on high-quality public education system and a superior force of educators. There is no work more important."

The renewed interest in producing more effective teachers stems, at least in part, from a realization that in the "information age" knowledge is power. In the 21st century, our economy and the well being of our nation, perhaps more than ever before, will depend on a well-educated populace. Academe also realizes that if it is to receive well-prepared students (its lifeblood) from secondary schools, it is essential that teachers in those schools must also be well prepared.

This new sensibility has resulted in the overhauling of teacher preparation programs in over 300 colleges and universities in the last 10 years. The some times radical changes made in education departments have produced some impressive results. Trinity University, Michigan State University, University of Cincinnati, University of Connecticut, University of Virginia have been cited as producing "extraordinarily well-prepared teachers" (Darling-Hammond, 1999).

What modifications in teacher training have lead to this success? The National Commission on Teaching and America's Future found that the most successful teacher preparation programs share common characteristics. The truly outstanding programs examined in the Commission's study were found to base their teacher training on the findings from cognitive research. Among other things, this research suggests a new paradigm, one that challenges the culturally-inculcated model of teaching in which the teacher is seen as the dispenser of knowledge. Student teachers are shown the efficacy of replacing the time-honored, teacher-centered model with a student-centered, inquiry-based pedagogy. Using this approach, the teacher, serving as a guide or facilitator, creates a setting in which students can explore and solve real-world problems.

Successful programs provide a thorough grounding in subject matter (most require a disciplinary degree) and extensive clinical experience. To produce well-prepared teachers, education courses are carefully integrated with the courses on subject-matter topics. To accomplish this, in some cases teacher preparation programs are extended to five years.

Furthermore, the colleges and universities cited as having excellent programs have forged close alliances with local schools. This synergy is found to benefit both student teachers and their students. For example, in San Antonio, improvement in test scores is attributed to the collaboration of school- and university-based faculty and teachers-in-training.

The Physics Teachers Education program at Illinois State University has combined all the above elements. Considered one of the most innovative and the largest in the nation, the program prepares students to teach physics and at least one other subject at the high school level. This is accomplished by integrating a strong physics content major of 44 - 48 semester hours (s.h.) with a professional education sequence of 22 s.h. and the University's general education requirement of 45 s.h. Physics department personnel teach six of the teacher education courses. A total of one hundred-clock hours of clinical experiences is associated with required professional studies and science method courses.

A rather revolutionary feature common to many of the successful teacher-training programs is the "teacher as researcher" model. Not only do future teachers learn from the literature, but they are also taught to use their own classroom experiences to analyze the learning process and modify their teaching accordingly.

This somewhat radical approach is seen by some educational researchers as the solution to America's constant battle to improve the quality of the educational system. In *The Teaching Gap*, Stigler and Hiebert conclude that the failure of many of the reforms instituted in this country can be attributed to a " top down" approach. They argue that only by allowing teachers to apply the results of their own research will improvement in student learning be realized.

Stigler and Hiebert's thoughts on improving teaching grew from their study of the TIMSS data. Through a cross-cultural study of standard professional practices in three countries - Germany, Japan and United States - they observed how incremental change in classroom practice can lead to an improvement in student understanding.

It is interesting to note that the "teacher as researcher" model was once used in the United States with great success. According to Stigler and Hiebert, at the turn of the century, John Dewey transformed the University of Chicago laboratory school into a "hotbed of educational improvement...where teachers and researchers, through collaborative planning and experimenting, developed knowledge of effective classroom practice and fed it back into the system. The lines between teachers and researchers were blurred; all were engaged in learning about teaching and how to improve it in the context of real classrooms." The great experiment came to end when Dewey left Chicago. His replacement, Charles Judd, separated the researchers from the teachers, a situation that continues today.

Alternative Teacher Training and Certification

Over the past ten years, more than one hundred alternative teacher certification programs have been instituted in this country. Faced with the threat of teacher shortages, especially in the areas of science and mathematics, 40 states have passed legislation that encourages alternative programs for the preparation and certification of individuals who already hold a bachelor's degree and want to become teachers. Critical teacher shortages in the Southeast have caused states like Georgia to provide signing bonuses to teachers willing to go into critical fields like science and to provide full tuition for teachers willing to return to school and earn additional certification in science. As of early 1998, it was estimated that, nationwide, over 75,000 people had been granted certification through such programs.

Retirees, mid-career professionals from business and industry, ex-military personnel, and liberal arts graduates are among those seeking alternative teacher certification. The programs that have emerged to meet the demand for alternative licensing are as diverse as the clientele seeking licensure. Most alternative route programs are based at colleges and universities. They are designed to provide accelerated or post-baccalaureate training for people from various educational backgrounds and occupations. These programs all include formal classroom instruction, some form of practice teaching and mentoring.

According to Paul Vallas, CEO of the Chicago Public Schools, the Chicago system is using an increasing number of alternative certification programs to recruit talented graduate students and mid-career professionals in non-education fields to become teachers through a shortened certification process. One such program, Chicago's Golden Apple Teacher Education (GATE) program, relies on the expertise of K-12 classroom teachers who are recognized leaders in their field. Recently established by the Golden Apple Foundation in partnership with the Chicago Public Schools and Northwestern University, GATE is open to people who hold college degrees in the arts or sciences and have five-year work histories. The GATE program's reliance on award-winning classroom teachers to create and administer programs, teach courses and mentor GATE graduates is unique. A GATE program intern receives a provisional teaching certificate after completing one year of training and a four-year renewable certificate after a successful first year in the classroom.

Under the Department of Defense Troops to Teachers Program, military personnel and Department of Defense (DOD) and Energy (DOE) civilian employees affected by military "drawdown" are given the opportunity to pursue a new career in public education. One of the goals of the program is to help relieve teacher shortages, especially in the subjects of science and math.

AAPT's Efforts to Alleviate the Problem

AAPT, along with some fellow professional societies, has made a major contribution in the area of science teacher preparation. Currently AAPT is sponsoring Powerful Ideas in Physical Science, a 1000 page college curriculum designed for university faculty to instruct prospective elementary teachers and non-science majors in elementary physical science. The course provides a wide range of materials and assessment tools and incorporates innovative instructional approaches based on decades of research on physics education.

Middle school teachers have profited from Operation Physics, which is not an AAPT project but is heavily staffed with AAPT people. The program provides a series of modules covering the major topics of physics and physical science. Each module contains written material, worksheets, problems and hands-on activities written by experienced physics teachers.

High school physics teachers have benefited from the highly successful Physics Teaching Resource Agents (PTRA) program which, since its beginning in 1985, has trained approximately 900 PTRAs in content, pedagogy, methods and specific laboratory activities. These PTRAs then serve as teachers-of-teachers, providing professional development through workshops and summer institutes for thousands of teachers across the country. In 1999, PTRAs provided 85 six-hour workshops, with a total of 1545 participants, 30 percent of which were minority teachers. Participants cover a wide spectrum of teachers: 80 percent high school, 16 percent middle school, 4 percent elementary; 51 percent male, 49 percent female; 58 percent urban, 34 percent suburban, and 9 percent rural.

College instructors benefited from the Introductory University Physics Project (IUPP), a joint venture with APS which ran from 1987 to 1995 and was originally directed toward reform of the calculus-level introductory physics course. Current AAPT programs include the Physics Revitalization Conference, Two-Year Colleges in the Twenty-First Century (TYC21), Workshops for New Physics Faculty and Preparing Future Physics Faculty (PFPF).

The Physics Revitalization Conference focused on planning for and implementing and assessing change in undergraduate physics. One of the main topics of discussion was the preparation of future physics instructors. The draft report of the conference states "physics education research has shown that passive methods (such as straight lecture) are less effective than teaching methods that actively involve students in learning. Active engagement techniques have been shown to improve student's conceptual understanding, and physics education research has led to the development of instructional methods and materials that improve conceptual understanding and problem solving skills."

TYC21 was designed to improve physics education by promoting communication and interaction among two-year college faculty, who are often isolated and overlooked in their small colleges. One of their goals was to increase awareness of current developments in physics education research and innovative teaching strategies. The American Council of Education document *To Touch the Future* notes that 20 percent of all classroom teachers begin their training in two-year colleges. Two-year colleges provide the majority of our minority and multicultural teachers and teachers who come into the profession as middle career adults.

The Workshop for New Faculty was initiated to help new college and university faculty members become more effective instructors. The four workshops held thus far have addressed recent developments in physics curriculum and pedagogy.

Preparing Future Physics Faculty is part of a new NSF program designed to create a model graduate program to prepare future faculty for emerging and evolving roles in five academic disciplines: chemistry, computer science, mathematics, microbiology and physics. The program will increase knowledge, broaden perspectives and develop skills of graduate faculty members and graduate students about how to incorporate research, teaching and service components into doctoral education for aspiring faculty.

Over the years, there have been numerous alphabet soup programs, some with substantial professional development components. Many of these have all but faded from sight: NSTA Scope, Sequence and Coordination, Introductory Science Curriculum Study (ISCS), Introductory Physical Science (IPS), Physical Science Study Committee physics (PSSC), Man Made World, Harvard Project Physics, to name a few. Current programs include Principles of Technology, Active Physics, Comprehensive Conceptual Curriculum in Physics (C3P), Modeling and the new NSF joint AAPT-APS proposal PhysTec.

Recommendations

AAPT has the unique distinction of being the recognized authority in physics teaching in America. Along with that distinction goes the burden of dealing with the problems of preparation of potential physics instructors. There are five major areas where AAPT can have a strong voice in the solution to this problem.

(1) AAPT should continue to support all current programs that directly affect teacher preparation at any level.

Powerful Ideas in Physical Science…elementary school
Physics Teaching Resource Agents (PTRA)…middle and high school
PhysTec…high school and undergraduate
Workshops for New Faculty…undergraduate
Preparing Future Physics Faculty (PFPF)…graduate

(2) AAPT should work to develop new college courses and programs for the preparation of future teachers K-18.

(A) Teacher preparation courses should address content, methods, on-the-job training and observations in real classrooms. Instruction should be appropriate to the level of students who will be taught. Serious consideration should be given to providing a thorough understanding of the intellectual development of the student at each level, and appropriate hands-on activities should be designed. (Swartz, 1967, 1990, 1991) (Jossem, 2000)

(B) The physics department and the science education department should work together to design these courses, with the assistance of experienced classroom teachers. (PhysTec, 2000)

(C) Colleges should be encouraged to design a 5-year degree program, offering a B. S. in science or physics and a B.S. Ed. in science education. There are numerous colleges in America which already do this, and their graduates are far better prepared when they enter the classroom. Most foreign countries require a degree in the discipline before a prospective teacher is allowed to enter the teaching profession. (Stevenson & Stigler, 1992) (AAPT USA/Japan/China conference reports)

(3) AAPT should take the lead in developing follow-up programs for first year teachers.

Currently most American teachers never receive any formal support from the school of education of the science department from which they graduated. They are left to “sink or re often too embarrassed or overwhelmed to ask for assistance. In Japan, first-year-teachers must spend 20 hours per year in professional development, supervised by a mentor teacher. They meet on a regular basis, share lesson plans, teach each other’s lessons, and evaluate the plans (Stevenson & Stigler, 1992).

Retired teachers, many of whom were actively involved in innovative programs, before leaving the classroom, could serve as mentors. The PTRA program is making extensive use of retired PTRAs to run their urban centers (Horizons Research, 1999).

This approach could also be applicable at the college level. AAPT has a large cadre of retired professors who could serve as excellent role models for new professors.

(4) AAPT should devise a plan for developing a set of national standards for the certification of science teachers to match the national science standards.

AAPT’s support of the national standards indicates an acceptance of the designated science content appropriate for each level of education. It therefore follows that teachers should be trained to teach that specific content in a manner appropriate for the developmental level of the students. If we believe this to be true, then there should be a set of national standards for obtaining a teaching certificate.

(5) AAPT should take the lead in developing follow-up programs to provide life-long professional development of physics teachers at all levels.

A successful local effort along these lines is the Arizona Science and Technology Educational Partnership, which grew out of the Modeling Workshops. As was mentioned above, many good physics programs (PSSC, Harvard Project Physics, etc.) have disappeared, primarily because there was no infrastructure to keep them going. To counter this trend, perhaps a national effort should be undertaken. The Modeling Workshop authors have proposed a National Center for Physics Education (NCPE). The principal activity of the NCPE would be to organize meetings and workshops to drive science education reform and provide life-long professional development through university-high school partnerships.

Some Concluding Thoughts

In addition to their classroom responsibilities, teachers in America are expected to be counselors, surrogate parents, psychologists, and disciplinarians. Pre-college teachers are required to also attend faculty meetings, parent conferences, and professional development sessions. They have hall duty, bathroom duty, bus duty, and lunchroom duty. In many areas of the country, they are given what amounts to a subsistence wage and asked to teach subjects for which they have little or no training. In far too many situations, science teachers are asked to teach science without adequate equipment or facilities. At the same time, teachers are accused of being incompetent because they can't remedy the ills afflicting our young people, our schools and our nation.

Presidential candidates and legislators propose programs that they insist will improve the educational system in America. Efforts are made to encourage talented young people to pursue careers in teaching. Yet it seems that these attempts at educational reform rarely bring about any fundamental change in the quality of education in this country.

What can the AAPT do to improve America's educational system? First and foremost, our organization must continue to support and develop programs that improve physics instruction at all levels. This begins with improved teacher preparation and continues with professional development opportunities for teachers in the field. We must strive to insure that the brightest and best trained find their way to the front of our classrooms as well as into our nation's boardrooms and laboratories. Then, and only then, will our students have the schools they require and deserve.

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