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TITLE: TECHNICAL MANPOWER NEEDS AND RESOURCES AT LOS ALAMOS NATIONAL LABORATORY

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TECHNICAL MANPOWER NEEDS AND RESOURCES AT LOS ALAMOS NATIONAL LABORATORY

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Abstract

The decline in America's educational system is cause for national concern, especially in the areas of science and mathematics at the secondary level. While many recommendations have been made to rebuild excellence into our schools, their teachers and students, most lasting solutions will require long term restructuring of public policies and attitudes. In the near term, however, much can be done through cooperative programs involving the great national resource of technically trained professionals, scientists and engineers working together with their local schools. The Los Alamos National Laboratory has begun a program to share its scientific and technological expertise with students and teachers in the surrounding area. The goal of the Laboratory's Educational Outreach Program is to stimulate an awareness of professional opportunities in the sciences and engineering.

1. INTRODUCTION

Recent studies have pointed to an imminent crisis in American education, and in particular to a severe decline in our nation's ability to attract and train students in quantitative fields of study such as physics, chemistry, biology, mathematics, computer science, and engineering.[1,2] American students are not pursuing education and subsequent careers in these fields in sufficient numbers to ensure the economic strength and national security of our nation for the future. This is occurring at a time when technology is developing at an ever increasing rate, making many older skills obsolete and forcing the retraining of many in the nation's work force.

At the same time, the nation is also suffering from a shortage of teachers who are qualified to meet the need to teach science and mathematics. The shortage has persisted for

over five years and, except in biology, it shows no signs of improvement. College students today are reluctant to major in science and mathematics education. The reasons for this are manifold and well documented in several studies and reports, but the most obvious is salary. For example, a recent study compared the starting salaries of secondary school teachers having masters degrees in physics, with those of their counterparts in industry.[3] The differential is $10,000; after 15 years on the job, the differential becomes more like $25,000.

Beyond the issue of salaries, however, other forces have combined to hasten an exodus of qualified science and mathematics teachers from our schools. Among these factors are first, poorly equipped instructional laboratories and inadequate budgets for improvement, and second, isolation and difficulty in keeping professionally current and active.

2. SOLUTIONS

The needs for more and better teachers and students in the sciences, mathematics, and technology are intertwined with a collateral national need for a technologically literate populace. Solutions to these problems will require a national commitment involving changes in public policies and attitudes at the federal, state, and local levels. Long term solutions may well take a generation to set in place.

However, in the short term, there is much that can be done using the 3.3 million scientists and engineers in the US labor force. These men and women are especially knowledgeable of the technological trends in the world today and are aware of the importance of a good education in science and mathematics. They are a national resource that can be tapped to provide immediate assistance to virtually every community in the country by serving on school boards and curriculum committees, giving guest lectures on special topics to students, organizing and helping to judge science fairs, tutoring and other special activities. Local businesses and professional societies can be especially effective in mobilizing their employees and members to become involved such activities that augment science and mathematics education in their regional schools.

3. EDUCATIONAL OUTREACH PROGRAM

The Educational Outreach Program at Los Alamos National Laboratory is one example of how our vast national resource of scientists and engineers can work with local communities to improve educational opportunities for students and enhance possibilities for self improvement for teachers. The program began four years

the students and educators of northern New Mexico, an awareness of career opportunities in science and engineering. Literally thousands of students have been involved in the program's various activities, the interest by local school systems in science and mathematics has grown, and the number of course offerings in these areas has grown.

The Los Alamos Educational Outreach Program is faced with a challenging situation. While New Mexico is the fifth largest state in the union, it is 37th in population, with only one city having a population in excess of 50,000. For centuries the state's population has concentrated along the Rio Grande River Valley, and half of the population is classified as minorities. The major minority constituents are Hispanic, American Indian, and Black. The most recent recession arrived late in New Mexico, but hit the energy related and extractive industries especially hard. Unemployment in the state has just now dipped below the national average, but northern New Mexico and the Indian reservations and pueblos have a sustained history of high unemployment.

Los Alamos National Laboratory is in a unique position, providing 20% of the income base to northern New Mexico. The small villages along the Rio Grande River are mostly Hispanic or Indian and their economy logging and some mining. The State government, in cooperation with the National Laboratories (Los Alamos and Sandia), universities, and other federal and private technology-based institutions, is developing the Rio Grande Research Corridor to encourage the growth, development, and location of "high-technology" business and industry in the state. A well educated population is a requisite part of this technology-based economic development plan.

The Los Alamos Educational Outreach Program is designed to inspire interest in science in its broadest sense, in remote and rural areas. The six activities described below were developed in response to regional school requests and through study with the New Mexico State Board of Education.

3.1 Science Beginnings

The Science Beginnings program is for grades 4 through 6. It introduces science-related subjects and teaches energy conservation through programs in the schools that use a variety of hands-on instruments from the Laboratory. This program is designed to provide stimulating experiences for young children so that they will develop an interest in science and engineering. Subject topics vary from year-to-year with programs often being developed from Laboratory research projects. Popular topics in the past have been

presentations on environmental monitoring with radio collars for tracking elk and deer, heat pipe technology, solar energy, and the Rio Grande Rift. Because there are a variety of new programs offered each fall, as well as established presentations on energy and energy conservation, these programs are viable as an annual event for schools. In the 1982-1983 school year 2600 students from 32 schools were reached through this program. This past year, 1983-1984, 2400 students attended 92 presentations of Science Beginnings Program.

3.2 Careers in Science

The Careers in Science program is for students in grades 7 through 10. Educational research has shown that pre-adolescent and early adolescent children are very receptive to role modeling. This has been the basis for this program. We also realize that the school systems are organized so that if a child decides to begin taking elementary math or science courses when he is a junior or senior in high school that it is almost impossible.[4] These courses are arranged and made available only to students at a much younger age and grade level. So, we believe students must have personal experiences with people who are pursuing scientific and technical careers as early as possible.

This program exposes students to number of levels by using role models. Laboratory employees from a variety of fields visit schools and talk with students about what they do in their jobs, what classes they need to take in school, what machines they work with, where they went to college or vocational school and how they were able to afford their educations. We try to find alumni from each school district to return to that area and talk about their careers. It is especially important in northern New Mexico to send women role models, for in the traditional Spanish home women are not often seen as professionals with careers. We try to bring to each school people that come from all areas of the scientific world, technicians, administrators, secretaries, photographers, draftsmen as well as scientists in careers that involve physics, chemistry, mathematics or engineering.

This program has been especially effective in our surrounding rural communities that do not have an environment that promotes post-secondary education. As part of this program 35 area schools were visited during the 1981-1984 school years; over 16,000 students have had the chance to interact with a Laboratory role model since 1981.

3.3 Science Youth Days

For 27 out of 29 years, Los Alamos National Laboratory has participated in the international "Edison Days"

program by sponsoring events for high school students with special aptitudes in science and mathematics. Each Spring students are invited from high schools in New Mexico and surrounding states to visit Los Alamos. The young people are involved in demonstrations, tours through laboratories and technical sites, and provided with ample opportunity to talk with scientists about careers and their projects.

This year students from forty schools in Arizona, Colorado, Texas and New Mexico participated in Science Youth Days. In most cases the teenagers had spent the winter raising money for their school to be able to fund the trip so they could take advantage of this program. In 1984 almost 1,000 talented science students were able to participate in this program.

3.4 Los Alamos Science Student Program

The Los Alamos Science Student Program offers courses to high school juniors and seniors after their regular school day. This program was developed to augment the regular school curriculums by offering classes using technology, equipment and teachers that would be unavailable in our local schools. Students are taught to use such things as sophisticated word processors, machining equipment, electron microscopes and various computers. Volunteers from evenings two days a week to serve as scientist-instructors to teach students how to use state-of-the-art equipment and introduce them to new scientific and technical areas. Fourteen courses were offered during the spring and fall of 1983 with 91 students. Because classes are taught by volunteers they vary from term to term. Students obtain school credits for their work. The school systems are supporting this program by funding buses that transport the students from their schools to Los Alamos and home again.

3.5 Los Alamos Science Student Program--Summer Session

A more intensive program for high school students is offered as a six-week summer session. This program is for New Mexico high school students who have completed their junior year. Students are selected on the basis of academic qualifications, motivation and geographic representation. Students come from as far away as Penasco, New Mexico --50 miles from the Laboratory. The American Nuclear Society has provided transportation assistance for this program.

Students attend morning enrichment classes under the direction of two instructors. One math/science teacher and the other a counselor proficient in communications skills. During the afternoons, students worken with a laboratory scientist

that was to be finished and presented to the class at the end of the term. Each student was matched with a Laboratory volunteer for the purpose of designing, executing and presenting a science project. Additionally, throughout the summer there were field trips, tours and guest presentations on subjects as varied as tree ring dating, stellar research, and soil maping. Twenty high school students from northern New Mexico communities will participate during 1984. The main goal of this program is to give students the math/science/communication skills needed to produce and present a successful project. This goal improved the competence and confidence of the students in all areas of their academic life.

3.6 Teacher/Counselor Workshops

Each year special conferences or workshops are offered to fill needs that have been perceived in our local educational community. The Laboratory works with the State Department of Education and area teachers and counselors to determine how the Laboratory could assist them. These conferences have been very popular because they bring high school guidance counselors and math and science teachers up to date on current technology and career opportunities. More than 90 mathematics and science instructors attended a series of workshops designed to help them learn about and choose appropriate computers and software for their schools. In March of this year, guidance counselors from all over New Mexico were invited to attend a seven-panel presentation on "Careers in High Technology." Another two-day conference on new energy technologies was also highly attended by science teachers from northern New Mexico.

3.6.1 Los Alamos Science Teachers Institute. This summer we will introduce a work/study program for high school chemistry teachers that will allow them to receive college credit while working on projects at the Laboratory. Twenty teachers from Northern New Mexico schools will attend the Institute for four weeks and receive a small stipend to defray their costs. Staff members from the Laboratory's Chemistry and Materials Science Divisions will serve as instructors.

3.7 Mutual Benefits

The Educational Outreach Program and other similar activities at Los Alamos National Laboratory have a direct and immediate benefit to the school systems, teachers, and especially the students of northern New Mexico. However, the long range effects of these programs will be beneficial to the Laboratory as well. As mentioned before, Los Alamos is geographically isolated from the large concentrations of technically trained manpower, and the Laboratory expends much effort to recruit and hire the best technical people to

carry out its programs. Obviously, such people are fairly mobile and are quite capable of relocating again if they are persuaded to do so.

On the contrary, employees at Los Alamos National Laboratory from the surrounding communities generally have families and other historical ties to the area, and are more inclined to stay here if at all possible. But the pool here of highly trained professionals in science, mathematics, and engineering is still small. We believe that programs like the Educational Outreach Program will contribute to increasing the local employment base of the Laboratory as well as promoting to economic development of northern New Mexico, the Rio Grande Research Corridor, and the State in general.

4. CONCLUSION

The Los Alamos National Laboratory and its employees are involved in many other activities that either directly or indirectly address the issues surrounding science and mathematics education in America. The purpose of this paper is to highlight one program that is an example of how the national resource of scientists, engineers, technicians and other technically trained people can become involved with their local schools in a partnership. For mutual benefits and the intellectual strength of the nation.

5. ACKNOWLEDGEMENTS

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6. REFERENCES

1. David P. Gardner, Chairman, National Commission on Excellence in Education, "A Nation at Risk: The Imperative for Educational Reform," U.S. Government Printing Office, Report 065-000-00177-2, 1983.

2. William T. Coleman, Jr. and Cecily Cannon Selby, Co-chairmen, National Science Board Commission on Precollege Education in Mathematics, Science and Technology, "Educating Americans for the 21st Century: A Plan of Action for Improving Mathematics, Science and Technology Education for All American Elementary and Secondary Students...," National Science Foundation, 1983.

3. Beverly Fearn Porter and William H. Kelly, "Why Physicists Leave Teaching," Phys. Today, 36, No. 9, 32 (1983).

4. Sue E. Berryman, "Who Will Do Science?" The Rockefeller Founda-