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**Key Address on Education in the Space Age**

Walter Williams

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Dr. Walter R. Williams, Jr. spent his early youth in the vicinity of Nanking, China, as the son of Quaker missionaries. He received his degree from Ohio State University and achieved the rank of full professor at the age of 31. He has been a senior member of the Graduate School staff of U of Florida, primarily directing the doctoral and master's degree programs. Dr. Williams is past president of both the American Industrial Arts Assn. and the American Council on Industrial Arts Teacher Education and holds a number of honorary memberships in industrial and vocational arts organizations.

EDUCATION IN THE SPACE AGE

In studying the theme of your conference, I was struck by two things. One was its euphony---"The Challenging Pace of the Race to Space". The other was the arrangement of words or, more specifically, use of the descriptive term "race" and the position of the adjective "challenging".

"Race" has connotations of active competition between spirited contestants over a measured course. Compounded breakthroughs resemble Leacock's legendary horseman who mounted his steed and rode off in all directions simultaneously. This is almost literally what has happened. Findings in one field have been applied to others with the result that the world as we knew it only a few short years ago is vastly different from the world of today.

The position of "challenging" before "pace" is so very apt. Pace is rate of movement. It has a deliberate rather than a headlong connotation. It implies individuals who are capable of purposeful direction, who pose challenges in meaningful terms and adjust the tempo of their responses to changing demands. In short, your theme, describes the function of the school in society and the very purpose which, ideally, it serves.

In every society the school fills the role which the society wants it to serve. And that function grows out of the values to which the society is committed and which it wishes to emphasize. Current America is no exception. Since the turn of the century, we have been trying to grasp the implications of the revolution in science and mathematics effected by Einstein and some of his contemporaries such as Planck and Fermi. These have contributed enormously to the space age which is the concern of all in this room.

As we read of orbital and suborbital flights, of advances in rocketry and missilery, of the shrinking globe and the relativity of time, we know that something big is happening. We know that we are part of it, but we are not quite sure what it means nor that we have the necessary baselines for evaluating its implications.

In a sense, however, these things are not really new. Their impact upon us in ways that are changing our lives, however, is new.

Democritus, for example, in Periclean Athens, speculated upon the existence of atoms. It was a challenging philosophical concept good for hours of stimulating rumination. But it was of little popular concern until recently when sophisticated experimentation and instrumentation removed it from the mystic realm and drove home its immediacy with stupefying abruptness. More, it showed that the atom is not indestructible and it revealed a
microcosmic order of which Democritus never dreamed.

Light is a phenomenon which has always been with us, but the degree to which it is currently manipulated and controlled is an evolving achievement with almost fantastic implications. The needle-like concentration of energy produced by lasers permits extremely delicate brain and eye surgery, yet penetrates the hardest substances known to man and promises breakthroughs in planetary communication and control which are only dimly perceived.

Still another illustration is provided by the recent accomplishment in redirecting the path of Mariner II. The fantastic technical refinement required to permit a pair of radio signals to cause the craft to roll on its axis, flip over on itself, slow its speed slightly, and reorient its antenna earthward while over a million miles out in space demonstrates an almost unbelievable manipulation of natural forces.

These few illustrations serve to dramatize some of the problems which confront the schools. The achievements recounted result from the activities of trained men. Other trained men will add to them. Though most educators cannot hope to master all of the essential details, they must attempt to spy out guiding peaks so that the school can help people to live in a world which is increasingly shaped by sophisticated control over the forces of nature.

Therein, however, lies a problem -- and a concern. Education attempts to anticipate the shape of the future, but is also firmly rooted in the accomplishments of the past. Unfortunately, that past does not consist of marked levels like geological strata. If the analogy is extended to include faults and slips in the earth's crust and the resulting distortion which projects one stratum into another, a somewhat more accurate picture obtains.

This, of course, is also true of developments in technology and industry. As you know so well, scientific progress does not occur evenly. Instead, it is marked by many false starts and blind alleys as the search for an anti-polio vaccine or a cancer deterrent demonstrates. Social change, however, is even more irregular and is subject to numerous retarding influences.

To a point, this may be good for there is real danger that our absorption with technological and scientific achievement may lead us to become overly preoccupied with scientific demands and to lose sight of the importance of other talents and areas of learning. Beyond this point, however, inattention borders upon irresolution and may dry up the very well-springs of talent upon which further progress and wellbeing depend. The school can permit neither of these to happen. It must exert its energies and exercise its best judgment to ensure appropriate cultural balance.

In a real sense circumstances today compel us all to be technicians. Some work with formulae and instruments in solving technical problems. Others use tools and materials to create, design, and fashion new products. Still others operate farms, repair mechanisms, and tend homes.
Certainly these callings require the mastery of specialized skills and understandings if they are to be successfully accomplished. In addition, however, these practitioners are required constantly to manipulate social concepts and make social judgments if the society is to forge ahead and take advantage of the scientific advances which you have helped to achieve. That is why it is so imperative that they possess the necessary information and perspective to draw sound conclusions and make responsible decisions, for the current state of world society no longer permits the luxury of many mistakes.

It is often impossible to anticipate fully the implications of scientific experimentation, but frequently cause and effect relationships are quite predictable. In the laboratory, individual factors may be deliberately controlled and the effect of any single influence measured.

Let us think for a moment of the school as a laboratory, for in a real sense it is America's greatest social laboratory. Each student, however, is more than a discrete factor for he, in turn, personifies a veritable tangle of influences of varying intensities which make him almost a laboratory within a laboratory. I do not call him an experiment, but he is a continuing demonstration that learning, like satellite launching, is a highly complex process involving many variables which operate simultaneously. The individual significance of each and their peculiar interrelationships are almost impossible to identify at this time. Yet, this complex individual -- and I am including all of us -- is a being capable of formulating concepts, of acting in terms of his beliefs, and of making decisions for good or ill.

I have taken just a few moments to summarize our problems so that you will be more familiar with the complexities confronting educators. Those problems are by no means insurmountable, but I trust they will help to explain why our breakthroughs have been slower in coming and are less spectacular than yours although just as urgently needed.

Florida, however, has not neglected technical education as shown by the following review of the current program. Indeed, it has demonstrated marked growth with total enrollment increasing by fifty per cent during the past year.

In recognition of the importance which training for technical occupations has assumed for the economic and industrial welfare of the state, a Consultant for Technical Education has served on the staff of the Division of Vocational and Adult Education of the State Department of Education since 1958. He has been responsible for helping counties and communities to identify their technician training needs, developing training programs, securing appropriate equipment, and assisting in the organization and preparation of courses of instruction. Assistance has been given by an eight-member State Advisory Committee consisting of industrial representatives who are familiar with the responsibilities of technicians.

Although the state consultant and state advisory committee are familiar with the general need for technicians and with training requirements, it is impossible for them to remain abreast of specific local demands.
This is the responsibility of local technical education advisory committees. These committees consist of technicians and engineers from local firms who are familiar with specific technician employment requirements in their areas. They are able to provide invaluable assistance to school officials in identifying the kinds of proficiencies and understandings needed by beginning technicians and also to define areas of concentration in which more experienced technicians require additional training.

It will be noted that reference has been made to two types of training -- one for beginners and the other for experienced personnel. The former is for adults or older high school youth who have an interest in technical employment and are able to meet the minimum scholastic standards required for entry into a training program. This is called preparatory training because it readies inexperienced people for employment in technical occupations.

The other is extension training. It is designed for technicians who are already employed but who wish to learn more about their occupations or to master and refine additional specialized skills and understandings related to their responsibilities. Essentially, it is upgrading training which leads to new or greater responsibilities.

Currently, technical education, supported jointly by local, state, and federal funds, is concentrated in twenty counties in five areas of the state. These include the lower southeast coast counties, the middle east coast counties, the central gulf counties, the northwestern counties, and a cluster of counties in the north central and northeastern part of the state. Combined, their facilities make technical education available to well over eighty per cent of the state's population.

Specifically, in the Cape Canaveral area, an arc centered on the Cape and having a radius of seventy-five miles includes all or part of fifteen counties containing about one-fifth of the state's people. In 1960, over half had populations of less than 40,000 and only four exceeded 100,000.

Four junior colleges, four high schools, and one vocational school in this area, however, accounted for approximately one-fifth of the technical preparatory and extension training carried on during the past year.

In both extension and preparatory programs greatest interest was shown in electronics. The next popular preparatory areas were mechanical design technology and electrical technology while mechanical production technology was the second preference of experienced technicians. Certain other technologies enrolling smaller numbers of students in which demand is almost certain to grow are electronic data processing, aeronautics, instrumentation, civil and construction technology, and medical and chemical technology.

Population density is one key to successful technical education. Technical education is expensive education and training programs must be located in centers of high population concentration or must have the support of several counties with a potential student population large enough to support technical courses both financially and in numbers. That is one
reason why two of the state's most densely populated counties (Dade and Pinellas) accounted for slightly over forty per cent of the total enrollment last year. As the less heavily populated counties move to pool their resources to achieve a common goal, more extensive technician training programs can be provided.

Cooperative effort will assume increasing importance in meeting the growing demand for technicians. It was estimated recently that the state faces a deficit of approximately 20,000 engineers by 1970 unless steps are taken immediately to remedy the deficiency. Assuming conservatively that three technicians are required for each engineer -- and, I am told, the ratio varies from three to five in terms of the tasks performed -- a minimum of approximately 60,000 new technicians will be needed by the end of the decade. This is a far cry from the 7,000 who were trained in Florida schools during the past year. It should further be pointed out that well over half of this total were already employed and were taking extension courses to improve their proficiencies.

On the surface it appears that the state will be fortunate if it prepares just half the estimated number needed. However, training facilities are now in existence and the program is in operation. As you well know, the process of "tooling up" requires time and careful planning if costly mistakes are to be avoided. For the most part, that process is now completed although new programs will be added and existing programs extended to provide more adequate training in terms of evolving demands.

To meet existing needs in technical training areas which are sure to evolve, certain innovations may need to be introduced. These will be considered briefly under three headings, namely, instruction, curriculum, and program administration.

We are all probably more or less familiar with the educational ground-well urging that new ideas and procedures reflecting recent technological developments be incorporated into education to revitalize and improve teaching. Among these are closed circuit television, team teaching, and study in cooperation with industry.

Closed circuit TV is not the long-sought panacea for all chronic instructional ills, but it has the potential of adding a valuable dimension to particular phases of instruction in medical, electronic, aeronautical, and production technology among others which cannot be ignored. An intimate review of surgical practices, jet engine testing, or the sensitive check of satellite components, can provide a depth of perspective which is not attainable in the typical classroom or laboratory.

Closely related to closed circuit TV instruction is an arrangement whereby preparatory trainees may have an opportunity under supervision to observe and to work for short periods in laboratories or firms employing technicians in the specialized responsibilities for which they are preparing. In effect, it would constitute a period of supervised study and work carried on in cooperation with industry.

Team teaching may also have much to offer for it permits more comprehensive instruction and provides a better picture of the coordination of technician
responsibilities. In technical instruction, as in other areas of education, much additional research is needed to determine the best procedures for providing the most effective and lasting instruction at the greatest economy in cost and student time.

The training of technicians is a relatively new and, as you know, rapidly changing field. Therefore, it creates many problems for the teacher in keeping his instructional content abreast of evolving demands. Particularly, is this true in the extension program where changes in tools, instrumentation, and processes should literally reflect almost immediately in the teaching program. We trust that we may count upon your assistance in the future as we have in the past in wrestling with this problem.

With the demand for technicians mounting constantly it will almost certainly be necessary to develop additional programs and to enlarge and extend those currently in operation. With this factor in mind, Mr. Thomas D. Bailey, State Superintendent of Public Instruction, has authorized me to state before this distinguished group his willingness to present during the forthcoming legislative session a request to create a Technical Education Section to be administered by an Assistant Director for Technical Education supported by a full-time specialist and office personnel whose energies would be devoted to the rapidly expanding statewide programs of technician training. I am sure Superintendent Bailey would be most happy to hear from you with regard to your wishes and desires.

In closing permit me to re-emphasize that the school is responsible for squaring the values of the present with the challenges before us. A short time ago a statement describing most vividly the immensity of the universe was noted. If a spacecraft, traveling at the speed of light, had started to traverse the Milky Way at the time of Christ's birth, it would now be less than one-fiftieth of the way across.

There is much to learn! Indeed, the intellectual universe is as boundless as the physical. Though the educator's knowledge of potential human attainment does not always approach your precise mastery over natural phenomena, the State Department of Education in cooperation with the Public Schools of Florida will use the capacities at our command to provide the type of education needed to meet the challenges posed by your spectacular achievements.
COMPARATIVE SIZE OF TECHNICIAN TRAINING PROGRAM,
BY GEOGRAPHIC LOCATION, 1961-1962