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RESEARCH AND DEVELOPMENT:

ITS APPLICATION TO URBAN PROBLEMS

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I. INTRODUCTION

There is no need here to elaborate on the urgency and importance of the urban crisis. Recent events have underlined the significant cogency of our symposium. But it remains for us to analyze the nature of these events and to try to arrive at some understanding as to ways of attacking the problems which underlie them. All of us, I suspect, feel a need for a basic understanding of the critical changes taking place in our society; we need this understanding at a philosophical level as well as at the level of technical solutions. In a brilliant article titled "Revolution and Counterrevolution," Professor Brzezinski of Columbia University has analyzed some of the underlying elements making for our current unstable situation. He said (1):

> "A revolutionary situation typically arises when values of a society are undergoing a profound change. The crisis in values in its turn is linked to profound socioeconomic changes, both accelerating them and reacting to them. For example, the transition from an agrarian to an industrial society produced very basic changes in outlook, both on the part of the elites ruling the changing societies and also of the social forces transformed by the changes and produced by them. Similarly, it can be argued that today in America the industrial era is coming to an end and America is becoming a technetronic society, that is a society in which technology, especially electronic communications and computers, is prompting basic social changes

(see 'The American Transition,' The New Republic, December 23, 1967). This automatically produces a profound shift in the prevailing values.

"...It is revealing here to note that some of the recent upheavals have been led by people who increasingly will have no role to play in the new technetronic society. Their reaction reflects both a conscious and, even more important, an unconscious realization that they are themselves becoming historically obsolete. The movements they lead are more reminiscent of the Red Guards or the Nazis, than of the Bolsheviks or the French revolutionaries. Thus, rather than representing a true revolution, some recent outbursts are in fact a counterrevolution. Its violence and revolutionary slogans are merely--and sadly--the death rattle of the historical irrelevants."

We are, indeed, entering the technetronic society. The revolutions in communication, in digital computers, in the applications of modern technology, are having, and will have, a most profound effect on the culture in which we live. But this effect is being exercised through the traditional institutions of our society; the local government, educational institutions, the police, the housing authorities, all of these people are the instruments through which the technological society is being formed. Because of this, it is essential that we examine the ways in which new developments can be engineered so that they will not only be accepted by society, but will be readily welcomed as filling important needs in the society.

A part of the technological revolution is an increasing reliance on research and development. We have a basic understanding of the way in which research and development proceeds in the physical and biological sciences. But our understanding of the way it proceeds in the behavioral and social sciences is

much less developed and rests on a smaller amount of experience. Thus it is important to examine how research and development can be conducted and effectively applied in the behavioral and social areas so that it will have an appropriate coupling with the hard science research and development in bringing about effective application to the problems of society.

Although we commonly think that the research, development, and application cycle in the physical sciences is reasonably well understood and straightforward, such, indeed, is not the case. I was both amused and pleased by a recent article by John Pierce, who is Executive Director of the Research Communications Sciences Division of the Bell Telephone Laboratories. Those of you acquainted with Dr. Pierce know that he holds strong opinions which he expresses straightforwardly. I quote from his recent article (2) "When Is Research the Answer? " "Knowledge can be power only when there are able people to use it " is the heading. He says:

> "Recently I unexpectedly heard that a large mission-oriented organization proposes to inaugurate a multimilliondollar program of 'basic' research. Among the reasons given was that their large program of 'applied' research has proved ineffective in advancing their field of responsibility.
>
> "My violent and continued reaction has been that the organization needs basic research like it needs a hole in the head. My diagnosis is that people have not been doing their daily work well and thoughtfully, that they have not been doing their job better day by day, and that they now think that the magic of basic research will sweep away or supplant their troubles. My prognosis is that if they get and spend the money, and even if good research is done as a result, the organization and its mission will benefit not at all. No one will be in a position to interpret, exploit, and apply valid new findings and to reap new benefits.

> "...I hope that no one doubts that good research is essential to technological progress, along with good and aggressive development, trial, production, distribution, and continual evaluation and improvement...
>
> "From society's point of view, research is useless in a practical sense unless it is exploited. Such exploitation requires some successful, aggressive, forward-looking, satisfactorily organized mechanism for development, trial, production, distribution, evaluation, and improvement."

I agree with Dr. Pierce. His observations regarding the application of research in the technical world are eminently correct, but how correct are they when applied in the urban environment, in the social world in which we live, and to its institutions? I would suggest that in this area all of his observations apply, but that the problem of transferring research and development into application is much harder and requires not only the cooperation and understanding of the individuals involved in a particular institution, but also a deeper appreciation of the problems of application on the part of the researcher.

In this paper I will examine four different studies of the research process as it relates to the development of new knowledge and the transfer of this knowledge to the applied situation. One of these examples will come from military technology, but the other three are derived from urban or social situations. Following a review of these four examples, I will try to draw some generalizations regarding the way in which research and development can be most fruitfully conducted to assure its maximum application to the problems with which we are all concerned.

II. FROM RESEARCH TO DEVELOPMENT TO USE REVISITED

At the 1966 annual meeting of the American Educational Association I participated in a symposium on the functions and operation of the then recently instituted program of regional laboratories. At that symposium I read a paper (3) titled "From Research to Development to Use." I was surprised at the wide interest shown in the paper, and think it will be worthwhile to review here some of the points made in it. Two of the examples I will cite below are adapted from that paper, but I have added two more recent examples which I believe have particular application to our symposium today.

A. A Study of Translating Laboratory Research in Learning to Operational Settings

Since my earlier paper, Mackie and Christensen (4) have published a report which is particularly relevant to education. This study was undertaken to describe the processes involved in translating the results of laboratory research in psychology into forms that would be meaningful and useful in operational settings. The investigation concentrated on experimental studies of the learning process. Selected studies of human learning were analyzed in detail and their findings were reviewed for possible practical application in Navy training. Also, the apparent impact of the findings of these studies on actual Navy training personnel and training practices were studied. Additionally, a number of well-known psychologists in the field of learning, in educational psychology, and in positions of responsibility for training research were interviewed on issues that were considered vital to the translatability and applicability of research results. In reporting their findings, Christensen and Mackie say:

> "It was found that the research-to-application process never has properly developed for the psychology of learning. Consequently, there have been far fewer applications and much less impact on the

> educational process than might reasonably be expected in view of the size of the learning research effort. The reasons are believed traceable, in large part, to the research philosophies of experimental psychologists. But it was evident, also, that potential users have been reluctant to make the effort necessary to realize the benefits of research findings...
>
> "Research on learning processes represents perhaps the largest single area of investigation presently being pursued by experimental psychologists. Although this has been true for some time, there has been no systematic effort directed toward practical application of the findings from learning research. As a consequence, modern learning research is producing very little impact on educational technology or training practice."

Some will think that the above quotation represents too harsh an evaluation of the results of years of experimentation in the psychology of learning. One can speculate what conclusion would be drawn from a similar study from various other fields in psychology and education. I suspect that a careful examination would show that much of the research done in these areas has resulted in only fairly limited application in real life situations. It seems probable that the recognition of this fact was an important stimulus to the U. S. Office of Education in establishing the research and development laboratories and the regional laboratories. It is my belief that a successful program in the area of education will result only from very extensive and lengthy work on the part of these research and development agencies in intimate involvement with actual school environments and problems. To me the important implication of this study is that in the behavioral and social sciences, laboratory research tends to be isolated and relatively unrelated to real-life situations. If R&D is to be useful for current problems it must be undertaken within the environment where it will be applied.

B. A Study of Problems in Teaching Reading to Mexican-American Children

The previous study leads me to conclude that socially meaningful research and development must be undertaken within the context of the situation in which it is to be applied. If one grants this, then the next problem is to examine the kind of research that should be undertaken. Here one is faced with the problem of exactly what part of a problem should be studied. Is the apparent or obvious manifestation of the problem the real problem? How does one go about deciding which area to attack and what kinds of solutions might be appropriate? I would like to describe a study (5) recently completed by Ralph Melaragno and Gerald Newmark which illustrates very well that the common sense solution to a difficult educational problem did not attack the real problem and that considerable preliminary exploration was required to identify the fundamental problem and unusual techniques were needed to help solve it.

The experiment described here was concerned with the difficulties first-grade Mexican-American students have in learning to read English in the Los Angeles school system. It has long been reported that students coming from a Mexican-American family tend to have much greater reading difficulties than students from Anglo-Saxon families. When one tries to determine the cause for this, teachers and school administrators give a number of different reasons, such as the children have problems because of their frequent bilingual background, they are not as intelligent as the Anglo-Saxon children, they do not pay attention, they do not seem to be able to listen, and other similar common sense, but somewhat superficial, reasons. A team from SDC was formed to investigate this problem, under a Ford Foundation grant to do so. Their first step was to observe the teaching of reading in a large number of different classroom situations. In addition to simply observing the first-grade teachers trying to teach Mexican-American children, they also interviewd experienced

teachers, school administrative personnel, and curriculum supervisors. From these interviews a heterogeneous group of reasons were given for the difficulties in teaching reading. One of these was that Mexican-American children did not seem to be able to follow directions and, indeed, this was observed frequently in the classroom.

With these informal observations as background, the investigators then attempted to isolate the factors which were most important in inhibiting reading. First, a test of elementary reading skills was given. The Gates Primary Reading Test was given to a sample of Mexican-American and Anglo-Saxon students who had completed a year's instruction. The average score for the Mexican-Americans was 13, while the average score for the Anglo-Saxon students was 52. Thus the difference in reading achievement between these students from different backgrounds was clearly demonstrated. Next an effort was made to see if there was a difference in general ability between the two groups. The Inter-American Test of General Ability was given, which allows for both English and Spanish questions and response. Here there was practically no difference between the Mexican-American students and the Anglo-Saxon students. The deficiency in reading scores appeared not to be attributable to any difference in general ability. The next question investigated whether or not these students could understand spoken material and had appropriate listening skills. Again, it was determined that there were no significant differences between the two groups. Finally, a special test was constructed for 23 directional or relational words, for example, words such as: on, under, above, first, last, etc. Using a test of 23 such words, it was determined that there were large and significant differences between the two groups. Ten words were selected as being particularly important to understanding reading instruction. These words were: top and bottom; alike and different; first, middle, and last; and under, over, and underline. It was quite apparent from the test result that a fairly large number of the Mexican-American children did not understand these words and thus could not carry

out the instructions which each word implies.

Consider for a minute the situation of a first-grade child who is being taught reading and does not understand what the teacher means when she says, "Underline the picture of a cat "; or does not understand what it means to say, "Point to the middle one of the three words "; or, "Take the book off the top of the desk "; or cannot understand similar instructions having to do with relations or directions. Such students very rapidly fall behind because they are unable to accomplish much of the work requested either verbally by the teacher or in workbooks at their desks. Thus we felt that it was extremely important to try to devise methods of trying to teach these relational words to the Mexican-American children.

Teachers were brought to SDC during the summer, and many discussions were held as to how such instruction could take place, and efforts were made to develop instructional material. As a demonstration of a possible way of getting these concepts across to the Mexican-American children, two classrooms, in a school attended predominantly by Mexican-American children, were selected in which to try out the new instruction techniques. There were four different techniques attempted. First, material was prepared for the teacher to give in class as lecture-demonstrations. This included efforts to convey the concepts involved in these relational words through the teacher lecturing and using material such as blocks, books, toys, etc.,and moving them from on top of the desk to under the desk, or having three of them and picking up the middle one and explaining the idea. It turned out that this procedure was not useful whatsoever. The scores on tests taken before and after the teacher instruction showed that the teachers had not effected any improvement in the students' performance. Next the idea was developed of using those first-grade children who understood the concepts in tutoring those children who did not understand them. Special materials were prepared which the first-grade tutors could use, and tape recordings having the stimulus words and related to various test materials were prepared so that the students

could test themselves while their tutors were present and the tutors could help them in trying to explain what the correct answer was and in physically demonstrating by the manipulation of materials. The results showed that this procedure of student teaching student was fairly effective for a significant portion of the students but there were some cases where it did not seem to work and where the relationship between the students was such that the tutors' suggestions were rejected. This was particularly true where young girls were trying to teach the young boys. We understand that in the Mexican-American culture there is a wide gulf between the two sexes. A third procedure was developed which was to use fifth- and sixth-grade children as tutors. Here the children came to the classroom and spent about half an hour twice a week for several weeks tutoring the younger children who did not understand the concepts. Again, this instruction worked for a fair number of students. After the completion of tutoring by both first-graders and older children, a large number of the children had learned the concepts, but even so there were still some who had not mastered them. We then obtained the services of an adult Mexican-American who was interested in reading and was willing to go into the home and try to either tutor the student in the home or find a parent or older child who would agree to do such tutoring. This final procedure proved to be successful with students who had still not learned, and by the end of eight weeks we were able to show that all but one of the students in the classrooms had mastered the concepts involved in these 10 directional words.

The next step was to try to see whether or not the procedures developed could be transferred so that they could be routinely applied by classroom teachers. For the second semester, two additional classrooms in a different school were selected. The teachers involved were instructed at some length in the various materials and procedures that had been developed in the previous semester. Again, it was found that a high proportion of the students did not understand

the directional stimulus words. The procedures of tutoring with the first-grade students and with the sixth-grade students were again tried. In this case the experimenters did not involve themselves in the instruction or classroom procedures, and merely observed what activity was going on. In this case the instruction resulted in about 80 percent of the students learning the directional words rather than the almost perfect success the experimenters had. Attempts were made to assess the reason for this difference, and it is believed that the deficiency related to the fact that the various teachers did not always follow the tutorial procedures with rigor. At times they felt that it was too much trouble or an imposition on the fifth- and sixth-grade students to have them come and do the tutoring. To a certain extent we felt that the teachers had a traditional way of giving reading instruction and did not want to depart from the traditional role and depend on children as tutors or cause the inevitable disruption to other administrative and teacher personnel involved in arranging for the tutors to come at the appropriate time.

We have just received a new Ford Foundation grant to attempt to develop a total tutorial community within a single elementary school. We plan this as a seven-year program to start with all of the subjects in the first grade and to proceed through the full seven years until the entire school is operating as a tutorial community. I mention this to specifically emphasize the point that even though a new technique has been demonstrated to be effective, it is often extremely difficult to get it adopted because it does not fit within the total framework in which the institution is operating. In this case, even though the tutorial methods developed for teaching directional words appear to be highly efficacious, it is doubtful that they would be successfully adopted within the present school system structure. Rather we need two things: first, to study in detail and develop revisions of instructional techniques and materials in the many elementary school subjects; and, second, try to reconstitute the formal organization of the institution in such a way that it will be able to adapt to these changed techniques.

C. A Case Study of a Study of a Successful Development Project but Unsuccessful Diffusion of the Techniques Developed

A good illustration of the points just made is given by the history of a development project undertaken in the area of vocational rehabilitation of the mentally retarded where some successful techniques were developed, but the diffusion of the information about these techniques and the rigidity of the institutional setting was such that, while the project itself was successful, it had essentially little impact on the overall rehabilitation of the retarded.

Edward Glaser's Human Interaction Research Institute (6) has completed an interesting study for the Vocational Rehabilitation Administration. They examined the factors which seem to have inhibited a number of vocational rehabilitation agencies from adopting the techniques and methods of a successful demonstration by the Tacoma Goodwill Industries in a project titled "The Development of an Occupational Evaluation and Training Center for the Mentally Retarded." (VRA 308) The objective of the Tacoma Project was to demonstrate the feasibility of rehabilitating severely retarded people to a level of sustained employment. The population consisted of young adults between 16 and 30 who had measured IQ's between 50 and 75. In addition to vocational training, the workshop emphasized training in work habits and in the various attitudinal and performance characteristics which would make these people acceptable to employers. A team consisting of a psychiatrist, a psychologist, a nurse, a social worker, and a vocational specialist worked with the individuals trying to impart the necessary skills. As a result of this effort, 63 percent of the subjects were placed in jobs, with each person remaining on the job for a minimum of three months. Some of the individuals were retained in sheltered workshops but many were placed in competitive employment in janitorial, domestic, factory, and farm settings. Although the original project was sponsored by federal funds, the Tacoma Goodwill organization has been able to continue this work under local auspices.

This study was completed in June of 1963, and the results were communicated through formal reports to VRA and distributed to a number of rehabilitation agencies. Despite the successful demonstration by the Tacoma Goodwil Industries, no other organization was known to have adopted the procedures used.

Glaser and his associates studied the efficiency of various methods of communicating the results of this study. As a first step, a questionnaire was sent to 40 widely separate VRA-sponsored occupational training centers for the mentally retarded inquiring whether or not they were aware of the study and its results. Since very few knew of the study, they were sent reports and a special brochure on the study. As a second communication step, a representative of the Tacoma workshop visited a selected sample of agencies in the California area to communicate the Tacoma results to them. As a third technique, a conference and demonstration for 33 representatives of workshops was held in the State of Washington. In addition to the representatives themselves, consultants from Human Interaction Research Institute, the VRA, Tacoma Goodwill, and the University of Washington participated in a discussion of the Tacoma Goodwill project. A fourth communication method involved direct psychological consultation to the management of various workshops. It was hypothesized that when an organization becomes involved in a self-examination of its goals, opportunities, ways of operating, and its problems, it would tend to seek new ways to reach those goals. If a skillful psychological consultant were available to management, it seemed probable that the organization would be led to change more rapidly. To evaluate this hypothesis, a psychological consultant was made available for 15 day-long visits over a period of six months to each of five workshops.

As reported by Glaser and his associates, the major results of this investigation were as follows:

1. If promising research or demonstration findings are reported in easily readable, brief, and non-technical form, and are widely distributed to potential users, the chances of their having impact and being used will be increased relative to reporting by a formal report.

2. If potential users of the research or demonstration attend a conference where they can discuss the innovation and through the site visit see it in operation, the use of the innovative research or demonstration is significantly facilitated, especially if there also is an opportunity for the conferees to tell each other about their own innovative programs or practices.

3. If rehabilitation workers who have heard about and seen an innovative demonstration elsewhere are later visited in their own agency by a member of the demonstration project staff, that added increment of face-to-face communication on one's own premises and with one's own working group further promotes the use of the innovation.

4. Psychological consultation to management helps the organization change more rapidly and become more open to change.

The important point of this study is the demonstration of the difficulty of getting social organizations to adopt new ways to deal with their institutional problems. Even though a new technique is shown to work, the diffusion of operationally detailed knowledge regarding the project tends to be very slow and a great deal of consultation, guidance, and mutual discussion is required before an institution will change its ways and adopt the new techniques.

D. A Study of Factors Influencing Technical Developments

I want to shift now from considerations in the social and educational area to study of hardware development. I will review some of the findings of Project Hindsight. It is my belief that this is an important study which deserves careful consideration. While it has been criticized, I tend to think that the criticism has often been wide of the mark. Certainly, studies of this nature need to be undertaken, and I would suggest that those who tend to discount Project Hindsight have a responsibility to undertake similar studies under

well-controlled conditions to find out what the facts really are. Having made this somewhat defensive statement, what was Project Hindsight?

Since the Department of Defense spends about $1.4 billion a year on basic research and exploratory work, it was interested in learning to what extent this expenditure contributed to the development of new weapons systems and the value which could be placed on the improvements resulting from these expenditures. Twenty different weapons systems were examined in detail to determine the various important events or specific technological developments which allowed the design and production of the new weapon system. Once an event had been identified, a team of investigators visited the individuals responsible for its perfection and interviewed them intensively regarding the scientific or technical origin and the environment surrounding the development of the particular event. An interpretation of the data allows a number of important generalizations (7,8):

1. Technology Predominates, but Basic Science is Fundamental

It was found that 9 percent of the events could be classified as science events while 91 percent were classified as technology events. In other words, the new capabilities which allowed for the development of these weapon systems derived from technological studies and applications rather than from basic science itself. The authors are quick to point out that this result does not show that science is unimportant but rather it points to the time scale involved in the application of science. They say in their report:

> "It is clear that, on the 50 year or more time scale, undirected science has been of immense value. Without basic physical science we could scarcely have had nuclear energy or the electrical industry or modern communications or the modern chemical industry. None of our science events could have occurred without the use of one or more of the great systematic

> theories--classical mechanics, thermodynamics, electricity and magnetism, relativity and quantum mechanics... But, however important science may be, we suspect its primary impact may be brought to bear not so much through the recent, random scraps of new knowledge, as it is through the organized, 'packed-down' thoroughly understood and carefully taught old science."

This finding leads one to the almost inescapable conclusion that if a technical development is needed and its achievement is limited by current technology, then the way to solve the problem is to directly attack it in terms of applied research utilizing the then known science and advanced technology rather than to hope that basic science will, in any short time period, provide the new knowledge required to lead to a successful system development.

2. Development is Closely Related to Mission Requirements

Another important finding was that of the various technological events, about 95 percent were directly motivated and supported by the Department of Defense. That is to say, almost all of the events contributing to these weapon systems were developed and refined as a direct result of a perceived need in the development of this or similar weapons systems. Only very few events resulted from general technical developments or from technical developments outside of the weapon system area. This finding indicates that if a particular problem area is to be solved, the motivation and support must come from people working in that particular area rather than from the hope that spin-off from other technological developments will make important contributions.

3. Technical Developments Take a Long Time

Another important finding of Project Hindsight concerns the time distribution of events. The time from which the development of a particular weapons system was initiated to the time at which its required events became technologically feasible, shows a very wide range. Of the 700 events studied, the range in time was from 20 years before the weapons system was started through 10 years

after it was started. Most of the events occurred before the weapons system was started--on the average, around five years before. Even so, many of the events were not available at the time a decision was made to proceed with the overall system and had to be perfected in parallel with the system development. On the average, the delay between the discovery of an event and its application was nine years for science events and five years for technology events. This result implies that there is a considerable lag between the time knowledge or a technique is developed and the time it is applied. Also, even though all the technology is not available at the time a particular system is started, the pressure of working on the system and having schedules to meet tends to force the development of missing events so that, by and large, a successful outcome is achieved.

I have not reviewed the many detailed results of Project Hindsight, but I believe that this is one of the most important studies ever undertaken of the process by which knowledge is put to use. The study indicates clearly that an orderly process from research to development to use is largely a myth and that, in fact, there is a great deal of crossing back and forth in terms of the development cycle, in terms of funding, and in terms of the people involved.

III. USING KNOWLEDGE IN ATTACKING MAJOR CONTEMPORARY URBAN AND SOCIAL PROBLEMS

Now, I wish to draw together the separate ideas presented and to consider some new material which should give insight into the ways in which research knowledge can be used in attacking some of the major contemporary problems facing our civilization. Many will not agree with the comments I am about to make. I hope that by stating some fairly dogmatic positions, I can stimulate discussions of these important problems and help those who disagree with the positions I have taken to examine the basis for their position. Thus, we can come to some agreed upon conclusions regarding the proper role of knowledge development in our culture. The points I wish to emphasize are:

A. Seek the Solution Within the Context of the Problem

If a major problem area needs resolving, then the solution should be sought by work within the context of the problem area itself rather than hoping that knowledge developed in basic research or in other applied areas will have great application to the particular problem needing solution. This conclusion tends to place basic scientific research in a less central position than is often done in discussing ways of solving major problems. Although basic research and scientific theory remain fundamental ingredients to solving problems, the knowledge derived from current basic research tends to be too narrow to guide the way for the solution of specific contemporary problems. This conclusion is borne out by Project Hindsight, by the Mackie and Christensen study, by the Pierce article, and other studies.

B. The Solution to Contemporary Social Problems Will Be Complex and Many Faceted

Simple solutions are extremely unlikely. If there were simple solutions to the problems we are facing today, the problems would have ceased to exist long ago. Rather, these problems persist in spite of the efforts to apply common sense and straightforward approaches. All our experience shows that the solution to major system problems involves the application of many different developments and their integration into a concentrated attack on the problem. One can cite the Hindsight experience where it was shown that the development of a major new weapons system depended on the solution to a large number of relatively well defined, small, but critical problems. Similar results can be cited from other fields. One of the great successes in America has been the revolution in agriculture. Recently, Sprague (9) has reviewed the conditions necessary for agricultural production in the developing countries. He emphasizes the many factors

which are essential for the successful introduction of high-yield crops. After reviewing the increase in rice production in Japan, he says: "As is typically the case, this increase in yield is the result of many factors: improvement in varieties, increased use of fertilizer, modification of cultural and production practices, and better control of disease, insect pests and weeds."

C. Certain Critical Conditions Are Essential for Successful Work on Any Major Problems

Prominent among these critical conditions are: first, there must be an appropriate acceptance and motivation on the part of the community, the government and other involved agencies in recognizing the need for a concentrated effort toward solving the problem under consideration. Second, there must be a trained, motivated and experienced staff available for long-term application to the problem. Generally, the problem will not be solved in any short period of time and those responsible must recognize that the same staff must be maintained over a number of years if the problem is to receive real attention and solution. Third, funding must be available not only to support the staff but often to make many physical and organizational changes within the setting in which the problem exists.

D. The Concept of Assessment is Fundamental to Solving Significant Problems

It is surprising how frequently we resist the idea of assessment. We will deplore some existing condition or state that a serious problem exists without being willing to undertake the necessary effort, or even to recognize the necessity for a quantitative assessment of the existing situation. Further, such assessments must be based on rigorous and

objective techniques. In weapons system development, specifications are worked out in great detail which define the various parameters which must be satisfied before the weapons system will be considered satisfactory. These specifications are clearly understood by the developer and the user. At times, almost as much money is spent in evaluating and assessing the weapons system as went into its original development. Frequently, modifications and continued development are required if deficiencies in the original design are demonstrated during the assessment phase. Similarly, we should not be satisfied with introducing ameliorative efforts in the social and educational areas unless we are willing to undergo the stringent test of objective assessment so that an evaluation of the effectiveness of new methods can be made and cost/effectiveness estimates derived.

E. A New Profession of Social Engineering Needs to Be Developed

In evaluating contemporary problems in education and the social area generally, it seems there is a wide separation between the practitioners in these fields and those engaged in research in our academic institutions. We do not have the middleman who, as in the case of the engineer, is devoted to solving specific problems. The engineer takes accumulated experience in technology and general principles of basic science and applies them to the solution of problems. His orientation is towards neither the development of basic new science nor the operation of a particular system but rather that of the designer, architect, and introducer of the new system. Such people are lacking in the education and social fields. The universities and government must take the initiative towards defining this new profession and training the people who will become its practitioners. Since contemporary social problems largely arise in the sector where government is primarily involved, that is to say, problems in education or in urban development or in environmental

control, where there is a clear recognition of government responsibility, the social engineer needs to be trained to serve within a government-oriented context. Thus, the government, if we wish it to deal adequately with these problems, will need to encourage over a long period of time the training and employment of people in this new profession.

F. Simple Solutions and Instant Experts Are Counter-Productive

It is my impression that there are still a large number of well-educated people who feel that somehow a simple solution can be found to most of our problems. Often these same people believe that if a good sensible person would just look into the problem for a short period, he would be able to perceive what needs to be done. A striking example of this phenomenon is the number of people who believe they are experts in the area of education. Recently Joseph Alsop (10) authored an article titled "No More Nonsense About Ghetto Education." On the basis of his short acquaintance with this subject, Alsop advocated that "brilliant Negro achievement" could be realized if the education world would only adopt New York City's "More Effective Schools" program. For those who are unfamiliar with educational developments, Alsop's article probably carried great conviction and no doubt led many to believe that here we had an example of the wise man coming up with a sound solution. It was with real pleasure that I read a reply by Schwartz, Pettigrew, and Smith (11) titled "Fake Panacea for Ghetto Education." These Harvard educators were able to show the misinformation contained in Alsop's article, his rejection of much pertinent information, and his relative ignorance of developments in the problems of ghetto education. Yet, I venture that Alsop, because of his wide reputation as a syndicated columnist, has influenced many more people than has the reply by the group of experts in the subject.

One long-range approach to this problem suggests that educators have a special responsibility to transmit an understanding of our contemporary

problems in such a way as to insure that college graduates are reasonably immune to the idea that simple common sense solutions are the answer to most of our contemporary problems.

G. A Special Problem Exists Because of the Nature of the Gatekeeper in Contemporary Problem Areas

By gatekeeper, I mean the individuals and organizations which are critical in the solution of contemporary problems because of their strategic location in approving or disapproving particular solutions for these problems. I have in mind such gatekeepers as school boards, legislatures, city councils, planning commissions, etc. In the development of weapons systems, we have quite clearly defined gatekeepers. One of Mr. McNamara's great achievements has been his ability to establish responsibility within the military services for clear decision-making and clear lines of authority as to whether or not a particular weapons system will be developed. Once the decision has been made to proceed with the development of a weapons system, the necessary budgeting, development plan, personnel allocation, industrial contracts, etc., follow. In these developments, the location of the gatekeeper is clear but, equally important, the gatekeeper has a professional expertise in the subject about which decisions are being made. This may be a professional military background, a highly technical engineering or science background or other background which is appropriate to the particular problem. In marked contrast, we often find that in contemporary educational and social problems the gatekeeper is not well defined. It is unclear exactly what body or institution is responsible for making a positive decision. Likewise, the person filling the gatekeeper role often does not have the technical or expert knowledge necessary to make the decision. Too frequently the gatekeeper in the education and social area occupies his position because of ability to win elections, general social affability, or narrow business interest rather than a trained professional expertise in the problem under

consideration. I do not suggest any simple solution to this problem, but as time goes on we will have to try to better educate or to change the role of these gatekeepers.

In conclusion, then, I would suggest that this seminar serves a most useful purpose in focusing the highly important task of developing strategies for solving the many contemporary problems our nation faces. It seems apparent that the utilization of knowledge is one of the important ingredients in coping with contemporary problems, but much more is involved. The whole problem of a strategy for change and the method of bringing together the necessary resources and techniques deserves our most serious attention.

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