The Industry of Discovery:

New Roles for the Non-professional*

Joan Grant

"...the newest type of economic activity in the
country, aptly named 'the industry of discovery'--
the pursuit of new inventions, new techniques,
new materials, and new weapons."[1]

Research: what is it?

Research is an approach to ignorance. A function rather
than a field of study, it is hard to discuss in the abstract.
The university psychologist watching rats run in mazes, the

physician trying out a new drug, the engineer working on

improved design for a bomber or an automobile, the

advertising agency testing the impact of a new television

commercial, the State Department of Education gathering

information to estimate future budget needs, are all

doing research, of one kind or another.

Research methods are basically a matter of observa-

tion and counting. What is observed and how it is counted

will vary with the field of study. Techniques of observa-

tion may range from direct looking to the use of complex

machines, and some will call for highly specialized kinds

of training. Counting may be a matter of one-two-three

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or require the use of high-speed computers. Yet research generally, even more than education or welfare, lends itself to division into a set of tasks that makes it uniquely suitable for the development of new careers.

It does not require a college education to read a dial, make a calorimetric determination, conduct an interview, or prepare cards for a computer. Much of research can be reduced to routine. Routines can be taught. There is substantial evidence that they can be performed successfully by persons with no professional training and with little formal education.[2]

Research: who needs it?

In many fields, the need for research is accepted without question. This holds for the physical and biological sciences generally, and it is true for their many areas of application--engineering, medicine, agriculture, and the manufacture of new products. For the social and behavioral sciences, particularly in their applied forms, research has a less certain status.

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[2] The reduction of statistical computations to simple routines makes it "possible to train persons to use a desk calculator and have them accurately computing regression equations and correlation coefficients after less than a day of practice." Cole, LaMont C. On simplified computations. Amer. Statistician, 1959, 13,

It is seen as essential in the apprenticeship served by graduate students, but once out of formal training and into real life, knowledge gained by research begins to compete with the knowledge of "experience," "common sense," and "intuition."[3] Yet even here a research approach to the problems dealt with by social and behavioral science has made surprising inroads. Advertising agencies, as well as the manufacturers that support them, have their research departments. Consumer organizations rely on research in efforts to pick their way through the maze of competing advertisements. Politicians make use of research findings in the form of public opinion polls in preparing campaign strategies, and election night is now unthinkable without the research predictions of a computer.[4] Even war strategies are based to a large extent on research.[5]

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[3]This is especially striking in the split between the academic training and clinical practice of many psychologists. It holds as well in the social work field.

[4]Computer achievements in this area may pose real problems. The prediction of the winner of the California 1964 presidential primary 38 minutes before the polls closed in some parts of the State led Governor Sawyer of Nevada to warn against the dangerous influence of early predictions on the course of voting. ("Nevada governor assails election 'computer derby.'" San Francisco Chronicle, June 7, 1964, pl. 24.)

[5]This extended use of research findings has led a high-ranking member of the military to complain that the computer simulation of war games, as an approach to strategy, is taking the human element out ot warfare. (Fortune Magazine, April 1964.)

If this were a static world, research could be an intellectual game. In a world of change, research is essential to find the most effective ways of meeting change. Business and government speak of it as "research and development," development connoting the action implications of research. In the eight-year period from 1953-54 to 1961-62, research and development activities more than doubled in private industry and expanded three-and-a-half times in those supported by the Federal Government.[6] It is reasonable to expect this expansion to continue, at least parallel with the expansion in technological change and perhaps at an even faster rate. Research and development activities are not only a response to technological change; they stimulate further change which calls in turn for further research.

Research needs: the physical and biological sciences

A projection of needs for research personnel, per se, is difficult to make since employment figures lump together professional and technical workers of all types, some of whom are engaged in research proper, some in service roles, and some in mixtures of the two. An analysis of occupational growth over the decade of the 1950's shows a 47 per cent increase in the professional

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[6]Manpower Report of the President and A Report on Manpower Requirements, Resources, Utilization, and Training, March, 1963, U.S. Department of Labor, p. 75. The bulk of the work supported by Federal funds was actually performed by private industry.

and technical group, compared to a total change over all

occupations of 14.5 per cent. Some professions grew

more rapidly than others. The most extraordinary growth

occurred in the employment of mathematicians (345 per cent).

Engineers as a whole increased by 64 per cent, but aero-

nautical engineers by 193 per cent and industrial engineers

by 142 per cent. The growth for physicists was 88 per cent,

for geologists and geophysicists 75 per cent, and for

biological scientists 51 per cent. There was similar

growth in the technical occupations that work with these

professionals. Electrical and electronic technicians

increased by 679 per cent, other engineering and physical

science technicians by 102 per cent, medical and dental

technicians by 80 per cent.[7]

Employment projections for the next decade carry

out the trends of the past. Per cent growth over all

occupations for the 15-year period 1960-1975 is estima-

ted as 31 per cent, but professional and technical employ-

ment is expected to rise by 65 per cent. The demand for

engineers and scientists will be even greater: it is

expected to double in this period. Yet the supply of

new engineers to meet this growth may fall below demand

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[7]These figures are taken from Table G-6, p. 202, Manpower
Report of the President, op. cit.

by as much as one-third. Extremely rapid growth is also

anticipated in the supporting technician occcupations,

partly to meet the shortage of more trained scientists,

but also because of the increased complexity of our

technology. Requirements for technicians to work

with engineers and scientists are also expected to

double by 1975.[8]

Research needs: the social and behavioral sciences

Comparable figures for research in the social and

behavioral sciences are not readily available. The Depart-

ment of Labor reports a 60 per cent growth in the social

science fields over the decade of the 1950's, with the

greatest increase occurring for economists (118 per cent)

and psychologists (150 per cent), but these figures do

not necessarily cover all work in these fields.[9] Current

applications of social and behavioral science are still

quite sketchy. Research in these areas has scarcely

begun to make its impact felt upon the culture as a

whole. There are at least three ways in which social

science research could be immediately greatly expanded.

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[8]ibid., pp. 100-101, 125.

[9]See footnote 7, p. 4

Accounting for operations. The most obvious way
of expanding research can be described simply as "keeping
track of." No industry or business concern of any size
could exist for long without an accounting system for
its operations. This system is basically a matter of
keeping track of input, output, and costs, for both
products and personnel, with built-in checks on the
adequacy of the information obtained.

Most social agencies have some type of operations
accounting. This is essential for the management of
institutions in which eating and sleeping arrangements must
be dealt with on a daily basis. It is also important
for those agencies that rely on size of client rolls to
determine the number of staff they may hire. But the
kind of information necessary for rational program
planning and for assessing the effectiveness of the
agency's day-to-day operation is often far from adequate.
Few businesses would survive with the type of operations
accounting considered sufficient for most social agencies.

The Department of Labor, in preparing its latest
manpower report, found itself hampered by the limitations
of available information on employment, unemployment, and
the labor force. Because of this, a Presidential Committee
appointed to investigate employment and unemployment

statistics has recommended improvements in both the col-

lection and the analysis of basic information in this

field.[10] The situation is not unique. Many correctional

systems, for example, have no way of knowing what happens

to the people who have passed through their programs, and

it is rare for even those agencies with extensive record-

keeping systems to have knowledge of their clients'

contacts with other social agencies. This means that is

is difficult to collect information on the relation of

prison incarceration to changes in welfare rolls, to

relate employment data to vocational training experience,

or to link alcoholism and delinquency. Yet planning of

new programs--especially those that represent an attack

on many interrelated social problems at once--requires

just this kind of basic knowledge. Information on

technical problems and resources is well advanced. In-

formation on human problems, and the resources for

meeting them, is scarce and often totally unavailable.

This is true, unfortunately, even in those areas in the

most urgent need of social planning. The Manpower Report

of the President comments:

> "Despite the tremendous potentialities for economic
> and social change inherent in automation, there is a
> paucity of factual information with respect to its

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[10] op. cit., pp. 112-114.

current nature, extent, and employment effects."[11]

There is nothing inherently difficult about this kind

of research. The greatest difficulty actually lies in

deciding what is the relevant information to collect.

The collation and summarization of information can be

readily done by punched card data processing equipment

or, where these are available, by computers. One of the

most striking examples of the successful use of non-

professionals(to be discussed below) has occurred in

the development of a social agency operations accounting

system.

The demonstration program. All social agencies

complain of lack of funds. Social services are unprofi-

table and business rarely supports them. Government

spending is at best a compromise between the electorate's

concern for tax rates and its demands that something

be done about the most visible and disturbing aspects

of social problems.[12]

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[11]ibid., p. 113.

[12]Contrary to the publicly expressed concern of many people
about increased Federal spending (the bulk of which is
actually going into defense), most spending for social
services is at the state, county, or municipal level. Of
the nine-and-a-half million government employees of all
types, five million work for state or local agencies (half
of these in education). Federal employment has grown only
6 percent over the last ten years, while state and local
employment has risen by 65 percent. The latter figure reflects
the demand for increased social services, a good part of which
has been made necessary by the rapid increase in our population.

The demonstration program is an effort to get around the problem of limited funds for social services by obtaining special funding for attacking social problems in miniature. If we show what can really be done, the argument runs, by increasing services (or upgrading staff, or changing our approach to treatment or rehabilitation), then government budget sources and the public itself will recognize the utility of expanding services on a large scale.[13]

The specially funded demonstration program is a relatively new development in our approach to social problems. Some of these programs are funded by private foundations, but by far the larger share are financed by the Federal government. Through the argument supporting the demonstration requires that some evidence of its effectiveness be obtained, the type of evaluation and the level of sophistication required for it vary widely from one funding agency to another.

Demonstration programs in the last few years have been undertaken most often in the name of mental health,

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[13] Though most demonstration programs would greatly increase social service costs if implemented on a large scale, they are expected to ultimately save money in other ways. Thus increasing the cost of parole services by reducing parole officer caseloads is expected to reduce recidivism and thus the cost of maintaining prisons.

of education, delinquency, or vocational training and
re-training. Of late, the broad-based program, offering
an attack on several of these problems at once, has come
into fashion. Thus the Mobilization for Youth program
in New York City, though focused on the problems of
delinquency, has set up a variety of programs in education,
job training, and welfare and has worked not only with
problem youth but with problem adults in the community
as well.[14] Such programs may form the prototype of the
demonstration programs that will be focused on poverty,
and they could indeed be considered as demonstrations of
ways to attack poverty. Conceptualizing programs under
this larger title will broaden the base of attack and
provide an overall integration of the work on social
problems that is now the function of a variety of social
agencies working in isolation.

But as the base of demonstration programs is broadened,
to that extent do programs tend to become diffuse. When
action is taken on many fronts, the difficulties of con-
ceptualizing a research-evaluation approach increase.

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[14] Other examples are the Youth Opportunities Board program
in Los Angeles, the HARYOU (Harlem Youth Opportunities)
program in New York, and the newly developing WAY (Washington
Action for Youth) program in Washington, D.C. The latter will
be the first such program to build in extensive mental
health concerns as well.

Staff on demonstration programs quickly become caught

up in getting the multi-faceted programs underway, and

planning for research evaluation is often relegated to the

last (when it is too late to plan properly). Moreover,

there is a good deal of impatience on the part of people

involved in social action with researchers generally,

particularly when research is seen as a way of delaying

the implementation of a new program.

To add to this, it is hard to find competent social

science researchers who are willing to leave tenure college

and university positions (where as likely as not they have

control over their own research grants) for the uncertain-

ties of being full-time staff on temporarily funded

projects.

We thus have a situation in which research evaluation

of demonstration programs is often postponed in order to

get the program started, turned over to part-time advisory

committees, or simply not thought about at all. The

approach is short-sighted in the extreme.

It is against Federal law to market a new drug

without extensive clinical investigation: giving the

drug to a selected number of patients and observing the

results. It would be absurd to think clinical investigation

needs were served by administering the drug and then failing

to look at how patients responded to it, or by relying on

the manufacturer's opinion that the drug, in theory, ought

to be effective. Yet this is precisely the case in many

of our education, welfare, and mental health programs, our

approaches to employment training, criminal rehabilitation,

and delinquency prevention. Ideas are common and cheap.

Implementing ideas is expensive. Implementing ideas without

collecting information on how they are working, or in ways

that prevent the collection of relevant information, is

like giving a new drug without systematically observing

its effects on patients. The demonstration is wasted.

Social agencies and innovation. Social agencies are

also engaged in running demonstration programs, though they

do not always have this title. Special classes for retarded

or gifted children are "demonstrations," and so are

experimental parole or probation caseloads, a changed

policy for administering welfare funds, or the opening

of a new outpatient clinic to treat disturbed adolescents.

Though these are ordinarily not conceptualized as research,

they are trials of new procedures, without prior know-

ledge of effectiveness. Do theywork? All too often,

this is a matter of someone's subjective judgment, and

new programs are dropped or become institutionalized

as part of regular procedure without any real knowledge

of whether or not they are doing what they were intended

to do.[15]

Two questions must be answered if an agency is to learn anything from its innovations. Did the program do what the agency convinced its budget sources it was going to do? And was the program carried out reasonably similar to the program as originally planned?

Pearl has spoken of this second question as one of quality control.[16] A term taken from manufacturing, it refers to the periodic inspection of a product to find out whether or not it is within acceptable limits of manufacturing standards. Social agency programs need the same inspection. Programs on paper are one thing. Programs in practice, as is recognized by everyone involved in them, are frequently something else, a matter of compromise, expediency, loss of interest, and change in personnel. Sampling of a program to find out if it has

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[15]This situation does not always go unrecognized. California, for example, one of the most rapidly growing states, has had a corresponding growth in state personnel and state spending. Pressures for developing more efficient ways of operation have been on the increase and have led to state agency demands for budget support for new program innovations. In the face of such demands, the Legislative Analyst recommended in the 1957-58 budget that both the Departments of Corrections and the Youth Authority, which handle adult and youthful felony offenders, create divisions of research for the express purpose of finding out whether their new programs were any more effective than their old ones.

[16]Pearl, Arthur G. Quality control in research evaluation. Paper read at meetings of National Council on Crime and Delinquency, Seattle, August, 1962.

remained the same throughout a study is an important part of research evaluation, and must indeed precede that evaluation. Few agencies, however, are able to answer questions of either program effectiveness or quality control.

Who does research?

To qualify for professional research training, one must in most cases be a university graduate student. The present university training model is patterned after that of an apprentice in a guild. Although courses in research design and methodology have appeared on the increase since the second world war in both psychology and sociology departments, research is still taught largely by doing. The graduate student becomes qualified by conducting independent research, under supervision and conforming to accepted guild requirements. Typically he also gains experience by working, for low rates of pay, on faculty research projects.

The pattern has altered somewhat in recent years as computers and other machines have taken over increasingly large amounts of routine research functions. With the machines have developed cadres of special technicians who go through an entirely different training procedure. This varies with the kind of work. It may include junior college experience, special training in technical institutes, or training given on the job. In general, technical training beyond the high school level is required. Just as there

has been a trend toward the educational upgrading of pro-
fessional workers, there is also a trend toward increasing
educational requirements for the technical occupations.

Technicians have taken over many functions formerly
performed by graduate students or beginning professional
workers. They are used as resource people by the university-
trained researcher in much the same way that a doctor will
send a sample of blood to a laboratory for clinical examina-
tion. It is difficult for the technician to move up to
professional status and responsibility. The route to the
professional level continues to lie in advanced academic
training.[17]

Not all research is done by professionals or specially
trained technicians. In public opinion and market research,
untrained interviewers and coders are frequently hired on
a short-term basis to work on specific projects. These
are typically drawn from the ranks of certain types of
marginally employed groups: students, non-working house-
wives, unemployed actors (actors have made superb inter-
viewers). These research functions are not seen as requiring
general or prolonged academic training; brief on-the-job

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[17]There are some exceptions to this, particularly in civil
service systems that permit on-the-job training to
substitute for formal education.

training is the rule. The untrained person is more available

to the research organization than the professional, and

he is certainly cheaper. His use, however, is haphazard.

Through the temporary interviewer or coder is a kind of

social science technician, he does not usually see himself

in this role, neither making a career out of a low level

research function nor taking training to become a more

qualified research person.

Research and the non-professional

Considerable evidence has accumulated in the social

science field to show that non-professionals can learn

to perform complex and responsible research functions.

This experience lends plausibility to the main thesis of

this book: it is possible to stratify professional jobs

into a hierarchy of functions, and it is possible to train

non-professionals--persons with a high school education

or less--to perform them. Moreover, there is evidence

that non-professionals can be prepared through on-the-job

training to assume professional-level positions. Our

present training for research--through university and the

graduate school--is not necessarily the only way to develop

skilled research workers. This point is of especial

importance when many young people, under our present

education system, are being kept out of university-based

career development, through either cultural sets or basic skill patterns that do not favor the verbal, abstract thinking orientation of college-preparatory courses and university curricula.

Camp Elliott: the Navy does research. In 1954, a group of Psychologists set up a research program at Camp Elliott, supported by funds from the Office of Naval Research. Camp Elliott was then one of three Naval Retraining Commands for the rehabilitation of naval and marine offenders. The Navy, concerned with its internal delinquency problems (expressed mostly in AWOL offenses, but ranging the gamut of civilian misdemeanors and felonies), was ready to support projects offering new approaches to the handling of its delinquents. The research program, a study of the military nonconformist, included setting up a series of 20-man therapeutic community-type living groups as a way of effecting changes in delinquent attitudes and behavior. The groups, incidentally, were run by non-professionals--marine sergeants--with consultation by professional psychologists, an early example of the use of non-professionals in a therapeutic role.[18]

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[18] Grant, J.D. and Grant, Marguerite Q. A group dynamics approach to the treatment of nonconformists in the Navy. Annals Emer. Acad. pol. soc. Sci., 1959, 322, 126-135.

The living group program involved some 500 subjects, each of whom had two lengthy tape-recorded interviews and a large battery of pre- and post-experiment attitude tests. A number of other studies were also done, including one on delinquency prediction that was run on 20,000 naval recruits from all over the country. The amount of data collected was enormous. Computers were still in their infancy, and were not available to the five research staff members. This staff, concerned with test development, interviewing, rating interviews, consulting with treatment groups, and participating in other Retraining Command programs, had no time for data analysis.

The Armed Forces have long made a practice of using non-professionals to perform professional tasks within their system. Most of their medical services are performed by service-trained technicians, not by doctors, while education is largely in the hands of men without teaching credentials. This practice is the practical solution to the problem of a small professional staff and a large need for service. In the Camp Elliott study, need dictated that additional staff be found. The Command agreed that one of the next group of Chief Hospital Corpsmen sent to the Camp for duty would be assigned to research.

The Chief Corpsman chosen was selected from a group of three on the basis of his test records. Though he had not finished high school, and though he was seen as the least promising of the three by Command staff, largely because of apparently poor verbal facility, his tests showed that he was of superior intelligence and had a flair for mathematics. Beyond some limited experience in keeping medical records, he had had no experience with statistics nor with research. He had no prior acquaintance with social scientists.

In keeping with Armed Forces tradition, the Retraining Command staff had previously assigned six confined men (retrainees) to help in the administration and scoring of tests given to retrainees at reception and before release; this group helped with special research testing as well. The Chief Corpsman, faced with research program pressures, a backlog of data already collected, and his need to learn a minimum about the processing of data, was in no position to handle the workload alone. His immediate need was for more help. Retrainees were in plentiful supply, and there was little for them to do. Within a few months he had developed the research section from one using the part-time services of the retrainees engaged in testing to a semi-automated data

processing unit employing 42 retrainees.

Research was done on a production-line basis. The testing section remained, but it had doubled in size. In addition, there was a section to handle population accounting for the Command as a whole (a new service taken on by research); one for data preparation and reduction (coding), which included filing and a typing pool; another for data analysis; and a fifth for computation. This last function was performed on five hand calculators which were run in two shifts, from 8:00 A.M. to midnight. Each section was under the direction of a Corpsman, five of whom had subsequently been assigned to the project at the Chief's suggestion. They reported to the Chief Corpsman who directed the work of the entire unit. This unit handled not only data from the several research studies, but was able to run an operations accounting system for the Command as a whole and to do special studies for other Navy facilities in the area.

The data processing unit was set up to get a job done, not to train men in research. There was thus no attempt to teach an approach to research, nor to create a hierarchy of skills which would permit the retrainee to work his way up to more responsible positions--things which would need to be done if on-the-job training were

to be given to career research workers. The retrainees were concerned with return to Naval duty, not with new careers. But the Chief Corpsman was, though he did not know it at the time. After five years with the data processing unit he was ordered back to active sea duty. By this time he had been encouraged by his research experience to complete high school work through extension courses. Two years later he retired from the Navy, took a civil service examination as a statistician, using his Navy experience as qualification, and began work in a state agency research unit. He is now nearing college graduation, with a major in mathematics and statistics, has published more than twenty technical research reports, and has given papers at two professional meetings.

The Chief Corpsman would not in any case have been an occupational failure. But he had never seen himself as an "intellectual". Without his accidental involvement in the research unit, he was unlikely to have pursued a professional career.

What can be learned from the Camp Elliott experience?

1. Many necessary research tasks can be performed with a minimum of training. These are not limited to computational routines.

2. An apprenticeship can be served on the job as
   well as in graduate school. Academic experience
   may in fact be more meaningful and more effective
   if it accompanies or follows related work experience.

3. Persons who are considered relatively "non-verbal"
   and hence are cut off or discouraged from academic
   advancement may possess skills that are lost from
   development because of academic emphasis on verbal
   modes of functioning.

4. Even persons who are considered behavior problems
   serious enough to warrant confinement can work
   productively on technical white collar tasks.
   Though the retrainees assigned to research were
   usually not the pick of those available for
   assignment and were sometimes serving time in
   the brig, disciplinary problems in the research
   unit were minimal and morale was high. Many of
   the retrainees worked nights and weekends on

their own initiative.[19]

State prisons: the inmate researcher. Our prison system

provides a captive, generally youthful, and largely idle

population. Medical researchers have long taken advantage of

the situation by using inmate volunteers to try out new drugs

or procedures on a large scale. Social scientists have some-

times done the same, not only to study crime and delinquency

problems but also as a way of finding large numbers of easily

available subjects for other types of studies.

Prison administrators also make use of inmate availability.

Inmates not only handle most of institution maintenance, but

perform a variety of clerical tasks. In a few prisons they

have also been trained to do research.

One of the most impressive examples of the potential

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[19] This last point is worth noting, for it has implications for training. A similar experience occurred at the California Medical Facility, where inmates perform routine laboratory work for the physicians who work in the institution. There were frequent complaints about hours and workload in the laboratory. The introduction of several outside medical research projects into the institution increased the demand for laboratory work, but the number of complaints actually decreased and there was a marked improvement in the laboratory's efficiency and output. The Research Coordinator at the Facility attributes the new esprit de corps among the inmate assistants to the role of the outside researchers who treat them as technical colleagues with a stake in the successful outcome of the research. Some have been given specialized training on new equipment and new procedures for specific projects.

This experience suggests that the use of non-professionals to do the "dirty work" for professional staff will not necessarily result in the effective performance of routine tasks. Routine is better performed when it is seen as a necessary part of a total team effort.

strengths available in non-professionals comes from the

State of Indiana.[20]   Six institutions handle its adult and

juvenile offenders, women as well as men.   There has been

little integration of program over the six and no central

record keeping system.

Three years ago a young inmate, serving a one-to-five

year sentence in the Indiana Reformatory for assault and

battery, discovered that some outdated Remington Rand

punch card equipment, formerly used by the Motor Vehicles

Department, was stored in the institution's basement.[21]   The

inmate had a B.A. degree in business administration and

before his arrest had worked for a year as supervisor of

a medium-scale computer installation in a steel company.

He saw the possibilities of using the equipment to set up

a data processing system for the Reformatory and, at the

same time, to provide training for other inmates.

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[20]Information on the Indiana program was provided by the
courtesy of the Data Processing Coordinator of the Indiana
Department of Correction.   For published reports on the
Work of the inmate-run Tabulating Department, see: EDP
behind prison walls, Business Automation, May 1962, 34-36;
a controlled training environment to challenge the EDP
industry.   Data Processing Digest, 1963, 9, 19-23.

[21]This consisted of 20 keypunch verifiers, one sorter,
one interpreter, one reproducing punch, and two tabulators.

Working with a 23-year-old fellow inmate who had taught himself something about data processing, he spent five months developing a proposal to present to the institution staff. He was supported in this by the institution's Assistant Superintendent of Classification and Treatment, to whom much credit is due for his readiness to accept the idea of an inmate-run system and for his ability to modify institution policy to bring it about.

The proposal was accepted and the machines transferred to an unused basement room which was turned over to the inmates. More important, the institution agreed that the men in the Tabulating Department, as it was named, were to be placed on an honor system, without custodial supervision, and were to be housed in a separate unit where they could work together in the evening hours.

The first inmate class opened in the fall of 1961. The course was publicized through the institution newspaper. Screening was rigorous. A minimum I.Q. of 105 on the Revised Beta Examination and a grade level of 8.0 on the Stanford Achievement Test were required, though men who fell below these standards might qualify if their performance on other tests was high. In addition, the

applicants were required to solve a problem in logical

thinking,[22] to write an essay on "Why I want to study data

processing," and to take the IBM Machine Operators Test and

IBM Programmers Aptitude Test.[23] There is also a personal

interview to assess the applicant's motivation for the

course and the extent of his previous attempts at self-

improvement.

Eleven men passed this screening. They ranged in

age from 21 to 30 years. Four had earned some previous

college credit. Four had not finished high school.

Classes were taught by the inmate who had originally

conceived of the project. The eleven became the sub-

sequent teachers for the Tabulating Department and the

first to develop and run the institution's data processing

system. Their first task after selection was to put the

obsolete machines into operating condition.

The training program for the Tabulating Department

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[22] The problem requires the applicant to find all three
solutions and write each solution out in sequential order for
the following: "You want exactly four gallons of water. You
have a three gallon bucket and a five gallon bucket. The bases
are such that one bucket will not fit inside the other and there
is no way to measure or mark the containers."

is more rigorous than the screening required to enter it,
and is constantly being revised to take account of the
teaching experience and of changes in the data processing
industry. After each class, the instructor rewrites the
class outline to emphasize those points the students have
questioned. No instructor teaches the same machine twice.

The course is divided into three parts, the total running
approximately five months. Phase I has 168 hours of in-
struction and covers a variety of key punches, verifiers,
sorters, interpreters, reproducers, collators, and accounting
machines. Phase II, with 120 hours of instruction, covers
programming and wiring for the IBM 407 Accounting Machine,
the 101 Statistical Machine, and the 604 and 609 Electronic
Calculators, and for the Rem-Rand 60-120 Computer and the
1004 Card Processor. Phase III, with 96 hours, covers flow
charting and programming for the IBM 650 and 1401 computers.
In addition, there is an advanced computer class, taught by
and to the graduates of Phase III.[24]

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[23] A summary of test performance is available on the first
40 students who enters training. The average I.Q. is 113,
with a range of 96-133 (the average for the institution as a
whole is 98). Average score on the Stanford Achievement Test
is 8.8, with a range of 6.5-11.2 (the institution average
is 6.3). Average scores on the two IBM tests are in the above
average range. (Quoted in "A controlled training environment to
challenge the EDP industry," op. cit.)

[24] This description of the three phases is taken from the curri-
culum as revised on 10-1-62. Subsequent revisions have been made,
deleting obsolete machines and moving the teaching of others from
later to earlier phases. New computer systems have been added to
Phase III.

No IBM equipment is available to the students and the only Rem-Rand machines are those originally obtained from the Motor Vehicles Department. The students work from manuals donated by private organizations. There is also a Minivac 601, a desk model educational computer donated to the Department, which is used in teaching the principles of computer operation.[25] Classes are held four hours a day. The students work in the Department's data processing program in the afternoons, and have three to four hours of homework each night. There are daily quizzes and a 400 question final examination for each phase. Students who pass Phase I successfully are given a Certificate of Accomplishment. The same is done for Phase II. After the successful completion of Phase III, the student is awarded a Data Processing Certificate which has been endorsed by the Central Indiana Chapter of the Data Processing Management Association. In addition to their performance on class work, students are graded on their outside reading, mathematics, use of a slide rule, business applications, procedure writing, business English, and their contributions to the service work of the Department.

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[25] As of 6-20-63, the Tabulating Department had been in contact with 297 persons and organizations and had received the equivalent of $33,908 in books, manuals, and other materials.

The students work from 7:30 to 6:00, seven days a week. Homework is done in their living quarters. The inmate teachers work from 7:30 A.M. to 10:00 P.M., also seven days a week. They are paid, at the rate of five cents an hour.

There are course dropouts. These are usually due to weakness in mathematics and/or in comprehension of the applications of the machines. The highest failure rate occurs in the 1401 course. To pass, an 85 per cent average is required. The final examination has one problem (the student must construct a flow chart and symbolically program a complicated business application of the computer) and is graded A or F--no errors are allowed. This problem counts 80 per cent of the Phase III grade.

What of the students? As of January 1964, 90 students had been given some training in electronic data processing. Fourteen had completed all three phases and been awarded the Data Processing Certificate. Of the fourteen, six have been paroled or discharged; four are presently in jobs in data processing and two are still looking for work in this field.

The first supervisor of the Tabulating Department, the inmate who initiated the program, was transferred to the State Prison early in 1963 to assume a newly created position, Director of Penal Data Processing. His job was

to set up a data processing system to cover all six of

the state's correctional institutions. He was paroled the

following year, and is presently Assistant Director of

Classification and Treatment for the Department of Correction.

This man, of course, had had data processing training

and work experience before entering the prison system, but

the program did not stand or fall with him. He had trained

his successor before his transfer to the State Prison

(the first duty of each supervisor of the Tabulating

Department is to train the man who will follow him), and

all subsequent supervisors of the Department have received

their training there. It is not necessarily the men with

the most education who go the furthest. One of the students

entered the Reformatory when he was 18 to serve a ten-to-

twenty-five year sentence. He had not finished high school.

Forty-two months later he had completed a high school course,

was taking university correspondence courses, and had be-

come Chief Instructor of the Department. Another student

entered training after seven years in the Reformatory. Almost

16 of his 32 years had been spent in institutions. He has

also acquired a high school diploma and a semester of college

credits and is described as "the pillar of the advanced

programming class."

Though not all the students are this successful, the
Department itself has functioned well on the honor system.
As of January 1964 there had been only one disciplinary
incident in 170,000 accumulated man hours.

Training has been extended from the Reformatory to
some of the state's other correctional institutions. Classes
have begun at both the State Prison and the Girls' School,
with instruction given by the Reformatory inmates. At the
latter, classes are attended by both inmates and staff. Special
classes in Penal Data Processing have also been given by the
inmates to institution custodial staff and civilian personnel.
The Department is prepared to give courses on four different
computers.

In addition to its training program, the Tabulating
Department performs a growing number of services for the
Reformatory and for other parts of the correctional system.
Tehy do all statistical reporting for the institution. They
developed a punch card system to help the Supervisor of
Central Stores maintain inventory control. They prepare
the monthly and annual movement reports for the Division of
Probation. They helped the State Prison Data Processing
Office (which is staffed by professionals with some inmate
assistants) set up a statistical reporting system for that
institution and do all the key punching and tabulations
for its reports. They have prepared special reports for

the Board of Corrections and other state agencies and have
helped graduate students from nearby universities with data
processing on their research projects.

The Department has attracted a good deal of attention,
both in Indiana and in other states, and has been written
about frequently in data processing journals. Several
tours have been arranged for the Department's students
and teachers to data processing installations outside the
Reformatory--the first time any of them have seen computer
equipment in operation.

Another model of inmate training is provided by the
State Prison of Southern Michigan. The State Highway
Department has been running a school for computer programmers
at the Prison since the fall of 1961. Students who have
finished the course are used to program Highway engineering
problems. The school was organized by the Michigan Department
of Corrections and the Systems Service Company. Instruction
is provided by educational personnel from computer
equipment manufacturers and from the Programming Unit of
the Highway Department.[26]

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[26] Information on the Michigan program is taken from an unpublished manuscript, "Inmate Computer Programmers at
Michigan State Prison," March, 1963, made available through
the courtesy of the Prison Programming School.

The first announcement of the class drew 300 applicants.
A third of these were eliminated on the basis of intelligence
and education test performance. The remaining group was
narrowed to 40 by tests of vocabulary and word meanings,
general mathematics, and abstract and symbolic logic,
most weight being given to the latter. Personal interviews
further reduced the group to 22.

This first class had an average grade level of over
twelve and an average I.Q. of more than 130.[27] One of the
group had had a year in college and another had graduated
from high school. The remaining 20 had not gone beyond
the tenth grade. None of the men had any notion of what
computers or programming were like. They expected to be
trained to run some type of machinery and were actually
disappointed to find that they worked primarily with paper
and pencil.

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[27]
   This is substantially above the averages reported for the
Indiana students (average grade level of 8.8 and average
I.Q. of 113). However, there is no information on the
tests used at Michigan and the figures may thus not be
strictly comparable.

The course covers computer concepts and programming. Operating manuals are provided, and an IBM 026 key punch has been installed in the class quarters, but other machines are not available. The men in the first class were taught to program for the RCA 301 and the IBM 650 and 1620 computers, and were given sufficient instruction on the 1401 to program output format. More recent classes are being taught to program the 1401 completely. In addition to their formal instruction, the students, working in groups of three, are required to program sample problems. After six-and-a-half months of training (following instruction on the 650 computer), they begin programming of engineering and data problems for the Highway Department. This Department, and its equipment, are 40 miles away from the prison. To help coordinate the work of the two units, a professional programmer from the Department has been assigned to work with the inmate group.

Seventeen of the 22 men in the first class completed the course. Five of these have been paroled. As of July, 1962, two of the five had obtained employment as computer programmers and a third was being seriously considered for a programming position.

The California experience provides an interesting variant on that of Indiana and Michigan. Inmates have

been used to help in data processing for the past five

years, but there has never been a formal training program.

In 1959 an inmate clerk at the California Medical

Facility, the most research-oriented of the state's prisons,

was assigned to perform some routine clerical tasks for

two research staff members. The problems posed by their

research (the development of a personality test for

classification of social maturity) involved some complicated

statistical data analysis. The clerk, who had spent a

good part of his life in youth and adult correctional

institutions and was then serving his fifth term, had

taken a few college courses but his formal training

and work experience had been limited to the printing and

photographic trades. He had an interest in mathematics

and time on his hands. Research staff discussed some

of their statistical problems with him, and he began

to read statistics books in his spare time.

The clerk became the first inmate member of the

institution's present Data Processing Unit. After his

parole, he was hired back by the Unit in a research

position, for which he qualified by passing a civil

service examination. The State Personnel Board, in a

precedent-setting action, declared that his research

experience while confined was equivalent to paid research

experience outside of prison (which in turn can be sub-
stituted for formal academic achievement). He has since
been discharged from parole, the first he has successfully
completed, and is now working in an advanced research
position with the state. On his last civil service
examination, he scored first in a field of sixty.

The Data Processing Unit itself has had an uneven
history. Originally set up to handle the personality
test project, it expanded its functions to the processing
of data for other Department of Corrections research
and for a time was handling research data from outside
the Department as well. Its equipment has grown from the
original hand calculators to include key punches, sorters,
a reproducer, a collator, and access to university
computers. The machines are run by inmates who also
do statistical procedures on hand calculators as well
as coding and other clerical tasks. Some of this expansion
was occasioned by the introduction of a National In-
stitute of Mental Health funded project into the
institutions.[28] The project was set up at the Medical
Facility because of the availability of inmate help, and

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[28] Social Agency Effectiveness Study. The study is
sponsored by the Institute for the Study of Crime and
Delinquency and is directed by Don M. Gottfredson.

project staff (the director and a statistician) have hired

inmates and parolees to handle all of their data.   Together

the project and the Data Processing Unit employ some thirty

inmates.   The institution superintendant has been unusually

supportive to this development since its inception and has

made its rapid growth possible.

Unlike both Indiana and Michigan, systematic training

of inmates in data processing has not been attempted in

California.[29]   Inmates are recruited on the basis of their

social history records and past work experience plus word

of mouth recommendations from the institution counselors.

Training is given for the tasks assigned.   Some inmates

have managed in this way to pick up a fair amount of

experience in the handling of data; others have not gone

beyond specific coding or calculation assignments.

It was the hope of staff who originally developed

the Unit that it would become a permanent service

facility to the Department as a whole and would eventually

take on some of the routine statistical accounting functions

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[29] One inmate member of the unit who had had some data
processing experience prior to his confinement gave a
course to a combined group of inmates and staff in "Data
Processing and Systems Development," but this effort has
not been repeated.

performed in the Department's central office. There has,
however, been little central administrative support for this
idea, while considerable concern has been expressed about
the ability of inmates to be trusted with the effective
handling of data. This concern has sometimes been justified.
There has been frequent staff turnover and the inmates
have not always received the kind of supervision necessary
for persons working in an unfamiliar field. Because there
is no systematic training program, there is little commitment
to career development on their part, and there is often
little commitment to the projects on which they are
employed. The dedication and close group feeling of the
original members of the Unit have been dissipated and
for many the Unit's work has become just one more clerical
job.

This difficulty has not been experienced with those
inmates employed on the foundation project. Though here
too there has been no systematic training program, demands
for performance are higher and the inmates are in continual
close touch with staff (they work in adjoining rooms and
the doors are always open).

The original inmate clerk has been a clearly success-
ful graduate of the Data Processing Unit experience. Others

have been hired in data processing and research roles, but
not all have made it. The Medical Facility project has
hired back two of its former work crew as parolees. The
first, a man with a severe alcoholic problem, worked
effectively when he was on the job but would disappear for
long periods when he got a paycheck. His personal dif-
ficulties were aggravated by the uncertainty of his job
future; his assignment on the project was a temporary
expedient until he could qualify for a civil service data
processing technician position. The position did not
materialize and the man himself is now back in prison.
The second parolee managed to last for the duration of
his temporary assignment, but he too would disappear
for periods of time--the problem in his case was gambling.
As of this writing, project staff are planning to hire
their present inmate work supervisor as soon as he is
paroled. They have high hopes for him.

Another inmate who had had research experience in
the Data Processing Unit was hired, some time after his
parole, by the Youth Studies Center at the University of
Southern California. His task was to collect information
on community problems and resources for a study of the
narcotic problem in East Los Angeles. After several months
on this job, the Center released him, reluctantly, to take

a research position with the State of North Carolina. He

was replaced by another parolee from the Medical Facility

Unit who is currently collecting interview and other data

for a study of a halfway house for delinquent adolescent

boys.

Research includes activities other than data processing.

In California, two inmates turned to research methods,

on their own, to answer questions of importance to them.

The first was confined in the women's prison. Concerned

about the personal problems shown by many of her fellow

inmates, she undertook a study of the attitudes of women

prisoners toward group therapy. She reported on her method

of sampling and its inadequacies, described her interview

technique, coded interview responses on a scale, and related

these to inmate characteristics. Though her statistical

handling of the data did not go beyond the computation

of percentages, research conceptions were clearly not

beyond her. Staff (including research staff) learned

about the study only after she had laid a report of it on

the superintendent's desk. The study, she felt, called

for an expansion of available therapeutic services.[30]

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[30] A survey of inmate attitudes toward group therapy in a
women's institution. The Research Newsletter, California
Department of Corrections, 1961, 3, No. 1, pp. 5-8.

In another institution an inmate became upset by remarks of a visiting Parole Agent on the lack of parolees' contributions to the outside community. He was first angry, then wondered if perhaps the remarks were justified. He requested permission to study inmate attitudes in the treatment unit in which he was living and was assigned as the institution's first research clerk. He began by collecting demographic data in his housing unit and re- lating this to social groupings within it. He developed and administered attitude questionnaires and ran some short experiments (such as implanting rumors and tracing their gossip chain, and studying the effect of rewards on interview responses). He faced the problem of dissemination of results by preparing a bi-monthly Research Report which he distributed to both staff and inmates in the unit. He turned his attention to the study of staff behavior and these findings too were fed back to the group. A member of the institution's research staff worked with him in studying the effect of interviewer group membership on staff and inmate responses to questionnaires. After his parole, he reported his experiences at a conference sponsored by the National Institute of Mental Health.[31]

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[31]Measuring the motive. In: Experiment in Culture Expansion, proceedings of a conference on "The use of products of a social problem in coping with the problem,"Norco, California,1963,91-96.

Inmates have also been engaged in other types of research. The Upjohn Company is building a complete research facility on the grounds of Michigan State Prison. Inmates will be used not only as subjects in drug research, but as research assistants as well. In California, a private physician conducting research with prison inmates has trained some of his subjects to do laboratory work on his projects. Inmates perform all of the laboratory and related clerical tasks on medical research projects at the California Medical Facility. The Facility's Research Coordinator, whose job is to handle relationships between the institution and outside researchers, is an ex-inmate.

What can be learned from the prison experience that can be applied to the use of non-professionals generally?

1. Administrative support is essential if new career opportunities are to be opened and maintained, at both a local and a central agency level.

2. Making an opportunity available is not enough. Non-professionals, as much as graduate students, need training, supervision, and guidance.

3. A sense of commitment to a job must be fostered. This is easier when the non-professional is in a job that has a future, in which he has reasonable

certainty of recognition and advancement. But

commitment can also come about when the future

itself is uncertain. What is needed--this is

hardly unique to the non-professional--is that

the non-professional be taken seriously as a

contributing member of a work effort. Expecta-

tions for performance should be high (it is

demoralizing to feel that others are making

allowances for one's weakness or inadequacy)

and failure to meet expectations should result

in the same sanctions imposed on the professional.

4. At the same time, attention must be given to

the unique problems faced by the non-professional.

In the case of prison inmates, the problems that

lead them into prison are seldom solved by

the experience of incarceration and that

experience in itself poses further problems.

Ex-offenders are not readily acceptable as

employees. They are frequently in debt before

imprisonment, and often more in debt upon their

release. The immediacy of financial pressures

and the precariousness of employment opportunities

make them wonder how much they dare commit to a

new type of job that may or may not have a future

for them. These problems must be dealt with in
preparing people for new careers. They must be
dealt with not by lowering standards for work
performance but by adjunct training and/or
therapeutic experience that help them in the
management of those internal problems and ex-
ternal realities that interfere with job per-
formance.

The outside: the school dropout in research. The New
York State Division for Youth recently undertook an interesting
experiment. Five unemployed adolescents, all school dropouts
and with delinquent histories, were hired by the Division
to work with professional research staff in the collection
and coding of interview and questionnaire data. Because
of changes in the Division's research personnel, the
experiment did not run for long, but long enough to answer
several questions and to raise others.

The five did not immediately become good researchers.
They did not even immediately become good workers. Training
was needed in work habits (such as arriving to work on time)
as well as in interviewing and coding techniques. The
major difficulty,however, came in the relationship between
the five youths and the professional staff. No attention
was given at the time to re-orienting professional staff

toward their changed roles vis-a-vis the apprentice researchers, and the professionals largely ignored them. The group of youths, too small to build any group identification among themselves, began--unsuccessfully-- to imitate the professionals.

Now the use of non-professionals in research may not only be a way of providing jobs to people who are becoming increasingly without them, but it may have unique advantages in its own right. In the case of this group, tape-recorded interviews showed that the same subjects responded quite differently to the dropouts and the professionals. Delinquents who appeared inarticulate and passive then interviewed by the professional researcher were far more animated and highly articulate--in the language of the streets--when talking with the adolescent interviewers. Moreover, the information obtained by the dropouts was not the same as that obtained by the professional-- not truer necessarily, but different. Non-professionals may thus provide an entree into the lives of problem people that has not been heretofore available.

Building on the New York experience, the Center for Youth Community Studies at Howard University has obtained a Federal grant to train ten school dropouts for new careers. Four are being trained for positions in day care center,

four for positions in city-run recreation programs, and

two for positions in research. The two are learning

about research by studying the other eight.

The non-professional: where does he do research?

Research in the social and behavioral sciences is

done in four places: the university, the private research

organization, the research-granting foundation, and the

social agency.[32]

Universities, as they are presently structured, offer

no scope for the non-professional. Their only use is in

temporary interviewing or coding positions on projects run

by university institutes or departments, and even here

graduate students have first call on employment. But

perhaps universities can alter the way they do research

and the way they train researchers. The collaboration of

university faculty and graduate students with non-professionals

who are part of specific social problems--the delinquent,

the school dropout, the mentally ill, the economically

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[32]Training for technical occupations in the physical and bio-
logical sciences is requiring increasing amounts of formal
education. It is quite possible that the new jobs opening in
these fields could be filled by persons trained on the job and
given opportunities to move up into more professional roles as
they gained experience and skills, in much the same way as
suggested here. The writer is unfamiliar with job possibilities
in these areas, and this section is thus limited to a dis-
cussion of research in the social and behavioral sciences.

displaced, the minority group member--could revolutionize

our teaching and research approach to such problems and

might alter drastically the kind of social science data

collected as well.[33]

This kind of collaborative research offers two things.

First of all, it suggests a way of setting up training for

research that bypasses the usual channels of university

education. The examples cited above indicate that higher

education may not be all that important, for certain types

of research functions at least. An apprenticeship served

outside these channels may develop a group of competent

technicians who can be employed in the nation's rapidly

expanding research interests. And it may build a way for

persons whose school experience was too unsuccessful to

make college training feasible to develop the interests

and skills necessary to move back into the mainstream of

academic education. The second point concerns the type of

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[33] "...this...points out an interesting methodological approach
to the solution of any social research problem. Our inordinate
desire to follow in the safe footsteps of the physical scientist
is nowhere more disastrous than in the area of methodology. Had
it not been for this reluctance to devise new methods, we might
long ago have hit upon the incorporation of research subjects
as members of the investigatory team. No doubt there have been
countless times when some physicist would have welcomed the
opportunity to ask an atom just how he might best be studied.
Fantasy ceases when such a question is directed toward another
communicating organism." Fowler, R. Role transactions in an
integrated research unit. The Research Newsletter, California
Department of Corrections, 1961,3, No. 1, p. 12.

data collected. The involvement of people who represent

problems in the initiation of ideas and the design of

research may lead to more realistic appraisals of these

problems and to new insights on ways of dealing with them.

Private research organizations, such as the national

opinion polling and market research organizations, and

foundation-supported projects, either private or government

sponsored, may provide possible sources of jobs for the

trained non-professional. By far the greatest area for

potential employment, however, is the social agency,

particularly those municipal, county, and state agencies

that are concerned with aspects of the social good--public

health, education, welfare, mental health, and corrections.

There is no question that services in these areas are

increasing, both because of a growing population and be-

cause people now demand greater amounts and variety of

service.

But as services increase, so do expenditures, and as

expenditures rise, so do demands for improved agency per-

formance. The one thing of which we may be certain is that

agencies charged with these responsibilities are going to

innovate, at increasing rates. We may also be certain that

innovation will not always be accompanied by evaluation,

and that enormous amounts of money will be wasted because

new ideas are tried haphazardly and experience with them is neither recorded nor communicated to other groups concerned with the same problem.

If social agencies and the governments they serve are to proceed rationally in spending money for the public good, research must be a part of their everyday operation. This means that an agency's staff should include persons whose specific job it is to sample the agency's behavior and collect information on the performance of its clients. In an education system, this may refer to methods of teaching, or organization of teaching personnel, and pupil performance. In public health, this may refer to programs of public education and incidence of disease. In vocational training programs this may refer to what a counselor does and whether or not the counselee finds an appropriate job and how he performs on it. This kind of evaluation is not a one time thing, but a necessary part of the agency's ongoing operation. Just as industries have built-in fiscal accounting and quality control procedures, so social agencies should have built-in operations accounting and quality control. This is all the more important when agencies begin to spend money on new kinds of programs to improve their services.

This field offers especially useful opportunities for the non-professional. To begin with, professionals have little interest in social agency research and would not in any case be available in large enough numbers to meet the needs that exist. Non-professionals may also be better able than university-trained researchers to bridge the gap that too often exists between the man who runs the system and the man who tries to evaluate it.

Not every university graduate can do research. Not every non-professional has the talent for it. But there is a sufficient shortage in the supply of professionally trained researchers, and sufficient evidence that non-professionals can be trained to fill this gap, to suggest research as one of the most promising new careers.