THE IDENTIFICATION OF INSTRUCTIONAL PROBLEMS OF TEACHING ASSISTANTS IN CHEMISTRY

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PREFACE

This report represents the metamorphosis of an idea. Initially it started with the belief that teaching assistants have problems that can be helped, and that someone ought to find out the best way to help them. Quite naturally this led to the idea that there should be an experiment, hopefully proving that teaching assistants who had help did a better job than those who were left to their own devices. Survey and analysis of this approach revealed that (1) proof of value of change in educational procedure is very difficult; (2) there was certain to be a lack of personnel, time, and funds available which would hamper research with an experimental design; (3) no one had made an attempt to discover systematically just what really are the problems of teaching assistants; and (4) any research in the area should be proceded by a thorough understanding of these problems. Thereupon, the purpose of the research was founded

But how do you carry on research which ends with problems, instead of solving problems? Reading revealed that anthropology had developed a tool--used for years in the study of primitive people--but only recently adapted to the study of organizations in complex society. Participant observation, utilized in a sociological study by Howard Becker and Blanch Geer at the University of Kansas Medical Center, appeared to be a suitable research procedure. In addition, a teacher evaluation program, in the chemistry department at Oklahoma State University, already armed with a student rating scale for teachers, was made available for sampling student opinion. Thus, an exploratory

problem was made operational.

Needless to say, what has been done here is just the beginning. If this be metamorphosis, then the idea is still in the "pupa" stage. Perhaps it may best be left dormant until a favorable "climate" prevails.

The assistance of many people who have contributed to the work remains to be acknowledged. First of all, there is Don M. Orr, for many years professor of agricultural education at Oklahoma State University, who during high school days, taught the author how to take a problem and analyze it into elements which could be "worked on". This skill saw much use in this research.

My committee contributed much in suggestion, support, and criticism. My heartfelt thanks go to Dr. Kenneth Wiggins, chairman, Dr. Harry K. Brobst, Dr. Henry P. Johnston, and Dr. Roy W. Jones. Dr. Robert Sweitzer, a previous committee chairman, had much to do with the planning and the design of the research.

I am deeply indebted to the chemistry department at Oklahoma State University for its cooperation in this study. Dr. O. C. Dermer, department head, and Dr. Johnston, chairman of freshman chemistry allowed me many privileges, without which the research could not have proceeded. The staff individually spent many hours, listening to my questions and conscientiously answering them. Not the least important were the 22 teaching assistants, who permitted me the privilege of watching them work, and sharing their problems.

Then there was the contribution of my family, who came to believe that the "paper" was a household invader who would be with us always. They successively promoted and despaired, yet resolutely insisted that it be finished.

Finally, the "hand" that laid most heavily upon the work was that of my daughter, Carol Wall, who typed the revisions and the final copy.

To these I am humbly grateful.

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CHAPTER I

THE PROBLEM

Introduction

Extensive use is made of teaching assistants in beginning courses in science at most universities. Such persons are used in the field of chemistry as well as in the other areas of science. As a rule the assistants have no formal training in psychology or education and are without previous teaching experience; yet they are the first direct personal contact of beginning students with chemistry. They are also the pool from which future instructors are drawn for teaching on the college and university level. Therefore, the improvement of teaching methods used by teaching assistants would appear to be a "target area" for the improvement of science teaching in higher education.

The Purpose of the Study

In the area about which this study is concerned, there is little evidence of systematic research which would bring about improvement (Cooper, 1964). Actually very little is being done by most chemistry departments to help teaching assistants teach (Carter, 1964). There usually are one or two sessions at the beginning of the fall semester to provide for administrative briefings, and perhaps one session in which techniques of classroom management are relayed to the assistants.

During the academic year, there are often junior staff meetings scheduled to inform teaching assistants about changes in plans, what materials to emphasize, how to conduct laboratory sessions and the physical arrangements for hourly tests. Occasionally a professor of chemistry will become so concerned about the work of teaching assistants that he will write an article in a professional journal about the problem. These may deplore the use of teaching assistants (Caldwell, 1959), outline a procedure for giving them guidance (Lippincott, 1959), or suggest procedures for the assistant to use in doing his job (Cheronis, 1962). These were found to be "how I do it" articles and in no sense reports on research.

The determination of pertinent problems in a field of research or study usually is done by analysis of personal experience of the researcher and associates, by the collection of data from literature and other sources, and by the utilization of certain logical reasoning processes (Van Dalen, 1962, p. 111). Because of the paucity of research of the work of teaching assistants, and because of the seeming lack of interest among members of chemistry staffs in initiating improvement, an extended inquiry into the problems of teaching assistants seems appropriate.

Therefore, the purpose of this study is to systematically provide a basis of understanding for the initiation of change and the development of research in the work of teaching assistants. The understandings which will be herein effected are about the work of teaching assistants in the chemistry department at Oklahoma State University. The change anticipated would be in the form of a program within the department. This program should be an overall plan for the improvement of teaching assistants' work in this department. No matter

how extensive this plan is, some method of evaluation would be desirable which would determine whether the change improved teaching. This evaluative function could become a predominant feature of the plan. In this respect, this study is the identification of problems for research.

As previously stated, this study will specifically concern one aspect of the work of one chemistry department in one university. However, by characterizing as fully as possible the teaching assistants observed in this research, by describing the type and the organization of the beginning chemistry courses at Oklahoma State University, and by describing the perspective concerning this aspect of chemistry instruction of the chemistry staff at Oklahoma State University, some universality of the findings of the study should be apparent.

Statement of the Problem

This study is an attempt to define as precisely as possible the problems of teaching assistants in chemistry and ascertain to some degree the relative importantce of these problems.

Analysis of the Problem

The problem naturally divides itself into three areas of inquiry. First, how can the teaching assistants be described? Second, what are the instructional problems of the teaching assistants? Third, to further clarify and characterize the problems and to suggest possibilities for further research, solutions to the problems and an overall training program are suggested.

In the first area, which deals with the description of the

teaching assistants, five problems were selected for investigation: (1) A study was made of the identifying characteristics including age, sex, previous experience, academic records, and original home of the teaching assistants. (2) Motivating factors such as reasons for entering the chemistry field, interests, goals, and reaction to students were investigated. (3) Characterizing personality traits were studied. (4) Status of the teaching assistants with respect to general knowledge, educational knowledge and techniques, and chemical knowledge were studied. (5) Classroom behavior of the teaching assistants was characterized.

In the second area of study, which deals with a compilation of the problems of teaching assistants, there were present (a) problems of relationship between the staff and the teaching assistants, and between students and teaching assistants, (b) communication problems such as disruptions in the flow of information between hierarchial levels, (c) problems arising from the lack of educational knowledge and experience, and (d) problems arising from organizational and physical factors.

Three groups of people were able to help in identifying these problems. First, there were the chemistry staff members--especially those who supervised the teaching assistants or taught freshman chemistry. Second, there were the teaching assistants themselves. Third, there were the students who studied under the teaching assistants. Information was gathered systematically from each of these three groups and then reconciled.

Data from the staff was collected by participant observation. Data from the students was collected by use of student rating scales,

interviews, and observations. Data from the teaching assistants was collected by participant observation, formal interviews, two simple questionaires, and from the permanent files of students and graduates in the office of the Department of Chemistry, Oklahoma State University.

Analysis of identifying characteristics was made by descriptive summaries. Analysis of the data from the Cattell and Strong tests was made by comparison to norms developed by the authors and users of these tests. Analysis of the material from the student rating scales was made by quasi-statistical methods explained in Chapter III under "Method of Analysis". These data were incorporated later into the participant observation analysis.

For data collected by participant observation, and also for the data summarized from the unstructured responses on the back of student rating sheets, a sequential analysis was used. Supporting evidence was supplied by anecdote, illustration and a consideration of the frequency, range, and collective character of assimilated problems. An attempt was made to describe adequately the conclusions drawn, the evidence supporting the conclusions, and the manner by which they were arrived. The reader can make his own judgment as to whether they are warranted.

In finally deciding whether problems were amenable to a training or assistance program, they were reviewed in terms of the characteristics of the teaching assistants, the operational climate--type of course, the course organization, and the physical conditions--and the staff perspective--the response of the staff to the training program. Evidence from data are presented as in participant observation. Conclusions are drawn in terms of organizational behavior theory (Griffiths, 1964 and Bennis, 1965).

Limitations of the Study

This is an exploratory study. There is no attempt to prove the effectiveness of one teaching method as compared to another. Since no attempt is made to control variables, we cannot expect to get positive answers about the causal effect of one variable upon another. Neither should it be construed to be the final answer as to what problems teaching assistants always have, no matter where they work. This is an attempt to systematically select those problems which are common to one set of teaching assistants working in a particular chemistry department with a specified body of students under the existing condition at the time of observation. The problems selected and described are those which under the specific conditions and in view of of the perspective of the present chemistry staff at Oklahoma State University appear to have the possibility of amenability as outlined in the summaries and the conclusion. The plan for a training program as presented as part of this conclusion is presented not as the culmination of that conclusion, but as a part of the description of this research--on the assumption that the problems involved can be described better in terms of a program for their correction. This suggested program should be viewed as a basis for further study; its implementation could be a part of any further research into improving the work of teaching assistants in chemistry.

Though the results apply, as suggested above, to a very limited situation, it is hoped that the characterization of the teaching assistants, and the description of the conditions under which they worked, will permit the application of the results to different surroundings.

The tools used in this research are not those which gather data leading to precise answers. The use of instructor rating by students can be supported only to the extent that the validity of student ratings are supported (Remmers, 1963 and Sorey, 1966). Participant observation depends upon the acceptance of subjective data, the validity of which must be proven within the context of the individual study. The intrusion of another person into the area of activity of an individual or group, no matter what safeguards are taken, must be expected to make changes. In this research these intrusions took the form of classroom visits, of conversations between the observer and the other teaching assistants, and the presence of the observer in discussion groups. An attempt was made to minimize this effect by the identification of the observer with the teaching assistant rather than as a member of the supervisory staff. The recognition of the bias in this type of research allows for compensation; yet the limitations on objectivity certainly must be accepted.

Definition of Terms

This study cannot be adequately described without the use of several appropriate terms. Such terms follow:

1. Teaching Assistant. A graduate student teaching part-time as an assistant in one of the departments of the university. When used in this study, the term usually will refer specifically to graduate assistants teaching first-year chemistry students at Oklahoma State University. Such persons are actively engaged in procuring a higher degree and teach as a means of support for that endeavor.

2. Permanent Instructors. Assistant professors and instructors on the permanent staff of Oklahoma State University who teach some laboratory sections of first-year chemistry. Since they perform the same function as graduate assistants, yet are experienced teachers, their behavior in the classroom gives a norm to which that of the teaching assistants can be compared.

3. Staff Members. This term includes all persons with permanent status in the department of chemistry at Oklahoma State University. They may or may not be directly associated with the first-year chemistry program, yet as staff members they exercise some influence on the educational policy of the department.

4. Students. Undergraduates at Oklahoma State University who are enrolled in first-year chemistry courses.

5. Instructional Problems. Any difficulty confronting teaching assistants in connection with their teaching responsibilities in first-year chemistry. As used here, it may refer at times to difficulties arising out of administrative processes and physical conditions.

6. Training Program. An in-service aid program to be designed to help teaching assistants become more effective in their teaching activities. At times it may be desirable to include technical assistance and facility improvement as well as training activities. In such cases, the term Assistance Program will be substituted.

7. Participant Observation. This is a procedure where by the researcher gathers data by participating in the daily life of the group or organization which he studies. Becker and Geer (1960) describe it as follows:

> The term "participant observation" covers several kinds of research activity. The researcher may be a member of the group he studies; he may pose as a member of the group, though in fact he is not; or he may join the group in the role of one who is there to observe. Though the technical problems of managing one's role and gathering data differ greatly, the researcher in any of these three situations faces the same kinds of analytic problems. . . . .
>
> In general, the participant observer gathers data by participating in the daily life of the group or organization that he studies. He watches the people he is studying to see what situations they ordinarily meet and how they behave in them. He talks to the other participants and discovers their interpretations of the events he has observed.

8. Rating Scale for Teachers. A scale for recording student reaction to instructors, developed jointly by the College of Agriculture and the Department of Chemistry at Oklahoma State University.

9. Perspectives. This is a term often used in participant observation, which describes a set of ideas and actions used by individuals or groups in solving their problems. It describes the relationship or the relative importance of facts or matters from a special point of view.

10. Theoretical Treatment Areas. In order to develop the generalizations and conclusions of this research, problems have been assimilated into theoretical treatment concepts. These areas provide knowledge and techniques which appear to provide problem solutions. The concepts utilized in this study are defined as follows:

11. Learning Theory (Educational). How do people learn? How do we control these learning processes? Certain problems which teaching assistants have may be understood in terms of educational psychology. This is applied psychology--the psychology of teaching and of learning. It would include the methodology ordinarily

associated with teaching processes. In this study a separate category is provided for problems associated with testing.

12. Communication Theory. Here are categorized those problems which have to do with the freedom of flow of ideas. The indoctrination of subject matter is only one phase of communication considered here; there must also be information conveyed to both teaching assistants and students describing desirable skills and behavior in the classroom. There must be adequate means provided for "feedback"--detailing to responsible individuals just how the work is proceding. Communication theory is concerned with techniques for expediting and improving this interchange. The chief medium for this interchange is language; yet at time other modes of concept movement are necessary.

13. Interpersonal Theory. This body of knowledge, within the field of social psychology, here is thought to connote specifically relationships between individuals. It is applied behavioral science--utilizing psychological and sociological theory, borrowing from the fields of education and communication--but occupied especially with processes and dynamics of groups and how groups affect the behavior of individuals.

14. Administrative Theory. In this area, closely related to communication and interpersonal processes, the concern is with how best to organize for productive work.

15. Chemistry (Subject Matter Organization). This category is included since the broadening and deepening of subject matter knowledge of the teacher is considered by many to be the chief means of improving instruction. Certain problems suggested by all classes of respondents fall in this area. Included are those problems which have to do with the teaching assistants' need for improving their knowledge of chemistry

and any methods that would bring it about.

16. Testing Theory. A specialized field within education has been developed in the area of testing and evaluation. Problems related to the making, giving, and grading of tests will be considered here.

17. Change Theory. Modern thinking in interpersonal and group processes suggests that changes in individuals and in institutions can be theorized. The specific considerations within this category have to do with the methodology of change--theories and methodology are drawn from applied behavioral science.

18. Counseling and Guidance Theory. This is a field of psychology that has been shown to have industrial applications. Problems which appear to be responsive to counseling and personal work were considered here.

19. Mechanics of Course Procedure. This category is basically technical rather than theoretical, and allows the research coding arrangement to be inclusive. Here are considered those problems which have to do with the mechanics of the course--which may be related to but do not fit the other categories. Though administrative in nature and sensitive to communicative processes, the problems herein are more likely to respond to "how" rather than "why"--there is little relation to any theoretical approach--yet they are problems in the real sense which must be solved by the administration or the teaching assistants.

CHAPTER II

REVIEW OF THE LITERATURE

Introduction

In examining the literature concerning this study, three features were noted. First, the use of teaching assistants is related to the larger overall problem of the improvement of instruction in higher education. Second, a search of current literature revealed relatively little interest in the problem of teaching assistants. Third, those individuals who have dealt with the problem of teaching assistants have approached it logically; research is almost non-existent.

Because of these three facts; the review of literature gives (1) an overview of the interest in and the criticism of teaching methods in higher education; (2) it touches on the professional training controversy and the related teaching-research dilemna; (3) it considers the criticism arising from the use of teaching assistants and (4) it looks at some of the efforts made for the improvement of the work of teaching assistants.

Public Interest in Quality Teaching

The public is showing evidence of becoming concerned about the quality of teaching being given to its sons and daughters in colleges and universities. One of the most tangible demonstrations of this is the effort to control standards by rewards for good teaching and the

specific requirements set up by legislative bodies for the use of building funds. For instance, the Oregon state legislature last year (Anonymous, 1965, and Willis, 1965) appropriated $500,000 to be awarded to teachers in state colleges and universities for excellence in teaching. A lack of confidence in faculty and administrative judgment is shown by the stipulation of how the recipients of these awards are to be determined: "Students shall be involved in either the nomination or the selection of grant winners. They may be involved with the nomination and the selection."

Certain elements of the American press have been quite voluble in the criticism of college and university teaching practices. The impression that articles give is that professors have quit teaching on the undergraduate level and spend their time at research, off-campus counseling or at professional meetings (Kemeny, 1963). Apprehension is often expressed that the teachers in college have lost contact with the students (Ciardi, 1965). An anonymous author (Academesis, 1960) writing in the New York Times Magazine insists that the fault lies in the research function being the key to academic advancement. He feels that people support colleges and universities to provide education for their children. "Colleges and universities are duty bound to give what they are paid to give."

Criticism from within Universities

Individuals within universities are also concerned about the quality of teaching in higher education. John Gustad (1964), Chairman of the 1963-64 Committee on Teaching of the Association of Higher Education says: ". . .thoughtful and competent observers must concede

that curricula and teaching methods of higher education are in urgent need of extensive improvement." He feels that in curriculum selection and organization, too much emphasis is placed on organization growing out of subject matter research. "A discipline organized for research is not necessarily well organized for effective teaching."

Gustad goes on to suggest that there is a need for improving teaching methods. "Unfortunately many college teachers are unashamably ignorant of the most rudimentary ideas regarding human learning." In line with Ciardi (1965), Fischer (1965), and several others, Gustad thinks the key to the whole problem lies in the lack of faculty evaluation:

> In my study of faculty evaluation for the American Council on Education, I found that although every single reporting institution listed teaching effectiveness as the most important trait considered, not a single one had an even approximately effective system for finding out whether faculty members were or were not good teachers. Until such time as teaching effectiveness is really taken seriously, progress in this important area will be painfully slow.

The teaching during the first two years of college comes in for much of the criticism. Tead (1959) suggests the first two years are often inadequate because of failure to meet the students "on the grounds of their puzzlements and confusions." He deplores the lack of direction and the failure to help students clarify their own purposes. He thinks that an effort needs to be made to "infuse the content of all courses with value judgments. What is valuable in what I am studying? Why? How are values determined?" In a previous writing, Tead (1958) suggests that "The kind of teaching first year students experience saves them for or drives them from a scholastic career. Give your freshmen your best teachers and implicate them emotionally in a learning career."

Lippincott (1965) also considers that quality teaching in the

freshman and sophomore years is the critical problem in American universities:

> This situation is desperate on two counts. First, because of what is happening to students in the lower division of the university, and second, because the public image of the faculty and the university is being damaged to the point that the public respect is dwindling and hostility is being aroused.

Lippincott suggests that we must solve the problem of quality instruction at the lower levels as rapidly as possible. He thinks we may utilize television, programmed instruction, and other methods of individual study, but that these are not enough--

> . . .the basic philosophy here--demanding that the beginning college student learn on his own without the encouragement and stimulation which contact with a sympathetic instructor provides--is questioned seriously by responsible educators.

Lippincott's concern with the problem is particularly significant since he is a nationally recognized chemistry teacher and since his statements were made in a paper presented at the April, 1965 meeting of the Cooperative Committee on the Teaching of Science and Mathematics of the American Association for the Advancement of Science. It was endorsed as a position paper by that committee. Furthermore it was reported in the Chemical and Engineering News, the offical organ of the American Chemical Society.

Training Responsibilities of Graduate Schools

Some observers believe that graduate schools are failing to assume their responsibilities in the preparation of college teachers. Thus Solotaroff (1961) says: "Indeed were graduate schools to take seriously their own announced purposes, and prepare teachers for their own undergraduate colleges, they would be very different institutions."

Carmichael (1963) also thinks graduate schools and their faculties

are at fault:

> I assume that no one today would deny that developing college teachers is an essential function of the graduate school, since about half its products enter into the teaching profession.
>
> . . .graduate professors sometimes refuse to recognize the development of the teaching art as their responsibility. Often they make no effective plan for meeting it even if they recognize it as their function. Graduate schools have not developed an integrated plan of education for graduate students covering both research and teaching, as the professional schools have done.
>
> This means that graduate schools have failed to meet one of their major responsibilities, that of preparing college teachers adequately for their task as teachers. Some blame the graduate school for this, others the graduate dean. Could it be that the structure and organization of the graduate school is at fault? To get the job done, the dean must depend upon the individual faculty members, some of which scorn the idea of being expected to assist graduate students in the art of teaching. For some odd and unaccountable reason, they seem sometimes to feel that it is beneath their dignity as scientists or as scholars to undertake the task. In such cases what can the graduate dean do but accept the professor's decision?

Improvement Through In-Service Training

If graduate schools fail to provide teacher training for graduate students, there is always the possibility of providing such training after the individual accepts a permanent position. In-service training is often considered as a means of improving college teaching. This training is often given in the form of a seminar offered at the beginning of the academic year. The following description of one such seminar is given to show what may be the nature of such an offering:

The College of Arts and Science at Oklahoma State University annually holds a Teaching Seminar, which consists of four Saturday morning sessions at the beginning of the fall term. These sessions are three hours in length. New staff members and teaching assistants are

urged to attend. During the sessions, the participants are given an overview of the University, and informed about such programs as: Student Personnel Service, The General Education Program, Services to Augment Instruction, The Research Foundation, The Computer Center, The Reactor Laboratory, Fringe Benefits of Employment, Arts and Science Extension, and The Foreign Aid Program. In the 1962 sessions, two hours were devoted to "Techniques and Methods of Teaching in Higher Education" and "Motivation and Its Application to Instruction".

Battino (1966) suggests that the past experiences of the beginning teacher do not ordinarily prepare him for teaching. He thinks new staff members should be brought to their jobs two weeks before scheduled classes begin for an orientation and training program.

Brooks (1963, page 199), in a study of the improvement of instruction in Land-Grant Colleges of Agriculture, found that thirty-seven out of fifty-four colleges reporting had some sort of an in-service program. Twenty of these reported that they had definitely organized programs. The seminar type program, operated with a teaching improvement committee was by far the most used kind of in-service program.

Disadvantages of In-Service Training Programs

Certain disadvantages of in-service training programs have been noted. By the time a person has completed a doctoral program and possibly one year of post-doctoral study, he has developed rather fixed ideas about some areas other than his field of study. (In the course of this research, the writer has had occasion to question students nearing completion of their doctoral programs about their

attitudes toward education courses. He has found rather strong negative "sets" already developed about the value of such courses.) Furthermore, persons with permanent positions in universities and colleges have other interests. They have research to do, courses of study to prepare, committee assignments to fulfill. The development of an interest in the instructional method at this stage, unless the interest is already present, is quite unusual.

Outside pressure, perhaps from other teachers, the administration, or even public or student demand, may make the consideration of in-service programs mandatory. When they are thus developed, they are normally of the nature of self-study programs and participation is voluntary. Analysis of the types of activity of in-service programs is revealing. Usually when college teachers think of improvement of teaching, they include such things as adequate clerical assistance, ample instructional materials, smaller teaching loads, opportunity to visit other colleges, membership in professional organizations, and exchange fellowships. The least wanted is classroom visitation by other professors or the introduction of consultants into a program.

Cooper (1964) comments thus on the value of in-service programs:

> Since the graduate school apparently assumes that the young college teacher will learn the tricks of the trade while on the job, let us look at collegiate in-service education to see whether it is rising to the occasion. Here again, surveys conducted by the North Central Association of Colleges and Secondary Schools, testimony of observers, and literature in the field of teacher training all indicate that very little organized in-service training is going on. Most institutions have an orientation day or two in September to help new faculty members get acquainted with the institution, but apparently these programs are more concerned with administration routines than with pedagogical issues. Only occasionally are the incoming professors given suggestions concerning the distinctive character of the student body and ways of challenging the interest of this group. Only occasionally are systematic and reliable studies of the various teaching methods

> made to help the professors and their colleagues gain new wisdom concerning the best practices. Some institutions to be sure have academic committees and administrative officers whose special function is to help faculty members with instructional problems, the preparation of valid tests, the improvement of lectures, the conducting of significant discussions, the use of audiovisual devices and the like. But such programs of aid appear to be few and even where found--to be utilized by a minority of the staff, often those least in need of help.

There is little doubt that teaching methodology improves with experience. College teachers may correct their own faults on the job and can become quite skilled in their procedures. In-service programs can, if carefully planned and properly introduced to the staff members, improve the behavior of teachers as teachers. But to wait until the teacher is on the job to teach him to teach is as illogical as it would be to leave the clinical training of medical doctors until after completion of formal education. No profession other than college teaching is as unsystematic in the method of developing proper professional practice. Perhaps this is the reason the President's Commission on Higher Education for American Democracy (1947) took the position that

> The major responsibility for the inadequate mastery of teaching techniques on the part of new recruits rests with the institutions which prepare them. These institutions are largely responsible for one of the serious weaknesses of our system of higher education--teachers with undeveloped teaching abilities.

The Professional Training Controversy

The value of training in psychology and educational methodology for college teachers is one controversial question that must be dealt with in this research. Acceptance or rejection of such training methods as legitimate determines not only the nature of the training program, but to a great extent whether it is even initiated. It

affects the attitude of science people toward training programs in their departments.

Bestor (1955) recently has become a foremost critic of courses in education, especially courses in progressive education. The following quotation is characteristic of the expression of the opinion of many liberal arts professors about such courses (Bestor 1955, page 271):

> Courses in pedagogy--the mere know-how of teaching--are multiplied, expanded, subdivided, amplified, protracted, inflated, spun out, and padded. The real service that one or two courses might perform for the prospective teacher are completely lost sight of in the frantic effort to make each petty detail of teaching into a separate course.

Auerback (1957) surveyed 628 professors of liberal arts and 76 education professors as to their attitude toward teacher training. Auerback came to the conclusion from his research that very little of a constructive nature had come out of the controversy between liberal arts and education. He found a lack of communication throughout the controversy.

Usually those who deprecate the value of methods courses contend that what is important for good teaching is knowledge of subject matter. (Bestor would say training in the 'Disciplines of Knowledge'). Auerback analyzed the research found in nine studies concerned with the relation of professional education and subject matter education to other criteria of teacher success:

> There is no proof that courses in education or courses in subject matter produce a more effective teacher. (This is not to say that knowledge of subject matter and knowledge of how to teach--both of which can be acquired away from college halls--are not important.)

The American Chemical Society officially handles problems in the area of instructional improvement through it Committee on Professional Training. This committee takes the position that teachers

are best prepared for teaching by making them competent in research. In a committee report on doctoral education (Carter 1964) the following statement is found:

> There seems to be a general agreement (among contacted faculty members in chemistry departments) that a major objective of the Ph. D. degree in chemistry is the training of students for a career in research, not only because of the continued and growing demand for chemists who will continue in research careers, but because such training is well suited as <u>preparation for teaching</u> and other professional activities. The importance of aptitude for and experience in research is well recognized in graduate teaching, when the two functions are necessarily combined. It is also increasingly a requirement for successful undergraduate teaching, because of the growing emphasis on undergraduate research. . .

In an earlier report (Young 1957) the committee discusses the importance of research to the faculty:

> The faculty must be deeply interested in scientific research, and not only the accomplishment of research but also in the training of young men and women in the methods of research. . . They (the faculty) must be aggressive and not easily deterred from their objectives by the numerous duties of teaching. . .

The reliance on research as teacher training would appear to be an extension of the idea that training in subject matter (or discipline) is a way to train teachers. The above references also introduce another controversy in science education: the relation and the importance of the research function and the teaching function in university education.

Research has a facility for being viewed and evaluated. Teaching is difficult to evaluate. Research is quite tangible. Government and industry find means of supporting it in educational institutions. The Committee on Professional Training of the American Chemical Society believes that the publications of research are the chief valid bases for the evaluation of graduate programs (Carter, 1964, page 77).

. . .Judicious examination of the publications of individual

> faculty members is an important means of judging the competence of their graduate research programs. The scientific reputation of a staff member thus stands or falls upon the quality of his published work. Failure to publish is not only a disservice to his graduate students, but exposes him to the suspicion that he is lazy, irresponsible, and even incompetent to produce publishable work.

The primacy of research is not always considered a blessing. Many writers point out that research is so demanding that some professors have little time to attend to their students. Weaver (1966) sums up the teaching-research dilemna as follows:

> I do not think a teacher can be judged by weighing publications, but I also think no teacher can be successful unless he is alert to the new knowledge in his field. In many instances it is absurd to expect a teacher to be a scholarly producer of original research; but it is fatal not to require him to be alive to his subject.

Criticism of the Use of Teaching Assistants

> The sum of such pressures /shortage of professors, increase in number of students, growth of post graduate education/ is that many universities are turning over a large share of their freshmen and sophomore teaching to graduate assistants. These teaching fellows or teaching assistants--often called TAs--have for thousands of students became the prime contact of the university. (Anonymous, June, 1965)

The above quotation is from a recent article in Time which discusses the extent to which teaching assistants are used. The author found that at Harvard, out of 1816 teachers, there are 893 teaching assistants. In the University of California, at Berkeley, out of 3,460 teachers, there are 1,303 teaching assistants. The University of Michigan, which had 4 teaching assistants in 1933, now has 579.

(A survey of the use of teaching assistants in Oklahoma State University, made as a part of this study, showed that in 1965-66 there were 412 graduate assistants on the campus who were employed in some

manner with instruction.)

The Time author found considerable support for the use of teaching assistants. Rogers Albritton, Chairman of Philosophy at Harvard, feels that they are often better teachers than senior staff members. "Students find TAs easier to approach than professors." Graduate Dean Sanford Elberg of the University of California finds that the use of teaching assistants allows large classes to be broken up and individual instruction to be given when both otherwise would be impossible. He feels that "it begins to humanize the institution". The article was summarized by suggesting that the bedrock defense of the TA system is that it is "inevitable in the current state of supply and demand of teachers and students".

Many others are quite critical of the use of teaching assistants. Conant (1963) considers that the use of graduate students as teaching assistants to be one of the unfortunate practices found in many colleges. Solotaroff (1961) suggests that the main purpose of graduate student teaching is to cut costs. "Where there is a large freshman population, as at state universities, the graduate student is used to provide instruction at one-half to one-third the cost."

Caldwell (1959) felt, through his own experience, that the high percentage of recitation and laboratory teaching being done by teaching assistants has resulted in lessened teaching efficiency. In order to substantiate his experience, he wrote letters of inquiry to several prominent teachers at larger colleges and universities. Caldwell found that in general his respondents were in agreement with his supposition. He believes that administrative personnel should be presented with the actual facts on the percentage of college and

university teaching done by "the new, inexperienced, short-tenure, secondary-interest graduate assistant".

Murray (1961) thinks that the widespread use of graduate assistants for undergraduate instructional purposes should be severely curtailed. He feels that it is obligatory that departments make the superior knowledge of senior staff members available, at least to a limited extent, to the undergraduate program. Besides "these staff members will profit by participation in both the methods of teaching and the philosophy of the learning process".

Overmeyer (1965) defends the use of teaching assistants. She does not believe the degree is any guarantee of teaching ability. She observes that many college teachers are hired, not for their ability to teach, but their ability to do research. She finds that often the supervision of teaching assistants is quite competent. She feels that most teaching assistants will skip preparation for their own courses rather than shirk the preparation for the classes they teach. Because of these factors she concludes that the teaching of graduate assistants is really quite comparable to that of senior staff members.

Mulligan (1959) sees the youth of the teaching assistant as one of his assets. He finds that he is approachable by undergraduates and that he can communicate with his students. He believes that because of this lack of experience, he will "stick to his subject." Since he is "short" on knowledge, the class can follow his explanations.

Literature reveals much criticism of the use of the teaching assistant. This criticism stems from his lack of experience and knowledge, but also because of the conditions under which he works. Not all persons concerned see the use of the teaching assistant as bad.

Some believe it makes for better instruction, especially if he is properly supervised.

Efforts to Improve the Work of Teaching Assistants

There are two purposes which guide the work of those interested in helping teaching assistants teach. There is first of all the purpose stemming from immediate needs: since teaching assistants are engaged in teaching, the improvement of their techniques will improve the present work in which they are engaged.

A second purpose grows out of the fact that teaching assistants later become teachers. Any teacher training they receive should have a residual effect. Such training will improve the work of full time professors.

These two purposes have some overlap. However, generally when the purpose is concerned with long time goals, more theoretical concepts are likely to be considered. A necessity is felt for the student thinking through course purpose, course content, and theories of learning. Formal courses may be included in such a training period.

Those interested in immediate purposes are likely to be concerned with departmental policy and services, with classroom discipline, with mechanical techniques of teaching, and when it applies, the development of continuity and uniformity in multi-section classes.

Programs for the Improvement of College Teaching

Susskind (1957) studied the types of programs which would help in teacher training. He found five elements in such programs. He believed that these elements should be attempted in this order:

1. Supervision of laboratory instruction of the teaching trainee

2. Regularly scheduled conferences between the teaching trainee and a staff adviser

3. Supervision of the recitation period and the classroom instruction of the teaching trainee

4. A teaching seminar

5. A formal course

The formal course would be the top of the "five step ladder", required of all graduate assistants participating in the teaching program and recommended for all doctoral candidates who planned to make teaching a career. All new faculty appointees with the rank of assistant professor or below would be required to participate in the course. Susskind would have the course consist of "presentations before the class for criticism," and discussions of the theory and practice of teaching. This plan was presented in the American Journal of Physics as a procedure for training college science teachers.

Bruce (1954) outlined a plan recommended by the graduate faculty at the University of Wyoming. This plan calls for a course to be initiated to acquaint prospective college and university teachers with some of the areas in which he is supposed to function competently. The graduate student enrolls with a major problem of teaching within his own field of specialization, exactly as if he were doing a research problem with a professor. During the first two quarters, the students meet for one hour each week as a group to listen to lectures and to participate in the discussion of the ideas presented. Students are required to do a certain amount of reading from bibliographies prepared by the staff. In the third quarter there is no class

session but students receive actual teaching experience under the supervision of a professor.

Among topics discussed at the class sessions are: (a) understanding the student; (b) some principles of educational psychology; (c) some principles of effective learning; (d) the lecture technique as a teaching device; (e) the discussion technique as a teaching device; (f) evaluation techniques--how to construct and use examinations; (g) current experiments in general education; (h) what the guidance center can contribute to the classroom teacher; (i) university organization and function; (j) faculty organizations and the young instructor; (k) the registrar's role in the university set-up; (l) higher education in contemporary society; (m) the role of the library in education; and (n) current trends in higher education.

Methods of Assisting Teaching Assistants

English departments make much use of teaching assistants. Some of the plans for helping teaching assistants in this area are of interest. Macrorie (1966) suggests that a department should search out those people who are having success teaching English--whose students really excel in their ability to write. Have such persons write out their programs. "If the program has enough continuity that a teacher can follow it, publish it. Get other teachers to try it. Then you have a basis for judging the worth of a program."

Lacy, Lenehan, and Thomas (1966) discuss a program for Master Teaching Assistants at the University of Wisconsin. In this plan followed in the English department, every new teaching assistant is placed in a group of eight or nine, where he will be known and given

attention from the first day he becomes a teacher. These groups are led by a Master Teaching Assistant, an individual who has previously taught the same course, who is now teaching one section, who is interested in teaching composition, and who has a concern for his profession. The Master Teaching Assistant is expected to spend as much time with his group as he does with his one class. He is available to his group for individual conferences; he shares an office with them; he teaches at a time when they can visit his classes; and he conducts a weekly staff meeting with them. He also acts as a communication channel between his assistants and the freshman English administration. This supervision is in addition to classroom visits made by two administrators of the English department during the year. Though at the time of writing the experimental program was less than one year old, it had been found to have flexibility, to provide conditions for smooth administration, and to have a capability for intellectual and professional stimulus and interchange.

Halio (1964) outlines a plan being tried in the English department at the University of California at Los Angeles. Here the teaching assistant works under a regular staff member. It is the duty of this staff member to aid the teaching assistant in developing awareness and skill in teaching. During the first semester, the teaching assistant attends staff meetings, visits the supervising teacher's classroom, and toward the end of the semester, does some teaching under the guidance of his supervisor. At this time his work is evaluated, and if satisfactory, he is allowed to teach a section of freshman English under staff supervision. Weekly conferences are held between the supervisor and the teaching assistant. Some classroom visits are made by the supervisor for the purpose of developing the teaching assistant

as a teacher. A third phase of this apprenticeship program coincides with the advancement to candidacy under the Ph. D. program. The assistant is now allowed full direction of his own course in freshman English.

Svein (1963), in discussing the training of the foreign language teaching assistant, believes that prospective assistants should be selected and have professional guidance even as undergraduates. He would have them take some courses in professional education. Later a course should be provided for them in foreign language methodology.

Remak (1957), gives a rather detailed course of training and supervision of teaching assistants in German. Under the plan, the teaching assistants work under a Director of First and Second Year Work, who is a faculty member with a teaching load reduced to three hours. Because the program seems to have possibilities for other departments, the detail are given:

(1) There is a two hour briefing before the term starts. This includes a discussion of university regulations, a day-by-day course outline, an introduction to the first lesson, and general do's and don'ts.

(2) During the first week of instruction, teaching assistants meet every afternoon for post-mortems of classes taught and analysis of classwork to be taught the next day.

(3) Starting the second week, the teaching assistants meet once each week, auditing teaching materials distributed, and receiving explanations of such materials. After midterm, they meet every other week.

(4) The director visits every teaching assistant's class

unannounced three times during the first semester.

(5) Two other faculty members each make one visit. Teaching assistants are instructed to get with the visitor after class to discuss strong and weak points.

(6) Evaluation is made by the director at end of each term to the departmental chairman.

(7) Teaching assistants are asked to visit two class sessions of faculty members teaching the same course during the semester.

(8) Teaching assistants participate in departmental examinations. Questions are graded by all faculty members. Questions of "what to allow and what not to allow" are discussed.

(9) Evaluations of student's oral and written work by teaching assistants are handed in to the director for his perusal.

(10) Conferences are held by teaching assistants with students.

(11) Students rate the teaching assistants at the end of the term.

Baller and Worcester (1954) discuss a method of training doctoral candidates in teaching at Teachers College at the University of Nebraska Department of Educational Psychology and Measurement:

Certain doctoral students are invited to accept part-time instructorships to teach introductory courses in educational psychology. The part-time instructor, who handles two sections of thirty five students each are members of an apprentice teaching program. The general direction and integration of the work is assigned to one staff member, who is available for aid when needed. The entire staff, including both part-time and full-time instructors, meet for a two hour seminar and planning period each week. At the meeting the objectives of the course are discussed, syllabuses developed, reading

assignments suggested, films previewed and criticized, teaching methods compared, and examination questions prepared.

Training Teaching Assistants for General Chemistry

As a part of the effort to help teaching assistants teach, many departments of chemistry in colleges and universities distribute copies of the Handbook for Chemistry Assistants to their teaching assistants. This booklet, first published in 1952, was originally the work of the Handbook Committee for the General Chemistry Workshop of the Committee on Teaching of College Chemistry, the Division of Chemical Education of the American Chemical Society. The initial manuscript for the booklet was submitted and critically reviewed by the Third Conference on General Chemistry at Oklahoma A. and M. College in June 1952. Other General Chemistry Conferences also gave suggestions. Therefore it would seem that the statement that the handbook contains the "integrated ideas of experienced chemistry teachers from practically all types of higher education institutions" seems to be substantiated.

A recent revision of the Chemistry Assistants Handbook was made by the Committee on The Teacher and His Work of the Division of Chemical Education. The purpose as stated in this booklet is to "set forth certain concrete suggestions and directions to aid you in your teaching". In the section in the handbook on conducting a discussion class, there are topics on written tests, construction of tests, grading practices, discussion sessions, class records, the need for uniformity of presentation, attitude towards students, and teacher preparation. A second section covers the laboratory class and includes methods for helping students in the laboratory, laboratory instruction

techniques, laboratory house keeping, report writing, and report grading. Another section discusses safety precautions.

There is also a section on Attitudes and Ethics. Problems included are relationship with students, tutoring, and relationships with faculty and fellow graduate students. Finally there is a section entitled the Art and Profession of Teaching, which includes a short bibliography of materials which "can give you a fine background for the serious consideration of the profession". This little booklet of twenty seven pages is well written. The teaching assistants in this study received copies of the first edition, and part of them felt that it was of value. The revised version contains more theory and philosophy of teaching and is less a book of "do's and don'ts" than was the original publication.

One of the most thorough discussions of a program for teaching assistants in chemistry is that of Lippincott (1959). He believes that the lack of experience of teaching assistants in teaching techniques and the handling of subject matter, plus the need for the graduates passing their own work, are factors which decrease the effectiveness of the instructional programs in which they are involved. One way to improve the situation is to "subject all teaching assistants to a vigorous training program which begins before they start teaching and continues throughout most of their tenure". Four functions of the teaching assistant, according to Lippincott, serve as guideposts for a training program. These are:

1. To make close contacts with students
2. To help cement principles of chemistry in Students' minds
3. To cultivate observation and interpretation
4. To teach laboratory techniques (Lippincott, 1959, page 84)

Lippincott divides the training program into formal and informal

portions. The formal portion includes an orientation program, regular staff meetings, attendance at lectures, and on-the-job training. The informal portion consists of machinery whereby the teaching assistant is encouraged to have conferences with the senior staff members as often as necessary. Lippincott feels this should be emphasized, since the attitude of the teaching assistant toward his students is very often a reflection of the attitude of the senior staff member toward his teaching assistant.

In speaking of the formal portion of the training program, Lippincott sees the orientation program as quite important. He thinks this should include:

1. The philosophy of the course and possibly of the entire general chemistry program of which the assistant is a part.
2. The role of the teaching assistant in the program.
3. Some information about the handling of students.
4. Some essential teaching techniques.
5. Some standard operating procedures for the laboratory under consideration.

Lippincott then details plans for a series of five orientation periods which constitute portions of orientation programs at Ohio State University, Michigan State University, and the University of Florida. This outline is as follows:

Discussion I. General Organization
- (A) An over-all view of the general chemistry program
  - (1) Answer each of these questions:
    - Whom are we trying to teach?
    - What are we trying to teach?
    - Why are we trying to teach it?
  - (2) Nature and structure of various general chemistry courses offered by the department
- (B) Standard Operating Procedures in this laboratory
  - (1) Mechanical:
    - Storeroom arrangements and procedures
    - Treatment of laboratories and equipment
  - (2) Pedagogical:
    - Approach to problem solving to be used in this department
    - Methods of balancing equations

Conventions regarding mole concept, definition of oxidation-reduction, etc.

Discussion II. Conducting Recitation and Laboratory Sections
(1) Establishing rapport
(2) Personal contacts with students--individual teaching
(3) The value of a lesson plan
(4) Set an interesting, learning atmosphere
(5) Actually demonstrate operation of a recitation class
(6) Simulate a laboratory session

Discussion III. Some Important Teaching Techniques
(1) The question and answer period
(2) The drill-sheet method--each student work at his own speed
(3) How to demonstrate
(4) Special techniques for beginning and ending laboratory sessions

Discussion IV. Laboratory Safety and First Aid
(1) Require all assistants to learn material in "Handbook for Teaching Assistants"
(2) Location of First Aid equipment in laboratories and how to use it
(3) Tips on accident prevention
(4) What to do in case of accident

Discussion V. Evaluating Student Ability and Performance
(1) The obligation to know each student
(2) Preparation of tests, grading, reports
(3) Criteria for personal evaluation

The staff meetings and lecture attendance are a second phase of Lippincott's formal program. Clarity and reasonable uniformity of subject matter presentation are the goals of attendance at staff meetings and lectures. It is here that the senior staff attempts to "feel the pulse" of students and teaching assistants. Lippincott believes that this feedback (communicative) function of the staff meeting controls student and staff morale and often makes the difference between a mediocre and a good general chemistry program. Staff meetings are also a training period for teaching assistants. Some of the time is set aside for the asking of questions similar to those students might be expected to ask. Each teaching assistant is held responsible for discussing a particular laboratory experiment. Others devote a portion of staff meetings to preparing quizzes or sections of longer exams.

Lippincott sees the on-the-job phase of the training program as a must for improving performance. He believes the teaching assistants need help and encouragement, that they must be given considerable freedom in solving their own problems, yet guidance and support at just the right time will strengthen their confidence and improve their judgment. To do this the senior staff needs to work with the teaching assistants in the laboratories and recitation sections and share their experience and enthusiasm with them.

Lippincott sees no one plan as most effective in the on-the-job phase. Sometimes a senior staff member is assigned to a group of laboratory and recitation sections and the training of a group of teaching assistants to handle this section. Sometimes each lecture section is set up as an independent unit with students attending a particular lecture section in laboratories together. In this case, the plan may allow the lecturer to have maximum control of the students and supervision of only the teaching assistants working in this unit. In some other cases, several experienced teachers are assigned as laboratory supervisors. They spend all their time seeing that the laboratories run smoothly and helping the teaching assistants do a better job of teaching.

Lippincott, (1959, page 85) believes these training programs are successful.

> . . .most persons who have seen the results of such training will never "turn assistants loose" in a laboratory or recitation without some preparation. Finally, the essential point of this article is that training programs are vital; that they can be worked into the overall program without major schedule revisions, but that in order to be successful they must be planned and in perpetual operation.

In conclusion it is recognized that many of the problems of

improving instruction in higher education posed by references reviewed in this are not within the scope of this study. It is hoped, however, that this literature survey shows that there is a public concern about the quality of teaching which is being received in colleges and universities and that there are persons among college administrators and among the teaching profession in higher education who are concerned about the lack of interest in good teaching in colleges and universities. The basic assumption of this research is that many graduate assistants in chemistry temporarily are teachers in undergraduate colleges and later become full-time staff members in undergraduate colleges, the improvement of their ability as teachers offers a way of improving college teaching practices.

We have explored the criticisms of the use of teaching assistants, since rational criticism inherently points up the problems from which it stems. Finally there has been a survey of suggested plans for improving the work of teaching assistants, not only in chemistry departments but in other areas of higher education. Though these proposals are not research reports, they are representative of the approach now being made toward improvement of the work of teaching assistants. Procedures in all of these suggested plans have merit; there is however a lack of provision for evaluation. Innovation without systematic review and revision is inefficient and may be self defeating.

CHAPTER III

METHOD AND ORGANIZATION OF THE STUDY

Description of the Research Environment

Teaching assistants in the Chemistry Department at Oklahoma State University are usually employed in the instruction of beginning chemistry students. During the academic year 1963-1964, there were 22 individuals so engaged during the first and second semesters as teaching assistants. Eight other persons were also listed as graduate teaching assistants in the department directory; these were employed in lecture demonstration preparation and in the teaching of advanced courses.

Because the method and organization of the research can best be understood in terms of the environment in which it is carried on, a description of the type of courses and the organization of courses in General Chemistry at Oklahoma State University is included in this chapter.

Types and Organization of the Courses

There were five General Chemistry Courses taught at Oklahoma State University during the academic year 1963-64. Chemistry 1X4 was a four-hour credit course consisting of 3 lecture hours and 3 hours of laboratory. The prerequisites to this course were: high school chemistry with a C grade and a composite score on the ACT Test

(American College Testing Program) of 24 or better. This course fulfilled the same university requirements as two semesters in the course sequences discussed in the following paragraphs.

Chemistry 115 was a five-hour credit course consisting of 3 hours of lecture and 1 hour of discussion and examination, and 3 hours of laboratory. This course was designed for students who had no high school chemistry or who had a composite score on the ACT test of 17 or below. Chemistry 125 was a second semester sequence of Chemistry 115. These two courses were designed to cover the same material as Chemistry 1X4 but at a slower pace.

Chemistry 164 was a 4 hour credit course with 2 hours of lecture, 1 hour of discussion and examination, and 3 hours of laboratory. Prerequisites for this course were a credit in high school chemistry and a composite score on the ACT test of 18-23 inclusive. Chemistry 174 was the second semester sequence of this course. These two were also designed to cover the same material as Chemistry 1X4, but in two semesters instead of one.

Students in Chemistry 115 and 164 took the same 3 common 1 hour examinations. Common examinations were also given in Chemistry 125 and 174. Lecture sections contained from 70 to 150 students, depending upon the total enrollment in a particular course. Laboratory sections contained 30 or less students. Students in the laboratory in Chemistry 115 and 164 did the same experiments; the same was true of Chemistry 125 and 174. There was no mixing of students from two different courses in the same laboratory section. However, the members of one laboratory section might be members of 3 and possibly 4 different lecture sections and have as many as 3 different lecturing

professors. Grade distributions were made for Chemistry 115 and Chemistry 164 on a common basis.

Due to the common subject matter (the same text was used) the Chemistry 115 and 164 classes operated as an unit, and Chemistry 125 and 174 operated as another unit. Laboratories of all 4 classes met in one common laboratory under the supervision of an assistant professor in charge of General Chemistry Laboratories. Laboratories in Chemistry 1X4 were independently organized, in a separate building, under the direct supervision of the lecturing professor.

Lecturing professors were assistant professors, associate professors, or professors of chemistry. Laboratories and discussion periods were taught by either staff members or teaching assistants. There were 6 lecturing professors teaching 11 sections of theory in the 5 courses. There were 4 staff members and 18 teaching assistants handling 54 laboratory sections.

Table I (page 40) contains a breakdown of the instructional staff and the students, as found in the general chemistry courses during the first semester, 1963-64.

Administratively, the control of the courses rested with the lecturing professors. When there was more than one professor lecturing in a course (or a unit of courses, such as Chemistry 115 and 164), the lecturing professors acted as a committee. Teaching assistants and staff members not lecturing had responsibility only for the discussion and laboratory sections assigned to them. Junior staff meetings for each course of course unit were scheduled weekly and usually lasted 30 minutes to 1 hour. Generally these were used to outline to the teaching assistants what was to be covered during the following week,

TABLE I

ORGANIZATION OF CLASSES AND CLASSIFICATION OF STUDENTS ENROLLED IN BEGINNING CHEMISTRY DURING FALL SEMESTER 1963-1964

Chemistry course number	No. staff lecturers	No. theory sections	No. lab Teachers (staff)	No. lab Teachers (TAs)	No. lab sections	Students by colleges									Classification					Sex	
						Agriculture	Arts and Science	Engineering	Home Economics	Business	Trades & Industry	Education	Graduate	Total	Freshmen	Sophomores	Juniors	Seniors	Graduates	Male	Female
115	2	3	0	6	15	132	80	97	70	4	23	18	1	425	270	96	52	6	1	329	96
125	1	1	1	1	3	20	14	15	26	0	3	0	1	79	3	54	16	5	1	61	18
164	3	4	3	5	20	144	179	171	30	13	4	14	2	557	441	29	29	6	2	467	90
174	1	1	0	3	5	29	44	35	14	1	2	1	3	129	15	71	34	6	3	105	24
1X4	1	2	1	4	11	6	93	144	14	5	1	2	1	266	234	24	4	3	1	210	46
Total	6	11	4	18	54	331	410	462	154	23	33	35	8	1456	963	324	135	26	8	1172	284
% of Total	**	**	**	**	**	22.7	28.2	31.7	10.6	1.6	2.2	2.4	0.6	100	66.1	22.2	93	1.8	0.6	80.5	19.5

Source: Official role books of Freshman Chemistry, Department of Chemistry, Oklahoma State University

to specify what was to be emphasized during the discussion and examination sections, and to make corrections and suggestions for the implementation of laboratory work. Teaching assistants were given a chance to ask questions during the period.

The lecture professors were responsible for the writing of the hour comprehensive examinations. These tests were machine graded. Eight unannounced tests were given at the lecture periods during the term; these were graded by the teaching assistants. In addition, the teaching assistants made up and gave 8 tests over laboratory work during the semester. Students were encouraged to write up their laboratory reports even though the reports were usually not evaluated for grade determination.

In Chemistry 1X4, the teaching assistants had more freedom in the operation of their sections. No supervision was given other than that of the lecturing professor. Laboratories were shorter; more had to be accomplished by the students if they were to complete their work. Reports in laboratory were turned in for grading; no set form for these reports was given. Students were allowed more freedom for personal innovations.

Specific Areas of Study

The foregoing pages describe the courses, the students, the staff, and the conditions which make up the environment in which chemistry teaching assistants at Oklahoma State University work. The description is specific for the first semester, 1963-64; however, conditions remained constant during the second semester. The same teaching assistants were teaching students from the same colleges in the same

courses, and under the same administrative direction.

This study is concerned with the behavior of this group of teaching assistants working in this environment. Specifically the study is occupied with their problems. To know about their problems, it was necessary to ask them questions about their work, to observe them at their work, or to ask questions of people who were familiar with their work. In addition it was wise to know what kind of people the teaching assistants were--to be able to establish their identity.

This research is exploratory. Means needed to be provided, within the framework of the purposes of the study, to allow for freedom of discovery. Like Becker, Geer, Hughes and Straus, (1961):

> . . .we necessarily had to use methods that would allow us to discover phenomena whose existence we were unaware of at the beginning of the research; our method had to allow for the discovery of variables themselves as well as relationships between variables.

Participant observation, borrowed from anthropological research, allows this freedom and provides a means of analysis of the data and integration of conclusions. The student rating scale (Appendix A, page 160) was added to this in order to facilitate the gathering of data from large numbers of students. Structured questionaires were utilized to allow for the procurement of data not available from the two primary sources.

Participant Observation

The basic research process used in this study is participant observation. This technique is a sociological procedure developed especially for and used in anthropological studies, and outside of one instance, has apparently not been used in educational research.

That one instance is found in the report of Becker, Geer, Hughes and Straus (1961), where they study the perspectives about medical school held by students in the University of Kansas Medical School.

It must be assumed here that the educational field is certainly social and that the concern of this study has social aspects, and that these are the important aspects which this study will sample. This is the justification of the use of participant observation as the basic technique in this study.

In the definition of terms (Chapter I) it was suggested that participant observation covers several kinds of research activity. Generally the participant observer shares in the life activities and the sentiments of the observed group in a face-to-face relationship (Bruyn, 1963). Since he shares in the sentiment of these people with whom he is involved, the observer is affected and even changed somewhat by his contacts. It is important, however, that to some degree he remain unchanged and detached. The observer thus takes on a dual role. This role depends upon the demands of his research and the social structure in which he works.

There is an interdependence between the scientific aspect and the social aspects of participant observation. According to Bruyn. (1963, page 225)

> In his scientific role the participant observer is seeking to apprehend, register, interpret, and conceptualize the social facts and meanings which he finds in his prescribed area of study. He is interested in the people as they are, not as he thinks they ought to be from some standard of his own; he is interested the uniformities of their culture, in their existent, predictable state of being. To achieve these ends he finds his cultural role an indispensable part of the process.
>
> He finds that only by coming to know people personally can he achieve his scientific aims. In his cultural role he becomes involved, but his procedures, his hypotheses, his experimental

> design, his social role remain objectively recorded. They are not so rigidly fixed that they cannot be changed. As with all experimental work if he finds that any one of these elements is not broadly enough conceived to encompass the data, he refocuses, reformulates his project in whatever way he finds advisable. He assumes he can do this without ignoring the interests of the people he observes or the standards of his research.
>
> The scientific role and the cultural role of the researcher are interdependent and complimentary. The personal lives of the people he is studying are of great importance to him in both roles. It may be assumed that without this primary interest in them as persons in his active role as participant observer his study and findings become subject to distortion. His skill in reporting his findings objectively and the means he takes to insure this are also of primary interest to him. He assumes that one dimension makes the other possible. (He also assumes that no wholly "neutral" relation can exist in personal relations; such attempts often result in being impersonal, which is in effect becoming personal in a negative way.) He believes that valuing his subjects as persons increases the likelihood that he will come to understand them in their true state. The two roles not only coexist and compliment each other, in some ways they can be seen as two reflections of the same social process as the researcher becomes a natural part of the life of the people he studies.

Something here needs to be said about sources of knowledge and the effect of these sources upon data gathered in research. Traditionally scientists have depended upon two sources of knowlege, empirical and rational. Empirical knowledge comes from knowledge gained through the senses. Modern physical science is built upon a foundation of knowledge derived from observations, either direct observation or observations monitored through sensitizing instruments. Associated with this empirical or "sense" knowledge is rational knowledge--that which is created by the association and dissociation of concepts--knowledge revealed in the structure of thought.

Social science relies on these empirical and rational sources of knowledge. In addition, it necessarily utilizes, in techniques such as participant observation, a third source of knowledge--the intuitive capacity of the mind (Bruyns, 1963, page 227). "Thus the observer

relies upon the nonrational, nonsensible, affective experiences of the observed, as reflected in his own experience." The defense of this source of knowledge rests upon its ability to produce knowledge that stands the test of time or shows ability to predict or anticipate human action.

This interdependency (synodic functionalism) of the three types of knowledge sources is recognized even in physical science. Thus the genius of the work of Copernicus rested not just on his observation of certain physical phenomona and the rationalization of resulting concepts, but also on intuitive aspects that turned on vague emotional attributes. More recently Einstein has stated in his autobiography, that the assumption he made about the impossibility of a light source never being able to overtake a beam sent out by it, was arrived at intuitively (Polanyi, 1966, page 86-88). Polanyi emphasizes the importance within this interdependency of the powers of "dynamic intuition". He believes that:

> . . .We can pursue scientific discovery without knowing what we are looking for, because the gradient of deepening coherence tells us where to start and which way to turn, and eventually brings us to a point where we can stop and claim a discovery.

The acceptance of intuitive and introspective sources of knowledge as legitimate for scientific studies makes it necessary to find ways of exploring for, discovering, and substantiating such knowledge. In social studies, this means that in some way we must gain insights into the inner perspectives of the people whom we are studying. Participant observation has been developed with this in view. Understanding is achieved by participating in the life of the observed and gaining insight by introspection.

It is recognized that introspective data is subjective, is not

definitive, and therefore may not meet certain standards of operational research. Yet quantitative data also lacks a certain validity, simply because the process of operationalizing a concept changes its meaning. When ever data is subjected to measurement, some of its distinctive meaning is lost. In reporting participant observation data methods other than quantification must be utilized in describing the derived concepts:

> . . .It is accomplished instead by exposition which yields a meaningful picture, abetted by apt illustrations which enable one to grasp the reference in terms of his own experiences. (Blumer, 1954, page 9)

Methodology in Participant Observation

In the beginning of the research, several hours were spent just watching teaching assistants at work. This was initially done in the laboratory, where it was possible to observe as many as six assistants and their classes at one time. During this first phase the observer simply tried to see what was going on. He observed each teaching assistant as he started his students at work, how he occupied his time while the students were busy with laboratory routines, how he answered their questions, how much time he spent talking to other assistants. Periodically there would be visits from the laboratory supervisor. What did she observe that was wrong? How did she go about correcting the behavior of teaching assistants? How did they react to her supervision?

During this initial observation period, the primary purpose of the research was kept in mind. What really were the problems of these teaching assistants? What mistakes did they make? What happened in case of student accidents? Were there situations arising

where the teaching assistants did not seem to know what to do? And finally, how did their behavior differe from that of experienced staff members doing the same kind of work?

This was a period of getting acquainted. Teaching assistants at this time were informed that the researcher was studying their work. Quite often they showed an interest in the use of the studies. If such an interest was revealed by an individual, the work was described to him and he was made aware of what use would be made of the data. Effort was always made to assure him that no individual evaluation of his teaching would be made. Sometimes the teaching assistant would approach the observer and question him about these matters; many times the approach was deliberately made by the observer, during the assistant's unoccupied time.

Often these hours were unproductive as far as data gathering was concerned. Nothing really seemed to happen. Notes that were made seemed to be trivial. Yet as the data accumulated, it took on meanings not at first apparent and later provided the basis for describing the work of the teaching assistants in the laboratory.

Laboratory observation extended over a period of about two months. During this time an effort was made to observe every laboratory assistant and staff member at some time. Later on in the year, additional observations were made to see if there were changes in teacher behavior, to make sure there were adequate observations made on all assistants, and to look for additional evidence of problems derived from other data.

As the observer became acquainted with the assistants, he started attending quiz hour (discussion and examination periods). The assistants

had been informed by the Director of Freshman Chemistry that these visits would be made, but that they would have no effect on their status in the department. These visits were unannounced; there was no chance for additional preparation because of the visit. Undoubtedly the assistants were affected by these visits. (The writer has personally found the entrance of outsiders a cause for uneasiness. Sometimes he has found the visits stimulating.) After the class was over the observer made an effort to visit with the assistant a few minutes and talk about the work that had been done during the period. Sometimes the assistant would bring up class problems and ask for advice. They seemed to develop some confidence in the observer's judgment on classroom techniques. No attempt was made to "supervise", or correct faults. Discussions of teaching, if they occurred, were initiated by the teaching assistant. To the observer it did not appear out of his role to discuss classroom problems with them.

While visiting laboratories and classes, the observer also spent much time in the junior staff room, where many of the teaching assistants had desks, where there was a conference area, and where the assistants congregated. This proved to be a very fertile field for data collection. It was possible here to listen to the assistants discuss their problems, to ask them about their work, and often to become a part of their conversations.

Most of the time data collection was done without visible note taking. It was felt that such activity on the part of the observer would alter the normal responses of the observed. Usually recourse was made of adjoining rooms in the laboratory, or sometimes the observer simply "walked out" to some spot where he could make his recordings

unobserved.

Later the notes were typed on hand sorted data cards and coded in order to facilitate analysis. Coding was especially important due to the large amount of data to be handled; yet coding was not completed at first, since the establishment of categories depended upon the analysis taking place. Ideally, in participant observation, the analysis would go simultaneously with data collection. Actually the time available did not allow this always to happen. Analysis was carried out after most of the observing had been completed. The chief analysis carried out during data collection was to make sure data coverage was complete and in depth.

Some time was spent in junior staff meetings, the weekly sessions at which the teaching assistants were informed as to what was planned the following week, what changes needed to be made in laboratory routines, and what was to be emphasized in quiz hour. These were sources of information about what the staff thought were the problems of the teaching assistants.

To some degree the participant observer was a part of the staff. He sat in on classes and observed the work of the permanent instructors. He often was a listener to their ad hoc discussions. He at times engaged the staff members in talk about the work of beginning chemistry and about the work of teaching assistants. It was felt however that this role should not be too prominent, since it might affect the observers relationship with the teaching assistants.

Analysis of Participant Observation Data

Following the guide lines laid down by Becker and Geer (1960,

page 271) the research data were subjected to a sequential analysis. As new material was uncovered, leads were followed up that were suggested by the data at hand, keeping in mind the primary research goals. This meant asking just what problems were revealed in the data and what problem areas seem to be developing. This type of analysis assumes that the observer's "hunches" and insights are abbreviated and nonformalized acts of analysis. As these preliminary interpretations were made they were written down and supportive data coded to them. This data, it should be made clear, consisted of items of evidence derived from (a) observations of behavior of teaching assistants, staff and students, (b) information derived from individual or group conferences and discussions and (c) expressions of opinion or feeling by teaching assistants, staff, or students. In the final stages of analysis, the data gathered from the Teachers'Rating Scales were incorporated into the participant observation summaries in the same manner as Becker, Geer, Hughes and Straus (1961, page 29) incorporated the material they collected from formal structured interviews. This consisted in using the verbal expressions of the students on the scales as a source of teaching assistant's problems and supporting conclusions with mathematical summaries from the scales.

The analytical operation can be thought of as consisting of three simultaneous stages (Becker and Geer, 1960, page 271).

Stage 1. The Selection and Definition of Problems, Concepts and Indices

As data items or incidents were placed on cards, a preliminary theoretical designation (coding) was made which attached this incident to one or more problems or concepts. Coding was inclusive; if there was any reason to include the incident under any concept or

problem, it was included. Critical categorization was left for a later time.

Coding was full: not only were the concepts and problems identified; the people present were also indentified, individuals as well as groups. Dates, the setting, and the activity involved were also coded. Items were scrutinized at this time for indications of other phenonoma which should be observed.

Certain tests of validity and reliability were made at this time. This included questions concerning the credibility of informants:

(a) Does he have reason to conceal truth?

(b) Does his vanity or does expediency lead him to mistake his own role or his attitude toward it?

(c) Was he really a witness to the incident he is describing?

(d) What about his feeling toward the people or the issues under discussion?

(e) What does his statement tell us about the relationship between his perspective and the group perspective?

(f) How much has the research affected his response?

(g) Is the evidence volunteered or did the observer direct the answer?

(h) Is the informant speaking for himself or for the group? (Adapted from Becker and Geer 1960, page 273)

Not every one of these questions was asked every time. Only when the question seemed appropriate was it applied. However, the last two questions were applied generally.

Stage 2. Checking the Frequency and Distribution of Phenomona

As previously suggested, problems and concepts were arrived at

informally. Quite often insights leading to conclusions were quite largely speculative (developed intuitively). In the final stages of analysis, these items of evidence were counted (quantified) to decide whether a conclusion was justified. Not only were the number of items supporting a generalization noted--the accuracy or strength (plausibility) of the support was evaluated. This included observing whether the material was the result of (a) direct questioning, (b) volunteered information, or (c) observed information. (Credibility usually would be considered to increase from (a) to (c). Supporting evidence was also scrutinized to determine the variation in kinds of evidence. (The inclusion of many kinds of evidence increases validity.)

Stage 3. Construction of a Descriptive Model

> . . .In the final stage the observer designs a descriptive model which best explains the data he has assembled. (Becker and Geer, 1960, page 277)

As problems and minor concepts were developed in this study, it was possible to start bringing these together into broad generalizations. These generalizations took the form of theorized concepts about the social organization being studied. The generalizations were views of the field being studied in terms of theories of communication, administration, psychology, and organizational change. Or viewed inductively, the specific instances of the data were grouped about communicative, administrative, or other theory that applied to the work of teaching assistants in chemistry. At first there were only partial generalizations which seemed to niche together into a unifying whole.

The final summarizing statements make up the conclusions of the

research. Support of these conclusions has been made by first checking the field notes for instances which characterize the problems, concepts, and unifying theories, and supporting these conclusions by references to data observations.

Stage 4. Development of an Overall Pattern.

Participant observation, in the end, allowed the development of a comprehensive conceptualized scheme. Problems and concepts seemed to "fit together". Problems seemed to group themselves into classes or areas which appeared as parts of major social theories--communicative, administrative, educational, etc. But because they grew out of a study in which opportunity was allowed for nuances, they were unique areas. Specifically, the end result was not just communication theory (or some other theory), but communication theory impinging upon the problems of teaching assistants in chemistry. In other words, the end result was the development of social models, unique for the field being studied. Operationally these were termed theoretical treatment areas.

Rating Scale for Teachers

The Rating Scale (Appendix A, page 160) used in this study has been used for a number of years by the College of Agriculture and the Department of Chemistry at Oklahoma State University. The scale has been utilized several times by the Department of Chemistry in an attempt to improve the instruction of chemistry teaching assistants.

For the purposes of this study, the questionaire was administered to classes in beginning chemistry with the teaching assistant absent. The students were told to check the point on each scale which best

described the behavior of the teaching assistant. In addition they were told, "When you have completed the front page, turn the sheet over and write as you choose, enlarging upon and adding to the material on the front. Use your own honest judgment." Scales were filled out by all students in beginning chemistry at the end of the first semester, January 8 and 9, 1964. These became a part of the data of this study.

Visual inspection of the items on the scales would lead to the conclusion that there are inter-correlations within the scales. Since the usuage within this study is quasi-statistical, it did not appear that these correlations would be of consequence. No detailed analysis of any kind was made of this instrument. The assumed validity as a measure of teacher behavior must be supported by its acceptance at Oklahoma State University. During the year 1965-66, it has been distributed by the Student Senate over the entire university as a part of an effort to improve instruction.

It must be recognized that the items on the scale are not "scalable" (Sherif and Sherif, 1962, page 520). The items on the lines are not necessarily equal and for some respondents do not even represent a continuum. More precisely, these are <u>ordinal</u> and not <u>interval</u> scales (Van Dalen, 1962, page 268). This necessitates an analysis that does not involve a mean. The procedure used was to establish a breakpoint--to divide the scales into two parts: those positive for acceptable teacher behavior, and those items generally considered poor teaching behavior.

This division called for subjective judgment as to what is proper teaching behavior. Thirteen individuals were asked to subjectively divide the scales: four were undergraduates, two were graduate students

two were teaching assistants participating in this research, and four were chemistry staff members. Their common judgment was then used to determine the breakpoints; if there was a divergence of opinion, the researcher subjectively located the most plausible compromise breakpoint.

Next student ratings for each assistant were summarized. If 10% of the responses were below the breakpoint, the item was listed as a problem for that teacher. If 25% of the responses were below the breakpoint, the item was marked as a major problem.

Material from the back of the rating scale (elicited from students when they were asked for an enlargement upon or addition to the material on the form) was analyzed by using a type of item analysis analogous to that previously described for the analysis of participant observation. Essentially this process consisted in the listing of the students' statements in the wording of the students themselves. Usually, the statement found on the first sheet picked up was generalized; subsequent statements were coded as duplications of the first whenever meanings seemed to overlap. A check was kept of which students were credited as contributing to each general response, and a count was made of the total number making the response. When summaries were developed for the total group of teachers, the problems were reanalyzed and similar statements were combined. The importance of a problem was determined by the number of students voicing the criticism.

The positive criticisms (favorable responses) found in the written comment on the back of the scales were classified as criteria for proper teaching behavior.

Since the problems mentioned on the back of the sheet were recalled by the students without any clues it appeared that that

material was actually more credible than that derived from the structured scales. Because of this, any problem from the back of the sheet was listed as a problem for that assistant when 10% of the students mentioned it. This breakpoint was arrived at as a result of a previous study made of the ratings of teaching assistants by students during 1962 (Wall, 1967). In the case of positive statements, 10% was maintained as a breakpoint--if 10% of the students mentioned the favorable comment, it was considered a student criteria for judging teachers.

Once this manipulation of data from the scales was completed, it became a part of the body of data utilized in participant observation.

Review of Selection Process

Primary data came from several sources. The Rating Scale for Teachers (Appendix A, page 160) was administered to 1030 beginning chemistry students. Scales were analyzed as detailed on page 53; major and minor problems for each assistant were determined and the data summarized and discussed in Chapter V (Table VII, page 74). Responses on the back of the scales were item analyzed as to which specific problem was indicated and overall results summarized in Table VIII, page 77. Since there were a great number of student responses, and therefore a resulting accumulation of some 54 different discernible problems, re-analysis, combination, and selection were necessary. The final selection was made on the basis of frequency of response for each specific problem. (Refer to theoretical description, stage 1, page 50 and stage 2, page 51.)

The problems from the viewpoint of the teaching assistants were

determined by a structured interview and by the teaching assistants' reactions and responses as recorded on the participant observation data. These problems were summarized in Table IX, page 85. Staff reactions were determined in much the same manner staff data is summarized in Table X, page 91. Finally participation observation data is summarized in Table XI, page 94.

One resource outside of the data collected in this research was used as a check against problems listed. The Handbook for Teaching Assistants, published by the division of Chemical Education of the American Chemical Society, and included in the bibliography of this paper, is a compilation of suggestions for teaching assistants by college chemistry staff members throughout the United States. (See Chapter II, page 31.) The suggestions in this handbook were analyzed as to just what problems of teaching assistants were being inferred, since these can be considered the opinion of college chemistry teachers in general. These inferred problems were considered along with the problems resulting from the present study.

As analysis and summarization took place for each of these varied sources, two different procedures were utilized for the selection of a finalized list of problems and the development of solutions to these problems. First, as lists of problems from each source were developed, the individual problems were analyzed and categorized into a more comprehensive list of problems and statements which encompassed all problem sources. This "common problem" coding originally was composed of some 60 items, but later analysis reduced this number to 30. Also a list of theoretical treatment areas were developed (which are defined on page 9, Chapter I), and each problem coded into one or more of these,

depending on the nature of the problem, and what theory or theories seemed to offer a solution (Stage 3, page 52)

All items were then placed on individual three by five "sorting cards". These were first of all intuitively sorted, simply on the basis of whether they "seemed" to go together. After this initial grouping, the "intuitive sets" were analyzed and placed in broader, functional categories: These categories were deductively-arrived-at divisions of the teaching assistants' work load, each representing a task area unique because of difference in approach, difference in the nature of the work, and/or difference in the nature of solution. What this procedure consisted of was the inclusion of inductively-arrived-at "intuitive sets" into broader deductively-arrived-at "job analysis sets".

Finally, items were again analyzed, taking each "intuitive set" as a unit, dividing the included items into the original "common problem" coding which was used initially to initiate the combination of problems from the various sources, and then re-phrase this "common problem" into a clarified operational statement that had some possibility of solution.

This analysis, which was done by charting all of the accumulated material, showed that for solutions to be attainable, some problems needed to be divided. Other problems were found to be related--as far as possible these were brought together. The result was a final set of 27 problems, dealing with most of the aspects of the teaching assistants' job. Some are highly supported by the research from all data sources, some are strongly supported by some sources and not by others, some are included because they are part of a total supported problem but have a different solution, or simply because common

reason justified inclusion. Some problems are more important than others; some have easy-to-reach solutions; all, according to the various sources of this research, exist (Stage 4, page 53).

Analysis of the Strong Vocational Interest Survey

The Strong Vocational Interest Blank was administered to 16 of the teaching assistants. The results were analyzed according to procedures developed by Darley and Hagenah (1955, pages 76-102).

Primary Pattern: is the interest type within which an individual shows a majority of A and B/ scores on specific occupational keys.

Secondary Pattern: is an interest type within which the individual shows a majority of B/ and B scores.

Tertiary Pattern: is an interest type with a majority of B and B- scores. (This pattern was discarded due to the fact it was so close to the area of chance scores.)

Reject Pattern: A reject interest pattern was recorded whenever a majority of the scores of any interest type lay to the left of "chance" or the shaded area of the profile.

Using this procedure it is possible for a person to have one or several primary, secondary, and reject interest patterns.

Seven Interest Types were specified corresponding to the following occupation groupings found on the Strong Interest Blank, with indicated inclusions:

I. Biological Sciences (8 occupations)

II. Physical Sciences (4 occupations)

IV. Technical, including III. Production Manager. (11 occupations)

V. Social Service (10 occupations)

VIII. Business Detail (8 occupations)

IX. Business Contact, including XI, President Manufacturing Concern (4 occupations)

X. Verbal Linguistic, including VII, CPA Owner. (4 occupations)

The summary of the results of the Strong Test shows the number of individuals with number of primary, secondary, tertiary, and reject interest patterns, and the distribution of interest patterns as to occupational types In addition, the occupations with the highest ratings for the individual teaching assistants were noted as well as their score as chemists. The specialization level, the interest maturity, the occupational level, and the Masculinity-Femininity score were recorded.

Method of Summarizing Cattell Sixteen Personality Factor Questionaire

The Cattell Sixteen Personality Factor Questionaire, Form A, was administered to 15 teaching assistants, January 14, 1964, in order to identify the personality traits of the group with a standard instrument. The answer sheets were checked by hand methods, and the results tabulated as raw scores for each individual. The mean and the standard deviation (sigma) for each factor were calculated. Means were then compared to Sixteen Personality Factor Test Norm Tables for Form A: College Men, (Appendix B, page 162) found on page 4 of the preliminary (mimeographed) set of tables (Cattell, 1963). The profile was then constructed from these standard scores (Appendix C, page 165). Deviations from the norm were then described.

Standard score profiles were then compared to three other profiles "Eminent Researchers", "Eminent Teachers" (Cattell and Drevedahl, 1955) and Chemists (Cattell, 1960), by the use of the r_p (Profile Similarity Coefficient, Cattell and Stice, 1962, page 31).

CHAPTER IV

THE TEACHING ASSISTANT IN CHEMISTRY

What kind of people are selected as teaching assistants in Chemistry at Oklahoma State University? What is their age and sex? What has been their previous experience? What are their motivations? What are their characterizing personality traits? What about their general knowledge, their knowledge of chemistry, their training in education?

Before this research can have any validity in another institution, there must be a basis for comparing those who are teaching assistants in this study with those at the other institutions. Therefore, this chapter attempts to answer the above questions.

How Teaching Assistants are Chosen at Oklahoma State University

Graduate assistants are chosen from a pool of applications submitted by the prospects. Applications are submitted on standard forms utilized by the university for all personnel applicants (Oklahoma State University, 1962). The application blanks ask for certain personal information (age, home, physical characteristics, marital status, physical handicaps), for a recapitulation of schools attended, with dates and degrees granted, for a record of major subjects studied, honors granted, organizations joined, languages spoken, and publications authored. Finally there is a request for a

listing of previous experience and for three references. Pictures of the applicant and a transcript must accompany the application. This is a standard form used in gathering information on all prospective academic personnel at the university.

Usually the applications are placed in the hands of one or two persons in the department, who rank the prospects as to the considerations they are to get. In general this is done on the basis of grades in chemistry, with some consideration of grades in mathematics and in physics. If they have taught in the laboratory or have worked in industry, they may merit some secondary consideration. However, there is practically no consideration of teaching experience unless one of the references says, "He just cannot teach." Grades get the principal consideration. (This material is from staff interviews.)

Identifying Characteristics

A summary of the identifying personal characteristics will be found in Table II, page 63.

Motivating Factors

Choice of chemistry as an occupational field and goals within the field were determined by structured interviews with the graduate assistants. Reproduction of the questionaire used for these interviews will be found in Appendix D, page 169. The summary and the analysis of these interviews will be found in Table III, page 64.

TABLE II

PERSONAL SUMMARY OF TEACHING ASSISTANTS

Number of individuals in study.	22
Number from Oklahoma.	11
Number from adjoining states (Texas, Kansas, Arkansas).	1
Number from states west of the Mississippi. .	14
Number from states east of the Mississippi. .	5
Asian Students.	3
African Students.	0
American Negro Students	0
Number married.	6
Number unmarried.	16
Men	21
Women	1
Number of dependents. . . .5 listed 1 dependent each	
Experience:	
Work: Non-university connected.	8
In research laboratory.	5
No previous work experience . . .	9
Teaching: as a teaching assistant . . .	7
Undergraduate college attended:	
Oklahoma State University.	6
Other Oklahoma colleges.	4
State universities not in Oklahoma . . .	3
Church and liberal arts colleges	6
India colleges	2

TABLE III

SUMMARY OF MOTIVATING FACTORS OF TEACHING ASSISTANTS

Why Did You Decide to Major in Chemistry?	
Influence of particular persons.	11
Interest of a teacher.	9
Interest developed through chemistry kits. . .	
Interest stemming from reading of study. . . .	1
Interest caught during grade school.	2
Interest caught during high school	5
Interest caught during undergraduate classes .	12
Promise of economic success.	1
Good Grades.	3
Other.	1
What do You Finally Expect to Become?	
Industrial chemist	7
Industrial chemist or college teacher.	5
Research chemist.	
High school science teacher.	1
Teacher of college or university chemistry . .	
Other--Industrial management	1
Patent lawyer	1
What is the Highest Degree You Expect to Finally Receive?	
Masters Degree in chemistry	5
Ph.D. in chemistry	10
Masters of Business Administration..	1
L.L.D.	1

TABLE III (CONTINUED)

Ph.D. in Business Administration. 1

Undecided. 4

The Strong Vocational Interest Survey was administered to 16 of the teaching assistants. The Darley-Hagenah Analysis of Interests Patterns was used in the analysis of the results (Darley and Hagenah, 1955). The procedure for analysis will be found on page 61. Results are summarized in Table IV, page 66.

Considering individual ratings, five teaching assistants showed the highest scores for chemistry as an occupational interest, three for that of a farmer, three for that of a physician, and three for engineering. Twelve showed an A score for the occupation of chemistry. Sixteen showed an occupational level score of above 50, which would be normal for the professions.

A study of the above results would lead the observer to wonder just how many would remain in chemistry. It is true that a large percentage showed an interest in physical science, and that very few were interested in social service, yet the number with no strong interests or with multiple interests made up better than one half of the group.

In order to get an indication of how they viewed their students, a set of five questions were presented orally to the teaching assistants and their responses recorded (Appendix D, page 182). The first question was, "Did you find the students in your sections of laboratory average, above average, or below average in ability?" Seven of the teaching assistants felt that there was a range in their students from above average to below average. Five considered them above average, and four considered them below average.

TABLE IV

SUMMARY OF STRONG INTEREST PATTERNS

Interest pattern	Primary pattern A and B+	Secondary pattern B+	Tertiary pattern (B and B-)	Reject pattern (Left of chance)	Occupation with highest interest rating		Rating for chemistry	Specialization level	Interest maturity scale	Occupational level	Masculine feminine scale
No interest pattern at this level	5	10	5	5	Chemist	5	12 A ratings for chemistry			+ 2 below 50; 14 above 50	10 above 50 (Masculine)
One interest at this level	5	6	9	4	Farmer	3					
Two interests at level	5	0	1	6							
Three interests at level	2	0	0	1	Physician	3					
I. Biological Sciences	4	1	4		Engineer	3					
II. Physical Sciences	7	0	0	0							
IV. Technical	3	1	2	1	Teacher	1					
V. Social Service	2	2	0	3							
VIII. Business Detail	1	1	4	4	Credit mgr.	1					
IX. Business contact	1	0	0	6							
X. Verbal Linguistic	1	1	1	5	Aviator	1					

(Initial analysis will be found in Appendix E, page 176.)

The second question asked was, "Did you find your students cooperative, non-cooperative, or antagonistic?" Five saw their students as very cooperative, 12 expressed the idea that they were cooperative, two teaching assistants found one or two students non-cooperative or antagonistic in every section, and only one thought of his students as generally uncooperative. There seemed to be a general feeling among the teaching assistants that the students as a rule were cooperative.

There were mixed responses to the question, "Do students apply themselves to their laboratory work, or do they slight it?" Nine teaching assistants viewed their students as applying themselves to their laboratory work. Six thought that some applied themselves, while others just tried to get by. Five expressed the idea that students in general slighted their work.

To the question, "Do you enjoy working with the students, do you look forward to quiz hour and laboratory, or would you prefer to do something else?", there appeared to be ambivalent feelings. Nine teaching assistants expressed the idea that they enjoyed teaching and looked forward to their classes. Three stated that they enjoyed teaching when the students cooperated. One enjoyed the quiz hour and one said he enjoyed the laboratory periods. Five stated that they would prefer to do something else, three preferred to do research. About one half of the teaching assistants responded positively to this statement.

The fifth question was, "Do you find it easy to make your students understand you or do you find them unable to understand what you are trying to explain?" Five believed they were understood by

their students. Two teaching assistants reasoned that this depended upon the subject under consideration. (If it were difficult, or not within the experience of the students, it was generally not understood.) Five teaching assistants believed they were understood by the students only after they had presented a subject several times.

Considering the responses of the teaching assistants to these questions and also considering their reactions to students at other times, it would appear that the teaching assistants certainly were not negative in their reaction to their students. As a group, the teaching assistants seemed to "reach out" and attempt to do the best possible job when teaching. Many teaching assistants put in extra time and extra sessions with their students prior to examination without additional renumeration. Rarely would a student be refused individual help if he asked for it. The number that pushed their students aside without consideration was a minority. The teaching assistants were conscious of the student's problems and attempted to do something about them. Reaction of the students on the rating scale for teachers (Chapter V) will bear this out.

Personality Traits

Sixteen of the teaching assistants were administered the Cattell Sixteen Personality Factor Questionaire, form A. The six other members of the teaching assistants group were either foreign students who failed to respond to the request to participate in this part of the study or were students not teaching during the first semester,1963-1964.

Scores were standardized on this test by use of Norms for College Men (Appendix B, page 161). Scores showing deviation were those scores

which varied one sten score or more from the average sten score for College Men. These deviations showed that the teaching assistants were higher in submissiveness (E-), seriousness (F-), persistance (G+) adaptability (L-), self-sufficiency (Q_2+) and will-power (Q_3+).

Cattell and Drevedahl (1955) investigated the personalities of eminent science researchers and eminent science teachers. The rp (Pattern Similarity Coefficient) of the teaching assistants in this study, compared to the researchers and teachers tested by Cattell and Drevedahl, was 5.4 and 5.0 respectively, which would indicate more agreement with the profile of the researchers than with that of the teachers (Appendix C, page 164). Compared to the profile for chemists (Cattell and Stice, 1962), a rp of .6 was found, which would indicate the profiles were quite similar.

From the Personality Factor Survey, it would appear that the teaching assistants in this study were higher than average college students in intelligence, showing more than average seriousness and persistance. Along with submissiveness, there was adaptability. Coupled with these traits, there was a self sufficiency and a controlled exacting strength of will. Their personalities were more like those of researchers than of teachers, and were still more like those of chemists.

General Knowledge

The best criteria available to assess the general knowledge of the teaching assistants is their grades in their course work before entering graduate school at Oklahoma State University. Records were available on 21 of the 22 teaching assistants. Table V, page 70, summarizes

information concerning previous degrees earned. Table VI, below, shows the average number of hours of credit earned and the grade point average in chemistry, physics, mathematics, English and psychology.

TABLE V

DEGREES EARNED PREVIOUS TO ENROLLMENT IN OKLAHOMA STATE UNIVERSITY GRADUATE SCHOOL IN CHEMISTRY

B. S. in Chemistry	9
B. A. in Chemistry	4
B. S. in Chemistry and Mathematics	3
B. A. in Chemistry and Physics	1
M. S. in Chemistry	3
M. S. in Science	1

TABLE VI

SUMMARY OF ACADEMIC RECORD OF GRADUATE ASSISTANTS--OKLAHOMA STATE UNIVERSITY GRADUATE STUDENTS IN CHEMISTRY

Academic Area	No. of Assistants	No. of Hours	Grade Ave.
Chemistry Undergraduate	19	39.7	3.3
Chemistry Includes Grad.	20	26.1	3.4
Chemistry Total	21	65.8	3.3
Physics Undergraduate	20	12.8	2.9
Physics Graduate	8	3.	3.6
Mathematics Undergraduate	21	21.2	2.8
Mathematics Graduate	10	5.2	3.4
English	19	10.1	2.5
Education & Psychology	10	4.8	3.2

In physics, there were two with below a 2 point average, and five with a 4 point average. Three had below a 2 point average, and three were 4 point students in mathematics. Three had more than 30 hours of mathematics. There were none with 4 point averages in English. Neither were there any with below a 2 point average.

The assistants had taken an average of 135 semester hours before enrolling at Oklahoma State University for graduate work. The overall average grade was 3 points. If C (2 points) is considered average, these teaching assistants, as undergraduate students, were above average in class rank. They were much better than average students in physics and mathematics, but close to average in English.

Training in Education and Psychology

Only ten of the teaching assistants had evidence on their transcripts of formal training in psychology and education. For seven, this consisted of one course in general psychology. The only assistant showing definite training in this area was the individual preparing himself to teach in secondary education.

Training in Chemistry

As previously stated, 17 of the teaching assistants had a Bachelor of Science or a Bachelor of Arts in chemistry, and three had a Master of Science in chemistry. The other two were foreign students who had equivalent degrees from foreign institutions, but with different titles.

Records of grades made on the American Chemical Society Graduate School Entrance Examinations were found in the files of 19 of the assistants. The average score for the Physical Chemistry Test was

30.4 with a sigma of 10.7. A passing score of 16 was required by the chemistry department. In organic chemistry, the average score was 51.9 and the sigma was 21.5. The required score was 30. In analytical quantitative the average score was 44.2 with a sigma of 13.4, and the required score was 30. Though the average scores of the assistants on these entrance examinations were well above the required, there was a great deal of variation in the scores on these examinations, as shown by the high sigmas. Five of the members of the group were required to repeat undergraduate courses because of low entrance test scores.

The graduate assistants in the department of chemistry were selected principally on the basis of their grades in chemistry. Therefore it is not unusual that they should have higher grade averages in chemistry than in other subjects. Yet it was interesting to note that the staff members as a group felt that one of the chief weakness of the teaching assistants in teaching was their lack of preparation in chemistry. On the other hand, students believed that as a whole, the teaching assistants "knew" enough chemistry.

CHAPTER V

DETERMINATION OF PROBLEMS

Problems from the Viewpoint of the Students

Student reaction to teaching assistants was judged on the basis of (1) student rating of teaching assistants on Rating Scale for Teachers (Appendix A, page 160); (2) students' verbal responses on backs of Rating Scales for Teachers; and (3) student interviews by the researcher during the final week of the second semester, 1964. The rating scales were analyzed according to the plan outlined in Chapter III, page 53, a procedure developed in a previous study by the researcher (Wall, 1967). The summary of problems from the rating scale will be found in Table VII, page 74. The following descriptive analysis is taken from this summary.

Student Rating Scales

A study of Table VII will show that some problems on the rating scale appeared to students to be much more serious than others. Two problems especially should be noted:

1. Lack of ability to express thought--much hesitation or meanings not clear
2. Lack of organization

The first appeared as a problem on the rating scales of 95% of the assistants. Over 37.5% of the total student population in the

TABLE VII

SUMMARY OF PROBLEMS FROM SCALES OF SEVENTEEN TEACHING ASSISTANTS 1963-1964

Problem	(1) Percent of total students listing problem	(2) Major problem for this number of assistants	(3) Minor problem for this number of assistants	(4) Sum of major and minor (Column 2 & 3)	(5) Problem found on 0 to 29% of instructors	(6) Problem found on 30 to 44% of instructors	(7) Problem found on 45 to 59% of instructors	(8) Problem found on 60 to 84% of instructors	(9) Problem found on 85% or more of instructors
1. Lack of preparation for class meetings.	11.3	1	4	5		30.0%			
2. Lack of interest and enthusiasm in subject by instructor.	13.9	3	8	11				65.0%	
3. Inability to arouse interest of students.	8.3	1	3		23.6%				
4. Lack of organization.	27.9	6	9	15					88.0%
5. Little thinking demanded of the students.	5.1	1	0	1	6.0%				
6. Indefinite assignments.	5.3	1	0	1	6.0%				
7. Spends too much time on unimportant topics. . . .	8.1	1	3	4	23.5%				
8. Poor enunciation--words indistinct.	8.0	1	3	4	23.5%				
9. Manifests little humor.	9.7	1	5	6		35.0%			
10. Knowledge of subject deficient.	14.4	3	6	9			53.0%		
11. Much hesitation and/or meanings not clear--lack of ability to express thought.	37.5	11	5	16					95.0%
12. Students frequently antagonized	3.6	0	2	2	12.0%				
13. Cheating prevalent on examinations.	5.7	0	3	3	18.0%				
14. Instructor often hesitant or confused by students.	7.5	1	4	5		30.0%			
15. Instructor shows lack of tolerance--is impatient..	6.4	1	3	4	23.5%				
16. Lack of punctuality	5.9	0	3	3	18.0%				
17. Untidy or careless in appearance.	4.3	0	2	2	12.0%				
18. Distracting personal mannerisms	12.2	1	9	10			59.0%		
19. Fairness in grading	6.7	0	5	5		30.0%			
20. Generally leaves the impression of a poor teacher	19.7	3	7	10			59.0%		

study rated their teachers as below the breakpoint on the scale for this item. The second was a problem for 88% of the assistants; 27.9% of the students listed this as a problem.

Seven other problems were found on the summaries of 30% or more of the teaching assistants. There were

3. Lack of interest and enthusiasm in subject by instructor (65%)
4. Distracting personal mannerisms (59%)
5. Knowledge of subject deficient (53%)
6. Manifests little humor (35%)
7. Lack of preparation for class meetings (30%)
8. Instructor often hesitant or confused by students (30%)
9. Lack of fairness in grading (30%)

This list of nine problems represents the expression of the students as found on the rating scales as to what were the important problems of their teachers.

Comment on Backs of Rating Scales

Table VIII is a summary of problems identified by students in the comment on the backs of the rating scales. The nineteen problems listed are all above the 1% level, which according to criteria established in previous research (Wall, 1967), should mean they should merit consideration. In this list, however, we find certain problems appearing more often than others. If a minimum of 50 individual student responses is categorically assumed as a division point, the following would be the problems which remain:

1. Meanings not clear; does not explain fully (152 responses)
2. Unsatisfactory communication techniques: enunciation poor,

low speaking voice, handwriting poor (69 responses)

3. Lacks confidence, appears shy to class (60 responses)

4. Inability to arouse interest in students, or shows an impersonal attitude (51 responses)

5. Talks above the heads of the students (52 responses)

When compared to the problems from the rating scale, problems one and two above appear to be like problem one from the rating scale (Inability to express thought). Problem four stems from scale problem three (Lack of class preparation). The other problems appear to be different in nature than those responded to on the scales.

Some problems are mentioned for a high percentage of teaching assistants but are seen by a relatively smaller number of students. Unfair in grading is found in only 21% of student comments; these comments referred to 11% of the assistants. The problem Discourages questions--fails to get questions answered appeared in comments of nearly the same number of students, (19%), yet it was a problem for only 3% of the assistants.

Consideration should also be given to the positive responses of students about their teaching assistants. These give a key to what students look for, and indirectly point up problems which students perceive in their teachers. These responses are categorized under five major topics as follows:

1. He is willing to help. He is interested in students. He gives time to students.

Six hundred twenty-three responses were recorded in the category--by far the largest number of any group. These included such remarks as

He is willing to help students with their problems on his own

TABLE VIII

PROBLEMS OF TEACHING ASSISTANTS FROM STUDENT COMMENT ON BACK OF RATING SCALES 1963-1964 (1030 STUDENTS, 17 TA's)

	Problems (mentioned by over 1% of all student respondents)	Sum of individual student responses	No. of TA's for which this is a problem
1.	Lack of preparation for class meetings.	25	7
2.	Lack of interest and enthusiasm in subject by teacher; lack of interest in teaching	29	6
3.	Inability to arouse interest of students; impersonal attitude.	51	12
4.	Spends too much time on unimportant topics; stresses wrong topics, and irrelevant material	17	9
5.	Unsatisfactory communication techniques: enunciation poor, low speaking voice, handwriting poor. .	69	11
6.	Meanings not clear; does not explain fully	152	14
7.	Tends to confuse students.	11	5
8.	Talks above heads of students. . . .	52	12
9.	Knowledge of subject deficient . . .	33	9
10.	Discourages questions; fails to get questions answered.	19	3
11.	Does not help students enough; explains too hurriedly.	25	7
12.	Manifests little humor	24	8
13.	Fails to keep control of classes at times	32	9
14.	Hesitant or confused by students; misinterprets questions	11	6
15.	Lacks confidence; appears shy to class	60	8
16.	Unfair in grading: grades too harshly or too easiy; plays favorites	21	11
17.	Tests do not cover material presented; questions trivial	13	8
18.	Lacks experience	20	3
19.	Laboratory mismanagement: unsatisfactory prep period; lack of help and attention in laboratory	23	9

time. (16-1)[1]

He is always ready to help anyone with the simplest question and never makes anyone feel that they are simple. (5-51)

He goes out of his way to help in the laboratory. (8-67)

From the point of view of the students in these classes, this was the most important attribute a teaching assistant could have.

2. He is friendly and has humor. He is interested in students.

Four hundred seventy-three students responded with statements in this category. Included here were statements such as:

He never makes a student feel inferior to himself. (13-25)

He has a good sense of humor which keeps his students awake and interested in what is being taught. (4-2)

He is a very likeable person. (2-43)

In these responses is the suggestion that positive interpersonal relations are worthy attributes of a teacher.

3. He understands chemistry. He knows his work.

Relatively few students criticized teaching assistants for a lack of knowledge. Three hundred ninety gave responses in this category as a commendation for their teaching assistants. Though thirty-three students were critical of the teaching assistants in this respect, a much larger number believed that the assistants "knew their chemistry." They thought "His knowledge of the subject is very keen." (6-25) "His statements are quite accurate." (18-4) "He tells us what we need to know." (13-71)

4. He can convey ideas. He can get chemistry across to his students.

---

[1]Instead of ficticious names, sources of information in this and following chapters are identified by number.

Two hundred fifty items were categorized in this area. Though many other students saw this as a fault of their assistants, the high incidence of positive statements points out the facts that some students could understand them, and that students feel that this is a very important attribute of a teacher.

5. He is fair. He grades fairly. He treats students alike. He is not too hard.

One hundred forty students made such comments in their evaluations. Some comments were

He grades fairly but does not give grades. (8-42)

His tests covered exactly what we had studied. (7-6)

He grades fairly but strictly. (17-19)

6. He creates interest. He is not dull.

This last significant criteria of quality teaching received eighty-seven items. "He is a very good thought-provoking teacher." (16-22) Though coding did not reveal as high a response for this point as for the others, it is evident that students desire to have a teacher that is not "dull" or uninteresting.

Viewing student reaction as a whole, it should be noted that there is much variation in the reaction of students of a particular assistant, just as there is a variety of reactions in students of different assistants. No teaching assistant failed to strike some favorable response with at least one student. Students of the same teaching assistant would give opposing reactions. Thus: "One of his drawbacks is his inability to convey to students his knowledge and thought in an understandable manner," (9-2) and "He is able to give us information in a language we can understand," (9-6) were observation about the same

teaching assistant.

Something should be said about the minimizing effect of the above positive statements on problems derived from student suggestion. Sometimes a teacher has been given a preponderance of positive statements by his students; should the negative of these statements be then considered a problem?

In this study the assumption has been made that, if the frequency is high enough for the negative statement, it should still be considered a problem. These are the reasons:(1) Students, as previously mentioned, seem to feel they need to say something good about their teacher; therefore, positive statements may not always represent their true feelings. (2) There is a strong interpersonal feeling between most students and the teaching assistant under whom they work. This may stem, at least in part, from the age proximity of students and teaching assistants. (3) A sizable minority cannot be ignored. Even if many other students in the class do not recognize a shortcoming, it still exists for the minority and should be recognized as a real problem.

Random Interviews with Students

To further check the student viewpoint as to the problems of the teaching assistants, forty-five students were randomly interviewed after they completed "checking out" of the laboratory at the end of the spring semester, 1964. Seven basic questions were asked of these students at this time concerning their laboratory instructors. (See Appendix G page 180.) Replies having to do with teaching assistants were analyzed as "I like" and "I dislike" statements. These statements were

then grouped under generalized topics, which summarized the statements of the students. The negative generalizations, which give another clue to student conception of problems are as follows:

1. He fails to explain clearly.

Twenty-three statements were coded as pertaining to this problem. These included such items as:

He needs to clarify equations and experiments. (I-5)

He talks in a monotone. (I-16)

He got going too fast. (I-8)

Sometimes they were of a different nature:

He went into an awful lot of detail. (I-14)

He went into everything too deep. (I-31)

2. He was not helpful to students.

Twelve responses were coded under this problem. Some of them were:

He needed to emphasize reading the material. I need a lot of pressure. (I-6)

When he explained we got it only once. (I-12)

Another boy in class helped me more than the teacher. (I-29)

When we went into the lab, we did not know what we were going to do. (I-7)

3. He had a poor relationship with students.

There were ten responses supporting this problem. The responses were quite wide in range:

I would like to see him less serious minded. He is a neutral element. (I-28)

He is too strict. (I-21)

He lost his temper too much. (I-12)

He was afraid of his class. (I-23)

On the other hand some students thought that their teacher was "too personal--too close to some of his students." (I-23) Finally: "If he had been more strict, it would have improved his class. Respect got down to nothing." (I-33) The range of these remarks would suggest that the answers to relationships in a class are not simple, and may need to be looked for not altogether in class formality, but possibly in a relationship on the basis of student need.

4. His tests are too hard or unfair.

Eleven negative responses had to do with testing. Students were critical when:

> He had too many reactions on his tests. (I-2)
>
> He gave pretty hard questions on tests. (I-11)
>
> His tests covered a lot of detail. (I-8)
>
> It is stupid to have a lab and then at the next session have a test over the material before your questions are corrected.(I-33)

5. There is too much to cover in laboratory.

There were several responses to the inquiry as to how to improve laboratory work that had to do with time element. They often took the form: "There is not enough time in laboratory to think what is happening." (I-30) Apparently, some students would appreciate a laboratory where the emphasis is more on inquiry.

Students sometimes misinterpreted a teaching assistant's behavior toward them. One teacher, who in both observation and interview seemed to go out of his way to help students, was quite shy and reserved. Students interpreted this as a lack of feeling and regard for them. He was characterized as a "cold potato" by one student, an appraisal which was supported by similar statements from other students. Yet by and large students seemed to the observer to be quite discerning

in their criticisms.

Summary of Problems from all Student Sources

The following is a summary of the problems identified by the students. These are summarized on the basis of multiple expression in two or more of the research processes or because of heavy incidence in one of the research processes.

1. Lack of ability to explain clearly
   a. Inability to express thought
   b. Unsatisfactory communication techniques
2. Talks above the heads of the students
3. Inability to arouse the interest of the students
4. Shyness or distracting personal mannerisms
5. Lack of proper testing procedures
6. Impersonal attitude--unsatisfactory teacher-student relations
7. Lack of preparation for class meetings
8. Deficiency in subject matter
9. Failure to keep control of class
10. Laboratory mismanagement--lack of help and attention

The Problem from the Point of View of the Teaching Assistant

Teaching assistants were asked in a structured interview to list what they considered to be their problems. In addition the participant observation data was analyzed for expressed and deduced statements of teaching assistants as to what their problems were. Analysis showed twenty-three different problems suggested by the teaching assistants.

(Refer to Table IX, page 85) From this list ten problems, selected on the basis of frequency of mention, were thought to be significant. These problems, ranked as to frequency, with supporting statements included, are as follows:

1. Lack of coordination in the theory and laboratory work

This is a criticism of the organization dealing with the work of the course. Statements took such forms as these:

> There is not enough communication between staff and teaching assistants. Often after staff meetings, experimental procedures are changed--yet we go to the laboratory with not a word of the change. It is tolerable only because the store room clerks cue us in. (17)

> There needs to be more coordination. The situation promotes a bad relationship between the teaching assistant and the student. (16)

> One of the problems is trying to correlate yourself /your work/ with theory, since you do not want to confuse the students. (19)

> Professors should outline whatever they are going to emphasize in theory, and give it to the teaching assistants. (1)

2. How to hold the students' interest

Teaching assistants were concerned over students' lack of interest, even when they tried to help them:

> You cover the subject: With students not interested they cannot give you the answer to your question, let alone correlate it with answers to other problems. (6)

> I need additional material: When I have to use my own imagination I find students uninterested. (2)

> The problem is trying to keep students interested. The only reason they come to quiz hour is because of the tests. (8)

3. How to get chemical meanings over to students

> Students do not know how to concentrate on chemistry in the right way. They can read and understand but they do not apply it to a problem. (4)

> My biggest problem is my ability to get across to students and make them understand. I want them to know. (12)

TABLE IX

PROBLEMS SUGGESTED BY THE TEACHING ASSISTANTS

	Problem	No. from planned interview	No. from participant observation
1.	How to hold students' interest.	6	0
2.	How to get students to apply themselves	0	1
3.	How to be fair.	3	1
4.	How to overcome adverse feelings. . . .	0	1
5.	How to get chemical meanings over to students	4	0
6.	Lack of knowledge on part of assistant.	1	2
7.	Failure of Teaching assistant to prepare students for laboratory work. . .	3	0
8.	Lack of patience with students on part of teaching assistant.	0	1
9.	Improper laboratory techniques of Teaching assistant	0	1
10.	Teaching assistants not interested in teaching	1	0
11.	Lack of ability on part of teaching assistants to make tests	0	4
12.	How to deal with old students	1	0
13.	How to deal with outsiders who come into the laboratory.	0	1
14.	Foreign teaching assistant's problem with accent.	1	0
15.	Inability to get students to participate in class discussion. . . .	3	0
16.	What materials to use in supplementing theory work.	4	0
17.	How to properly utilize class time. . .	1	0
18.	Not enough time to cover materials which need to be covered in quiz hour. . . .	1	0
19.	Inability to control students	2	0
20.	How to get students to read directions	1	0
21.	Nervousness (insecurity) on part of teaching assistant	1	0
22.	Teaching assistants relate to students instead of staff (feel for students) .	1	0
23.	Lack of coordination within the department	6	0

4. Lack of ability on the part of teaching assistants to make tests

This problem was not mentioned during the interviews but was the subject of conversations recorded in participant observation. Three teaching assistants, observed discussing the problem, agreed that the most difficult task was "how hard" to make the questions. They felt that the students were "not ready" for application questions. There was also agreement that there was considerable difference between teaching assistants as to the level of expectation on tests. They felt it was unfair to average the scores of one teaching assistant against another. (18)

5. What materials to use in supplementary theory work

> There should be more discussion /in staff meeting/ of what the instructors should go over in quiz hour. (14)
>
> Teaching assistants need to know what is going on--what is being covered in theory so that they will not duplicate materials. (18)
>
> Teaching assistants need to know the important ideas students need to learn and what needs to be emphasized. (2)

6. How to prepare students for laboratory work

> The next time I teach I am going to make them take notes when I explain experiments. (3)
>
> The first experiment was "bad" to start off with. . .not over 1% knew what was going on. (5)

7. How to get students to participate in class discussion

This point was best clarified by the statement: "There needs to be more participation in quiz hour. It should be a two way affair; students should be encouraged to ask question." (1)

8. Lack of chemical knowledge on the part of teaching assistant

This point was only indirectly referred to, though there were inferences in conversation that at times the teaching assistants felt

pressed for more information than they had. One assistant did make this statement:

> The type of chemistry being taught /at Oklahoma State/ is entirely different than I had. It is an entirely different approach. There needs to be some help for persons coming from other schools. (5)

Another assistant suggested:

> Really we do not know much more than the students. We have been away from the material for two to three years and have forgotten much of it. (16)

9. Inability to control students

> Student look at you as if you were another student--they lack respect. (20)

> I had no problems. There was a little discipline problem now and then. (4)

10. How to properly utilize class time

Observations revealed that at the beginning of the teaching experience, this was a serious problem. As the year went by, most of the assistants found their contact time during quiz hour utilized rather fully.

Teaching Assistants Suggest Improvements

To elicit further answer from the teaching assistants concerning their problems, they were asked to suggest (1) what could be done by the chemistry department to improve their work and (2) what they would do if assigned the job of helping teaching assistants teach. Their answers are summarized in two sets of statements found in Appendix D, page 168. The following are the twelve problems suggested most often in their answers:

1. Improve communications to the teaching assistants from the staff

Teaching assistants felt that more information could be given at

junior staff meetings.

Provide an outline of work covered in theory. (9)

Make sure each teaching assistant knows what the theory teacher wants emphasized. (14)

See to it that the lecture theory teacher is definite about what he is going to teach in class and what he is going to test over.

2. Improve communication as to what is being taught between theory teachers

Students are often tested over materials to which they have not been previously introduced. (15)

The main problem is a lack of coordination. (16)

3. Provide mechanical helps to be used as hand-outs to students

Here would be included such items as valence sheets, pH tables, and sample problems.

4. Give teaching assistants a chance to go over problems beforehand

"We often hit our first laboratory cold." (14)

5. Help teaching assistants organize quiz section work

Help develop discussion items which students can tie in with what they know. (15)

Discuss in staff meetings what teaching assistants should go over in quiz hour. (9)

6. Help teaching assistants with tests

Show them how to make exams so that they can be graded easily. (16)

Have teaching assistants turn in their tests for appraisal before they are administered. (9)

There should be conferment between the staff and teaching assistants as to just how questions are to be answered. (2)

There needs to be more work on test construction and more effective correlation on test grading. (5)

7. Provide a pre-term seminar in the chemistry department for

teaching assistants

Continue the present training program. (13)

I found the sessions held before school started a great deal of help. (11)

8. Provide refresher work in beginning chemistry for teaching assistants

Provide a time when the material is covered which will be presented in quiz hour--there is bound to be a lot of material you /the teaching assistant/ have forgotten. (16)

Teaching assistants from outlying colleges need to be keyed into the way chemistry is taught at O. S. U. (13)

9. Help teaching assistants maintain proper relationships with their classes

"Improve the control of the teaching assistant over his students." (2)

10. Outline duties and responsibilities of teaching assistants and clarify departmental procedures at beginning of term (2)

11. Treat teaching assistants as individuals (22)

The individual expressing this last idea was probably suggesting three reactions: first, that teaching assistants should be given more responsibility; second, that, the problems which they each encounter are unique; third, that he wishes to be recognized as an individual.

12. Develop a safety code for the laboratory (1)

The problems in the two lists suggested by the teaching assistants have a special significance, since they represent the felt needs of the people we propose to help. An important significance should be noted about the problems suggested by the teaching assistants: These are the conscious needs of the persons whom we propose to help. The effectiveness of any program of change is going to hinge on the recognition of teaching assistants that their "real" problems are being

solved. Such a program will be ineffective if diagnosis of inadequacy is not a perception of the teaching assistant himself (Bradford, 1958).

The Problem from the Standpoint of the Staff

The viewpoint of the staff as to what problems teaching assistants have was determined by planned interviews with the individual staff members, supplemented by data from participant observation. The latter source was relatively unimportant, since the "participant" status of the researcher as a part of the staff was not realistic. Any observations made were normally not from that viewpoint.

Twenty different problems were coded as suggested by the staff. These will be found tabulated in Table X, page 91. The eleven problems most frequently mentioned are as follows, ranked on the basis of frequency. Supporting statements are included when they appear to clarify.

1. Teaching assistants lack knowledge of subject matter. They do not know chemistry.

There is no question in the minds of most staff members about the chief shortcoming of teaching assistants--the lack of chemical knowledge. Outside of two or three individuals, it was the problem most mentioned and the most emphasized. "They just don't know enough," (109) was the prevalent attitude, apparent in staff interviews, junior staff meetings, and in observations of staff reactions among themselves and often when in contact with teaching assistants.

2. Teaching assistants do not know what to cover in class. They need to be told what is important.

This problem, directly related to the one previously discussed,

TABLE X

PROBLEMS SUGGESTED BY THE STAFF

	Problem	Number of responses
1.	Teaching assistants do not know how to conduct class; the staff needs to specify what teaching assistants do in class.	3
2.	Teaching assistants do not know what to cover in class; the staff needs to specify what is important and what materials need to be covered	7
3.	Teaching assistants are very inexperienced in teaching.	2
4.	There is too much lecturing in quiz sections.	1
5.	Teaching assistants do not know how to conduct discussion groups	2
6.	Teaching assistants do not know how to motivate and involve students	3
7.	Often teaching assistants do not actively participate in the laboratory--observe students, find out if they know what they are doing, supervise--show a helpful attitude.	3
8.	Teaching assistants have had no experience in handling people; they are not experienced leaders, classes lack discipline.	4
9.	Teaching assistants lack knowledge of subject matter; they do not know chemistry	10
10.	Teaching assistants lack technical knowledge in the laboratory	1
11.	There is a lack of enthusiasm for chemistry and for laboratory work.	4
12.	Teaching assistants do not gauge the ability of students; they expect too much of the average, too little of the best.	4
13.	Teaching assistants cannot express themselves--need speech training.	3
14.	Teaching assistants not able to get material across to students	2
15.	The teaching assistant has too many other activities and interests--he is not interested in teaching.	4
16.	The teaching assistant must integrate his work with that of the senior staff member.	3
17.	Teaching assistants feel insecure at the beginning.	2
18.	Inexperienced teachers often have interpersonal problems with students--they need to relate positively with students; may intimidate students; "talk down to students"; treat them like children	4
19.	Teaching assistants fail to make specific and clarified assignments; instructions often too complicated.	2
20.	Teaching assistants do not plan ahead	1

includes both the idea "that the teaching assistant lacks knowledge" and "that he does not correlate his work with the theory lecturer."

3. There is a lack of enthusiasm for general chemistry and chemistry laboratory work.

4. The teaching assistant has too many other activities and interests. He is not interested in teaching.

This problem is closely related to number three. It is concerned with lack of interest in teaching, rather than lack of enthusiasm for chemistry.

> Many teaching assistants look upon teaching as a necessary evil. (113)

> Their purpose is to get through school. Therefore teaching is secondary. (109)

5. Teaching assistants have had no experience in handling people. They are not experienced teachers. Classes lack discipline.

> They have trouble adjusting to responsibilities connected with dealing with students. (102)

> It is difficult for teaching assistants to know when student behavior has gone too far--and whether to go to higher authority with their problems. (106)

6. Inexperienced teachers often have interpersonal problems with students. They need to relate positively with members of their classes.

> Teaching assistants "talk down" to students. They treat them like children. (114)

> Teaching assistants should not try to scare students. Students should not be insulted. Teachers should not use sarcasm or ridicule. (111)

7. Teaching assistants do not gauge the ability of their students. They expect too much of the average, too little of the best.

8. Teaching assistants do not know how to involve and motivate students.

Problems five, six, seven, and eight are all interpersonal or relationship problems, having to do with face-to-face reactions and the acceptance of the teaching assistants by the students, or the acceptance of the students by the teaching assistants.

9. Teaching assistants do not know how to conduct class.

> The staff should give the teaching assistants more detailed instructions as to what they are supposed to do and how they are to do it. (108)
>
> They are unfamiliar with the mechanics of classroom procedure. (101)

10. Teaching assistants fail to actively participate in the laboratory.

> There is too much of a tendency on the part of teaching assistants to just give a briefing, then turn the students loose, and stand around waiting for questions, rather than asking students what they are trying to do. (101)

11. Teaching assistants do not know how to express themselves.

"They must be able to relate the material to the student and get get it across to him." (108)

12. The teaching assistant must integrate his work with that of the senior staff member /theory lecturer/. (108)

"It is up to the individual /teaching assistant/ to find out what he lacks and remedy his defects himself." (118)

The Handbook for Teaching Assistants of the Division of Chemical Education, American Chemical Society (1965), has for its purpose "to set forth certain concrete suggestions and directions to aid you in your teaching." Inferences can be drawn from these suggestions as to just what the compilers thought were the teaching assistants' problems. Since it contains the "integrated ideas of experienced chemistry teachers from all types of higher education institutions," it provides

a comparative list of staff determined problems.

The handbook suggests that teaching assistants will want to know "how to organize your work for greater effectiveness, how to deal with students' problems, how to win and hold the respect of your students and colleagues, as well as what practices and other features are peculiarly significant in the teaching of chemistry." (page 2). If the statements in the manual are re-phrased, the derived problems would be as follows:

1. Teaching assistants lack the training and ability to organize their work.

2. Teaching assistants often fail to deal with student problems--answer their questions about chemistry, teach the right laboratory techniques, or teach basic facts underlying their classroom work.

3. Teaching assistants fail to develop proper safety routines in the students' laboratory procedures.

The following chapters discuss tests, their construction and evaluation, discussion procedures, classroom routines, attitude of teaching assistants toward students, and laboratory procedures. From these suggestions additional problems might be derived:

1. Teaching assistants need help in test construction.

2. Grading and evaluation by teaching assistants can be improved.

3. Teaching assistants need to know how to conduct classroom discussions.

4. Teaching assistants need help in class routine (opening and closing sessions, comfort of students, mechanics of blackboard presentation, etc.)

5. Teaching assistants need to know how to answer students'

questions.

6. Teaching assistants need instruction in laboratory management and routines.

7. Teaching assistants need help in teaching students how to write laboratory reports.

Usually when attempts have been made to deal with the improvement of the teaching practices of teaching assistants, the problems recognized were those which the planners (university chemistry professors) considered important. Therefore, problems in this section (from the viewpoint of the staff) should resemble those found in articles dealing with the subject in chemical literature.

Problems Derived from Observation

Participant observation data yielded a total of 19 problems. These will be found in Table XI, page 96. Judged by the frequency of reference, the following problems appear to be most significant.

1. Inability to handle discussion groups

The quiz hour, to be effective, needs to be the place where student questions are answered. Means should be provided for securing data from students as to what questions they have. Then these questions should be answered. Observations showed that these objectives are often not met by the teaching assistant.

2. Poor utilization of class time

3. Failure to control class properly

These two problems are closely related. By class control is meant not just discipline, but class organization and management--to where the class activity can be thought to be goal oriented.

TABLE XI

PROBLEMS FROM PARTICIPANT OBSERVATION DATA

	Problem	Number of responses
1.	Failure to keep classes interested.	8
2.	Lack of chemical knowledge.	5
3.	Failure to properly utilize class time.	9
4.	Inability of teaching assistant to express himself clearly in terms the students understand	5
5.	Teaching assistant presents material too advanced for students	6
6.	Failure to receive administrative communication of laboratory procedure	4
7.	Failure to stay with students in laboratory--sometimes due to outside distractions.	5
8.	Failure to control class properly	9
9.	Failure to relate to class (interpersonal problems)	8
10.	Inability to make good tests.	8
11.	Inability to handle discussion groups	11
12.	Failure to convey to students needed information--due either to not knowing that students should know or lack of concern	8
13.	How to keep students motivated in laboratory but still not pressured to the point they "do not know what is going on".	4
14.	Inability to communicate back up the line (to supervison)	7
15.	Need a greater variety of methodology for information giving	4
16.	Need training in first aid procedures	1
17.	Improper sequence of laboratory and theory.	2
18.	Equipment not in good repair.	1
19.	Inability to organize laboratory work for greatest learning and accomplishment	1
20.	The fact that the staff seems to believe that proper knowledge of chemistry is the only really important attribute of the teacher that can be	2

4. Failure to keep the class interested

5. Failure to relate to class

6. Inability to make good tests

7. Failure to convey to students needed information

8. Inability to communicate up the line

The rating scale for teachers (Appendix A, page 160), also represents a list of problems that university staff members, (and to a degree, chemistry staff members), believe are the problems of teachers and therefore the problems of teaching assistants. This scale was originally partially developed by members of the chemistry staff of Oklahoma State University. It should therefore be considered another indicator of problems from the viewpoint of the staff.

CHAPTER VI

RECONCILIATION OF THE PROBLEMS FROM THE SEVERAL SOURCES

The previous chapter discussed the problems of the teaching assistant from the viewpoint of the various data sources. This chapter reconciliates the problems from the several perspectives; it summarizes the evidence for the selection of each problem; and it outlines the solution of each problem in terms of theory and practice. The final approach to solutions, with various inter-effective ramifications will be made in Chapter VII.

The first four problems are in the area of communication. Three of these affect the teaching assistant's ability to find out what to teach and what to do in the laboratory. The first has broader implications: it affects the transfer of information about general procedure, about tests, about departmental policy, and may effectively block collaborative effort between staff and teaching assistants. It should also be noted that the first and fourth problems are symptomatic of discontinuity in coordination:

1. The failure of teaching assistants to receive staff communication
2. What materials to use in quiz hour to supplement theory
3. What procedures to use in laboratory
4. Inability of the teaching assistant to communicate "up the line"

Seven staff members believed that teaching assistants often did

not know what to cover in class. Three suggested that the teaching assistants needed to integrate their work with the senior staff lecturer. Others believed that the staff should tell the teaching assistants specifically what to teach. Students made no statements that were directly coded into these problems but indirectly referred to them:

> If a student wishes to have a subject cleared up that he has learned in theory, Mr. A cannot discuss it like it was done in theory. (5-32)

Teaching assistants deplored the lack of coordination within the program. Often they expressed the idea that they should be "let in" on what was going on (page 85). They believed that one of their important problems was the need for specification of what materials to use in supplementing theory.

Participant observation gave support to the idea that teaching assistants could be a source of information to the staff if some means of feedback is provided. Since they are in closer contact with the students than is the staff, they are in a position to provide information concerning subject matter difficulties which may justify re-teaching, laboratory procedures in need of revision, administrative malfunction which is causing confusion, or testing processes which are inequitable.

Solution to these four problems will be found in the area of communications. In class organizations as large as those found in beginning chemistry, there is justification for the use of highly structured techniques in order that necessary information is in the hands of persons on the operational level. This is the present practice of the department. In addition there needs to be a conscious effort to initiate a reverse flow of information, which must also be planned

for and systematically carried out. This might be done in staff meetings and by structured reports from teaching assistants. There should be the cultivation of a freedom of expression which would allow and encourage a sharing of ideas about the teaching program, much in the same manner that interest and suggestion about research programs is communicated between staff and assistants.

The next five problems are related to the maintenance of a group climate favorable to learning.

5. How to get students involved and interested and thereby motivated to study chemistry

Student response on the rating scale showed 23.6% of the teaching assistants with the problem--Inability to hold interest of students (page 74). On the back of the scales, this same problem, coupled with the allied criticism--Impersonal attitude, was seen as a problem for 60% of the assistants (page 77).

Teaching assistants found the holding of student interest to be one of their serious problems (page 85). They did not believe that students ask enough questions. The staff felt that the assistants should be more active and thereby more stimulating to students in the laboratory (page 91).

Solutions for this problem will be found in four theoretical treatment areas: communication, learning, testing, and interpersonal. Improvement might first come from solutions considered for the communication problems (pages 98-99). If the teaching assistants could be thoroughly informed as to just what the staff considers important, the value of quiz hour and laboratory to the students could be increased and their interest and motivation augmented.

In educational theory, research suggests that knowledge and acceptance of common goals by the teacher and students is important. Students do not become very involved until they have an acceptable reason. Ideally, therefore, not only the staff but also the teaching assistants and the students would be involved in goal setting and would be made fully aware of its conclusions. (Hilgard and Russell in Henry, 1950, page 62).

In connection with this, the nature of the assignment (problem 16) influences the involvement of the student. The assignment should be so developed that the student is made aware of what he will be tested over. Objectives of the course should be defined in terms of student behavior. Evaluative practices definitely affect the motivation of students. (Hilgard and Russell in Henry, 1950, page 50).

Physical facilities such as room arrangement may affect motivation. One teaching assistant gave a long narrow room as one of his problems. (P O 5) Students on the back row of such a room even when seats are randomly assigned, do not give the attention that will be found in the front of the room.

Some regard should be given to the effects of the group on motivation. The group develops and reinforces the individual's need to learn. (Thelen and Tyler in Henry, 1950, page 308). Some understanding of these forces and their utilization in chemistry teaching would be an avenue well worth exploring in the treatment of this problem.

6. How to keep control of the class

Students, in their comments on the back of the scales, rated this as a problem for 45% of the teaching assistants (page 86). Teaching assistants, when asked as to what they would do if assigned the task

of helping teaching assistants teach often responded, "Improve the control of the teaching assistant over his class." The staff connected this problem with inexperience.

The problem is closely related to problem 5 (keeping interest and providing motivation). It is affected by a teacher's assurance in subject matter and his experience in expressing his thoughts in public. One staff member suggested that he never had any trouble with discipline "if I go prepared and try to help the students". (114)

The problem is basically interpersonal. Its treatment probably best proceeds by attending to motivational factors in learning. If the teacher can be lead to confidence in his subject matter (problem 17), if assistance can be given to him in the organization of his teaching procedures (problem 15), if he can be shown the possibilities and trained in new teaching techniques (problem 12), the confidence engendered should help materially in lessening this problem. Once these steps are taken, it should be easier to cultivate an attitude of helpfulness, and a concern for the "real" problems of the student (problem 10). College students are as a whole task oriented. Deviant behavior (inattention, disruptive behavior, inappropriate talk), unless initiated by an individual with obsessive drives, is likely due to the failure to see any connection between what is happening in class and the problems in which he is already involved. (Thelen and Tyler, in Henry, 1950, page 323)

The discussion of treatment under the next problem also has relevance in classroom control.

7. <u>How to deal with interpersonal problems in the class (so that learning can be implemented)</u>

This statement is an amalgamation of related problems which can be treated under interpersonal theory. Three problems from rating scale data were integrated herein: Instructor shows lack of tolerance, is impatient, (23% of teaching assistants), Manifests little humor (35% of teaching assistants), and Students frequently antagonized (12% of teaching assistants).

Staff members identified this problem in statements such as:

> Some may ridicule students, or insult them. They may use sarcasm or ridicule. They should identify the student as an individual and help him accept himself. (111)

Two problems from participant observation--Lack of patience with students and How to overcome adverse feelings, were coded into this statement. Illustrations of the type of material in the items are:

Item one: A remark by an assistant: "I do not care for teaching. I have had some smart alecs in each group. They can spoil the whole class." (P O 4)

Item two: The extremely structured procedure of a foreign teaching assistant in introducing a new group to laboratory work. (P O 21)

Item three: Two teaching assistants were observed discussing the "goofs" pulled by their students in their classes. (P O 11)

Item four: The following interplay during a quiz hour between a teaching assistant and a student:

> Teacher: "You are going to run into this during 202."
> Student: "We won't take 202."
> Teacher: "I don't care. I am teaching for chemistry majors." (P O 22)

Though this failure to relate is certainly a problem, the impression should not be given that teaching assistant-student interaction was always strained. Teaching assistants appeared to relate better to the students than to the staff. In fact one of the teaching assistants

complained that his problems was "sympathizing with the students". (13)

There is a close correlation between these interpersonal difficulties and lack of experience--assistants were less likely to have trouble later on in the year. Yet at anytime of stress problems would arise. Often they represented personality difficulties. Sometimes they were projected into the classroom situation through lack of knowledge of how to deal with people. Still another causation seemed to stem from the lack of proper perspective as to what was the purpose and goal of instruction.

Treatment of this problem, in the area of interpersonal theory calls for individual counseling, informal discussions in small groups, observation of classroom procedures,and possibly some student interviews. Highly emotional behavior in the classroom, on the part of either the teacher or the students, usually stems from other causes. The treatment is likely to be found to depend on clarification of goals, improvement of knowledge of chemistry or laboratory procedure, better structuring of classroom procedures, or familiarization with teaching technizues which meet class needs. Pressures of the teaching assistant's other work may cause so much stress that the student's plight does not "come through" to him. The guidance of a staff member who has some sympathy with the needs of students who are non-majors, and who can interpret these needs to teaching assistants is very valuable in these cases.

8. How to overcome nervousness, shyness, and insecurity

This problem was directly referred to by only one teaching assistant, though at the beginning of the year it probably was a problem for the majority. Only two staff members suggested the problem. But students responded strongly. On the back of the scales, the analysis of comments

found 30% of the teaching assistants Hesitant or confused, and 40% of them Lacking in confidence.

This problem is generally a result of the lack of experience. Several assistants suggested that the pre-term training be pointed toward how to handle first week teaching. Staff members suggested that some sessions in the pre-term training period be used in handling quiz hour and in demonstrating laboratory techniques. (Refer to problems 12 and 19.) Attention to subject matter deficiencies of the teaching assistants will assist in minimizing this problem. Techniques for handling groups and class planning procedures could minimize the problem. Exploration during individual counseling of underlying causes should be worthwhile.

9. How to identify and correct distracting personal mannerisms and appearances

Students were alone in pointing up this problem--and this was principally on the rating scale. They saw 12% of the teaching assistants as Untidy or careless in appearance and 59% of them with some Distracting mannerisms.

The identification of these objectional personal characteristics is the most difficult part of the treatment of this problem. Personal observation of the behavior by a concerned staff member is one direct method. Criticism of other teaching assistants during demonstrations or practice sessions provides some discernment, but is dangerous at the beginning of the term. Anonymous student reports could be used, but only with care. Group counseling during pre-term sessions, possibly with some role playing, is the safest procedure, but may not identify the problem for the individual himself. Correction in many cases will come when the individual teacher becomes aware of the problem and

accepts its significance.

10. How to get "feedback" concerning student problems

11. How to conduct classroom discussions

These two problems are the first of a series having to do with inappropriate classroom behavior. The problem of discussion is set apart from other classroom techniques because the several data sources heavily supported it. There were eleven different items in participant observation coded into this problem. In the interviews with the teaching assistants, three mentioned their inability to get students to participate in class discussion. On the backs of the rating scales, students showed that 20% of the teaching assistants either discouraged questions or failed to get questions answered. Staff members did not mention this problem directly, but inferred that teaching assistants simply do too much lecturing, which is the next problem discussed.

The concept of "feedback" is introduced here because of the possibilities it holds for innovating change. "Feedback" is the procedure by which a group can become aware of its own difficulties, the reason for those difficulties, and the corrections which are necessary (Jenkins, 1948) As used in this discussion, it refers to the receiving of information about the deficiencies in the learning of students, which needs re-teaching.

The effecting of feedback can best be taught by demonstrations of possible techniques. Many persons simply do not recognize the number of methods--class questioning, use of question boxes, analysis of tests, selective interview, etc.--that are available. Experience in handling the various possibilities is the only certain way that teaching assistants will become familiar with their use. The most

valuable demonstration will of course be carried out when the staff members themselves utilize such methods, either in their work with students, or in the direction of the work of teaching assistants. Such a situation provides a high motivation for change.

Concerning the problem, How to conduct classroom discussion, it should be recognized that "class discussion", as suggested by students, teaching assistants, or staff, does not mean "group discussion". As conducted in the average classroom there is likely to be little class interaction. It consists of students making inquiry concerning subject matter, laboratory techniques, or class policy, and the teacher answering the question. The teacher thus acts as the sole resource person and as an authority figure.

This structure for classroom behavior grows out of the kind of goals usually established in beginning chemistry classes. Evaluation of student progress is in terms of factual or informational recall. Learning becomes the mastery of arbitrary associations. Grades depend on the correctness of response and the quickness of response (Henry, 1950, page 98). Since the student is aware of this, he wants to know the facts: "What will be the wording of the most acceptable answer?" He wants an answer, not from a discussion with other class members, but from the best authority he has at his disposal--the teaching assistant.

Nevertheless, conditions for good group discussions are still relevant. These include careful planning, common goals, valid resources, individual feelings of fitting into the group (and leader acceptance), group cohesiveness, freedom from distractions, and usuable recording facilities (Bergevin, Morris, and Smith, 1963, page 98).

It is quite possible that the use of true group discussions, with

implications for interpersonal involvement, the use of students' experience and knowledge for resource data, and the direction of class activity by within-group goal-setting will be necessary before precise conceptualization and problem solving can effectively take place in the quiz hour. (Nelson, 1950, page 325).

Today concise information on the handling of groups is available in adult education literature. The manual referred to before, Adult Education Procedures, by Bergevin, Morris, and Smith, is an example. Special fields of adult education, such as churches and parent-teacher association, have related materials designed for quick reading by leaders who do not have time or interest to do a great deal of study. Audio visual aids are available. Basic knowledge and practical experience in this area would not be amiss for teaching assistants.

12. How to vary quiz hour and preparation period presentations

This problem, of which problems 10 and 11 are a part, was mentioned twice by the staff. Though only four items were coded into participant observation data, every observation actually showed the need for improved discussion methods, use of visual materials, or the use of demonstrations.

In regard to demonstrations, teaching assistants would probably need assistance in developing class demonstrations because of their lack of time. At present this is done to some extent by suggesting that they show some particularly difficult laboratory technique before the period. One possibility would be for a teaching assistant to be assigned to the task of going through the next week's laboratory exercise before junior staff meeting and then, assisted by the staff, determine what techniques need to be demonstrated. Some techniques probably should be demonstrated at this meeting.

13.. How to explain chemistry to students

13a.. How to know how deep to go

13b. How to coordinate information with that given in theory

13c. How to "put" explanations in terms of the vocabulary and experience of students

13d. How to get feedback from students as to why you are not "getting through"

This complex problem was supported by data from all sources. (See Chapter V)

Before anyone can explain chemistry, he must of course know chemistry. He also must be sensitive to group needs. (Refer to problem 10) He needs to relate the subject matter to the previous experience of the students, since concepts follow experiences. Finally there is a need to listen to a student's response to a teacher's discussion, since the response gives a key to what has really been heard. (Schein and Bennis, 1965, pages 40 and 41).

Communication is very important in the treatment of these problems. Somewhere, somehow there must be communications between the staff members, and between staff and teaching assistants as to just how "deep" into a particular subject discussions will be carried. Along with this information there should also come an awareness of what "chemical theory" is to be covered, and what the teaching assistant will need to emphasize in his work. What is more, the responsibility for communication cannot rest with the teaching assistant. Even though it is vital to his work, he is not in position to implement the flow of information. Communications outside the classroom are the responsibility of the administration.

The teacher plays a key part in relating subject matter to the experience of students in term of their experience. Especially is this true of the teaching assistant, since usually he is only three to four years older than the student. If he can reach back into his own experience and explain an idea in terms of that experience, it is likely that the student has had a similar experience to the one described. What is more, this search for common place, analogous illustrations is one of the most effective ways he can fix an abstract concept in his own mind. It will not only clarify the idea for the student: it will deepen and extend the boundaries of the idea for the teaching assistant.

Further clarification can then come from feedback -the reactions of students to explanations. It is tremendously important that the teaching assistant be taught simple procedures which allow this inter-communication to take place. Probably the most important element is listening--attempting to hear what is being said by the student, and accepting the student's statement as legitimate. The process is expedited, however, by having a repertoire of techniques which will encourage the response of the students. Not the least of these are those which provide a permissive "climate". Again source material can be found in adult education materials.

14. How to overcome mechanical speech difficulties of presentation

This problem was suggested by one foreign teaching assistant; for him it was the matter of an accent. On the rating scale, students, reacting to the item Poor enunciation, words indistinct, rated this a problem for 23.5% of the teaching assistants. In the comments on the back of the scale, the composite problem Unsatisfactory communication techniques, enunciation poor, low speaking voice, or illegible hand-

writing was considered to be a problem for 55% of the teaching assistants. Three staff members thought that assistsnts often could not express themselves; one suggested that speech training might be of value.

This appears to be a counseling problem with individual teachers. However, some time might well be spent discussing the matter with the teaching assistants as a group during pre-term training sessions. Foreign assistants may handicap a section even though they understand English themselves. With sections composed of students who have had no previous experience with chemical concepts, the use of foreign persons as teachers should be scrutinized closely. Teaching assistants with speech difficulties probably need to be made aware of their problem. Difficulties could be minimized by the use of duplicated handouts, dependence on textual material for illustrations, and the utilization of student interaction during discussions.

15. How to organize class for efficient use of time and for effective teaching

Teaching assistants did not see this as a major problem. Staff members believed that teaching assistants did not plan ahead, and did not know how to conduct class. Nine different items in participant observation recorded instances of failure to properly utilize class time. Observation revealed that teaching assistants used up a great deal of the quiz hour in giving tests or handing back tests. Though tests certainly have value, this expenditure of time on tests limited the amount of time available for discussion of student questions. Since usually these tests were made by teaching assistants and graded by teaching assistants, they were not necessarily of vital concern to

the students; students are more concerned about clearing up difficulties in theory or problems in the laboratory. Often test answers were routine: they might be more efficiently handled by duplicating correct answers--then allowing students to react to these answers.

The matter of class organization revolves around teaching procedures as discussed under problems 10,11, and 12. It might be well for the staff to formalize class procedures during the first week. One staff member suggested that in pre-term sessions teaching assistants could be allowed to practice on other teaching assistants. As the asistants gain experience, they should individually adapt classroom procedure to the needs of the students.

16. How to make clear and specific assignments

Though seldom mentioned by data sources, observation showed that often the assignment is not explicit. Rarely is goal setting included or even the connection between the assignment and the student interest explained. Student participation in goal setting and the exploration of purpose is rare indeed.

Previously in this chapter, the need for planning of classroom activity has been discussed. Educational theory includes in planning the setting of goals and the development of evaluative procedures. Some consideration of the student's goal perspective should be taken into consideration. The student demand for extra sessions, before an examination, arises from his need to have some class activity where his own needs determine what happens.

17. How to overcome deficiencies in chemical knowledge

This problem was mentioned by ten staff members as the prime problem of teaching assistants. Teaching assistants inferred in various

ways that it was a problem. Student reaction on the rating scale showed 53% of the teaching assistants with this problem. In the comments on the back of the scale, 45% of the teaching assistants were reported as having a deficiency in subject matter. Five items in participant observation substantiated the other sources.

This problem, along with problem 18 (concerning laboratory techniques) appears to have possibilities for the coordination of the work of the teaching assistant with his graduate study program. Help given to the teaching assistants in subject matter and laboratory techniques used in his teaching should make them better chemists. While their ability to teach is being improved, their chemical knowledge can be broadened and deepened. What is more, it will be purposive training for the teaching assistant.

A refresher course taught by a lecturer would not be an effective way to do this. Individual graduate students vary a great deal in their subject matter preparation. Remedial teaching requires techniques for finding out just where the individual is, and then creating conditions which will bring about improvement, preferably through his own efforts. This may be done in groups working together under an interested staff member but will also call for individual counseling. Teaching assistants already do much of this among themselves. Study rooms might be arranged so that such informal sessions are encouraged. A staff member with an inviting attitude readily available in a close-by office, would be of great value. (Preferably this individual should <u>not</u> have supervisory powers over the assistants.)

The use of information sheets, just for the teaching assistants, would be appropriate. These might be only a page or two in length.

Carefully selected reading assignments could be used, detailing exactly the purpose of the assignment. Laboratory facilities for the pre-running of experiments, with the materials readily available should be provided. Demonstrations, during junior staff meetings, of specific procedures might be occasionally used. The lack of time for such "outside activities" is a limiting factor, but the fact that the teaching assistants' chemical knowledge and skill is being improved should be recognized. Here is a place where teacher-training for the teaching assistant might justifiably utilize some of their course time. Yet individual programs would need to be planned: the amount of time that could be utilized by the individual teaching assistant in such activity would vary.

18. How to improve laboratory techniques and skills of the teaching assistant

This problem is supported by items from the interviews with the teaching assistants and the suggestion of a staff member that the assistants are poor in their laboratory techniques. Several pages in the handbook (Division of Chemical Education, 1965) is devoted to the problem. Partial support comes from the data in problem 17. It is included separately, however, because treatment necessarily will be different from that provided for the improvement of the knowledge of subject matter. If teaching assistants are encouraged and assisted in giving more demonstrations in their own classes, the interest in improving their own techniques will be motivated. Concern for safety should be emphasized.

19. How to develop acceptable laboratory techniques in students

This is a transition problem between number 18 and number 20.

It is directly related to the development of the assistants' laboratory skills, yet it is an intrinsic part of laboratory management. Participant observation showed that it was a real problem.

Demonstration by the teaching assistants is a logical approach to a solution. There is much talk in the preparation period about what should be done in the laboratory--part of this time could more appropriately be used by showing rather than telling. Yet there should be a balance here. Too much preparation time takes students away from actual participation. Demonstrations should not be made a substitute for laboratory experience. Often, however, demonstrations may take less class time than an explanation.

20. How to organize and manage the laboratory period

Teaching assistants saw this problem in terms of the preparation of students for laboratory work. Three mentioned this particular problem. One suggested that students would just not pay attention. (10) One was concerned about how you could get students to read directions. (page 85). On the back of the rating scale, students mentioned Poor laboratory management, unsatisfactory preparation periods, and lack of help and attention in the laboratory as a problem for 45% of the assistants. Staff members suggested that teaching assistants should:

> actively participate in the laboratory--find out what students are doing, ask questions about the relation of laboratory procedures and results to theory, actively supervise, and show a friendly attitude. (101)

Observation data contains several references to teaching assistants' failure to stay with students and their inability to organize the laboratory work. The staff was concerned about the neglect of laboratory house keeping.

At the pre-term sessions, general guide lines and policies are

now presented to the assistants by the supervisory staff. The laboratory period is the most completely supervised of any of the teaching assistants' activities. It would be worthwhile for more effort to be made to help the teaching assistant understand the purposes of the laboratory. The Handbook for Teaching Assistants (Division of Chemical Education, 1965) would be of some help if carefully studied. It would also help (as two staff members pointed out) if provision was made for the teaching assistants to observe a good laboratory teacher at work. Some team teaching might be in order, where the teaching assistant has the opportunity to work with an experienced person. Perhaps (as one staff member suggested) groups of four teaching assistants might be put under the tutelage of a staff member. Special effort might be made at junior staff meetings to get individual problems of teaching assistants before the group. These could then be discussed by both staff and assistants.

21. Safety measure: How to instill in students a constant regard for safety--How to take care of emergencies

Outside of one suggestion by a teaching assistant, there is no support for this problem in the research. However, the Handbook for Teaching Assistants (Division of Chemical Education, 1965) devotes four pages out of 28 to the problem. Any training program, cursory or detailed, should deal with safety. Furthermore, safety training should be included in any elementary laboratory course in chemistry.

Safety attitudes will be instilled not only by the introduction of safety concepts into the subject matter, but also by involving the student's feelings. Interpersonal theory will therefore be utilized in any treatment of this problem.

Procedures for inculcating safety attitudes into industrial workers usually take the form of demonstrations, drill, and devices for keeping attention focused on the problem. Time at the beginning of the term utilized in demonstrating such procedures as the use of the safety shower, the use of the fire extinguisher, or the emergency treatment of acid or caustic spilled on the skin or in the eyes would be worthwhile. Industry has found that safety posters have value. Defensive safety procedures should be emphasized in the laboratory routines.

22. How to make good test questions and organize tests

Four teaching assistants specifically mentioned the lack of ability on the part of teaching assistants to make tests. They were concerned about whether these tests were too hard (6), whether they could be easily graded (16), or whether standards were too high (16). On the backs of the rating sheets (page 77), student comment expressed the feeling that 40% of the teaching assistants gave Tests that did not cover the material presented, or that questions were trivial. Observation data had eight references to the problem. Often it appeared to the observer that the assistants were not sure why they were giving tests or were reading into test-giving invalid purposes. Tests often seemed to be given "because we have to," "to use up time," or "to put the fear of God into them."

Twelve tests from various teaching assistants were examined. These tests varied from one with three questions to one with eight questions. Some questions demanded very specific recall: "What radioisotope was used in the laboratory experiment?" Some were true-false statements: "Gamma radiation has a mass and charge. T or F." One teaching assistant was observed administering a test orally.

Some tests were observed to take the students 30 to 40 minutes to answer.

Tests of teaching assistants exhibited a wide range of difficulty. Statements on some tests revealed a tendency for the assistant to make them less difficult in order that scores could be higher in his sections. Students in sections taught by certain teaching assistants complained about the difficulty of the tests in their sections.

Improved communications between the teaching assistants and staff would help considerably. There was frequent discussions observed among the teaching assistants about tests; the problem seemed to be one that disturbed them. This communication between teachers was not universal, since foreign assistants did not participate. These interchanges sometimes led to clandestine rules: One directive from the staff ruled that questions on certain tests given by theory theachers but graded by assistants were "to be marked all right or all wrong." When asked by the observer just how he was handling this directive, one teaching assistant replied, "Oh, we agreed sometime ago that you couldn't do it that way. We are giving partial credit."

Modern test theory, especially with reference to the values of various types of questions, is rather well established. Theory and techniques of test making could be demonstrated and discussed. Practice sessions could be given. The idea, which the department uses, of having teaching assistants hand in tests to supervisory staff members for criticism at the beginning of the term is good.

Some concern for the goals and purposes of testing in the particular courses being taught should be cultivated in the teaching assistants. Though the use of tests as a means of determining students'

grades is important, there are other uses that can also be made of tests In these large classes, tests should be used as a link in the feedback process, providing a source of information to the teaching staff as to just what the student has learned and what needs to be re-taught. Weekly or laboratory tests should be so constructed as to function in this manner.

Tests are also a means of guidance to students. They are the students' final criteria as to just what the teacher thinks is important in a course. Until a test has been evaluated and returned to a student, he has no dependable method of finding out what are the teacher's "real" goals. The outlining of goals and purposes in lecture and discussion are important; yet under our collegiate grading system this becomes deceptive unless supported by confirming test results.

Workshop methods, in pre-term sessions or in junior staff meetings hold the greatest possibility for improvement of test construction. It might not be amiss to bring teaching assistants together for group instruction and practice in test construction before their first tests are given. Such sessions should include discussions of what constitutes good tests, what was covered in class and laboratory that should be emphasized by tests,and practice in the actual wording of questions. The staff member conducting such sessions should give enough assistance to the new teachers that they are able to produce a fairly complete test during the period; otherwise they may feel that such sessions are time wasted. (Every session designed to help the teaching assistant do a better job of teaching should be so evaluated.)

This is one problem which is certainly vital enough to the teaching program to merit additional study by the teaching assistant. What is

more, research in testing has proceeded to the point where recommendation of procedure in the field are quite reliable and therefore will be found very useful by any teacher. One readable reference, which is written so that the reader can, by the use of the table of contents and the index, find answers to specific problems is Constructing Evaluation Instruments by E. J. Furst (1958).

23. How to be fair in grading and evaluating students

Due to the fact that as a rule, they relate rather closely to their students, teaching assistants were greatly concerned about this problem. On the back of the rating scale, the general problem, he is Unfair in grading--grades too harshly, grades too easily, or plays favorites showed 55% of the assistants with the problem. Staff members did not mention the problem directly.

This problem, highly interpersonal in nature, would be very hard to attack directly. A staff member, who could "level" with the teaching assistant as an individual or in groups, discussing the problem frankly and suggesting how he handles it, might provide a means of treatment. If teaching assistants could be led to open up in junior staff meetings, conversation between the staff and the assistants about what they feel are some weaknesses in the testing program could prove fruitful. The improvement of test construction, discussed in the previous problem, will help here also.

24. How to resolve conflicts of other activities and interests of teaching assistants with teaching

This is the first of a series of problems which were considered by the writer to be staff centered. It is staff centered because, as one staff member put it:

> These students /teaching assistants/ are forced to have a lack of interest in teaching. Each is primarily concerned with his own problems. We have to put pressure on graduate students to do research. . . .These must be applied. (114)

The students accented this problem. On the rating sheets 13.9% of all students considered that Lack of enthusiasm was a problem for their own instructor. They rated it a problem of 65% of the teaching assistants. Four staff members felt that the "teaching assistant has too many activities and interests--that he is not interested in teaching."

How could this lack of interest in teaching be ameliorated? First, it would help if the teaching assistant's research advisor could show an interest in the assistant's job. Along with the question, "How is your research coming?" another should be posed, "How are you getting along with your classes?" If this advisor could sit down with the teaching assistant, listen to the assistant's problems, and react to them out of his experience with the same concern that he shows for his research--the interest of the teaching assistant will be awakened.

Second, there should be some counseling with the teaching assistant about his work load. One staff member suggested that he thought while the graduate student was teaching, his research program should be curtailed. One teaching assistant suggested that the course load should be reduced while he was teaching. The systematic budgeting of time should be considered by the assistant. His advisor should have concern and should make inquiry to see that it is being done. Any assistance program, such as suggested in this research should be thought of as a means of helping the teaching assistant teach, and should not be sunerimposed on his already heavy load.

25. How to sequentially relate theory and laboratory

Both the staff members and the teaching assistants complained when

theory did not precede the related laboratory exercise. Apparently this was due to the feeling that laboratory was a demonstration of the facts learned in theory.When laboratory proceded theory, the assistants had to introduce theory in order that the students could understand laboratory. They considered this an extra chore, for which there was not enough time.

If the premise is accepted that concepts follow experiences (Schein and Bennis, 1965, page 40), it may be more appropriate for learning if the laboratory exercise precede the theoretical teaching. If this sequence is followed, the responsibilities of the teaching assistants with respect to introducing understandings underlying laboratory experiences will be increased.

Whatever procedure is followed, communication lines need to be kept open between staff and teaching assistants, so that the assistants can know what is expected of them.

26. How can the laboratory supervisor get information from the teaching assistants on the condition of reagents and equipment?

Throughout the year, the teaching assistants were concerned about the condition of the balances and other equipment, or the fact that "something" was wrong with the reagents--the results were not coming out right. When physical facilities failed to function, class activity would often be fruitless and teaching assistants would spend a frustrating afternoon.

Staff supervision considered this a problem of the teaching assistant. If something did not work right, it should be reported--at least it could then be corrected by the next period. Assistants, however, were involved in class control--even if they were able to

deduce the difficulty, it often was not reported.

Communication is here again seen as the problem. How do you lubricate the channels of information, or shorten their length? This is an interpersonal or administrative problem.

27. The teaching assistant needs experience.

This statement is brought in here because it was mentioned so often by the staff and by students. Here at least these two groups were in complete agreement about what was a problem of teaching assistants.

The question arises: Can the inexperience of the teaching assistant be lessened, or the period of inexperience be shortened by a training program? If it can, will it be worth the cost?

Not every problem discussed herein can be solved. Some are perennial--we can treat the problem--reduce its effect, yet it is ever with us. It appears that something could be done for all 26 previously mentioned problems in this chapter. For some, a little effort would make a great deal of difference.

CHAPTER VII

A RECOMMENDED TRAINING PROGRAM

In the previous chapter, an attempt was made to determine the theoretical treatment area for each problem, along with suggestions as to what procedures might be used for a practical attack. In this chapter, the concern is with the integration of these approaches to solutions of the problems. In terms of the staff perception of the situation and the researcher's approach to the initiation of change, what innovations will bring about the improvements desired? What particular segment of the departmental program can be utilized as the point of entry for these innovations?

The program outlined in this chapter is not a primary objective of this research, which was to determine, by surveying and analyzing the perceptions of three different groups of people, which problems could be considered "real" and which could be attacked operationally. However, to set these problems out, to describe more fully what they are and what they are like, a discussion of possible treatments and solutions is relevant. The training program here presented was in no way tested in this research; it is presented as a unified procedure which could be used, in the department studied, to treat the problems found in the research. Philosophically, an attempt is made to base the program on change theory (Lippit, Watson, Westley, 1958).

The Staff Perspective--The Climate in Which the Program Must Develop

The staff, consciously or unconsciously, deliberately or otherwise, defines the purposes and goals of the undergraduate program, and accordingly fits teaching assistants into the program. The staff structures the program in terms of what members would like to see teaching assistants do. This is determined by certain concepts that the staff holds about the importance of research to the department, about the nature of their instructional task, about the curriculum of the graduate program,about how the work of the teaching assistant should be directed, and about the value of teacher training in general. A look at these concepts is in order.[1]

1. Ability in chemistry is the most important requisite of a chemistry teacher. If you are going to improve chemistry teaching most of the effort must be spent in deepening and broadening a teachers'

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[1]This should not be construed to be in any sense an official expression from the Department of Chemistry as to departmental policy. It is a carefully drawn picture of what the writer sees as the perspective of the various members of the department toward the work of the teaching assistants, the assumptions of this research, and toward teacher training. It is based on notes from individual participant observation, conclusions drawn from several years of experience in the department as a student, as a graduate assistant, and as an instructor. The writer takes full responsibility for any bias entering into the statement.

The comments are not made as a criticism of the department. To the writer, the only way to begin any change program is to start with an organization and the personnel of the organization. The key to the effectiveness of effort to bring about change is a clear understanding of the perspective of the individuals in the organization toward the change being undertaken.

It appears to the writer that one of the reasons that science teachers in colleges and universities have been so slow to adopt educational innovation is that they have been presented information which, because of its nature, its source, or the method of presentation, has been in conflict with their value systems. The program suggested in this chapter is an attempt to relieve this situation.

knowledge of chemistry. It is through this kind of chemical understanding that a teacher can know what to teach.

2. Research is central and dominant in the graduate program in chemistry.

> The main features of graduate education should be the development of initiative and originality in research, of a critical evaluation of literature and the results of one's own research, of the ability to prepare concise and critical reports, and of skill in the oral presentation of the results of research. . .
> (Committee on Professional Training, American Chemical Soc., 1948)

Though staff members are not wholly in agreement on the dominance of research over teaching, the policy of the staff follows the above premise of the American Chemical Society. The staff membership would generally agree to a later statement of the same committee: ". . .such training /in research/ is also well suited as preparation for teaching. (Carter, 1964)

3. Any training program must be controlled by chemically oriented people. "If we did have the funds /for a training program/ and the personnel to put on a full staff member, he would have to be a chemist. . ." (114) This would be due to the need for the trainer to sometimes assume other duties, but also because his basic values need to be those subscribed to by the staff--at least to the point that they have confidence in what he does.

4. Graduate students are in school to be trained in chemistry. The department does not have time to waste in teaching something else. Any sort of training program must be so designed that those participating will be better chemists because of the program.

5. "We cannot afford to waste time or funds on a useless program." If a training program is initiated, there must be some sort of

evaluation included. The criteria utilized in the evaluation must be understood and accepted by the staff.

6. The staff orientation toward teacher education should be understood:

a. General education courses for our graduate students would be worthless. Teaching is individual, and cannot be generalized. You must be specifically trained to teach chemistry.

b. There are possibly ideas in education and psychology that might be helpful /some staff members are not sure/. However, whoever has charge of the program will need to be very selective--otherwise, the teaching assistants would spend a lot of time on worthless material. "It is general knowledge that education courses are repetitious and contain much filler."

c. Teaching is something you have to "have a knack for. . ." It is pretty much of an art. There is really very little that can be taught about how to teach.

d. Finally, ability in chemistry is the most important requisite of good teaching. To be a good teacher, one must "keep up" with the subject. The teacher who "keeps up" will have an active research program.

Not every staff member holds to these tenets. But when the staff makes up its "group mind", it appeared to the researcher that these would be, as far as this program is concerned, the concepts which would guide decision making.

Basic Approach to this Training Program

Before the following program can be understood, the treatment

approach needs to be described. Six perspectives for change have been adhered to:

1. Since administrative control rests with the staff, any change that takes place must be within the range allowed by the mores, purposes, and values of the staff (Bennis, 1965).

2. The teaching assistants are not professional students in education. They approach educational theory in somewhat the same manner as an individual drawn from industry to instruct in his trade at a technical school, as an army instructor drawn from the ranks to teach "basic skills" in which he is proficient, or as a church school worker who teaches adults on a volunteer basis.

3. Content of the training program must be derived directly from the kinds of problems the teaching assistants are having who are being trained. Though it can and should be based on theory and supported by pertinent research, it must be directly applicable to the teaching situation. Theory presented should only be enough to integrate materials and processes. Teaching assistants and staff members should participate in the diagnosis of problems and the application of treatment (Seashore and Egmond in Bennis, Benne, and Chin, 1961, page 660).

4. If a teacher-trainer is employed or assigned to help the teaching assistants, he should have little formal control over the assistants, since to wield power is at variance with his normative goals. Whatever influence he is able to exert should not be due to his coercive power stemming from a supervisory or administrative position, but should be due to "value" power, influence due to the value of what he has to offer (Bennis, 1965, page 353).

5. Changes typically involve risk and fear. Every effort will be

made to reduce these concomitant effects by "working through" changes with the teaching assistant and staff, showing where each change will be useful in the solution of his own problems, where it is congenial to his own point of view, or where it is necessary to the maximization of his own set of values (Kelman in Bennis, Benne, and Chin, 1965, page 513). Understanding of the change, involvement with the change and self-diagnosis of need, will be important considerations in any innovation.

6. The use of vocational, industrial, and adult-education material and management-science materials and theory are preferred whenever appropriate. The writer feels that ideas from these sources are particularly applicable to the approach used in the development of this training program.

Qualifications of the Teacher-Trainer

Any training program for 22 teaching assistants (number in the program under study) would require at least one-half of the time of a qualified person. In addition there should be secretarial assistance available for his use. This would be in addition to a present administrative and supervisory personnel in the Freshman chemistry department. If the program is successful, the department may find it worthwhile to increase the time allotted for training purposes. The qualifications suggested for this individual are as follows:

1. The person in charge of this program (teacher-trainer) needs to have the equivalent of a masters degree in chemistry. The quality of his work should meet the standards of the department for further work toward a Ph. D. degee.

2. He should have had some study or research in psychology, education, and an introduction to either adminstrative or communication theory, or be willing to do further study in these fields. He should be familiar with application of these theories in practical day-by-day situations. His experience should be practical rather than theoretical in these areas.

3. He should have some teaching experience in science. Part of this experience should be as a teaching assistant. Preferable, he would be a high school teacher, with a masters degree in chemistry, who wishes to come back for work on a doctoral program. Though individuals thus trained are scarce, they would meet departmental requirements and still be able to develop the suggested program.

As an alternative, a staff member who is interested could be given the time and authority to develop the program. The danger here lies in the possibility that this would be either an added duty or that it will be a deteriorative to his research in chemistry.

Status and Function of the Teacher-Trainer

The teacher-trainer, in order to be effective, needs a unique status as far as staff and teaching assistants are concerned. Within the staff structure he will work under the Director of Freshman Chemistry. His future should depend upon his success in accomplishing the departmental goals for this program. He should be given status and tenure in the department commensurate with his training and experience. To continue using a graduate student as program director after its initial phases would cause it to fail.

The trainer must be identified by the teaching assistant

principally as a part of "his group"; the assistant should view the trainer as a part of "staff" only to the extent that he values and accepts him as a subject matter and technical authority.

The teacher-trainer should ultimately function within the staff as a consultant on educational and behavioral science problems. He should advise on and implement evaluative procedures; this will allow him to structure feed-back on student progress. Often in the staff group he will act as a clarifier, summarizer, or expeditor.

As far as the teaching assistant is concerned, the teacher-trainer should be a non-threat, non-directive consultant and resource-person. There should be a strong identification with the trainer by the assistant. Every effort should be made to create an interpersonal relationship which is supportive.

The trainer should be competent in chemistry so that he can reinforce the teaching assistant in his subject matter knowledge. His office should be a resource center for introductory chemical materials.

The trainer should also be a source of practical procedures, of situational "set-ups" for learning, and of teaching skills. He facilitates communications between the staff and assistants.

Before the trainer can communicate, he must observe. He will need to utilize some of the processes demonstrated in this study. He will gather data that will allow an analytical evaluation of his own behavior as well as that of the teaching assistants and staff. At times he will need to engage in educational research, but this will be research about what is happening in order to see changes that will more precisely meet his objectives, as well as those of the department.

To some degree, the trainer needs to fill an "outsiders" role

(Seashore and Egmond in Bennis, Benne, and Chin, 1961, page 665). Since several status levels are involved, expressions of attitude and feelings will sometimes be threatening, and will not be forthcoming unless supported by an outside figure. This is one of the reasons for the insistance on the non-directive-supervisory role of the trainer, and the very careful protection of confidences.

The trainer will need an outside consultant. Though he must function as a member of the chemistry department, it will be helpful if there is some one outside to whom he can go for professional advice. The consultant should be competent to advise in the areas of change contemplated.

The Training Program

In order to meet the implications of the staff perspective and the specifications outlined under the basic approach to the program, the initial phases of training must make use of established routines of the department. There are three normally scheduled activities which could be used for training purposes:

1. Arts and Science Seminar for New Teachers
2. Pre-term orientation for graduate students in chemistry
3. Chemistry department junior staff meetings

For two reasons, the Arts and Science Seminar cannot be used for the purposes outlined here (for description of seminar, see page 16). First, it is principally concerned with administrative problems. Second, since it attempts to take care of the needs of new staff personnel from a number of departments, it is quite general in approach. The program needed for the teaching assistants in chemistry, at least during

orientation, must be quite specific and deal with immediate problems.

Pre-term Orientation

The pre-term orientation for graduate assistants already is used for some training. At least three staff members have suggested that the training function of this activity might be extended. The time allotted for the sessions should be extended to at least one full week and the number of training sessions per day increased. (The teaching assistants should be informed of this previous to their arrival so that they would make their plans accordingly.) The sessions should be under the direction of the teacher-trainer, working in close cooperation with the staff. This will give the trainer an opportunity to integrate the orientation activities with other efforts during the year.

No effort will be made here to construct a detailed schedule for these sessions. Certain activities and materials such as the following should be included in the program:

1. Describe the general organization of the courses.
2. Describe the laboratories and supporting store-room facilities.
3. Define purposes of the course, relate the course work to the educational objectives of the students.
4. Describe the role of the teaching assistant in the program.
5. Meeting of staff for specific classes: conduct of quiz hours during the first two weeks.
6. Introduce training procedure.
7. Establish a proper relationship between the trainer and teaching assistant group.

It is very important that the assistants have a conception of what is being attempted in the overall program and what part they play

in this program. If they are involved in goal setting, they are more likely to become interested and motivated in their teaching assignment. (Refer to problem 5, page 100, and problem 16, page 112.)

The planning for the first few weeks work should be explicit. The teaching assistants need to walk into their first classes with some knowledge of what they are going to do and why they are going to do it. They need definite ideas about what class set-ups may provoke learning experience, what laboratory techniques should be demonstrated, and how to organize the class for work. A demonstration of how a competent instructor handles a quiz section would be appropriate (problem 15, page 111, and problem 18, page 114).

Coupled with this training in meeting the immediate needs could be some background on the reasons for employing some of the procedures. Here is the initial opportunity to start generalizing their teaching repertoire by presenting a procedure--then discussing what it should do for student learning. This combination of process--then theory (with theory in small doses) should be followed throughout the year.

One afternoon could be devoted to a laboratory "jam session", at which time each teaching assistant may carry out one of the laboratory exercises his students will do during the first semester. Pre-plan so as to provide for the procurement of supplies and equipment, and to arrange a variety of exercises with which the individual is not familar. Make sure they have refreshed themselves on techniques they will need to teach during the first two weeks.

This pre-term period is the key time for the trainer to establish a working relationship with the assistants. He can establish this relationship by being available for informal conversation, as well as assisting them in preparing for their teaching duties.

For a generalized plan for pre-term training which has been utilized at several universities, please refer to page 32 of Chapter II. In addition, in Appendix H, page 182 will be found A Schedule for Orientation of New Graduate Students and Teaching Assistants as used at Ohio State University. This schedule is included to show what is being done in the training of teaching assistants. It should be recognized that the approach to the Ohio State program is generalized, whereas the suggestions presented here utilize the immediate needs of the teaching assistants as a focal point for training.

Junior Staff Meeting

The staff members who lecture in each introductory chemistry course hold regular weekly meetings with teaching assistants conducting laboratory and quiz sections of that particular course. These meetings, termed here Junior staff meetings to differentiate from regular departmental staff meetings, are briefing sessions with an agenda consisting of what materials to be covered during the coming week, suggestions and changes of laboratory procedure, directions for the conduct for quiz hour and laboratory, plans for the conduct of examinations, and a question and answer period. It is here suggested that by careful planning, and through the use of handouts of announcements and supplementary materials, the time used for routine processes in this session can be shortened and a part of the period utilized for training activities. If the training activities are effective the teaching assistants might find additional time could be profitably employed for training work.

These training sessions should be conducted so that top priority

is given to meeting the needs of teaching assistants. Each session should be planned as a model for teaching assistants. Classroom procedures, (discussion, demonstration, question and answer, and others) may be demonstrated during the conducting of these classes. Part of the value of the employment of the teacher-trainer is the opportunity of so structuring these meetings.

Teaching assistants should be involved in the discussion of subject matter, and the demonstration of salient laboratory techniques. Some might plan handout material, and pre-run experiments and report possible innovations which seem of value after their experience (problem 18, page 114).

The following are additional topics that need to be included in the discussions.

1. The cultivation of an "environment for learning" in laboratory sessions

2. Training in the use of techniques of feedback--how to evaluate our own efforts

3. Training in discussion methods

4. Other class methods and problems including "discipline"

5. Details of test construction, including purposes and values of tests

6. Safety training

These topics should not be presented apart from the problems of the assitants. The approach to these training sessions should be by "cases"; as far as possible, the experiences gleaned from the teachers themselves should be used. Theory should grow out of the specifics of teaching assistants' experience.

Opportunity for and encouragement of reverse communication from the assistants should be made. Student problems as seen by the teaching assistants, student progress evaluation and diagnosis, administrative maladjustments, and suggestions from teaching assistants for the improvement of course are topics which should come up in these discussions. This kind of discourse will not just happen. Often it must be triggered by information from previous conversations and observations of teaching assistants. It must be cultivated by an accepting attitude on the part of the staff (problem 4, page 98).

These sessions in pre-term orientation and in weekly staff meetings constitute the formal group training suggestions in this plan. There are also other ways of helping the assistants for which suggestions follow.

The Staff Planning Sessions for Courses

The direction and policy-making for any particular course in introductory chemistry is in the hands of the staff who provides the lectures for that course. If more than one person is lecturing, called meetings of the involved staff members are held for the purpose of making decisions about: course goals and content, nature of examinations and responsibility for preparation, course organization, and class and laboratory procedure.

It has previously been suggested that the teacher-trainer should participate in the work of these staff planning groups. Initially he would function as a communicator between staff and assistant, and also to the students (problem 1, page 98).

Later as the staff develops respect for the teacher-trainer's

competence, he may be able to help them map out teaching strategy, coordinate their group efforts, and structure examinations. Though these are activities which only indirectly affect the problems of teaching assistants, they should be effective in modifying conditions of which the teaching assistants complained.

The teacher-trainer acts here as a consultant for the staff in educational and organizational tactics. His position is not unlike that of "staff" which provides such services for management in industry (Morris, 1963, page 46).

The Coordination and Communicative Functions of the Teacher-Trainer

One of the most common complaints of teaching assistants was the "lack of coordination". This was in part reinterpreted by this research as communication failure: failure, to some extent, of information to flow "up" from the students and teaching assistants to the staff. Reasons for the failure of this flow could be thought to be: (a) no formal lines of communication open; (b) need for information not recognized by the teaching assistants or staff; (c) teaching assistant does not feel information will be accepted by the staff; (d) staff does not accept information. The teacher-trainer should be in position to clear this channel. He should encourage teaching assistants to give information, provide the tools for collecting needed information, and provide means for getting it into a form usuable by the staff (Thelen, 1954, page 110).

This communication function in supervision and administration is one of the important services that the teacher-trainer should be able to provide for the department, due to his intermediating position

between teaching assistant and staff. Theoretical communication models and communication techniques will be found in industrial management literature (Barnard, 1962, page 175). His duality of role as part-staff and part-teaching assistant is here both a help and a hindrance. The model for this is provided by Lacy, Lenehan, and Thomas (1966) and described on page 27 of this study.

The Observation of Staff Teaching

One activity for improvement of the assistant's teaching ability can be carried on without any cost of time on the part of the staff. This would be for the teaching assistant to visit one or more quiz hour periods and laboratory periods taught by a staff member. This should be done as near the beginning of the term as possible. After the visits, individuals or groups of teaching assistants might meet with the teacher-trainer to discuss their reactions to the methods observed. Such observations and discussions could well be the basis for training sessions for the entire group.

The Observation of Teaching Assistants at Work

The teacher-trainer should periodically visit the teaching assistants in their classromms. Though such observations do not give a true picture of the teaching behavior, and often are viewed as a threat by the teacher, they will provide some information about the assistants' organization and inter-relationship with students which can be used for focal points in trainer-assistant discussions. If such visits are made with the full knowledge of the teaching assistant, and if criticism is mainly constructive, and if effort has been made to

develop rappart between the trainer and the assistant, uneasiness on the part of the assistant should remain at acceptable levels.

As a part of this phase of the program, staff members concerned with lecturing might well be given supervision of the activities of groups of teaching assistants. One suggestion from a staff member was that one lecturing staff member should be available during every morning or afternoon period in which laboratory sessions are held. This would allow him to move from one laboratory group to another, observing what is being done, giving advice when needed, or answering questions when called upon. Every such opportunity should be utilized for bringing staff members and teaching assistants together. The presence of a teacher-trainer should not be allowed to weaken ties between staff and teaching assistants.

Some observations could be made by the use of the tape recorder and time lapse photography. Such instrumental observations may be less threatening to the teacher and class than the presence of an observer, and within their effective area, more exact in what is recorded. The use of instrumental methods cannot be considered as time savers; the analysis of recordings may take longer than actual observations. Mechanical observation may be worth more for evaluation than for instruction.

All observation should be utilized in the discovery of problems of teaching assistants which can be used as content for training sessions.

The Counseling Function of the Teacher-Trainer

Several staff members suggested that the training program should be

informal and individual. Such an approach allows a direct attack on the teaching problems and is in accord with the basic position of this study. Therefore, a part of the teacher-trainer's time should be scheduled so that he is available for conferences with the assistants as individuals or in groups. Observations made during the course of the research suggest that this may be the most effective way that teaching can be improved.

The role of observer may at times make the trainer appear as if he is doing nothing. The staff should be made aware of and find this phase of his work to be acceptable. The teaching assistants should also see this activity as something he does deliberately and knowingly. It undoubtedly will be necessary for the trainer to limit the time he spends in this manner; yet his schedule should be so arranged that every teaching assistant can take advantage of an opportunity to "level" with the trainer.

This activity should be purposive. Some of the goals to be striven for are

1. Cultivate a speaking acquaintance with each teaching assistant. Informality should be cultivated in this relationship. The trainer should make a point of knowing the assistants and letting them know him. Though this relationship should be kept professional and should never become simply a social interaction, it should allow the exploration of common interests and the freedom of expression. These should be periods when a good deal of non-directive counseling is done; the teacher-trainer should become a good listener; teaching assistants should feel secure enough in his presence to discuss common problems among themselves. Within-group talk should provide a valuable

data source for the training program.

2. Provide an opportunity to assist teaching assistants with chemistry. Observation of the graduate students' behavior revealed much time spent in threshing out chemistry problems, often those which they encounter in their teaching. The trainer has an opportunity to assist with this re-education.

3. Identify and treat the class problems of teaching assistants. Though informal observation has been previously suggested as a source of materials to be used in training sessions, the value of dealing immediately with problems should not be overlooked.

4. Identify administrative problems. "Beefs" about "how things are going" are often insights into administrative malfunction that can be corrected if information is fed to proper persons. Though the trainer will need to distinguish between real and imaginary problems, he should cultivate an attitude of "hearing the teaching assistant out". His own experience and training as well as his position as a staff member will make him knowlegeable about the real nature of the problem and the proper procedures for dealing with it.

5. Provide a means of personal mannerisms and behavior problems. Often over a coffee cup is the best place to help an assistant with personal difficulties. Here also the trainer can teach by personal example the acceptance of the student as he is.

6. Expedite the teaching of classroom skills and techniques. Here is the time to say, "Why not try. . .and see how it works. Maybe this approach will take care of your difficulty."

The Assemblage of a Resource Center

The teacher-trainer should have available for his own use and the use of teaching assistants, practical sources of technical information on subject matter, laboratory procedures, teaching techniques, classroom management, and other matters with which he and the teaching assistants are having to deal. Emphasis should be placed on sources of ideas which can be digested quickly, suggestion lists that are keyed to more complete plans on specific suggestions, and materials with ideas given in visual projection. Along with this there should be a file of accumulated handout materials--brochures that can be given to interested teaching assistants, duplicated information sheets, and other similar materials that will aid and assist teaching assistants.

Program Evaluation

One staff member stipulated: "Some sort of criterion should be set up in order that we will know whether the program is any good." Staff goals for such a program as herein suggested probably would include one or more of the following statements:

1. Improvement in student achievement
2. Increase in the number of chemistry majors
3. More effective use of staff time in teaching
4. Reduction or alleviation of problems of teaching assistants
5. Staff and teacher assistant satisfaction--a feeling of a job well done

Evaluation of any program for the improvement of teaching is quite frustrating. Theoretically, greater student achievement in chemistry is the ultimate goal of this program. At first the measurement of the

attainment of this goal seems easy: there are numerous achievement tests which could be utilized as measuring instruments. The several constructed and distributed by the American Chemical Society would be quite acceptable to the staff.

But what kinds of comparisons can be made? There needs to be a control group. The experimental design might be the splitting of students and teaching assistants into two equivalent groups. One group of teaching assistants would be trained; the other group with their students would represent the controls. Yet it would be impossible to maintain two unrelated groups of students and assistants. Besides there are the theory teachers who surely hope to affect learning.

Students in a nearby university might be used as a control group. Initial comparisons could be made with pre-experimental tests. Yet, how do you provide the same set of controlled variables in two universities, several miles apart?

Perhaps grades or test scores from groups taking chemistry in years immediately before the training program was instituted could be used as controls. Possibly some process could be set up by which the statistical variables could be shown to be equivalent.

Yet, even if we can find two separate equivalent populations, do we get the same kinds of conceptual learning with different methods of teaching? Standardized tests are designed to measure achievement of students taught chemistry in the usual manner: can such tests have validity for the learning achieved with different methods of teaching?

These questions are raised to show the problems involved in setting up an evaluation program. To really evaluate is not simple. However, some plan of checking student achievement should be a part of

such a program. Other evaluative processes should also be used.

It would be a worthy achievement if the program could bring about an increase in the number of chemistry majors. It should do this. But how could this be determined? Even if an increase is shown, perhaps it is not due to the training program, but some other factor. Yet as part of the evaluative process for this program, the number of chemistry majors should be watched.

The reduction of staff-time in teaching should increase the research productivity of the staff. But if the staff time utilized in teaching is reduced, what will be the effect on student achievement? And is this a really worthy goal?

Such a program should certainly reduce the problems of teaching assistants. This is the primary purpose. How could this be measured? The teaching assistants could be asked about whether they think such a program is helping them. Yet what would their answers be compared to?

How do staff members feel about the program? Does it appear to be doing good?. Is it a waste of time? But this is highly subjective. What will this opinion be based on?

Just how will this program be evaluated? A start might be made by asking, "Just how is the present program being evaluated?" Actually very few teaching programs, in chemistry or anywhere else, are ever evaluated objectively. Most programs must be evaluated subjectively. This is the only recourse.

It is well to draw here from studies in other fields which have to do with decision making from subjective data. First, let us look at mathematics. Polya (1954, Vol I, page 111) discusses what is involved in such decision making:

> To be a good mathematician, or a good gambler, or good at anything, you must be a good guesser. In order to be a good guesser, you should be, I think, naturally clever to begin with. Yet to be naturally clever is certainly not enough. You should examine your guesses, compare them with the facts, modify them if need be and so acquire an extensive (and intensive) experience with guesses that failed and guesses that came true.

The decisions to be made here are not unlike those found in business. Therefore, management science can be utilized as a source of clues for methods of decision making. Morris (1963, page 75) discusses the question of objectivity in management's decisions. He finds that the presence or absence of objectivity is a matter of degree, that often the initial lack of objectivity must be attacked by "calibrating" observers, that objectivity is related to the degree to which concepts can be made operational, and that variability can be reduced by working to make concepts more and more operational. In practical day-by-day decisions, the concepts of the decision maker about a given situation must be made more and more objective (operational) until there is enough assurance of success that a decision can be made. Risk is never completely removed.

Relating these two approaches to the present problem of how to evaluate, the present scheme is suggested:

Every method explored in previous paragraphs for the evaluation of this program should be utilized where possible. Student achievement should be compared to previous years. A standardized pre-test and post-test should be utilized. Results should be analyzed and summarized. Along with this student opinion should be sampled. The rating scale decribed in this research could be used and analyzed and compared with student reactions in previous years.

Check the number of chemistry majors. An increase in numbers is

certainly not a negative sign.

Find out what teaching assistants feel about the program. Sample their reactions with questions similar to those asked during interviews in this research (See appendix D, page 170).

Finally set up, at the beginning of the training period, a committee of staff members with varied viewpoints about teacher training. Inform them of the above checks which will be made on the program. Suggest that they observe student and teaching assistant behavior. Get an agreement among them as to what they are going to look for. (Operationalize the concepts.) Charge them with the evaluation of what is going on. Bring this committee of evaluators or observers together from time to time; let them share their observations and "recalibrate" (objectify) their measuring devices and thereby maximize precision.

Recruitment for Chemistry

Today the lack of qualified persons choosing chemistry as a career is a serious problem. The job demand is great; even greater demand seems certain in the future. The teacher-trainer, due to his unique relation to the teaching assistants, is in an excellent position to develop a recruitment program for chemistry. Assistants could (and should) be encouraged to identify students with ability and interest in chemistry. Since they are close to the students in age and viewpoint, they would be well fitted to make the first contacts with the students. If they are doing a good teaching job, they will be in a still better position to encourage and influence the students in career selection. Hand-out materials could be provided to the teaching assistants for this purpose. The student members of the American Chemical Society

might want to make this a chapter project.

Once the interested students are identified, the teacher-trainer would be in position to council with them and suggest other staff members whom they should contact. This recruitment activity is not unrelated to teacher-training and the improvement of the teaching of the assistants. The interest shown by such activity on the part of the teacher, will be a positive force for improvement of teacher-student relations. The cultivation of a recruitment perspective by the teaching assistant should improve his attitude toward the student.

CHAPTER VIII

FOLLOW-UP STUDIES

This research has posed more problems than it has solved. The conclusion of the research--namely, the 27 problems detailed in Chapter VI--represent 27 different subjects for further study. Each of these is deserving of a systematic probe into what it is, how it might be handled differently in the teaching program, and an evaluation of results after changes are made.

Certain broad topics can be pointed up that are a part of, or related to the problems above, and which can be viewed as areas open to research. The first of these is the suggested program which was discussed in Chapter VII. The use of graduate students as teachers will likely increase during the years ahead. Studies focused on the practice are quite opportune. As previously stated in Chapter I, if they could be taught to be better teachers, present education would benefit as well as the future when many of them will fill the ever widening ranks of professorship. This could well become a project for a foundation interested in the improvement of college teaching.

Second, any program for the improvement of teaching in colleges needs evaluative tools. Instruments for checking the value of a change program in teaching (such as outlined in this report) are badly needed. Studies are in order which have the development of testing techniques as key targets.

Third, closely related to this need for evaluative tools for change programs, is the need for diagnostic tests. This is especially true in chemistry, where with the advent of large lecture classes, "feedback" techniques have not kept pace with need. These are needed before teaching. can become "student oriented". Much of the chemistry and other science teaching consists of "telling" or outlining for students the information they are to learn and then moving on. Under such practices, especially in large classes of non-majors, many students are low achievers; standards are necessarily quite low. If we are really interested in raising standards of achievement in introductory college chemistry classes, we must start paying attention to what the student is actually learning, and utilize re-education processes when we find basic learning has not taken place. For the determination of what has been learned in large classes, diagnotic testing is almost the only tool available.

Fourth, this research has suggested that certain educational, administrative, and industrial management concepts be applied to the selected problems. Support for such applications is logical but untested. Studies need to be initiated for proof of value and to facilitate an adaptation. There are four such ideas that merit special attention:

1. The use of communicative techniques from industrial management and behavioral science theory. Many of these have had no previous application in science education. Their adaptation and evaluation needs to be studied.

2. Application of vocational, industrial, and adult education approaches to the training of science teachers has been emphasized here. Such applications are job or problem oriented; theory is taught inductively or not at all. Though this is not an unused approach in

public school education, it is especially emphasized in these specialized educational fields. Yet as innovations in teacher-training in college science courses, specific processes need to be clarified and developed.

3. Group techniques (applied behavioral science procedures) have been suggested as elements of change. Most of these ideas about how to bring change about have been developed since 1950. Little application of the principles here involved has been worked out for any area of education, since acceptance of these ideas has been mainly by industrial organizations. Thelen (1954) and Flanders (1956) have made some application in elementary and secondary education. Baumgartel and Goldstein (1967) have utilized group processes in college classes in Human Relations. Application in college science teaching remains for future study.

4. The teaching of problem-solving has been of interest to researchers in both science and education. There has been much study concerned with how problem-solving takes place. The teaching procedures for training science students to problem-solve still lack refinement.

Three predilections of college chemistry teachers deserve systematic study. It is not suggested here that they are fallacious; however, the apparent widespread acceptance by a group of scientists of concepts without systematic research seems inconsistent. Therefore, these studies are suggested:

1. About the relation of research ability to teaching ability The use of research training as a chief means of training teachers has the support of the American Chemical Society. Can this be supported by research data?

2. The effectiveness of lecture in college teaching Lecturing certainly has a place in any teaching process. Timewise, it seems

highly efficient. Yet its widespread use in colleges, under all conditions and for any subject matter seems questionable. Lecturing seems to help the lecturer (ego-supporting). We wonder what it really does for the student?

3. The importance of "knowing your subject" in teaching. The posing of this as a research problem certainly has heretical implications. It is inconceivable that anyone could teach without some knowledge of what he is teaching. Yet some of the finest science teaching that may be taking place in elementary education is by teachers who have found a way of launching their young students into science adventure, into areas unexplored by the teacher (Jones, 1961). One staff member interviewed in this research recalled that under war time conditions, it was necessary to use undergraduate non-majors as teaching assistants. Results were surprisingly good. The implication is not being made here that untrained teachers should be employed; yet to what extent can the subject matter training tenet be supported?

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APPENDIX A

RATING SCALE FOR TEACHERS

RATING SCALE FOR TEACHERS

Please rate your instructor as to each of the points named below. It is necessary in each case merely to circle the number at that point on the line which seems to be most accurate.

Date_____

Please make this rating conscientiously and individually. Your instructor will receive only the final summary of the results from the class as a whole. He will use them for self-improvement in teaching.

Do not sign your name or make any other mark which might serve to identify you.

1. PREPARATION FOR CLASS MEETINGS.

5	4	3	2	1
Class meetings very carefully planned	Usually well prepared	Preparation often inadequate	Little preparation	No preparation

2. TEACHER'S INTEREST AND ENTHUSIASM IN SUBJECT.

5	4	3	2	1
Very enthusiastic and interested	Frequently shows enthusiasm	Only mildly interested	Very seldom shows enthusiasm	Subject irksome to him

3. ABILITY TO AROUSE INTEREST IN STUDENTS.

5	4	3	2	1
Interest usually runs high	Students frequently show interest	Students occasionally show interest	Students seldom interested	Majority inattentive most of period

4. ORGANIZATION OF COURSE.

5	4	3	2	1
Every lesson well organized	Most lessons well organized	Some organization but not always clear	Very little organization	No organization

5. THINKING DEMANDED OF STUDENTS.

5	4	3	2	1
Thinking always necessary	Work demands much thinking	Some thinking required	Very little thinking required	No thinking required

6. ASSIGNMENTS.

5	4	3	2	1
Clear and definite	Carefully given but indefinite	Definite; often hurriedly given	Rather indefinite and often hurriedly given	Very indefinite; usually hurriedly given

7. SENSE OF PROPORTION.

5	4	3	2	1
Stresses fundamental topics, disregards trivial details	Spends most of time on important topics, stresses few details	Stresses important topics and details equally	Spends more time on details than on important topics	Often neglects subject for other irrelevant topics

8. ENUNCIATION.

5	4	3	2	1
Speaks very clearly and distinctly	Distinct but not loud enough at times	Loud enough but not distinct	Words sometimes indistinct and not easy to hear	Words very indistinct often impossible to hear

9. SENSE OF HUMOR.

5	4	3	2	1
Has keen sense of humor	Frequently shows real humor	Humor occasionally, but not often exhibited	Manifests little or no humor	Humor obviously not spontaneous

10. SCHOLARSHIP.

5	4	3	2	1
Knowledge of subject broad and accurate	Knows appreciably more than is in text	Knowledge limited to text material	Knowledge apparently deficient at times	Knowledge very plainly deficient

11. ABILITY TO EXPRESS THOUGHT.

5	4	3	2	1
Words come easily; meaning always clear	Some hesitation; meaning always clear	Some hesitation for words; meaning at times not clear	Much hesitation for words; meaning often not clear	Meaning almost never clear

12. FEELING BETWEEN INSTRUCTOR AND STUDENTS.

5	4	3	2	1
Complete harmony	Feeling of good-will prevails	Neither good-will nor antagonism seems to prevail	Students frequently antagonized	Instructor tends to antagonize class

13. PREVALENCE OF CHEATING ON EXAMINATIONS.

5	4	3	2	1
By no one	Only infrequently	Occasionally noted	By many students	By most students

14. SELF-CONFIDENCE

5	4	3	2	1
Sure of himself; meets difficulties with poise	Seldom if ever disconcerted	Fairly self-confident; occasionally disconcerted	Often confused by students	Hesitant, timid uncertain

15. TOLERANCE AND LIBERALITY.

5	4	3	2	1
Invites differences of opinion	Welcomes differences of opinion	Shows no personal response to opposition	Sometimes impatient when students oppose his views	Easily aroused to temper by opposition

16. PUNCTUALITY IN MEETING AND DISMISSING CLASSES.

5	4	3	2	1
Prompt	Rarely late	Occasionally late	Often late	Very often late

17. PERSONAL APPEARANCE.

5	4	3	2	1
Well-groomed; clothes neat, clean in good taste	Usually tidy and careful as to appearance	Sometimes careless as to appearance	Usually rather untidy and careless as to appearance	Slovenly; clothes and person untidy

18. PERSONAL PECULIARITIES.

5	4	3	2	1
Free from mannerisms	Free from annoying mannerisms	Annoying manner-isms not serious	Annoying mannerisms often detract	Constantly exhibits annoying mannerisms

19. FAIRNESS IN GRADING.

5	4	3	2	1
Very fair	Fair	Usually fair	Often fair	Unfair

20. GENERAL ESTIMATE OF INSTRUCTOR AS A TEACHER.

5	4	3	2	1
Excellent	Good	Fair	Poor	Very poor

APPENDIX B

16 PERSONALITY FACTOR TEST NORM TABLES

16 PERSONALITY FACTOR TEST NORM TABLES

These norms are for the 1961-1962 edition of the 16 Personality Factor Questionaire, published by The Institute for Personality and Ability Testing, 1602-04 Coronado Drive, Champaign, Illinois. The table was included in a mimeographed inclosure, consisting of pages of tables, provided for use with Cattell and Stice, Handbook for the Sixteen Personality Factor Questionaire, 1957 edition (with 1962 supplementation). The norms were used in preparing the Cattell profiles used in this research.

> Directions: The values within the table (i.e., in the body of table) are "raw scores"--the values obtained with the scoring stencils. To convert these raw scores into standard ten-point scores (stens), find the raw score for Factor A in the 'A' line and read the corresponding sten score above it. Do likewise for the other factors.

FORM A: College: Men October, 1963

Factor	Sten Score 1	2	3	4	5	6	7	8	9	10	Factor
	Raw Score										
A	0-3	4	5-6	7	8-9	10-11	12-13	14	15-16	17-20	A
B*	0-4	5	-	6	7	8	9	10	11	12-13	B*
C	0-7	8-9	10-11	12-13	14-15	16-17	18	19-20	21-22	23-26	C
E	0-6	7-8	9	10-11	12-13	14-16	17-18	19	20-21	22-26	E
F	0-5	6-8	9-11	12-14	15-16	17-18	19-20	21-22	23-24	25-26	F
G	0-4	5-6	7-9	10-11	12	13-14	15-16	17	18-19	20	
H	0-2	3-4	5-7	8-10	11-13	14-16	17-18	19-20	21-22	23-26	H
I	0-2	3	4-5	6	7-9	9-10	11-12	13-14	15	15-20	I
L	0-3	4	5-6	7-8	9	10-11	12-13	14-15	16	17-20	L
M	0-5	6	7-8	9	10-11	12-13	14-15	16-17	18	19-26	M
N	0-5	6-7	8	9	10	11-12	13	14-15	16	17-20	N
O	0-3	4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-26	O
Q_1	0-4	5	6	6-8	9	10	11-12	13	14-15	16-20	Q_1
Q_2	0-3	4	5-6	7	8-9	10-11	12-13	14-15	16-17	18-20	Q_2
Q_3	0-3	4-5	6-7	8	9-10	11		14	15-16	17-20	Q_3
Q_4	0-2	3-5	6-7	8-9	10-12	13-15	16-17	18-20	21	22-26	Q_4
	1	2	3	4	5	6	7	8	9	10	

FORM A & FORM B: College: Men

	Sten Score										
	1	2	3	4	5	6	7	8	9	10	
A	0-6	7-9	10-12	13-15	16-18	19-22	23-26	27-29	30-32	33-40	A
B*	0-10	11-12	13	14	15-16	17	18-19	20	21-22	23-26	B*
C	0-17	18-19	20-23	24-27	28-30	31-34	35-37	38-41	42-44	45-52	C
E	0-13	14-15	16-18	19-21	22-24	25-27	28-31	32-34	35-37	38-52	E
F	0-14	15-18	19-23	24-27	28-32	33-36	37-40	41-44	45-47	48-52	F
G	0-13	14-16	17-19	20-22	23-25	26-28	29-31	32-33	34-35	36-40	G
H	0-6	7-10	11-15	16-20	21-26	27-32	33-37	38-41	42-45	46-52	H
I	0-8	9-10	11-13	14-15	16-18	19-21	22-24	25-27	28-30	31-40	I
L	0-8	9-10	11-13	14-16	17-19	20-22	23-24	25-27	28-29	30-40	L
M	0-11	21-23	24-25	16-17	18-20	21-23	24-26	27-30	31-33	34-52	M
N	0-12	13-14	15-16	17-18	19-20	21-22	23-24	25-26	27-28	29-40	N
O	0-8	9-11	12-14	15-18	19-22	23-26	27-30	31-33	34-37	38-52	O
Q_1	0-10	11	12-12	14-16	17-18	19-20	21-23	24-25	26-27	28-40	Q_1
Q_2	0-10	11-12	13-14	15-17	18-19	20-22	23-25	26-28	29-31	32-40	Q_2
Q_3	0-10	11-13	14-15	16-18	19-20	21-23	24-25	26-28	29-30	31-40	Q_3
Q_4	0-9	10-13	14-17	18-22	23-26	27-30	31-34	35-38	39-41	42-52	Q_4
	1	2	3	4	5	6	7	8	9	10	
	Sten Score										

*When an answer sheet is being scored for someone who is not a college student, use the following values for Factor B (Intelligence) instead of the values given in the preceding tables.

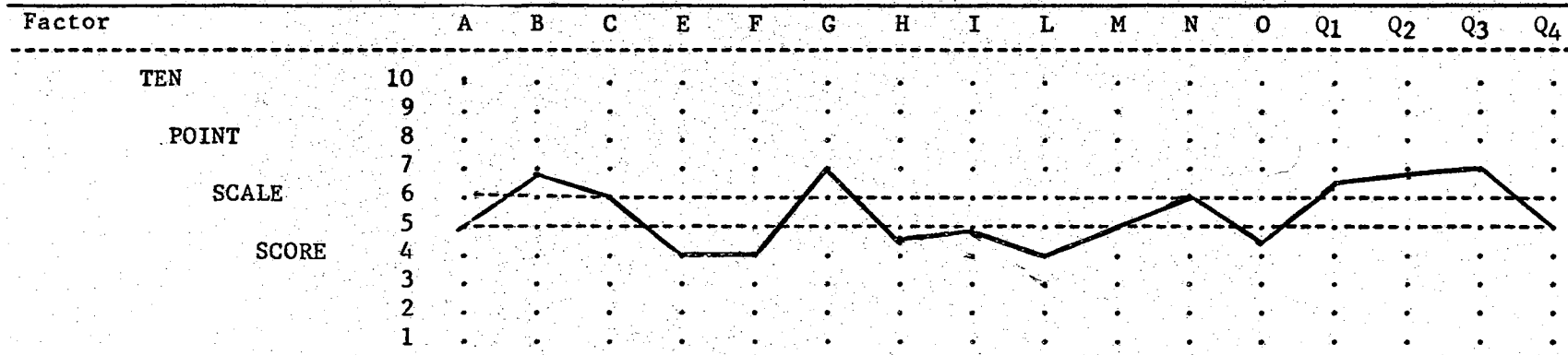
Conversions To Be Used For FACTOR B (Intelligence) For Either Men or Women For General Adult Population Or High School Students

	Sten Scores									
FORM	1	2	3	4	5	6	7	8	9	10
A	0-1	2	3	4	5	6	7	8-9	10	11-13
B	0-2	3	4	5	6	7	8	9	10	11-13
A/B	0-6	7-8	9-10	11	12-13	14-15	16	17-18	19	20-26
	Raw Scores									

APPENDIX C

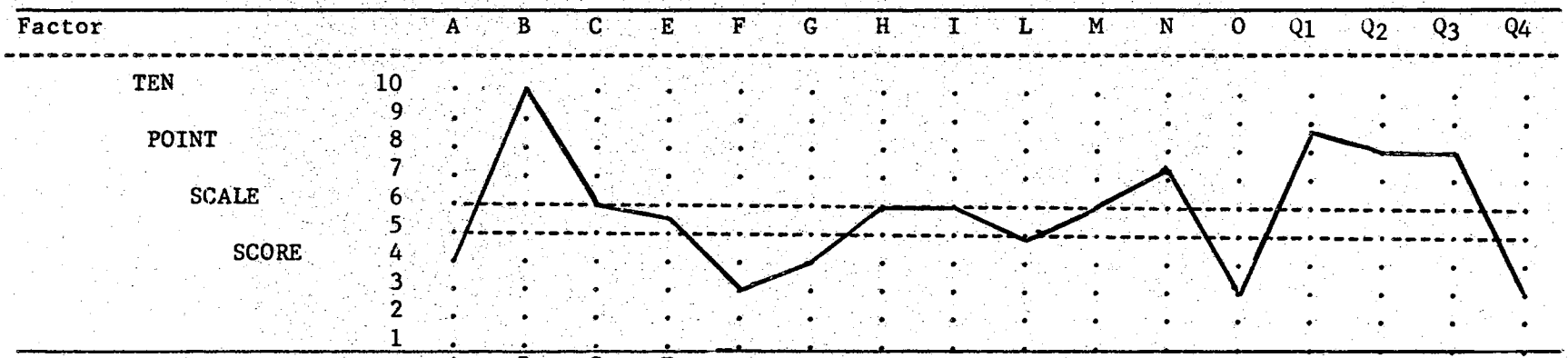
PERSONALITY PROFILES

1. Profile of Teaching Assistants
2. Profile of Eminent Researchers
3. Profile of Eminent Teachers



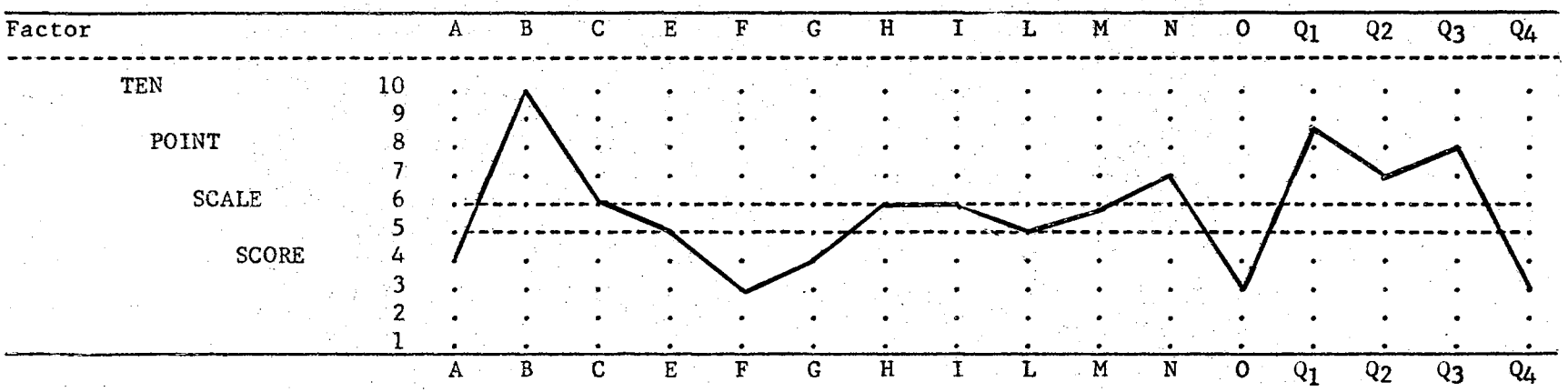
	A	B	C	E	F	G	H	I	L	M	N	O	Q_1	Q_2	Q_3	Q_4
Mean: Raw Score	8.6	8.8	16.0	10.4	12.8	15.4	10.7	6.9	7.3	10.8	11.5	8.5	10.4	11.6	12.0	11.9
Sigma	2.0	1.6	3.0	4.3	4.5	2.2	5.2	2.9	3.0	3.0	2.7	3.4	2.8	2.5	3.9	4.4
Mean on Norms: College Men (score standardization)	5.0	6.8	6.0	4.0	4.0	7.0	4.5	4.8	4.0	5.0	6.0	4.5	6.4	6.8	7.0	5.0

1. Personality Profile: Teaching Assistants in Chemistry (1963-1964)
Cattell Ten Point Scale Score. (16 Cases)



	A	B	C	E	F	G	H	I	L	M	N	O	Q1	Q2	Q3	Q4
Mean Raw Score	11.3	21.7	33.0	24.4	20.9	22.3	29.5	19.7	16.9	21.5	24.2	13.0	25.7	27.0	26.3	14.4
Sigma	4.83	2.61	5.17	5.97	7.31	5.64	9.92	4.57	4.71	6.49	4.04	7.56	5.10	5.91	5.68	7.23
S. S. College Men	3.0	10.0	6.0	5.5	3.0	4.0	6.0	6.0	4.9	6.0	7.3	3.0	8.7	8.0	8.0	3.0

2. Personality Profile: Eminent Researchers. Cattell Ten Point Scale Score. From study by Cattell and Drevdahl. British Journal of Psychology, 46:246-261 144 Cases. (Adapted)



	A	B	C	E	F	G	H	I	L	M	N	O	Q1	Q2	Q3	Q4
Raw Scores (A & B Form)	13.0	21.1	34.1	22.9	20.7	22.0	28.6	19.4	17.3	20.9	23.9	13.4	25.7	24.9	26.8	15.7
Sigma	5.20	2.35	5.34	6.58	7.39	5.22	10.35	4.24	4.47	5.64	3.67	7.12	5.26	5.32	4.99	7.82
Standardized Score	4.0	10.0	6.1	5.0	3.0	4.0	6.0	6.0	5.0	5.9	7.0	3.0	8.7	7.0	8.0	3.0

3. Personality Profile: Eminent Teachers. Cattell Ten Point Scale Score. From study by Cattell and Drevdahl <u>British Journal of Psychology</u>, 46:246-261
(81 cases) (Adapted)

APPENDIX D

QUESTIONAIRE AND RESULTS

ORAL INTERVIEWS WITH TEACHING ASSISTANTS

1. Choice of Occupational Field
2. Goal Determination
3. Reaction to Students
4. How Teaching Assistants Viewed Their Jobs
5. Answers to Questions by Teaching Assistants

1. WHAT DO YOU EXPECT TO FINALLY BECOME? Name:_____

    1. Industrial Chemist?_____

    2. Research Chemist?_____

    3. Highschool Science Teacher?_____

    4. Teacher of College or University Chemistry?_____

    5. Other._____

DO YOU EXPECT TO CONTINUE YOUR FORMAL EDUCATION AFTER YOU PROCURE THE DEGREE YOU ARE NOW WORKING FOR?

Final Degree Goal_____

---

2. DID YOU MAJOR IN CHEMISTRY BECAUSE OF:

    1. The influence of a particular person?_____

        a. What was his relationship to you?_____(Teacher, etc.)

    2. Interest developed through chemistry play kits?_____

    3. Interest stemming from reading or study?_____

        a. If so, what kinds of material?_____

    4. Interest czught during high school or undergraduate classes?_____

    5. Promise of economic success?_____

    6. Additional information, other than the proceding items, which tells why you really chose the chemistry field:

_____

_____

_____

(The above forms were duplicated on the opposite sides of a key-sort card, and filled out during an interview with each teaching assistant.)

3. REACTION TO STUDENTS:

a. Did you find the students in your sections of laboratory average, above average, or below average in ability?

_____

b. Did you find your students cooperative, non-cooperative, or antagonistic?

_____

c. Do students apply themselves to their laboratory work, or do they slight it?

_____

d. Do you enjoy working with your students, do you look forward to quiz hour and laboratory, or would you prefer to do something else?_____

e. Do you find it easy to make your students understand you, or do you find them unable to understand what you are trying to explain?_____

(These questions were asked with the idea that they might initiate additional response from the teaching assistants in this area. The secondary responses were also recorded during the interviews.)

4. HOW TEACHING ASSISTANTS VIEWED THEIR JOBS.

I. What problems have you run into in teaching your chemistry classes?

II. Would there be anything the chemistry department could do to improve the work of the teaching assistants?

III. Suppose that you had the job next year of "helping" the teaching assistants do a better job. What would you do?

ANSWERS TO QUESTIONS

HOW THE TEACHING ASSISTANTS VIEWED THEIR JOBS

I. What problems have you run into in teaching your chemistry classes? (Answers found in Table .)

II. Would there be anything the chemistry department could do to imrove the work of teaching assistants?

	Number of responses
1. Provide a consistent policy by the staf.	1
2. Provide teaching assistants with an outline of work covered in theory--outline what students need to learn and what needs to be emphasized	3
3. Develop a safety code for the laboratory. Go over first aid instructions.	2
4. See to it that lecture teacher is quite definite in what he is going to teach in class and what he is going to test over.	1
5. Improve the quality of theory instruction	1
6. Improve testing procedures.	1
7. Divide general chemistry into two groups.	1
Chemists Engineers Related Science	Remotely related science Liberal arts majors
8. Consider psychological organization of materials.	1
9. Outline duties and responsibilities of teaching assistants.	2
10. Treat teaching assistants as individuals.	2

III. Suppose you were given the job next year of "helping" the teaching assistants do a better job. What would you do?

1. Reduce the course load to less than half, teaching assistants need more teim.	2
2. Improve communications to the teaching assistants from the staff: hold more and better staff meetings, prepare lecture outlines.	5

ANSWERS TO QUESTIONS

		number of responses
3.	Improve communication (as to what is being taught) between staff members	2
4.	Provide the Teaching Assistants' Handbook for all teaching assistants and help them use it.	1
5.	Improve communications on grading procedures among staff, among teaching assistants and between the staff and the teaching assistants	2
6.	Improve the control of teaching assistants over classes, back them up, increase supervision.	2
7.	Provide mechanical helps)such as valence sheets) for students.	4
8.	Provide pre-term lectures (training seminar in the chemistry department) for teaching assistants	3
9.	Provide refresher work in chemistry for teaching assistants--encourage teaching assistants to review theory materials	3
10.	Give teaching assistants a chance to go over experiments before hand	5
11.	Correlate questions of tests given by teaching assistants with hour tests.	1
12.	Help teaching assistants maintain proper classroom relations with students	2
13.	Have teaching assistants assign 2-3 formal lab reports to students	1
14.	Help teaching assistants organize their quiz hour work...	4
15.	Help teaching assistants with tests--have them submit tests to supervisor before administering them.	3
16.	Encourage the teaching assistants to make points in their discussions as simple as possible.	1
17.	Provide a coordinator to go over points at the very beginning of term so that teaching assistants know where they are--clarify procedurs, rules, etc.	2
18.	Set in on quiz and lab sections in order to catch mistakes of teaching assistants	1

ANSWERS TO QUESTIONS (CONTINUED)

		Number of responses
19.	Round up teaching assistants, get them together, so that they can thrash out their own problems.	1
20.	I would deal directly with problems of each individual teaching assistant--I would go to him and ask, "What are your problems?".	1

APPENDIX E

STRONG VOCATIONAL INTEREST SURVEY

Summary and Analysis: Darley-Hagenah Analysis

ANALYSIS OF STRONG VOCATIONAL INTEREST SURVEY

Analysis of Interests: A Technique for Clinical Pattern Analysis of Interest Test Scores.

Reference: Darley, John G., and Theda Hagenah. Vocational Interest Measurement, Theory and Practice. University of Minnesota Press. 1955. Page 83.

Primary Pattern: is the interest type within which the individual shows a majority of A and B/ scores on specific occupationl keys.

Secondary Pattern: is the interest type within which the individual show a majority of B/ and B scores.

Tertiary Pattern: is the interest type with a majority of B and B- scores.

Reject Pattern: is the interest pattern with a majority of the scores of any interest type to the left of shaded portion of profile.

Seven Interest Types

I. Biological Sciences

II. Physical Sciences

IV. Technical (Include No III. Production Manager)

V. Scoial service

VII VIII. Business Detail

IX. Business Contact. (Include No. XI President.)

X. Verbal Linguistic. (Include No. VII CPA)

DARLEY-HAGENAH ANALYSIS OF STRONG INTEREST PATTERNS

Teaching Assistant code number	Primary Pattern (A and B+)	Secondary pattern (B- and B)	Tertiary pattern (B and B-)	Reject pattern (Left of Chance	Occupation with highest interest rating	Rating for chemistry	Specialization level	Interest maturity scale	Occupational level	Masculine-feminine scale
2	II	X	I, VIII	IV, V	Chemist	A	39	39	65	33
3	0	V	VIII	X	Farmer-banker	C+	28	48	52	53
4	0	I	IV	V, VIII	Farmer	A	22	42	56	48
5	II, IV	0	0	IX, X	Chemist	A	34	47	46	57
6	0	0	I	0	Chemist or Physician	A-	44	50	53	52
7	0	V	VIII	IX	Physician or Teacher	A	33	51	46	45
8	II	0	0	V, X	Engineer or Production Mgr.	A	34	39	58	56
9	V, VIII, IX	0	0	0	Credit Manager	B-	46	61	54	56
10	II	VIII	I	IX	Engineer	A	45	50	56	54
11	V	0	IV	IX, X	Math or science teacher	B+	44	62	50	60
12	I, II, X	0	0	VIII	Physician	A	54	52	66	49
13	I, IV	0	VIII	0	Aviator	B	41	50	54	56
14	II, IV	0	I	VIII, IX, X	Farmer	A	37	48	51	53
15	I	IV	0	VIII, IX	Osteopath	A	39	50	56	41
16	0	0	X		Engineer	A	57	58	61	57
17	I, II	0	0	0	Chemist	A	56	46	58	32

APPENDIX F

PLANNED INTERVIEW WITH STAFF

List of Questions Asked

Questions asked Staff in planned interview:

1. What problems do graduate assistants have in teaching undergraduates?
2. What other needs do teaching assistants have?
3. How would you go about helping graduate assistants solve their problems and meet their needs?
4. What do you think about including some teaching methodology (education training) in the teaching assistant's training program?

APPENDIX G

BASIC QUESTIONS USED IN PLANNED ORAL INTERVIEW WITH STUDENTS

BASIC QUESTIONS USED IN PLANNED ORAL INTERVIEW WITH STUDENTS

1. Who was your laboratory instructor?
2. Did you think he was a good instructor?
3. What did you like about him?
4. What would you want him to do that he did not do (or could have done better)?
5. Who was your laboratory instructor last semester?
6. How would you compare him with Mr. _____(your present laboratory instructor?)
7. Could chemistry laboratory be improved in any way?

APPENDIX H

SCHEDULE FOR ORIENTATION OF

NEW GRADUATE STUDENTS AND TEACHING ASSISTANTS

Department of Chemistry, Ohio State University

Department of Chemistry
The Ohio State University

SCHEDULE FOR ORIENTATION OF
NEW GRADUATE STUDENTS AND TEACHING ASSISTANTS

Monday, September 17, Lecture Room, Evans Laboratory

10:00 - 11:30 a.m. --- Placement examinations. Report for 10:00 a.m. with time to spare.

1:30 - 5:00 p.m. --- Placement examinations.

Tuesday, September 18, Lecture Room, Evans Laboratory

8:30 - 10:00 a.m. --- Placement examinations.

10:00 - 11:00 a.m. --- The Art of Teaching: Background and Philosophy

"What We Have Learned About College Students," Lyle Schmidt, Department of Psychology, Assistant Director of "How to Study" program.

1:00 - 3:00 p.m. --- "Why We Teach College Chemistry," A. B. Garrett, Department of Chemistry.

"The Undergraduate Chemistry Program The Ohio State University," W. T. Lippincott, Department of Chemistry.

3:00 - 5:00 p.m. --- Make appointments with assigned adviser

7:00 - 9:30 p.m. --- Appointments with assigned advisers.

Wednesday, September 19, Lecture Room, Evans Laboratory

9:00 - 11:00 a.m. --- The Art of Teaching: Recitation Class

"The Art of Quizzing," Frank Verhoek, Department of Chemistry.

"Conducting a Recitation Class," Andrew Wojcicki, Devon Meek; Department of Chemistry.

1:00 - 5:00 p.m. --- Appointments with advisers.

Thursday, September 20, Lecture Room, Evans Laboratory

All teaching assistants in General Chemistry must have their class schedules in the General Chemistry office, Room 115, McPherson Laboratory, by 8:30 a.m.

9:00 - 11:00 a.m. --- The Art of Teaching: Laboratory Class

"Laboratory Teaching," Thor Rubin, Department of Chemistry.

"Laboratory Safety," Sheldon Shore, Department of Chemistry.

1:30 - 2:30 p.m. --- Meeting of the Entire Staff of the Department of Chemistry, including graduate students, fellowship and research assistants.

2:30 - 4:30 p.m. --- Complete registration.

Friday, September 21, Lecture Room, Evans Laboratory

9:00 - 10:00 a.m. --- The Art of Teaching: Measurement and Evaluation

"Testing and Evaluation of Student Performance in General Chemistry."

10:00 - 12:00 a.m. --- Meeting of the Staff of the Division of General Chemistry.

1:00 - 3:00 p.m. --- Meetings of the Staffs of the Divisions of Analytical, General, Inorganic, Organic and Physical.

Rooms to be announced.

3:30 - 5:00 p.m. --- Chemistry Department Tea, Faculty Club Lounge. The entire departmental staff, including graduate students, fellows, research assistants, and their wives or husbands, is invited.

Saturday, September 22, Rooms to be announced.

9:00 - 11:00 a.m. --- Staff Meetings for Individual Courses in General Chemistry. Discussion of material to be presented during the first week.

Monday, September 24. --- Classes begin, 7:45 a.m.

VITA

Charles Ephraim Wall

Candidate for the Degree of

Doctor of Education

Thesis: THE IDENTIFICATION OF INSTRUCTIONAL PROBLEMS OF TEACHING ASSISTANTS IN CHEMISTRY

Major Field: Higher Education

Biographical:

Personal Data: Born near Chandler, Oklahoma, January 21, 1914, the son of Charles Ephraim and Louise Wall.

Education: Attended grade school in Payne County, near Perkins, Oklahoma; graduated from Perkins High School in 1931; received the Bachelor of Science Degree from Oklahoma State University in May, 1935; received the Master of Science Degree from Oklahoma State University in 1958; completed requirements for the Doctor of Education Degree in May, 1968.

Professional Experience: Taught vocational agriculture in Mooreland, Oklahoma, from 1935 to 1939; operated a farm near Perkins, Oklahoma from 1939 to 1956; taught science in Perkins High School, 1956-1957; taught physics, chemistry, and mathematics in Central High School, Guthrie, Oklahoma from 1958 to 1960; employed by Oklahoma State University as a Traveling Science Teacher for the National Science Foundation, 1960-1961; served as a teaching assistant at Oklahoma State University in the Chemistry Department from 1961-1964; employed as an instructor in chemistry at Oklahoma State University from 1964 to 1966; became Associate Professor of Physical Science at Langston University, Langston, Oklahoma, where he is presently employed.